

IUCN  
Twelfth Technical Meeting  
Douzième Réunion Technique

Papers and Proceedings  
Rapports et Procès-verbaux

BANFF, ALBERTA, CANADA  
12-15 September 1972

CONSERVATION FOR DEVELOPMENT



*Published with the assistance of UNESCO  
and the Canadian Government*

Union Internationale  
pour la Conservation de la Nature  
et de ses Ressources

International Union  
for Conservation of Nature  
and Natural Resources

Morges, Switzerland, 1973

The International Union for Conservation of Nature and Natural Resources (IUCN) is an independent international body, formed in 1948, which has its headquarters in Morges, Switzerland. It is a Union of sovereign states, government agencies and non-governmental organizations concerned with the initiation and promotion of scientifically-based action that will ensure perpetuation of the living world—man's natural environment—and the natural resources on which all living things depend, not only for their intrinsic cultural or scientific values but also for the long-term economic and social welfare of mankind.

This objective can be achieved through active conservation programmes for the wise use of natural resources based on scientific principles. IUCN believes that its aims can be achieved most effectively by international effort in cooperation with other international agencies, such as UNESCO and FAO.

The World Wildlife Fund (WWF) is an international charitable organization dedicated to saving the world's wildlife and wild places, and carrying out the wide variety of programmes and actions that this entails. WWF was established in 1961 under Swiss law, with headquarters also in Morges.

Since 1961, IUCN has enjoyed a symbiotic relationship with its sister organization, the World Wildlife Fund, with which it works closely throughout the world on projects of mutual interest. IUCN and WWF now jointly operate the various projects originated by or submitted to them.

The projects cover a very wide range from environmental policy and planning, environmental law, education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction, as well as support for certain key international conservation bodies.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.



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*Edited by*  
**Hugh F.I.Elliott**  
*Published with the assistance of UNESCO  
and of the Canadian Government*  
**International Union  
for Conservation of Nature and Natural Resources  
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# Foreword

The Twelfth Technical Meeting of IUCN was held in Banff, Alberta, Canada, on 12-15 September 1972 in conjunction with the Eleventh General Assembly of the Union. The theme chosen for the meeting, 'Conservation for Development', emphasizes IUCN's conviction that conservation must be at the root of all development. Effective development planning must be based on ecological principles so as to avoid disastrous consequences that will impose ever-greater burdens, and impede the realization of the legitimate expectations of peoples searching for a better quality of life.

The invited papers which were prepared for the meeting deal with environmental quality, the development of environmental policies at both national and international levels, a multi-disciplinary approach to development planning based on ecological principles, and the wise use and management of natural resources. On this occasion, too, some emphasis was placed on natural resources of marine habitats, which have become a matter of particular concern to IUCN in the last few years.

The twenty-five papers thus contributed form the core of the present volume but are supplemented and completed by summaries of the discussions they evoked. IUCN's warmest thanks and appreciation are due to the authors. The part played by all who participated in the discussions, including especially those who so kindly agreed to serve as chairmen and panel members at each of the sessions, is also gratefully acknowledged.

In making the material available in printed form, the Union draws attention to the widest goals of development, not merely economic development which often has short-term aims, but human qualities, educational and scientific values, aesthetic considerations, and above all, human health in the fullest sense as defined by the World Health Organization.

Conservation involves making the wisest uses of all resources, not only for today, but also for future generations.



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## TWELFTH TECHNICAL MEETING OF IUCN

### General Introduction to the Sessions and Editorial Notes

The 12th Technical Meeting was held in the Eric Harvie Theatre of the Banff Centre and was opened at 9 a.m. on Tuesday, 12 September 1972, by the Deputy Director General of IUCN, Mr Frank G. Nicholls. After explaining the procedures it was proposed to follow for the conduct and recording of the Sessions, Mr Nicholls referred in particular to the much regretted absence of one or two of the authors of Papers, and also of several of the chairmen and panel members listed in the sessional programmes, who in the event had been unable to get to the Meeting. It had been necessary to ask others to replace or deputize for them, sometimes at very short notice, as for instance in both parts of the opening session, for which one of the panel members had in each case kindly agreed to take the Chair in the absence of the designated chairman. IUCN was extremely grateful to them, as well as to all those who had contributed papers or who would be giving so generously of their services and sharing their experience, whether as authors, chairmen or panelists, in the development of the discussion over the next three and a half days.

As indicated by Mr Nicholls, the Sessions were (except for the last one) divided into two parts, each with its chairman and panel and, again with a single exception (Session F, part 2), with two previously circulated Papers as the basis of discussion. The Proceedings that follow, therefore, consist essentially of a series of self-contained accounts of the thirteen sub-divisions of the Meeting, although they are for the most part linked in pairs and with of course many other cross-references. Each division is clearly labelled by a half-title page, on the reverse of which the chairman, authors, panel members and staff are listed. This is followed by the text of the invited Papers and the report of the discussions, the latter normally comprising the Chairman's introduction, the points made by each author in presenting his paper (or, in his absence—indicated by an asterisk—by the person deputizing for him), the comments of the panel members and, in a more summarized form, the contributions from the floor and any replies or final comment from the platform. In one or two of the Sessions, where important additional points were submitted in writing to the Chairman but their oral presentation could not be called for because of lack of time (only ninety minutes, at most, were available for each of the thirteen sections), these have also been included, very briefly, to complete the record.

It should be explained that for logistic reasons (the saving of time and space and in order not to delay publication) all the Papers and contributions to the discussions are reproduced or summarized only in the original language in which they were submitted or recorded. Inevitably this has resulted in a slight bias, since in the case of contributors speaking in French, the chances are that, if they did not find time to commit their remarks to writing, the rapporteur would have recorded them in English. On the whole, however, it did not seem worthwhile translating them back again into French, since the result would still only be an approximation to the contributor's original phraseology.

Nevertheless, despite the bilingual presentation and any shortcomings in the provision of completely satisfying summaries, especially where fuller versions

of valuable interventions have had to be ruled out by considerations of length and over-all balance, it is hoped that the great majority of readers will have no serious difficulty in making good use of these Proceedings. If they succeed in facilitating future reference and enabling full advantage to be taken of the great range of information and ideas contributed by well over a hundred of the participants in IUCN's 12th Technical Meeting, they will have fulfilled their purpose.

**SESSION A**

**ENVIRONMENTAL QUALITY IN  
A CHANGING WORLD**

**Part 1:**

**SESSION A: PART 1**

*Chairman:* Mr. E. M. Nicholson (U.K.): Member, IUCN's International Commission on National Parks; Convener of Section CT (Conservation of Terrestrial Communities) of the International Biological Programme, London.

*Authors:*

**Paper (1): Planning for Diversity**

Professor D.J.Kuennen (Netherlands): Chairman, IUCN's Commission on Ecology; General Director, Research Institute for Nature Management, Arnhem.

**Paper (2): Quantity—Quality Relationships**

\*Mr. Lujo Toncic-Sorinj: Secretary General, Council of Europe, Strasbourg.  
Presented by: Professor O. Reverdin (Switzerland): Member, IUCN Executive Board; Faculty of Letters, University of Geneva.

*Panel Members:*

- 1 Professor D.H. Pimlott (Canada): Member, IUCN's Survival Service Commission; Department of Zoology, University of Toronto.
- 2 Dr. Edward L. Towle (U.S.A.): President, Caribbean Conservation Association, St. Thomas, U.S. Virgin Islands.
- 3 Professor F.E. Wielgolaski (Norway): Member, IUCN's Commission on Ecology; Department of Botany, University of Oslo.

*Rapporteur:* Mr. Joseph Lucas (IUCN)

*Secretariat Member:* Dr. John A. Staub (IUCN)

## SESSION A : ENVIRONMENTAL QUALITY IN A CHANGING WORLD

### Part 1: Paper (1)

## Planning for Diversity

D. J. KUENEN

*(Chairman, IUCN's Commission on Ecology; General Director, Research Institute for Nature Management, Arnhem)*

### SUMMARY

After a period of evolution of some 3,000 million years the biosphere contains an enormous diversity of species each needing specific circumstances to obtain food and to reproduce. The balance of numbers in each species is maintained by a complicated set of feedback mechanisms.

Man has had a devastating effect upon this complex system, wherever he has been active, resulting in destruction of the soil and its fertility, elimination of species of plants and animals, and situations of instability which have led to harmful numbers of certain pest species.

The precise relation between complexity and stability in the biocoenosis is still an object of study, but we know enough to be sure that any interference by man increases instability, unless ecological thinking is built into his activities.

We must preserve diversity in order to keep species of plants and animals for the purposes of biological control, domestication experiments, gene pools, new pharmaceutical products and the scientific study of the living world.

Further technological development is necessary in many areas, but we must not make the same mistakes that have been made elsewhere nor destroy the potentialities of the environment.

A well balanced environment is a prerequisite for a well balanced human society.

Technologically advanced countries must reorganize their land use so as to restore diversity wherever possible. Developing countries must remind themselves before it is too late that by concentrating on technological development and ignoring the natural diversity of the biosphere, they are squandering qualities which are becoming ever more scarce and, in the near future, will become invaluable.

Diversity must be safeguarded to leave the options open for meaningful future decisions.

### RESUME

Au bout de quelque 3,000 millions d'années d'évolution, la biosphère renferme une variété infinie d'espèces qui chacune exige des conditions bien définies pour se nourrir et se reproduire. L'équilibre des nombres au sein de chaque espèce est maintenu par un jeu complexe d'interactions.

Partout où il a exercé ses activités, l'homme a eu des effets dévastateurs sur ce système complexe, en provoquant la dégradation du sol et de sa fer-

tilité, l'élimination d'espèces végétales et animales, et un déséquilibre qui a abouti à des pullulations désastreuses de certaines espèces nuisibles.

La relation exacte entre complexité et stabilité dans la biocénose fait encore l'objet d'études, mais nous en savons assez pour pouvoir affirmer que toute ingénierie de l'homme accroît l'instabilité, à moins que les données de l'écologie ne soient intégrées dans ses activités. Nous devons préserver la diversité, afin de garder des espèces végétales et animales qui pourront servir à la lutte biologique, à des expériences de domestication, à la constitution de 'pools' de gènes, à l'élaboration de nouveaux produits pharmaceutiques ainsi qu'à l'étude du monde vivant.

Le développement de la technologie est nécessaire dans de nombreuses régions, mais nous ne devons pas refaire les erreurs commises autre part ni détruire les potentialités de l'environnement. Un environnement équilibré est la condition essentielle d'une société équilibrée.

Les pays avancés sur le plan de la technologie doivent réorganiser leurs plans d'utilisation du territoire afin de rétablir la diversité partout où cela est possible. Les pays en voie de développement doivent se rappeler avant qu'il ne soit trop tard qu'en concentrant tous leurs efforts sur le développement technologique et en ne tenant pas compte de la diversité naturelle de la biosphère ils gaspillent des atouts qui deviennent de plus en plus rares et deviendront inestimables dans un avenir proche.

Il faut préserver la diversité pour conserver toutes les possibilités d'options pour des décisions qui seront prises dans l'avenir.

## **PLANNING FOR DIVERSITY**

In the course of some 5,000 million years the earth has developed from a globular mass of gas to what it is now. Probably about 3,000 million years ago life appeared. It is now scientifically established that life could have emerged from physical and chemical processes taking place on the surface of the planet itself. We can now discuss in terms of chemistry and physics the pre-biological evolution which led to the formation of complex structures which were the first organisms. An organism is a complex structure which exchanges material and energy with its surroundings, is capable of building up its body and reproducing its kind.

Biological evolution shows a number of characteristic patterns. One is the continued growth of complexity of organic life and, coupled with it, a steadily increasing diversity in life forms. As soon as the biochemical pathway for capturing solar energy, in the wavelength bracket of visible light, developed, the distinction between the photo-autotrophic and heterotrophic became one of the important aspects in this diversification. The input of energy was now canalized in an efficient way. Plants began to occupy more and more sections of the environment: sea, freshwater and the interface between soil and atmosphere. Most plants still have roots to supply them with water and the dissolved anorganic ions which they need to build up organic materials.

Animals followed and moved from water to land. Their dependence upon water became more indirect and they moved on land even more freely than in water. They have always remained dependent upon plants for the synthesis of organic materials.

The varying environmental qualities of the lithosphere and hydrosphere induced a growing variety of plant species, certain groups of plants exploiting

particular features of different localities. As vegetation developed the influence of plants themselves created new environments for new diversification.

The same happened with animals. We now see that practically every possible source of organic material is sought for by one or more species of animal. Leaves, buds, shoots, bark, wood, roots, rotting remains and underwater parts of plants provide them with food. Animals themselves are exploited by predators, scavengers, parasites and coprophagous species. Even the blood of vertebrates, enclosed in a system of blood-vessels with a subtle mechanism to stop excessive loss if one of these vessels is punctured, is used as food by a number of species. They have had to adapt their mouth parts to this special, excellent food and their saliva has been changed into an anti-clotting fluid of great efficiency. It is one of the most strange examples of the extremes to which evolution of a group of species can go to exploit valuable food sources.

The diversity of species is maintained by a complicated mechanism. In the first place the genetic system ensures a near perfect reproduction of all essential characteristics so that the qualities are kept in existence for innumerable generations. Sexual reproduction introduces a system of mixing of alleles which produces adaptability to changes in the environment, while the small errors in copying the genes introduce a fundamental factor of mutation which ensures the possibility of large scale evolution.

But the balance between genetic stability and instability is not enough to maintain diversity. A complex system of feed-back mechanisms in population numbers of every existing species results in a balancing of reproduction and mortality in such a way that short term fluctuations, which may be quite violent, level out in the middle term. This mechanism quite efficiently prevents any one species from crowding out others. But here also we find limitations and, partly through long term changes in the environment, species drop out and become extinct. In evolutionary history these drop-outs seem to have been replaced continually by other species.

In this delicate structure of species, environment and regulation, man has quite recently evolved. In the very recent past he has begun to change fundamentally the system from which he emerged.

He has altered the environmental situation to suit his pleasure: he has suppressed nearly all regulatory mechanisms applying to his own species by exterminating predators, stabilizing his food supply through agriculture and reducing the devastating effects of parasites. By building houses he has increased the habitable area and the numbers that can live per unit surface.

At the same time he has drastically simplified his environment and reduced the direct impact of environmental factors upon himself. This has had far reaching consequences. Many species of animals have been exterminated or reduced to small refuge areas where they may at any moment finally become extinct. On the other hand quite a number, particularly some rodents, birds and a number of insects have made use of the changes and have increased to sometimes astounding numbers. As far as we can see, this has nearly always been a consequence of simplification of the environment by the reduction of the number of species present.

Agricultural practices have been developed to improve crop production for the benefit of man. From that point of view a pest insect is a nuisance. But to the insect it must often seem as if some agricultural practices have been developed for the sake of cultivating particular insects. The situation for certain species seems exceptionally good: one kind of plant, often with special-

ly selected qualities to meet the specific demands of the insect, all in good growing condition and, due to their local abundance, easy to find. It is just a pest's paradise. We must be quite clear in our minds that insect pests are not an unhappy accident but the logical, necessary consequence of our way of growing plants. It is the simplification of the biocoenosis which provokes the nearly uninhibited increase in numbers of certain species.

Insecticides have helped but are not the final solution. Resistance develops and secondary reconcentration in food chains threaten many other non-target species, including man himself.

Modern views of entomologists include, as one possible way out, the reintroduction of a limited amount of diversity. It is a working hypothesis that stability in numbers and diversity in species-composition have a strong positive correlation. There are a number of observations which support this view. There are also some quantitative data which can help to explain why this must be so. The difficulty is, of course, that it is impossible to count the numbers of all members of a biocoenosis with sufficient accuracy to produce completely convincing data. Only under very simplified circumstances, when we deal with only a few species, can reliable estimates be made. But we also need to know what happens in more complicated situations. Unfortunately, we do not have the techniques to count a sufficient number of species at the same time without disturbing the community.

It would seem that it is important that a major concerted effort of a number of biologists be undertaken to advance our quantitative knowledge. Only by producing sufficient indisputable facts can we hope to convince those who are not *a priori* prepared to be convinced.

There are still too many people who believe that some technological solution will be found for man to live in an entirely artificial environment. They do not realize that the fact that three astronauts can live for a few weeks in a space capsule does not mean that three and a half billion people can do the same on earth. For quite a long time, to say the least, we will need plants for food production.

We are dependent upon photosynthesis for organic material and thus for our food. Plants and animals can be reared under partly artificial circumstances, but not on a scale sufficient to cope with the demands of the world's increasing population. Experience has shown that the complexity of nature is such that if we interfere we set in train disturbing processes without knowing it. Our agriculture is part of an overall system of life which cannot be disentangled. We must live in a complete world or there will be no world to live in. We cannot allow deterioration of nature to continue. If the process continues mankind will suffer in the very near future.

We have to rely upon nature's diversity for our organic products. We need gene pools to maintain the genetic variability of our domesticated species of plants and animals. The results of artificial insemination in European cattle already show up the dangers of a restricted reserve of genetic material.

We need a reserve of species as yet unused, for biological control, for new pharmaceutical products, for new domestication experiments. We need diversity for the study of the working of natural ecosystems. Only by doing so can we understand what is wrong with our simplified environment and take measures to remedy it

But there are other aspects to be considered. Apart from the necessary materialistic matters, there is the problem of mental health and development

of man himself. Our environment must produce food and should not contain too many toxic substances. But that is not enough. For the balanced development of man we need a balanced environment. Only then can real happiness be achieved.

For most of the world's peoples the environment is not as good as it might be. For a great many it lacks the facilities which technological inventiveness could provide. Those who live under these circumstances strive to increase the availability of all assets which have characterized the industrial development of the last century. At the same time those who think that they have all they want, and certainly more than they really need, are experiencing the negative aspects of a too technological way of living. The natural environment, after all, has a number of qualities which begin to become apparent from the moment they are missing. Industrialized man needs more diversity for recreation, relaxation and enjoyment of the quietness a natural landscape can give. It is in fact an enjoyment which few people do not appreciate, although sometimes hardly being aware of it.

The great danger at the moment is that the world will not learn in time from experience. In seeking to better their material circumstances—a goal which has first priority and should be supported by all—the danger is implicit that men will continue to make the same mistakes that have been made in industrialized countries. To avoid this, without giving up the advantages of further industrial development, it is necessary to include in the thinking process which should accompany planning, the preservation of a variety of options for the future. It is necessary to plan in such a way that existing diversity is maintained and various possibilities for the future are kept open.

There can be no doubt that a diversified environment is a prerequisite for well balanced people. For children, in particular, it is a necessity. Playtime is part of a child's development and education and, to give a child scope to play, a choice of environment is needed. This can be realized in the simple form of the structure of a street and a town, by means of urban parks, but more specifically in the structure of the country outside urban areas.

By careful planning, a great many natural elements can be used in landscape building and a gradual merging into natural areas and national parks is an obvious way of attaining the maximum of diversity.

Developing countries do not have this need so much as yet because, in general, there still is a certain amount of variety left. But the rate at which this is being reduced, natural elements destroyed and monotonous environments created, calls up the spectre of the spoilt landscape, not fit to live in, already to be seen in so many parts of the globe. The final result will, in the long run, be no improvement upon the present situation, unless industrialization is developed within an overall plan for town, for province and for country, and—as we shall be adding, in twenty years from now—'for continent'.

Happiness does not come from unbalanced growth. Social improvement will attain a higher level if the environment retains as much of its diversity as can be reconciled with necessary changes. A well balanced landscape gives well balanced people. Winston Churchill once said—'First we shape our buildings and then the buildings shape us'. We can enlarge upon this and state that the landscape we live in shapes our lives; and we are responsible for the landscape around us as much as for our buildings.

There are a number of steps involved in the planning process. The first thing to do is to establish the situation as it is found. The second is to discover the

potentialities of the land. This needs a closer survey of soils, vegetation, animals and water supply, to name but the essentials. Sites for development schemes should be selected with an open eye for future use. The ecological consequence in each case should be studied as carefully as possible with the aim of excluding any unwanted or unnecessary side effects. Biologists are not always correct in their predictions. This is inherent in the immense diversity of the biosphere. But they can make fairly accurate estimates of the consequences of certain actions. In most cases they have obviously been right, whether their advice was heeded or not.

Not only can landscapes be built, but natural areas can be developed on land previously used by man. By carefully applying the knowledge gathered by botanists regarding the factors which induce the development of vegetation, it is possible to stimulate the development of natural areas. Once the vegetation is developing many animals will follow, as their powers of dispersal are often extraordinarily strong. When larger animals are involved careful introduction must be considered.

What we need is a worldwide system of examples of natural communities, showing their diversity and all the qualities which go with it. These areas could serve as models for many other areas where man's influence has been changing the original situation and where we wish to improve the situation. We can strive to correct the simplification wrought by thoughtless exploitation of natural values and thus attempt to improve the environment for plants, animals and so, ultimately, also for man himself.

We must keep options open for the future. By choosing one narrow solution we make any future policy modification difficult or impossible. In many cases we can increase diversity by careful planning. Often it is already too late to do so. We have already wrought irreparable damage. Over large parts of the world topsoil has eroded and the vegetation has been reduced to a few hardy species. It takes 3, 000 to 9, 000 years to produce a topsoil layer of sufficient thickness to allow permanent agricultural use.

We have created large areas of desert, which can only be reclaimed with great effort. But the deserts continue to encroach upon the agricultural land because we will not make the necessary effort. We have exterminated many animal species and will continue to exterminate more in the future. They will not be the ones we would like to be rid of. We are polluting rivers and lakes and seas and it will take dozens of years to repair the damage, if damage has not gone too far and has become irreparable. We are spreading poisons—insecticides and industrial waste products—at an ever increasing rate, and they will have far reaching effects on populations of plants and animals and man, long after we have stopped using them.

We do all this, regardless of the warnings that have been given, to satisfy our short term pleasure to the detriment of future generations.

We must mend our way of living soon. By preserving the diversity within the biosphere at the highest level we can achieve, we may help to pass on a world worthy to be lived in, a world rich in life and with a chance of happiness for those who have to live in it.

## SESSION A: ENVIRONMENTAL QUALITY IN A CHANGING WORLD

### Part 1: Paper (2)

## Quantity-Quality Relationships

LUJO TONCIC-SORINJ

*Secretary General, Council of Europe, Strasbourg*

### SUMMARY

There is no single quantity-quality relationship applicable to the total biosphere-technosphere complex; quantity is not wholly bad and quality is not wholly good. Greatly increased quantity is essential to satisfy the basic human requirements of food and shelter, even without meeting man's rising aspirations. This will make a heavy demand on resources. But higher quality almost always consumes more materials, energy and work-time. We have, therefore, to choose between certain quantities with certain qualities and other quantities with different qualities.

Although most of our modern problems stem from 150 years of industrial society, pre-industrial civilization also left a legacy of ecological havoc. Now we have not the excuse of ignorance: people realize that the quality of life has deteriorated despite and because of technological inventions and discoveries. Governments are beginning to take action on pollution reduction, waste disposal, urban and regional planning, and nature conservation.

I believe we have reached the turning point. The ecological havoc we are wreaking is not a necessary concomitant of the industrial system. The most urgent requirement is to re-establish our social order, and economic system, on an ecological basis. The environmental qualities we want will have to be paid for out of our disposable resources of materials, goods, services and capital. An enormous information and education programme will be necessary to re-direct thinking. I do not think that our only hope is to return to a village subsistence economy; but I do believe that citizens must be involved more directly in the government and management of their communities. It is our social order rather than the economic system that must be reshaped.

Our greatest problem is that of population, because it is the exponential driving force behind all the other exponential factors. Population growth cannot be expected to level off before about 2050 and therefore all our technological expertise to control pollution, rationalize waste disposal and encourage recycling must be used rigorously and immediately. Built-in obsolescence must go, in favour of durability, safety, silence and sensibility. This does not imply that the Gross National Product should be stabilized at zero, for clearing up the mess, improving the quality of life and keeping up with the increasing numbers of people will inevitably mean continuing growth.

### RESUME

Il n'existe pas de formule unique du rapport entre quantité et qualité qui

puisse être appliquée à l'ensemble du complexe biosphère-technosphère; le facteur quantité n'est pas totalement mauvais, pas plus que le facteur qualité n'est entièrement bon. Pour pouvoir satisfaire les besoins essentiels de l'homme—alimentation et logement—sans même aller jusqu'à combler ses aspirations grandissantes, il faut un accroissement quantitatif important. Ceci soumettra nécessairement les ressources à des pressions considérables. D'autre part, un accroissement qualitatif entraîne presque toujours une consommation accrue de produits de base, d'énergie et de temps de travail. Nous avons donc à choisir entre certaines quantités jointes à certaines qualités et d'autres niveaux quantitatifs joints à des niveaux qualitatifs différents. Si la majorité de nos problèmes actuels sont issus de 150 années de société industrielle, les civilisations préindustrielles nous ont elles aussi légué leur part de déprédations écologiques. Mais aujourd'hui, nous n'avons plus l'excuse de l'ignorance: l'homme a pris conscience d'une dégradation de la qualité de la vie, en dépit et à cause des inventions et des découvertes de la technique. Les gouvernements commencent à prendre des mesures à l'égard de la pollution, de l'élimination des déchets, de la planification urbaine et régionale et de la conservation de la nature.

Je pense que nous avons atteint un point décisif. Les bouleversements écologiques que nous provoquons ne sont pas une séquelle nécessaire du système industriel. Le plus urgent est de réaménager notre ordre social et notre système économique sur des bases écologiques. Les qualités que nous voulons voir à l'environnement devront être payées avec les ressources en matériel, biens, services et capitaux dont nous disposons. Il va falloir élaborer un vaste programme d'information et d'éducation pour réorienter les façons de penser. Je ne crois pas que notre unique espoir réside dans un retour à une économie de subsistance à l'échelle villageoise. Je suis cependant convaincu que les citoyens doivent participer plus directement au gouvernement et à la gestion de leurs collectivités. C'est notre ordre social plutôt que notre système économique qui est à remanier.

Notre problème majeur est celui de la population; celle-ci représente en effet la force motrice exponentielle qui met en mouvement tous les autres facteurs exponentiels. La croissance démographique ne pourra se stabiliser avant l'an 2050 environ; nous devons, par conséquent, appliquer immédiatement et rigoureusement toutes nos connaissances techniques à lutter contre la pollution, à rationaliser l'évacuation des déchets et à encourager la recyclage des matières. Le vieillissement attaché à tout produit doit être éliminé au profit des qualités de durabilité, de sécurité, de silence et de modération. Ceci ne signifie pas que le produit national brut doive être stabilisé à zéro car, pour réparer les dégâts, améliorer la qualité de la vie et suivre l'augmentation de la population, il faudra inévitablement avoir une croissance accrue.

## **QUANTITY-QUALITY RELATIONSHIP**

The theme of this meeting focuses on the necessity of applying our knowledge of ecological processes in deciding the direction, scope and speed of development. So interpreted, this theme is programmatic and expresses a positive philosophy. I wish to say at the outset that I fundamentally agree with this philosophy, and that it is in a positive and even relatively optimistic spirit that I shall deal with the subject I have been asked to introduce.

The first thing to observe as regards this subject is that its title 'Quantity-

quality relationships' has been couched in the plural form. There cannot, of course, be a single all significant quantity-quality relationship determining the whole biosphere-technosphere complex. But though it may be a commonplace to assert this, I believe it is useful to underline it with some force.

The fact is that in popular and I am afraid also in political discussion of today's environmental crisis, there is a tendency, sometimes subversive in intent, to oversimplify the issues at stake, to reduce them to a caricature in which 'quantity' is the villain and 'quality' the knight in shining armour. This dichotomy, opposing quantity and quality as irreconcilable enemies is, however, a fallacy. As in so many dramas of real life, the villain is not all evil and the knight is sometimes a Don Quixote or a defender of bad causes.

Food, housing, transport, machines, metals, chemicals and energy are needed in quantity to satisfy human needs of nourishment and shelter, and also of health services, education and a variety of other amenities. Indeed, the three billion people presently living on the earth need large quantities of all these things, directly or indirectly supplied by the biosphere, to meet their elementary needs and rising aspirations. Actually we know that even the former, let alone the latter, are still today, despite the soaring figures of exploitation of the resources of the biosphere and rising productivity, tragically denied to the greater part of the earth's population; and the problem of supplying out of the biosphere's resources the needs and wants of the five billion humans predicted by the year 2000—less than 30 years ahead—will obviously be more than proportionately greater if increased standards of nutrition and other basic amenities are to become available to all, and if the sizable pockets of relative poverty in the developed countries are to be wiped out. Surely, in practical political terms there is no alternative in the short run but to maximize production and concurrently—but this is an issue of a different nature—strive to ensure a fairer distribution of the wealth produced among the earth's peoples and the groups of which they are composed.

The notion of quality is more complex. First, it is worth observing that quality—good or bad properties—cannot for all practical intents and purposes be dissociated from the physical objects or amenities to which they pertain. What is more, superior properties—whether in the form of higher protein content in foodstuffs, more exacting heat-resistance specifications of materials, durability or aesthetic design in consumer goods—are almost invariably greater consumers of materials, energy and work-time; therefore higher priced and consequently out of reach of the masses and reserved for the elite. Similarly, natural amenities such as air and water, vegetation and landscapes of the qualities required for physical recreation and spiritual enjoyment depend on the use or abuse we make of them, and as they become scarce from having been abundant, they also have to be costed in global and local biosphere accounting where earlier they could be regarded as free.

Because environmental qualities ultimately involve a price in terms of resources we are permanently faced with a choice not between quantity *or* quality but between certain quantities of things with certain qualities and other quantities with different qualities—higher or lower. The general rule is that, wherever scarcity factors intervene and at any given level of technology and productivity (we might call this the inverted law of Gresham), superior quality has to be paid for in terms of quantity and, conversely, superior quantities in terms of quality. It follows that the notions of quantity and quality are in extricably intermeshed and require to be integrated in any appraisal of the life-supporting capacity of our planet. Though bread is a primary concern, we live not by bread alone.

The environmental crisis we are faced with today is, I believe, at one and the same time a legacy of the accumulated errors and sins committed in ignorance and thoughtlessness during the past 150 years in our industrial societies and a wakening up to the implications of the exponentialities of population and living-standard growth.

As regards the legacy, we know of course that pre-industrial civilizations, particularly in the sub-tropic areas, have occasionally made an ecological mess of things, leaving deserts in their wake where once the soil had borne forests and crops. This, our industrial societies are today on the verge of repeating on an unprecedented scale and at a staggering pace, both determined by the interlocking and accelerating growth of population, production and consumption, with their sequel of spreading cities and transport systems, pollution and wastes: with this difference, however, that we no longer have the excuse of ignorance nor the wide margins of tolerance that could, possibly, a hundred or even fifty years ago, exonerate thoughtlessness. Yet the cassettes warning us that our societies were on a catastrophe course long went unheard. As late as 1961 when the first intergovernmental machinery was set up, in the Council of Europe, to advise governments on conservation matters, it proved to be at first severely crippled by the indifference of the host of government departments and agencies involved, each dealing piecemeal in watertight compartments with various aspects of environment conservation and more often than not placing them low down in their scales of priorities.

In this respect, fortunately, and it is a first ray of hope, the situation has changed. Thanks to the unrelenting work of the cassettes, the gravity of innumerable ecological accidents, the degree of air pollution reached in the large cities, in particular, and such information and education campaigns as the 'European Conservation Year' organized by the Council of Europe in 1970, public opinion has become aware that the rising standards of living provided by the industrial society are to a considerable extent phoney. More and more, people realize that the quality of life has deteriorated despite, and partly because of, the multiplication of cars, plastic containers, detergents and other gadgets. Even more serious, the expectations of the living generation, not to mention that of future generations, for a better life are seen to be in jeopardy.

Simultaneously, pressed on by the anxieties of the public, political opinion in the industrial nations has started to concern itself with the environmental crisis and one government after another—the United States first, the United Kingdom and France next—is now organizing itself to cope with pollution reduction, waste disposal, urban and regional planning, and nature conservation.

Have we then come to a turning point? Can we, now, with reasonable confidence look forward to an improvement of our own and our children's and grandchildren's living conditions, including the factors of security and amenities that make up the quality of life?

Looking first at the specific problems of the industrial societies, I am inclined to answer in the affirmative. Without in any way minimizing the formidable scope and complexity of the task, I do not believe it is insurmountable, because the mess we have made and are still making worse does not flow from inbuilt weaknesses, a 'hereditary sin', of the industrial system. It is not the basic principle of the industrial system, to 'get more for less' by applying inventiveness and energy, which is at fault. Its by-products, pollution and waste, need not reach intolerable levels and volumes, nor be allowed to spread death in our streams and oceans or clutter up our countryside. If they do, it is because people fail to realize that harm is being done or, conversely turn a blind eye on it because it would involve costs to avoid the harm. The irra-

tional spread of our cities, grids, road networks, the wastelands abandoned by unprofitable agriculture, the scars left by mining—none of this, either, is the fault of the industrial system, but of bad husbandry and short-sighted planning. Ignorance, thoughtlessness, negligence and lack of intelligent appraisal and planning are thus the culprits. In other words, the gravest flaws of our industrial societies are rooted in the social order we have instituted, which has permitted these things to happen.

What is indispensably and urgently required today, if we are to reverse the course and steer away from impending disasters, is that we establish our social order, and through it our economic system, on an ecological basis. This means first that diseconomies, externalities and social costs have to be worked into our national accounting. It means that research and technology have to be re-oriented towards developing clean and space-saving industries, waste disposal and transport systems, bio-degradable chemicals and material recycling systems; that urban and regional planning has to be re-thought to take into account factors of scarcity, the supporting capacity of the ecosphere as well as the quality of life requirements of the population.

The reform of our economic account, which I have spoken of as one of the prerequisites, involves far more, of course, than a face-lifting operation in budgeting. Indeed, it must go hand in hand with profound changes in the economic and social preferences of citizens, amounting to a veritable revolution in our attitudes and expectations. For it is certain that clean air, clean water, well-planned cities and a rationally managed and attractive countryside, now increasingly demanded by citizens because they are indispensable for their material and spiritual well-being, have a price tag. In other terms, the environmental qualities we desire have to be paid for out of our disposable resources of materials, goods, services and capital. The change of preferences will, as I have intimated, necessarily be accompanied by numerous and substantial adjustments in present price-relationships to which producers and consumers will at first balk. Government, parliament and the courts will have to adopt very firm policies of fiscal incentives and disincentives as well as other coercive methods, such as fines, if we are to bring about a real change in the face of profit-greed, socially unacceptable speculation, habit and inertia.

Along with ecologically-based, general economic and social policies, and re-orientation of research and technology, an enormous information and education effort will be required to steer us into and keep us on the new course. The change in attitudes and ways of life required will not come about of themselves even though they offer hope of a richer life where the present course promises despair and doom. One reason for emphasizing this aspect of the task ahead is, of course, that individuals (as well as multi-billion dollar corporations) are polluters, who can and must bring their separately small, but collectively important, contribution to the cleaning-up operation. One may single out the agricultural profession as an example, as it is well-known that the harm done by certain pesticides is due as much or more to bad handling and irrational use as it is to inherent chemical properties. But, we are in fact all implicated, whether as household-heaters, car-users or tourists.

Viewed from the economic angle, it is quite possible that the savings gained in the form, notably, of the lighter administrative machine required to enforce regulations affecting private environmental behaviour would pay a substantial part of the cost of the informational and educational campaigns.

A more important reason, however, is that we cannot, in the type of democratic systems we cherish, hope to carry through programmes that will be felt to involve sacrifices in the standards of living—as they are now understood—except with the consent of enlightened citizens.

But, here again, I am fundamentally optimistic because I believe that most people, the young especially, can be sensitized to their responsibilities as members of the community, provided they are given guidance and the possibility of participating personally in its improvement.

In fact, though I do not share the nostalgic and unrealistic belief of the authors of 'A Blueprint for Survival' that our only salvation is to go back to the village or small-town subsistence economy, I do believe that we must and can find ways and means of involving citizens more directly in the government and management of their communities. Again, therefore, it is our social order more than our economic system that requires to be adapted to fit human aspirations, rather than the other way around. Here lies the root of that sense of alienation that throws so many of our citizens, particularly among the young, into the arms of the prophets of despair. It is, therefore, vital that the information and education campaign I am advocating should be accompanied by a substantial increase of research resources in the social science sector.

These relatively optimistic conclusions regarding the ability of industrial nations to strike a balance between quantity and quality, between needs and wants and resources, between conservation and development, have to be tempered by one overriding consideration: the relationship of numbers of living beings to the total supporting capacity of the earth, the problem of exponentialities and, ultimately, of the survival of the human race.

At this point the quantity-quality relationships problem enters a new dimension, transcending the situation and foreseeable prospects Of the industrial nations; and here one feels far less confident of the answer.

First it must be recognized that the evidence is contradictory. On the one hand, the nightmarish juggling by the distinguished MIT scientists in their work 'Limits to Growth' with the intersecting curves of extrapolated exponentialities: rocketing population growth, staggering consumption growth, and somewhere at the end of the day, the choice between materials exhaustion and starvation or ecocatastrophe. On the other hand, the projections, of no less distinguished scientists, of scientific and technological breakthroughs which would place at humanity's disposal virtually unlimited energy resources and the power to turn all wastes back into re-combinable elements and re-usable materials.

Manifestly, the margin of uncertainty is very great either way. The MIT nightmare is not—nor does it claim to be—a prediction of what will happen, but of what could happen, because it does not, and cannot, assess the impact of human responses in science, technology and politics. Likewise, the Promethean promises are uncertain almost the the degree of irrelevancy on the critical point of *when* the breeder reactor will come into large-scale use and, beyond that, the atomic fusion process will be tamed, and *when* molecular welding will become translatable into complete recycling systems.

In this impassioned debate on the environmental crisis and human survival, where the issues are still so clouded, panic and complacency are equally dangerous advisers, and the counsel of sanity is to keep our heads and insist on caution.

What then does this approach suggest? By which overriding considerations should our policies be guided?

First and foremost we must start to get a grip on the population problem, because population is the exponential motor of all the other exponentialities. Here, again, unless we envisage enforced birth regulation, information and

education have a crucial part to play. For many reasons, but principally because they are the heaviest polluters and consumers of material, not merely absolutely, but what is more significant in this context, per capita, the peoples of the industrial nations have to take the lead in achieving population stability as soon as possible. In many of our European countries there is the additional inducement that population densities are already among the highest in the world and in some places exceed optimal and even optimum limits.

But since we cannot, even on the most optimistic assumptions, expect world population growth to level off—probably at a figure of around 15 billions—until about the year 2050, it is abundantly clear that the best anti-pollution devices, waste disposal methods and recycling systems available with our present technologies have to be put into effect quickly and rigorously.

Another change we should bring about that could be highly significant in terms of materials and energy saving is to move away from our present commercially-induced fad for consumer gadgets of all kinds, most of them badly made and intended to be quickly discarded to make way for new commercially-induced fashions. This mentality is simply not compatible with the efficient management of a social system that has to start husbanding the resources of the biosphere. Instead of obsolescence being deliberately built into our household equipment and motor cars, we should insist on durability as well as safety, silence and sensibility. The warnings of industry and trade unions that this would bring the economic machine to a standstill, with massive unemployment as a consequence, hardly ring true if we consider the growth and employment potential of the new industries we shall need to deal with pollution and waste disposal, not to mention the public and private investment that will be required to improve housing, urban mass-transport and leisure facilities in town and countryside.

I wish to emphasize, as I stated at the outset, that these suggestions in no way imply that we should aim at stabilizing Gross National Product at zero. In quantitative terms—for instance numbers of cars per unit of time—personal consumption will no doubt have to make place for the cost of cleaning up the mess, improving the quality of life and keeping up, for the time being, with increasing numbers of living beings, not only in our own developed societies but also in the developing countries of the world, where the introduction of the policies required to balance human demands and natural resources will probably be impossible to realize without an increased flow of capital and technology from the richer countries.

In the last analysis, the fundamental lesson to be drawn from the environmental crisis is that we have only One Earth, as Barbara Ward and Rene Dubos have very aptly called their profound and sober report for the UN Conference on the Human Environment; only one finite unitary biosphere, where all our multitudinous activities interact with delicate and complex natural balances that we cannot any of us afford to ignore, being all equally dependent on them, and that we must respect and learn fully to understand.

The UN Conference on the Human Environment in Stockholm has had the lasting merit of bringing this truth home to hundreds of millions of people, and 114 governments there pledged themselves to cooperate to turn the tide of events and to give the UN itself the machinery and resources to assist in this task. We must all back up its efforts, not the least to set up a world-wide monitoring system. We must, however, also all of us in our different regional organizations make haste to solve the specific and often very different problems we have in common at that level.

The Council of Europe—the first regional organization to convene a ministerial conference on the environment, to be held in Vienna at the end of March 1973—is determined to make its contribution in the conviction that what it does is also to the benefit of our One World.

## SESSION A: ENVIRONMENTAL QUALITY IN A CHANGING WORLD

### Part 1: Discussion

After introducing the authors of the Papers (of whom the second was being represented, in his absence, by Professor Reverdin) and the members of the panel, the Chairman, Mr. **Nicholson**, commented briefly on some of the themes of the two papers which had been contributed as the basis for discussion. Professor Kuenen's focussed attention on the biosphere and the extent to which its self-regulatory mechanisms are based on diversity. Man has tended to assume that its diverse resources are inexhaustible, which had led to the belief that he can do what he likes with them. Every effort must be made to change this fatal attitude before it is too late. All would agree with Mr. Toncic-Sorinj that reform will not be possible without full public understanding and support, but he made a most valuable point in insisting that a simplistic approach to the environmental crisis is hopelessly mistaken: havoc is by no means an inevitable accompaniment of a civilization, as had also been made clear by the Keynote speakers at the previous day's plenary session. Economic growth is implicit in clearing up the mess in which we find ourselves.

Introducing his paper, Professor **Kuenen** said that he had had difficulty in finding the right balance between setting out the facts and trying to formulate the thoughts and ideas to be drawn from them. He hoped that more of the detailed considerations would be brought out in discussion, since we must always try to steer towards factual solutions: even now a biologist can only say that he *believes* that diversity is the key to stability, but exactly how this operates is still imperfectly understood. One aspect which had been intentionally omitted from the paper, for reasons of space, but might merit some discussion, concerned the ethical and aesthetical arguments in favour of maintaining diversity.

After summarizing the contents of Mr. Toncic-Sorinj's paper, Professor **Reverdin** expressed the view that its most important message, with which he was in complete agreement, was that the sound management of quantity-quality relationships was now fully within the competence of governments, always provided that they are given solid backing not only by scientists but also by public opinion as a whole.

Called on by the Chairman for preliminary comments, panel member Professor **Wielgolaski** offered a detailed example, in relation to Professor Kuenen's remarks, of the way in which the removal of a single species can effect ecosystem stability. With the extinction of the wolf in southern Norway, man had become the only serious predator on the reindeer, with adverse effects on the size of the animal due to his preference for hunting large males. In these circumstances, the possible advantages of reintroducing wolves were worth considering. In fragile environments, especially, changes in species composition can come about very quickly. IBP studies in Norway have shown the decline in plant diversity to be mainly due to human and domestic animal use; trampling by livestock is a well-known cause of erosion. In general, the impact of land use on natural diversity needs much more detailed study, on the lines of some of the work now being done in Czechoslovakia (based on records of land use in one area dating back several centuries) and in Norway. It is to be

hoped that IUCN, in collaboration with UNESCO's MAB programme, will encourage such research.

**Dr Towle**, panel member, expressed the view that while planning for diversity is an intriguing concept, Professor Kuenen's paper did not perhaps throw much light on how planning can and should be applied. The fact is that, while much is now known about diversity and its evolution, we have only a very superficial notion of how to plan for it. In his work in small islands he had been very concerned by the lack of a technology, of a technical procedural system, for translating ecological principles into factual planning. On the subject of the relationship of quantity and quality, he agreed with Mr Toncic-Sorinj that exponential population growth was now the major factor, but it was difficult to see how planning could take account of it without disturbing the diversity of ecosystems.

The third panel member, Professor **Pimlott**, speaking as a scientist and citizen-naturalist, believed that the most important point to emerge from the papers was the necessity for keeping the options open. Personal involvement or interest in exploiting particular resources was irrelevant and he recalled a Canadian example where, in 1968, a leading part had been taken in the campaign to safeguard the multiple assets and integrity of the Quetico Provincial Park, in the face of a project for wholesale logging, by someone who had no desire at all to visit the Park. In the same way he shared the anxiety that the plant and animal wealth of East Africa should be preserved for posterity, although he had no expectation himself for making use of the opportunities for study and enjoyment.

Before calling for contributions to the discussion from the floor, the **Chairman** made two further comments. It was clear that population growth was a key factor and at present the whole approach to it was to encourage and facilitate control. But it was worth considering whether more might not be achieved by concentrating on improving the quality of life for women and children, who still tended to form an underprivileged segment of society, cut off from many of the values represented by the diversity of natural environments. Secondly, although some emphasis had been placed on the need for more professional, less amateurish planning, and the trend is certainly in that direction, planning cannot and must not become the exclusive field of the professional: the widest possible public understanding and involvement remain essential.

The following were the main points made in the ensuing discussion.

More emphasis should be placed on maintenance of gene pools or genetic diversity. In relation to crop-plants this is threatened by the spread of high-yield varieties derived from a dangerously narrow segment of genetic variability, resulting in loss of disease resistance. Thus in 1970, 20% of maize production was lost through an epidemic of corn leaf blight, because the hybrid strain in common use was developed largely from Texas cytoplasm, which is susceptible. If a wide variety of genetic resources remains available from which to breed disease resistance and other desirable qualities, less reliance will have to be placed on chemicals, which can be harmful if misused. Out of 300,000 species of higher plants, only about 20 are yet used as food for the majority of the world's population and the potentialities are still scarcely explored. Since conservation of genetic diversity demands not only the maintenance of germplasm stocks, but the reservation of natural areas where evolutionary forces continue to operate, this is a field in which IUCN is specially suited to take a lead and supplement the technical initiative of F.A.O.—G. T. **Scarascia-Mugnozza** (Italy)

The committee on the Conservation of Mountain Regions of IUCN's Commission on Ecology is constantly stressing the very serious effects that misuse of mountain areas has on the quality and diversity of surrounding areas, ranging from the annual loss of an estimated 1-2% of the world's arable lands to all the damage and destruction that results from the diminution of forest cover and erosion. In view of the effects on national economies, the Committee believes there should be a series of discussions of the problems involved, leading up to a full-scale conference in 1974, and also supports the idea of forming working groups to evolve action programmes in specific fields such as control of erosion—**Kh. P. Mirimani** (USSR).

With reference to Professor Wielgolaski's remark on the effect of human hunting bias on reindeer populations, this is surely a matter for the enactment of appropriate legislation to ensure regulated selective hunting, as has been done in Germany. Enforcement is a problem, but if an offence can be proved, licence forfeiture is an effective sanction. Referring to Dr Towle's remarks, one may add that perhaps the main obstacle to planning is that there is insufficient scientific collaboration: few scientists are willing to spend time and energy in what is often difficult and controversial public discussion—**W. E. Burhenne** (Federal Republic of Germany).

A number of problems in gene pool conservation need to be stressed. Thus the lack of uniformity and localization of species in tropical forests means that it is difficult to assess their genetic value and food source potential or to work out the minimum size needed if a reserve is to be effective. Another set of problems in the tropics concerns the intricate relationships of plants and animals in such matters as pollination (papaya may be pollinated by mosquitoes) and seed germination; they involve co-evolution and successional processes the disturbance of which may have far-reaching consequences—**H.O'R.Sternberg** (USA/Brazil)

Lors de la récente conférence tenue à London (Ontario) sous les auspices de la Commission d'éducation de l'UICN, les problèmes de la qualité de la vie et de la diversité ont fait l'objet de discussions dont les deux aspects suivants sont à noter: (a) beaucoup de nos difficultés résultent de ce que le savoir a été de plus en plus compartimenté: pour que des progrès substantiels puissent s'effectuer dans la gestion de l'environnement, il faut opter pour une approche interdisciplinaire, qui constitue une condition essentielle à la sauvegarde de la diversité; (b) il faut agir au niveau des responsables des prises de décision pour que ceux-ci en arrivent à une meilleure perception des interactions des éléments de diverse nature qui entrent en jeu dans tout projet d'intervention dans l'environnement. La Commission d'éducation se propose, par exemple, de réunir l'an prochain, à Rocque, des ingénieurs civils afin de leur donner les bases d'une éducation mésologique—**Michel Maldague** (Canada).

Arising from Professor Pimlott's comments, one most disturbing effect of technological progress is the blotting out of human cultures and ways of life. This is as serious as the loss of species and biotic communities. We should plan to set aside areas in which certain ways of life may be pursued just as much as to protect natural diversity, and we need to safeguard such areas and their inhabitants from the encroachment of other cultures—**R. F. Dasmann** (IUCN)

Two of the conclusions to be drawn are that monitoring on a global scale is essential—for example monitoring of pollution in southern Norway is concerned with pollutants originating in central Europe—; and, secondly, that education is needed at all levels so that planning from the earliest stages is undertaken in

the knowledge of possible ecological consequences—**F.E.Wielgolaski** (panel member). °

Reference was made, previously, by the last speaker, to the possibility of reintroduction (in this case of the wolf) to restore stability: this is often much more of a sociological than a biological problem. Indeed one thing which has emerged from the discussion is that sociological factors, especially in relation to promoting a better understanding of ecological principles, are often the most important—**D.H. Pimlott** (panel member).

Three brief comments in conclusion. Basically the population problem is due to disruption of feed-back processes brought about by the control and slowing down of mortality. Secondly, the cultural conservation referred to by Dr. Dasmann needs a very special approach and terminology, which can only be worked out in the closest cooperation with sociologists. Thirdly, the difficulty mentioned of establishing the minimum area required for effective maintenance of genetic diversity, is complicated by the fact that the habitat requirements of, for example, a plant species are constantly changing as the plant grows—**D. J.Kuenen** (author of Paper 1).

**SESSION A**

**ENVIRONMENTAL QUALITY IN  
A CHANGING WORLD**

**Part 2:**

**SESSION A: PART 2**

*Chairman:* Mr. Zafar Futehally (India): Vice President of IUCN; Hon. Secretary, Bombay Natural History Society; Hon. Secretary, WWF (Indian National Appeal), Bombay.

*Authors:*

**Paper (3): A la Recherche d'une Moralité Nouvelle**

\* Professor Théodore Monod (France): Member, IUCN's International Commission on National Parks; Muséum national d'histoire naturelle, Paris.

Presented by: Dr. Ch. Jouanin (France): Vice President, IUCN Executive Board; Laboratoire d'Ornithologie du Muséum, Paris.

**Paper (4): Quality of Life in Different Cultures**

\* Professor D. P. S. Wasawo (Tanzania): Tanzania National Scientific Research Council, Dar es Salaam.

Presented By: Mr. Baba Dioum (Sénégal): Member, IUCN Executive Board: Directeur des Eaux, Forêts et Chasse du Sénégal, Dakar.

*Panel Members:*

- 1 Professor A.G. Bannikov (USSR): Member, IUCN's Survival Service Commission; Department of Zoology, Academy of Veterinary Sciences, Moscow.
- 2 Mr Anthony Wayne Smith (USA): President and General Counsel, National Parks and Conservation Association, Washington, DC.
- 3 Mr M. van der Goes van Naters (Netherlands): Member, IUCN's International Commission on National Parks, Wassenaar.
- 4 Mr R. D. Piesse (Australia): Director, Australian Conservation Foundation, Parkville, Victoria.

*Rapporteur:* Mrs Paule Gryn-Ambroes (IUCN)

*Secretariat Member:* Mr. Alfred Hoffmann (IUCN)

## SEANCE A: LA QUALITE DE L'ENVIRONNEMENT DANS UN MONDE EN EVOLUTION

### 2<sup>ème</sup> partie: Document (3)

## A la recherche d'une moralité nouvelle

THEODORE MONOD

*Membre, Commission International des Parcs Nationaux de l'UICN;  
Professeur au Muséum National d'Histoire Naturelle, Paris*

### RESUME

En inscrivant à l'ordre du jour de sa 12<sup>e</sup> Réunion technique un tel sujet, l'UICN prenait une initiative heureuse, et attendue. C'était en effet la reconnaissance de la place de l'éthique dans le mouvement en faveur de la conservation de la nature. Alors que trop souvent, dans un passé récent, on avait insisté sur le seul aspect économique de la défense de la nature, l'importance du facteur moral se voit, enfin, désormais reconnue: le terme d' 'éthique de l'environnement' est employé par des chefs d'Etat.

Après avoir rappelé le fondement de la morale suivant Schopenhauer et Schweitzer, parmi les rares penseurs ayant adopté une éthique du respect de la vie, l'auteur pose la question: 'Une moralité nouvelle?', à laquelle la réponse sera: oui et non, tout à la fois puisque les exigences de la morale *lato sensu* sont connues depuis des millénaires mais attendent de se voir, enfin, transcrites dans les faits et concrètement appliquées. Seul un changement décisif d'orientation, fondé sur les impératifs de l'éthique pourrait, en arrachant l'homme à l'idolâtrie d'une technologie devenue une fin en soi et à la religion du profit et de l'argent, le sauver des menaces qu'il a, inconsciemment jusqu'ici, et imprudemment, accumulées sur sa route.

Il va donc falloir enfin choisir entre le 'plus' et le 'mieux', entre 'l'avoir' et 'l'être', entre la seule quantité et la qualité, entre le *Discours de la méthode* et le *Discours de la vie*. L'alternative se précise chaque jour: ou une révolution éthique à penser puis à faire triompher, ou l'implacable montée des périls. Ou une moralité résolument neuve, ou, du moins foncièrement ré-orientée et la bataille gagnée de la 'révolution contre l'absurde', ou la victoire, et cette fois définitive, de l'inhumain. *Tertium non datur*.

### SUMMARY

By including this theme on the agenda of its 12th Technical Meeting, IUCN has taken a most welcome and awaited step. It means in effect the recognition that ethics have a place in the conservation movement. Whereas in recent years emphasis has all too often been exclusively laid on economic aspects of nature conservation, the significance of the moral factor is at last recognized. Now the term 'environmental ethics' is one that heads of states themselves are apt to use. After reminding his readers of the fundamentals of moral philosophy, as taught by Schopenhauer and Schweitzer, two of the few thinkers who have based their views on the ethic of a respect for life, the author asks 'A new morality?', to which the answer is both yes and no: the moral imperatives

*lato sensu*, have been known for thousands of years, but are waiting to be translated at last into facts and implemented. Only a decisive reorientation, based on the requirements of ethics, could, by tearing man free from the idolatry of a technology, which has become an end in itself, and from the religion of profit and money, save him from the threats which he has until now unconsciously and unwisely built up in his path.

The choice will thus necessarily lie between 'more' and 'better', between 'having' and 'being', between mere quantity and quality, between discourse on method and discourse on life. The alternatives are becoming clearer each day: either conceive and enforce an ethical revolution, or witness the implacable onset of perils; either a resolutely new or at least basically redirected morality and victory of the 'revolution against absurdity', or, alternatively, the victory, final this time, of inhumanity. *Tertium non datur*.

#### A LA RECHERCHE D'UNE MORALITE NOUVELLE

'... donner une dimension spirituelle au progrès' (Ph. Saint Marc, 1971)

'*Discours de la Méthode* ou Discours de la Vie ?' (D. Siboney et D. Guedj, *Survivre*, no. 10, 1971)

On ne devrait évidemment pas pouvoir s'avouer surpris qu'une réunion 'technique' de l'IUCN fasse sa place, il faudrait dire: fasse *enfin* sa place, & un problème en réalité aussi primordial, aussi fondamental que celui des bases morales de l'attitude de l'homme en face de la nature et, singulièrement, des êtres vivants.

Et cependant, c'est avec un certain étonnement que l'on voit aujourd'hui l'éthique acquérir droit de cité parmi les préoccupations explicites, ouvertement manifestées, et désormais quasi officielles de l'IUCN. C'est que cette attitude, dont je ne saurais trop, personnellement, me féliciter, représente ici, il faut bien le reconnaître, un courant de pensée à divers égards assez nouveau. En effet, les pionniers du mouvement pour la défense des êtres vivants et de leurs habitats étaient avant tout des naturalistes, sensibles au caractère non seulement insensé mais immoral, voire, pour certains, impie de nos économies de proies et du joyeux saccage de la planète auquel se livrait sans remords une société industrielle ne reconnaissant pour loi, pour religion que celle du profit. Et puis l'on devait voir disparaître du titre de l'Union le mot généreux de 'protection', remplacé par celui de 'conservation' tandis que se faufilait à la suite de ce dernier celui de 'ressources'. A une attitude qualifiée, avec peut-être une pointe de réprobation, de 'sentimentale'—adjectif devenu, paraît-il, péjoratif—se voyait, au moins partiellement, substituée une philosophie ou, plus exactement, une politique plus terre à terre, plus sage, plus raisonnable, plus 'réaliste', celle de la rentabilité (matérielle, bien entendu), celle de l'utilité pratique, celle que professait un Ministre français de l'Agriculture ne voyant dans la protection de la nature qu'une opération économique et devant 'payer', ou l'un de ses collègues, Ministre de l'Équipement, avouant: 'Je n'ai pas la manie des sites. De tous temps les hommes ont recherché la compagnie des arbres. C'est là qu'il faut construire'.

La réapparition de l'équation morale au sein de l'IUCN, si plusieurs d'entre nous, cela va sans dire, ne l'avaient jamais oubliée ni reniée, vient très heureusement rappeler que rien de durable, rien de solide ne sera jamais bâti sur les fondements instables, passagers, temporaires du profit économique ou de la réussite technique. Les *vrais* problèmes, les *vrais* mobiles, l'idéal

*véritable* et ses exigences sont, évidemment, ailleurs. Il n'y a pas d'action pleinement efficace, c'est à dire enracinée dans une vision globale de la réalité humaine et de son devenir, en dehors d'un choix et d'un choix faisant référence à un système de valeurs immatérielles. Ph. Saint Marc l'a fortement affirmé dans un livre lucide et courageux (1971): 'la politique économique suppose une métaphysique'. C'est l'évidence, mais le sait-on déjà chez les puissants du jour, responsables de l'avenir de la planète et de ses habitants ?

Les naturalistes, eux, en tous les cas, ne l'ignorent pas: après Charles Elton (1958), Marston Bates notait (1961) que trois ordres de considérations devaient inspirer nos relations avec la nature: éthiques, esthétiques, utilitaires, avec l'intention de maintenir les diversités naturelles ce qui est '*morally the right thing to do*'. Ce qui implique l'acquisition d'une vision nouvelle du monde, d'une morale nouvelle, d'une conscience nouvelle. Utopie?<sup>(1)</sup> Rêverie? Je ne sais, mais une chose en tous les cas demeure désormais certaine: ou l'homme acceptera la réconciliation avec la nature, et les responsabilités qu'elle implique, ou bien il ira joyeusement engager sa race dans les plus graves périls.

Il faut donc à l'homme une éthique nouvelle ou, plus exactement, renouvelée, du moins s'il doit demeurer fidèle à sa vocation véritable et, ce faisant, écarter les menaces les plus graves que son activité désordonnée et imprudente a accumulées sur sa route. Faute de quoi, il renoncera & sa dignité d'homme: 'un système de valeurs morales construit sur la base du confort ou du bonheur individuel est tout juste suffisant pour un troupeau de bétail' disait Einstein.

La nécessité de parvenir à voir le combat pour l'environnement soutenu par des préoccupations morales se trouve d'ailleurs sans cesse plus nettement reconnu, mais rarement il est vrai du côté du Pouvoir. Et pourtant, ne voit-on pas apparaître les mots '*environ-mental ethic*' dans un document officiel américain<sup>(2)</sup>. C'est un fait dont il faut savoir se réjouir, encore que l'on souhaiterait aussi qu'aux *mots* le *faits* viennent répondre mais où est l' '*environ-mental ethic* ' dans les colossaux épandages de défoliants et autres poisons en Asie du Sud-Est?

### Principe et fondement<sup>(3)</sup> de la morale

On ne va pas, que l'on se rassure, tenter ici de 'traiter' un pareil sujet, entreprise échappant d'ailleurs totalement à ma compétence. Je me contenterai seulement de rappeler deux des plus importantes contributions à la création d'une éthique fixant à l'homme des devoirs à l'égard de la nature vivante.

La première est, bien entendu, celle de Schopenhauer (*Le fondement de la morale*, 1840, trad.fr. 1928), l'un des très rares philosophes à avoir su intégrer le monde animal dans son système de morale. Pour Schopenhauer la maxime fondamentale serait: *neminem laede imo omnes, quantum potes, juva*<sup>(4)</sup> qui résume tout le principe de la morale. Le fondement de toute éthique c'est la pitié, donc la sympathie, mouvement spontané où moi et non-moi se rejoignent et qui deviendra la source à la fois de la justice et de la charité, au sens fort, bien entendu, et paulinien de ce dernier mot: *ἀγάπη*, *caritas*. Il est évident que mis en pratique et appliqués aux relations de l'homme et de son milieu naturel, ces principes bouleverseraient le comportement des Etats comme ceux des individus: la nature pourrait, enfin, guérir des maux et des blessures que nous lui infligeons sans scrupules. On peut lutter pour la conservation par in-

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(1), (2), (3), (4): voir notes au fin.

térêt, immédiat ou non (assurer la prospérité et la survie de l'humanité), mais c'est seulement quand l'entreprise reposera sur des exigences morales reconnues et adoptées pour règle de vie que la victoire sera définitive.

Le second exemple est, bien sûr, celui d'Albert Schweitzer, acceptant le principe du respect de la vie comme base de toute morale. On connaît le texte classique où Schweitzer raconte comment, en pirogue sur l'Ogooué, en septembre 1915, il a eu la révélation de ce principe: 'Dans cette Afrique équatoriale habituellement si humide c'était la saison sèche et nous remontions lentement le courant, glissant furtivement, essayant laborieusement de deviner l'orientation des passes entre les bancs de sable du fleuve Ogooué. Perdu dans mes pensées j'étais assis sur le pont du chaland, m'efforçant simplement de me faire une idée claire et simple de l'éthique que je n'avais découverte dans aucune philosophie. Les feuilles défilaient sous ma plume couvertes de phrases sans lien les unes avec les autres. Je voulais simplement rester concentré sur le problème. Le troisième jour, tard dans la soirée, juste à l'instant où dans de soleil couchant nous nous faufilions à travers un troupeau d'hippopotames, quelque chose d'imprévu me frappa comme une lumineuse évidence, jamais encore formulée: 'respect de la vie'. La porte de fer avait cédé, voici que le sentier apparaissait dans la forêt touffue. Enfin j'avais tracé le chemin qui mène à cette idée qui englobe à la fois les mondes, l'affirmation de la vie, la morale: je savais maintenant que la perspective universelle sur le monde éthique—sur l'affirmation de la vie avec ses idéaux de civilisation—est fondée sur la pensée. Ainsi pour moi l'éthique n'est pas autre chose que le respect de la vie'.

La grande découverte (ou, plus exactement, re-découverte car la chose n'était neuve que dans l'Occident 'chrétien') c'était, bien entendu, que l'éthique, dépassant son cadre accoutumé mais limité—les relations d'homme à homme—allait, d'un coup, s'étendre à l'ensemble des êtres. On mesure les conséquences de ce principe et ce que deviendrait le monde s'il se voyait pris au sérieux, et résolument appliqué. Non seulement la non violence deviendrait une loi morale à la fois individuelle et collective mais les ravages de nos économies de proie se verraient interrompus, une ère nouvelle commencerait, celle de la guérison et de la solidarité.

Si l'éthique du respect de la vie est née si tardivement en Europe, ailleurs, elle était connue depuis très longtemps. Que l'on songe aux religions de l'Inde, au jaïnisme, au bouddhisme, au taoïsme, etc. Un célèbre texte chinois du XVe siècle, le *Livre des récompenses et des peines*, devance Albert Schweitzer de 500 ans avec des maximes comme celles-ci: 'Montrez-vous humains envers les animaux. Il faut aimer non seulement tous les hommes mais même tous les animaux... Quelque petits que soient un grand nombre d'entre eux, un même principe de vie les anime, tous sont attachés à l'existence, tous redoutent la mort. Il ne faut pas se livrer à cette barbarie qui porte certains hommes à les tuer... Ne faites pas le mal, même aux insectes, aux plantes et aux oeufs...'. Parmi les choses à éviter: 'lancer des flèches aux oiseaux, et chasser les quadrupèdes ... faire sortir les insectes de leurs trous, effrayer les oiseaux qui sont endormis dans les arbres ... boucher les trous des insectes, détruire les nids des oiseaux ... tuer les femelles qui portent, briser les oeufs des oiseaux...'

### **Une moralité nouvelle ?**

Oui et non tout à la fois.

Non, d'abord, si l'on songe qu'au fond il pourrait s'agir bien plutôt d'appliquer enfin, dans la pratique, des règles morales connues depuis bien longtemps

mais auxquelles les hommes n'ont jamais obéi qu'individuellement, et le plus souvent de façon très imparfaite et fragmentaire, mais jamais en groupe: les Etats, par exemple, n'ont pas de morale et n'ont jamais hésité devant le mensonge, la fourberie ou la violence.

Historiquement, l'essentiel des grands codes moraux de l'humanité se voit formulé de très bonne heure. En gros, avec les Vile-Vie siècles av.J.C, donc avec un âge moyen de 2500 B.P., on assiste à une floraison extraordinaire sans doute mais—et qui s'en étonnerait ?—aussi convergente que des sentiers gravissant, chacun de son côté, une même montagne: et voici, s'élevant coup sur coup comme les pièces successives d'un feu d'artifice éclatant en plein ciel: les Upanishads, Zarathoustra, le Tao de Lao Tseu, les prophètes pré-exiliques d'Israël, une religion de la non-violence (le jaïnisme de Mahavira) et le Sermon de Benarès: celui sur la Montagne n'est que de cinq siècles plus jeune mais vieux déjà pour nous de quelques 1940 ans. En fait, depuis vingt siècles les plus hautes expressions d'un idéal moral se trouvent déjà formulées et 'théoriquement' connues: il ne reste 'qu'à' les appliquer et à les traduire en actes. On voit mal, en tous les cas, ce que, dans ce domaine, nous pourrions avoir la prétention d'inventer.

Mais ce qui précède ne satisfera personne car en réalité, il y a tout de même du nouveau. Non pas, répétons-le, que nous puissions nous imaginer appelés à 'perfectionner' le *Tao-Te King* ou les Béatitudes, mais parce que notre propre tradition morale, judéo-chrétienne, 1° a présenté, dans le domaine qui nous occupe, de trop évidentes lacunes et 2° se trouve confrontée aujourd'hui à des problèmes nouveaux, créés par le développement anarchique d'une religion du progrès mécanique, du profit matériel, d'une technolatrie finissant par tenir l'objet pour une fin en soi indépendamment de sa valeur humaine et de toute signification morale.

1° Le premier point n'exige guère de développements tant il est évident. Quel est en effet le postulat des trois grands monothéismes, judaïsme, christianisme, islam sinon un anthropocentrisme radical, tenant l'homme pour le roi d'une création faite en quelque sorte pour lui seul et sur laquelle il va jouir d'un droit régaliens sans réserves, celui de la soumettre à son usage et de la contraindre à le servir. D'un côté un propriétaire souverain titulaire du *jus uti et abutandi*, de l'autre la propriété, animée ou inerte, mais indistinctement soumise au bon plaisir du maître, taillable et corvéable à merci. L'homme d'un côté, la nature de l'autre, tous deux créés sans doute mais sans aucun sentiment chez l'homme de responsabilité morale, de l'interdépendance des êtres, de la profonde unité du monde vivant, de la sympathie qu'en son sein doivent manifester les éléments psychiquement les plus avancés. De cette orgueilleuse philosophie qui ne voit dans l'animal qu'un gibier et dans le cosmos tout entier qu'une 'ressource', de ce triomphalisme élémentaire, les signes, hélas, abondent. Dès le récit de la création, l'homme est invité à remplir la terre et à l'assujettir, à dominer sur les poissons, les oiseaux, les animaux terrestres (Gen. I/28), et les préceptes noachides sont plus durs encore (Gen. IX/2-3): 'Soyez la crainte et l'effroi de tous les animaux de la terre et de tous les oiseaux du ciel, comme de tout ce dont la terre fourmille et de tous les poissons de la mer: ils sont livrés entre vos mains. Tout ce qui se meut et qui possède la vie vous servira de nourriture: je vous donne tout cela...' Belle maxime, et qui, au cours des siècles, excusera tout, l'extermination des espèces, tous les massacres, toutes les chasses, même les plus sauvages, toutes les cruautés, y compris celles des divertissements sanglants qui sont la honte de prétendues 'civilisations' qui ne sont trop souvent que barbaries mal camouflées.

Rien d'étonnant en tous cas que, partant de semblables prémisses, les religions du Livre n'aient envisagé les rapports de l'homme et de la nature que comme ceux de maître à esclave. Les théologies monothéistes se ressentent d'ailleurs jusqu'ici de ce mauvais départ et n'enseignent pas encore une éthique de la sympathie et du respect de la vie. Ce courant religieux d'utilitarisme et de matérialisme pratique allait d'ailleurs se voir rejoint et fortifié par un cartésianisme mécaniciste, théoricien de l'animal-machine. Plus que jamais la morale et ses devoirs ne pouvait concerner désormais que les rapports entre les hommes, à l'exclusion de tout le reste qui, évidemment, ne saurait compter.

Une seconde religion, en effet, celle du scientisme matérialiste et du progrès technique, s'est développée à partir du XVIII<sup>e</sup> siècle au point d'être devenue aujourd'hui la doctrine incontestée des Etats modernes, et d'ailleurs quelque soit leur régime économique: capitalisme et socialisme demeurent, avec des nuances sans doute, fondamentalement d'accord dans la pratique d'une mystique de la production, de l'exploitation des ressources naturelles. Si d'un côté la Genèse autorise la *Raubwirtschaft*, de l'autre c'est le marxisme qui entonne un hymne prométhéen à la domination d'un *Homo* soi-disant *sapiens* destiné à transformer la nature sous toutes ses formes: les finalités pourront être différentes, la pratique demeure très comparable.

Marculesco (1970, p. 400) se demande à ce sujet si le marxisme ne serait 'qu'un rejeton à peine hétérodoxe' de la théologie judéo-chrétienne et il poursuit: 'Est-ce l'idée de l'homme maître-de-la-nature, de l'unicité de l'homme, mandataire de Dieu, de l'anthropocentrisme qui est une conséquence de ce prétendu type théologique, qui ont amené les désastres qui nous menacent? La bombe atomique serait-elle une conséquence funeste mais prévisible d'une attitude qui conçoit la conquête, la domination, la maîtrise par l'homme de tout ce qui n'est pas lui, comme une loi fondamentale?' Remarques auxquelles fait écho le philosophe Paul Ricoeur (1970, p. 394-395): 'la mythologie productiviste est-elle inscrite directement dans le socialisme et commune à tous les régimes connus? ... rien ne dit que le phénomène cancéreux de croissance galopante de la technologie puisse être aisément jugulé et qu'un 'socialisme à visage humain' comme on dit, soit en état de maîtriser les forces déchainées de la technologie'.

On est souvent surpris de constater à quel point le dogme de la nature 'propriété' de l'homme a marqué la pensée occidentale. Qu'un forestier puisse déclarer (23-XI-71) que la forêt a besoin de l'homme, c'est qu'il ne songe qu'à la forêt jardinée, exploitée, source de profit et oublie la *vraie* forêt, celle qui est encore autonome et libre. Mais on s'étonnera de trouver sous la plume d'un ardent défenseur du milieu naturel cet aphorisme: 'la Nature n'a de sens que par l'homme, c'est pour lui qu'elle existe...' (Ph. Saint Marc, 1971, p. 250). Ici encore, on n'a sans doute songé qu'à la nature domestiquée, peignée, asservie de nos paysages occidentaux: il en existe encore, dieux merci, une autre. 2° Toutefois, si les morales traditionnelles n'ont en général pas voulu—ou pas su ?—découvrir la solidarité qui unit entre eux tous les êtres vivants, elle va se trouver, *volens nolens*, confrontée tout de même, et par le jeu même de l'activité humaine, avec les problèmes qu'elle avait cru pouvoir durablement ignorer. En effet, le moteur emballé de l'industrialisation panacée universelle, le libéralisme matérialiste du 'laisser faire', le culte de l'argent, une technocratie 'emballée' finissant par se prendre pour un but en soi, l'identification du seul progrès véritable, celui des comportements moraux et des finalités supérieures, avec celui du PNB tenu pour une valable mesure du degré d'évolution d'un pays, cent autres préjugés, erreurs ou hérésies, devaient bientôt porter leurs fruits, leurs fruits empoisonnés.

On le voit assez aujourd'hui et à l'ampleur des dégâts déjà commis, et à celle des menaces nouvelles pesant désormais, chaque jour aggravées, sur la planète, et aussi, il faut bien le reconnaître, à la notoire insuffisance des réactions de l'opinion comme de l'Etat devant la montée des périls. Ph. Saint Marc n'hésite pas à le proclamer (1971, p. 59): 'Ce dont la Nature a le plus besoin, c'est d'une politique nouvelle, d'un refus de laisser notre terre mourir pour le profit. Pour éviter la catastrophe, il faudra ralentir fortement l'expansion de la population... Mais cela ne suffira pas. La croissance économique, beaucoup plus rapide que la croissance démographique, continuera à aggraver les nuisances jusqu'au point de rupture psychique et physique, si nous ne transformons pas fondamentalement l'orientation du développement. Il n'y a pas de solution à la crise de l'environnement, si l'on ne change pas de système économique en substituant au libéralisme matérialiste un humanisme socialiste, au culte du veau d'or l'idéal d'un progrès de l'homme, au 'laissez faire' la direction de l'Etat, au nationalisme le mondialisme'.

Oui, mais qui écouterait la voix du prophète, risquant une fois de plus de crier 'dans le désert' ? Qui oserait, par delà les chatoyantes fascinations de l'apparence et de l'illusion, par delà les blandices du confort ou les tentations de l'intérêt, découvrir les *vrais* problèmes, les seuls *vrais* problèmes, ceux que ne résoudreont qu'un choix réfléchi et courageux: pour ou contre 'l'Homme et la Nature', plus que jamais inséparables? Car en face des dangers sans cesse croissants qui le menacent, l'homme ne se sauvera pas seul. Ou bien, se découvrant enfin solidaire de l'ensemble du monde vivant, il acceptera la réconciliation qui s'impose et renoncera à ses cruels orgueils, ou bien il ira tout droit, à bord du convoi emballé dont il ne contrôle déjà plus la course, à une catastrophe où il risque malheureusement d'entraîner, avec l'apprenti sorcier puni de sa déraison, d'autres êtres, eux bien innocents des apocalypses, nucléaires ou non, qui déjà rougeoient sur l'horizon.

L'un des symptômes les plus significatifs de la maladie qui nous ronge, le productivisme se retrouve chez les 'Tisserins', ces charmants Plocéidés tropicaux qui sont à ce point conditionnés par leur manie du tissage que, même quand ce dernier n'a plus de sens, par exemple en dehors de la période des nids, ils continuent à tresser inlassablement des objets inutiles. L'homme moderne a rejoint les Plocéidés puisqu'indépendamment de tout objectif raisonnable et justifié, il en arrive à faire les choses *non plus parce qu'elles seront utiles mais parce qu'on peut les faire* ... C'est l'objet, l'entreprise, la machine, etc. pris désormais pour une fin en soi. On fera l'avion supersonique, note un éminent écologiste, Sir Frank Fraser Darling, non parce que le joujou peut trouver une justification réelle mais simplement parce que l'on est devenu capable de le construire. Qui ne voit le danger? Et les trop nombreux exemples de ce 'plocéisme' dans les branches les plus discutables de notre activité, armements par exemple. Peter Harper l'a dit dans une excellente formule: '*Our problem is not that we don't know how to do things but that we don't know what we really want*'. C'est bien marquer que la solution du problème général dépassera toujours le cadre limité des questions économiques ou techniques: il y va de bien autre chose, et de bien davantage.

Un *Homo 'sapiens'* qui tiendrait à mériter une épithète aussi prématurée accepterait-il de se lancer à l'aveuglette dans d'entreprises hâtivement décidées et sans que les conséquences lointaines n'en puissent être encore connues? Est-ce se comporter en être moralement responsable que de risquer ainsi, soit pour un profit immédiat soit pour un simple accès de 'plocéisme', de compromettre l'avenir? A-t-on le droit de prendre des risques non mesurés et peut-être énormes au détriment éventuel des siècles à venir?

Existe-t-il par exemple une solution satisfaisante au problème de l'élimination des déchets radioactifs? Est-on certain que l'optimisme officiel en matière d'énergie nucléaire soit justifié? Beaucoup, et pour de solides raisons, le contestent. L'éthique, une fois de plus, et que l'on avait cru pouvoir exorciser, et récuser, tient à avoir voix au chapitre: qui oserait l'en blâmer?

### A la croisée des chemins: le choix des finalités

Deux jeunes auteurs soucieux de voir les biens non matériels intégrés enfin à leur tour dans la notion d'économie, jusqu'ici toute quantitative, n'hésitent pas à affirmer que 'la finalité économique n'est pas la sécrétion du *plus* mais l'avènement du *mieux*' (Barde et Garnier 1971, p. 317), et à conclure: 'Il faut choisir: voulons-nous une économie de destruction ou une économie de création? L'être ou l'avoir?'. Ils posent ainsi un problème majeur et qui sera, cela va sans dire, moral, puisque l'économique, ici, 'intègre en soi la *réalisation d'une fin éthique*' (Barde, 1970, p. 379).

Rien de plus, mais rien de moins, bien que l'attitude soit encore très répandue qui veut limiter à l'utilité les raisons qu'a l'homme de défendre la nature. On en retrouve parfois la trace jusque chez certains conservationnistes, estimant par exemple que 'la conservation est une philosophie qui préconise l'utilisation rationnelle des ressources dans l'intérêt du public',<sup>(5)</sup> définition dont les défauts et les limitations sautent aux yeux, et tout à fait typique d'un certain anthropocentrisme courant.

Pour beaucoup, la seule justification d'une défense de la nature contre les excès d'une activité humaine incontrôlée, sauvage et, parfois, cruelle, reste donc l'utilité. On se place alors sur le seul terrain de l'économie pour n'accepter que ce qui se révèle, comme on dit, 'rentable', que ce qui se vend ou s'achète, que ce qui paye...

Mais l'*Homo oeconomicus* est-il tout l'Homme, comme si seul comptaient le quantifiable, le mesurable, le pesable, le vendable, comme si le domaine de la qualité était devenu négligeable et pour certains même, à la limite, méprisable?

On comprend donc Sir Julian Huxley, déclarant qu'il préférerait au terme de 'ressources' naturelles celui de 'valeurs', de façon précisément à empêcher 'conservation' de devenir synonyme de 'matériellement profitable', risque dont on voit tout le danger car, si l'on accepte de protéger la forêt uniquement parce qu'elle produit du bois, quelles raisons de la protéger le jour où le bois serait devenue sans utilisation pratique?

Ce qui signifie que le problème des relations entre l'homme et son milieu reste au fond, avant tout, un problème de choix et de finalités. Il ne faut pas avoir peur des mots, même au risque de s'attirer la réprobation des sages et des habiles. La solution de problèmes qui intéressent tout l'avenir de l'humanité, et sans doute même son existence, est bien loin de n'être que technique, d'autant plus que les progrès matériels sont trop souvent l'objet d'applications diaboliques, destinées, par exemple, à tuer mieux, de plus loin et en plus grande quantité, objectifs qui, eux, se voient beaucoup plus substantiellement financés que la lutte contre la maladie, la misère ou la faim.

On en revient toujours au problème central, celui d'une *option morale S.* effectuer et par conséquent d'une philosophie à adopter, d'un choix portant sur la fin de la destinée humaine. Au fond, que voulons nous, que devons-nous

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(5): voir notes au fin.

vouloir? Posséder de plus en plus (et 'être possédés' !), augmenter notre puissance (matérielle!) et multiplier nos 'gadgets' ou viser à un accroissement de l'être, à l'homínisation véritable seule en mesure de nous arracher aux barbaries ancestrales et de rendre enfin possible notre réconciliation avec la nature? Continuer à 'sacrifier le bonheur' au profit et à la puissance (Ph. Saint Marc, 1971, p. 153), à rester 'un homme vide aux mains pleines' (M. Lebesque, 1968), à justifier la définition de Thoreau: '*improved means to unimproved ends*'? Ou bien, tandis qu'il en est temps encore, *peut-être*, bifurquer hardiment, courageusement, sans arrière-pensée, pour *l'autre* direction, celle qui fait passer l'Homme avant le profit, la croissance spirituelle avant celle du PNB, le bonheur *vrai* avant la religion de la production?

Je n'ignore pas que l'antithèse du 'plus' et du 'mieux' n'est pas admise de tous: mais quand M<sup>le</sup> Président Directeur Général de la Société Française B. P. affirme par exemple (2-XII-1971) que c'est un 'faux problème, on n'est pas obligé d'accepter une vue aussi optimiste, et l'on préférera conserver une liberté de jugement bien nécessaire à une heure où l'on voit tant de puissants et notoires pollueurs se convertir, au moins en paroles, à la protection de la nature et même, à l'occasion, la subventionner.

L'opposition du 'plus' et du 'mieux' n'est pas nouvelle et on lui découvrirait sans peine une dimension historique si on lui superpose celle que décrivait Gutkind (1956) entre les deux types de relations *I-Thou* et *I-It*, le second caractérisant le monde moderne industrialisé, ou celle qui pour Servier (1964) sépare civilisations traditionnelle et occidentale: la première admet un *monde-en-moi* et un *moi-dans-le-monde*, la seconde sépare *moi* et *non-moi* (*monde*).

On a dit: 'la barbarie c'est s'éloigner de la nature'. Il faudra donc y revenir, et d'autant plus qu'il s'agit d'une double exigence, puisqu'il importe à la fois, par une acceptation réfléchie de l'unité des choses et des êtres, de guérir les maux d'aujourd'hui et de prévenir ceux de demain.

### A temps nouveaux, morale nouvelle

Quand l'Archevêque de Montréal, Mgr Paul Grégoire, écrit: <sup>(6)</sup> 'Le Problème de l'environnement passe par le coeur de l'homme'il rejoint, par une convergence absolument naturelle et significative, le célèbre écologiste américain, Paul B. Sears qui avait en 1969<sup>(7)</sup> le courage d'en convenir: 'la protection de nos ressources pour en tirer le plus grand bénéfice, tant actuel que futur, et la santé de l'écosystème dont nous faisons partie, ne dépendra pas seulement de notre nombre, mais de ce que nous savons, croyons, pensons ou éprouvons. Le résultat se verra déterminé par les valeurs qui donnent sa forme à notre culture'.

Le scientisme est en train de rejoindre la vaine religion du 'Progrès' dans les vitrines du musée historique. Ce qu'on a appelé déjà la 'révolution écologique'—et qui pourrait bien annoncer et préfigurer une ère post-industrielle risquant d'ailleurs de s'ouvrir avant que les chantages officiels de la technique et du 'développement' n'aient renoncé à l'orthodoxie régnante—dépasse, et de loin, les problèmes journaliers, techniquement solubles dès que l'on acceptera d'y mettre le prix, des pollutions industrielles. Il s'agit d'une autre dimension que peu d'esprits d'ailleurs acceptent encore de découvrir, il

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(6), (7): voir notes au fin.

s'agit, comme l'a montré récemment Fournier<sup>(8)</sup>, de la substitution d'un système de base à un autre, celui de la 'vie' à celui de la 'raison': 'Bref, il s'agit de passer d'une échelle de valeurs à une autre ... On assiste à l'écroulement du système du critère de référence 'raison' et & son remplacement par le critère de référence 'vie'. La crise écologique c'est bien autre chose que 'la pollution', problème marginal appelant des solutions appropriées. La raison ne pouvait constituer, à elle seule, ni un moyen ni un but, c'est à dire qu'elle ne pouvait fournir de base matérielle ni spirituelle viable... Le critère 'raison' se dévalue, le critère 'vie' hérite de la cote'.

On approche peut-être, on approche sans doute ici du coeur de la question qui nous préoccupe. L'adoption du respect de la vie d'une part comme base possible d'une morale capable de renouveler les rapports homme-nature, le passage, d'autre part, plus ou moins rapide, mais apparemment inéluctable si du moins la survie du *naked ape* doit être assurée, du centre de gravité 'raison' au centre de gravité 'vie', ces deux mouvements convergents, encore que jusqu'ici non concertés, seront-ils capables d'entraîner dans le comportement des Summoprimates les bouleversements qui s'imposent? On doit le souhaiter car l'alternative se précise chaque jour: ou une révolution éthique à penser puis à faire triompher, ou l'implacable montée des périls. Ou une moralité résolument neuve, ou du moins foncièrement ré-orientée, et la bataille gagnée de la 'révolution contre l'absurde' (J. Madaule, 1971), ou la victoire, et cette fois définitive, de l'inhumain. *Tertium non datur*.

## NOTES

- (1) Je rappelle que l'on a trop souvent qualifié d'utopie, au sens d' 'irréalisable' ce qui n'était en fait seulement qu' 'irréalité' mais devait le devenir.
- (2) 2nd Ann. rep. C.E.Q., 1971, p. 265. Le Président de la République française, à son tour, emploie l'expression 'morale de l'environnement' (Le Monde, 9-10-I-1972).
- (3) 'Principe' (le *datum*) en tant que différent du 'fondement' (le *quaesitum*, les 'raisons' du principe), distinction sur laquelle insiste Schopenhauer (1928, p. 76-78).
- (4) Ne nuis à personne mais au contraire viens en aide à tous autant que tu le peux.
- (5) Bull. U.I.C.N., (n.s.), no. 15, avril/juin 1966, p. 6.
- (6) Ecologie = Québec, I, 1, 1971, p. 8.
- (7) *The Ohio Journ. of Sc*, Jan. 1969, p. 14.
- (8) *Charlie-Hebdo*, no. 58, 28-XII-1971, p. 10.

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## SESSION A: ENVIRONMENTAL QUALITY IN A CHANGING WORLD

### Part 2: Paper (4)

## Quality of Life in Different Cultures

DAVID P. S. WASAWO

*Tanzania National Scientific Research Council, Dar es Salaam.*

### SUMMARY

The quality of life has numerous aspects, many of which depend upon the time and place of origin of the observer. The cultural and environmental factors underlying various human activities—music, festivals, drama and sport—in various parts of the world are compared and contrasted. But these manifestations, which are at the same time both part of and the results of quality of life, can be influenced by negative factors including hunger and disease. To combat these factors people must be exposed to the right kind of education, so that their productive capacity within a world context can be increased. At the same time, education stimulates imagination and leads to freedom of reflection unencumbered by prejudices based on ignorance.

Unfortunately there is the possibility of deliberate or accidental cultural murder, which is as culpable as the deliberate decimation of a rare species; and the possibilities of culture pollution, forced or by neglect, are ever present. Neither of these possibilities must be tolerated. The various cultures of mankind must be allowed to exist as patterns on a background of unspoiled landscapes, wholesome air and clean unpolluted water, the whole being the concept of quality of life. The healthy cross-fertilization of cultures can enhance that quality.

### RESUME

La qualité de la vie a d'innombrables aspects qui, pour beaucoup, sont fonction de l'époque et du lieu dans lesquels vit l'observateur. Les facteurs culturels et 'mésologiques' (c. a. d. de l'environnement) à la base de différentes activités humaines—musique, festivals, théâtre, sports—dans diverses parties du monde sont comparées et différenciées. Mais ces formes d'expression, qui sont tout à la fois partie intégrante et résultat de la qualité de la vie, peuvent subir l'influence de facteurs délétères tels que la faim ou la maladie. Pour lutter contre ces facteurs, il convient de donner aux gens une éducation appropriée qui leur permette d'accroître leurs capacités de production dans un contexte mondial. L'éducation stimule en même temps l'imagination et conduit à une liberté de pensée débarrassée de préjugés nés de l'ignorance.

Il existe malheureusement une possibilité de meurtre culturel, délibéré ou accidentel, qui est tout aussi condamnable que la décimation délibérée d'une espèce rare. De même, les risques de pollution culturelle, imposée ou due à la négligence, sont constamment présents. Aucune de ces possibilités ne doit être tolérée. Les différentes cultures de l'humanité doivent avoir la possibi-

lité d'exister dans un cadre de paysages intacts, d'air sain, d'eaux claires non polluées—tout ceci concourant au concept de qualité de la vie. La fertilisation réciproque des diverses cultures peut contribuer à accroître cette qualité.

## QUALITY OF LIFE IN DIFFERENT CULTURES

### The music

It is early evening in the land of my fathers. The sun's rays are playing beautiful patterns on the grass. The gentle evening breeze breathes its freshness upon the man-patterned leaves. In the homesteads, smoke is spiralling upwards from cow-dung fires. There is an occasional cackle of a hen. The grandfather asks a youngster to bring a bit of burning wood to light his pipe.

Suddenly there is melody in the air, from a distance. The shepherd, bringing home his flock of cattle, sheep and goats, is performing on his reed flute. He is a satisfied young man. The pasture is in perfect condition. There is plenty of good clean water, quite a lot of it coming up in springs from the hillside. His livestock looks good. Several of the cows are in calf so he can look forward to a good drink of curdled milk on arrival at the homestead.

The music from his reed is expressive! Now it phrases the call of a guinea-fowl, then it moves on to express the garrulous song of the sparrow. The whole theme of his music is evidently influenced and inspired by the natural environment surrounding him—the clean air and unpolluted water; happy birds that have known no sudden deaths from strange poisons; lush vegetation; wild-life; and the satisfied livestock that are his charge. The mother and father, sisters and brothers, neighbours, are all familiar with his melodious music. They enjoy listening to it. It is a part of their cultural way of life.

Far away in the streets of London we trudge through the messy snowbound streets towards the Royal Albert Hall. We enter and take our seats in our allotted places. There are general murmurs and chattering in the hall. Then sudden silence, followed immediately by clapping. The ritual has begun. The conductor enters amidst this applause, bows, and then another silence, this time of a different kind—the silence of expectation! We are then treated to a superb performance of Beethoven's Pastoral Symphony. I have the music from the shepherd's reed flute in my blood, yet I enjoy this Pastoral Symphony as well. We ask ourselves 'What inspired Beethoven?'; for we know what inspired the shepherd with the reed flute. Beethoven was a universal genius, with an original creativity in his field that has never been surpassed. Yet we are informed that this particular symphony was inspired by an excursion that Beethoven made into the countryside around Vienna!

The trappings of ritual that precede the performance are strange to me. They are elements of a culture that is foreign. Yet the product of that very culture, the music itself, plucks a responsive chord in my soul; the very chord that responds to that shepherd's flute. Is there anything in our universal experience of a common environment that makes this qualitative appraisal possible? Can we perhaps reflect on why I find it difficult to appreciate the greater part of modern European music, particularly that influenced by the strange noises of modern industrial environment?

### The celebration

It is harvest time in the land of my fathers. The season has been good. There

is plenty of maize, millet and beans. The finger-millet and 'simsim' have been particularly good. There is enough grain and cow-peas to last two seasons. Such good harvest is worth a celebration in each of the several neighbouring homesteads.

The beer is brewed and made ready, the fatted calf and a few goats and sheep are slaughtered and prepared for the festival. The harpist is ceremoniously invited to come and perform. He sings of the good things of life, of the wonders of nature, of departed souls. He sings of those that donate generously in appreciation of his art. At periodic intervals, he is stopped by those who would like to recount the praises of themselves as well as those of their friends and relatives. This cultural festival is open to all who come—no one is kept out, no one is denied the beer or the food.

I am celebrating something by bicycling with a friend through Denmark and Germany. Germany is still down and out as a result of the ravages of war, for the year is 1950. One late afternoon we reach the city of Cologne. There is 'no room at the inn' for the hotels are all booked because of a trade fair. After some search, Herr Lenz, whose hotel is still half in rubble as a result of bombing, finds us a nice attic. We soon become good friends of the family, and are initiated to the good German wines, for the bombs could not reach Herr Lenz's celebrated 'weinkeller'. One day Mr. Lenz suggests that we accompany them to the Mosel Country where they periodically collect their wines direct from the vineyard owners. We jump at the opportunity. We leave Cologne before dawn, and pass through the cobbled streets of Koblenz before many people stir. We stop for a cup of tea at a wayside shop and I am fascinated by the words coming from the gramophone record being played by the young lady in charge—something that goes like 'Ein kleines MSdchen mit dem grossen Herz'. Here indeed is a 'petite' lady with a big heart!

We reach Trier and pass into the vineyards. We spend the whole day loading drums of wine on to the lorry. Then the evening is with us. We hear that there is a wine festival nearby and are told that there is no need to have an invitation—~~one~~ just appears and is welcomed. But what I find at the festival surpasses all my expectations. We are all welcomed as if we were next-door neighbours. The wine is 'on the house' not only for us, it appears, but for everybody. The music from the accordion is infectious. There is dancing and merrymaking. We do not leave the place until 2:30 in the morning.

I reflect on this wine festival and on our own harvest festival back home. Here are two groups of people as different as one can conceive; each with their own history, their own culture, their own identity. Yet the invisible threads that permeate their two festivals have something in common that defies description. The happy faces; the apparent involuntary rhythm of their movements as they dance to their different kinds of music; their generosity towards all humanity irrespective of their origins. This is a veritable high quality of life in both instances.

But the example of the folks of Trier is reinforced by another experience—this time in the Far East. One early afternoon I walk down the Sule Pagoda Road in the city of Rangoon in Burma to look at the Sule Pagoda and then move on to see the Shwe Dragon Pagoda. After seeing the Sule Pagoda with all the crowds one encounters around pagodas, I come to the Town Hall. There is some interesting activity going on, so I move up the steps and reach the foyer. It is evident that there is a wedding reception going on. As I turn on my heels to retrace my footsteps towards the street, one of the men comes forwards and asks me if I could honour them by joining them. I am taken up to the dais to give my

blessing to the bride and the bridegroom; after which I join in the festivities as if I had had an invitation three weeks previously. It is generosity of the kind we had met with in Trier and in my home village. It is a generosity which opens its heart both to strangers and to neighbours alike. It is a quality of life that transcends petty human barriers.

### **The drama**

A great man has died in the neighbouring village. There is the customary crying and wailing, particularly from the women members of the community. There is drumming and the sounding of various horns. Here and there men move threateningly with spears and shields in feigned attack. Meanwhile the young men are digging the grave. The man has to be buried before sunset. On the morrow there is the traditional ceremony of 'Omo buru', wherein the men with their herds of cattle move to the traditional 'battle-field' and after some ceremonies which include the marking of faces with coloured clay, return to the homestead of the deceased with all their cattle; later on dispersing to their homes. What interests us from the point of view of the present discussion, however, is what happens after a few days have elapsed or in some cases even weeks. Experts in a special kind of drum-playing are invited to perform on a particular day. The news is spread widely and people come in the hundreds. The dancing that ensues to the rhythmic beating of the drums is of such variety and such abandon as to express the individual feelings and moods of the dancers themselves. Yet they move to the same rhythm. The individual movements are variations on a central theme. Occasionally the dancers are moved to singing or to uttering some words of praise. The whole scene is theatrical, but the kind of theatricality in which everybody participates.

We move on to Tokyo on a summer's day. We have had long meetings at the University of Tokyo, and we are invited to spend a pleasant evening at the Kabukiza to watch and listen to the Kabuki. I do not understand a word of Japanese, yet the drama fascinates me. There are elements in it which are universally human and which touch my soul. And yet how much better would it have been if I had understood the language. The quality of life is there, but I cannot penetrate it fully, as I penetrate the quality of life as expressed by those dancers at the old man's funeral, because of the language barrier.

### **'What My Grandmother Taught Me'**

The night is dark and starless. We are all lying down in our allotted places in our old grandmother's hut. A flickering flame from a log fire lights a small corner of the room. We are all quiet and spellbound by the stories our grandmother is telling us. She speaks of the clever hare and the bungling elephant. She tells of the visit of the gods in the form of thunder and lightning; of the wars and the brave men who fought them; of the happy harvests and of festivals. The narrative is interspersed with singing. We are lulled to sleep until the next day. This early experience is indelibly a part of me. I cannot remember the stories in detail, but the circumstances, I remember. I cannot remember all the songs, but occasionally some melodies intrude themselves into my consciousness.

I am staying in a small 'family hotel' in Inverness, Scotland. The rain is beating down hard at the glass panes of the windows. We have all had our 'Scottish afternoon tea' and are comfortably settled in front of a real and cheerful log fire. There is an old Scot sitting sipping his cherished whisky. We are all fascinated by the beautiful stories he is weaving for us—of the

battle of Culloden, of the massacre at the valley of Glencoe, of Bonnie Prince Charlie, of Mary Queen of Scots.

I reflect on the 'stories my grandmother taught me' in that room with a flickering flame of light, and the stories told us in front of that log fire in Inverness. I recognize a quality of life common to the two situations despite the differences in the culture of the Scots and the Luos.

### **Sports and ritual**

There is a wrestling tournament between Seme and Gem, a neighbouring grouping of some Luo Clans. Everybody is there, the young men and the not so young, the girl friends, the aunts and the mothers. The preliminaries are for the youngsters. You walk across to your opponent's group and you challenge one of the group. You enter into combat and whoever throws his opponent down wins the match. He is received with joy in his camp and receives congratulatory tokens such as a string of beads from his girl-friend's waist. The preliminaries are followed by matches between older people. But the real match of the day, the one that draws the attention of experts and connoisseurs, the one that decides whether the day will belong to Seme or Gem, is the one between two protagonists, acknowledged by their respective sides to be champions. Silence descends on the crowd as these two go into the arena. They enter into combat. There are unwritten laws that govern this match. They periodically break, only to enter once more into grappling with each other. None throws the other down. After a decent interval, the elders decide that the match is drawn. The tension amongst the crowd is broken. The two wrestlers congratulate one another, and they in turn are congratulated and feted by the crowd. The ritual over, we go home happy. We may individually have lost our matches, but that is a private affair between ourselves and our girl-friends or our aunts. Our champion has not lost, and therefore Gem has not lost.

I am sitting in a Ryokan (Japanese inn) where I am staying in Tokyo. The Ryokan manager has offered me a glass of saki, which I am enjoying while watching television. It is 'Sumo' tournament season, and one of the wrestling matches is on the screen. There are two seeming giants standing on the opposite sides of a circle, each with only a loin cloth around his waist. I am fascinated by the ritual. Each of the wrestlers slowly lifts his leg and then plunges his foot back into the ground. He does the same with the other leg, and so on. The rocking movement of the body is as ponderous as that of an elephant. Then they suddenly rush at each other in the centre of the circle, and set about grappling with one another in a manner reminiscent of our own expert wrestlers back home. From what I learn from Mr. Okamura, the manager of the Ryokan, the details of the rules are different from those of Luo wrestling, but the basic rituals appear to be similar. Again one reflects on these basic similarities in two peoples whose cultures in general are as different as they can possibly be. Yet compare these two types of wrestling with the so-called 'modern' prize wrestling seen in various European and American circuits. It is conceded that people's tastes differ, but the apparent brutality in 'modern' wrestling, the urge to inflict as much pain as possible on your opponent, is something which I find difficult to equate with the quality of life.

### **Hunger, thirst and righteousness**

Culture is part and parcel of the human condition. No society that I know of can be said to be cultureless. As I have tried to indicate in some of the examples I have given, the manifestations of some cultural activities in disparate groups of people, separated by long distances, seem to possess some

underlying similarities, as if they derive from a common experience far back in human history. On the other hand when one considers the totality of cultural activities in any group of people living in one part of the world, and compare it with that in another part of the world, there is an unmistakable distinctiveness. The isolation of people through geography, aided by language barriers, has led to a flowering of cultural achievements that are indeed an asset to mankind as a whole. The deliberate and wanton elimination of a culture is to me as significant in its negativeness, and as serious in its human implications, as causing a rare species of wildlife to become extinct. Indeed I would go as far as suggesting that the former is more serious than the latter.

Cultural activities are subject to development and to refinement. The milieu within which culture develops and thrives presupposes prior satisfaction of certain basic needs of human society—a condition which lends quality to the life of the people concerned. That quality depends on a number of things. One is the satisfaction of hunger. A person in a state of hunger for some days is a wretched enough sight; but when this hunger permeates a population, where it includes equally children as well as old people, then the wretchedness is complete. One cannot speak of a quality of life in such a situation, nor is there much that would be conducive to a flowering of culture. Those that have witnessed cases of children with kwashiorkor will appreciate that qualitative hunger is just as significant in this regard as the quantitative one.

Another impediment to access to a life of quality is disease. A people whose energy is continually sapped by the scourge of bilharzia, malaria, tuberculosis or leprosy, have very little left of the quality of life. The suffering is there, the wretchedness is there, and one can see an element of hopelessness that cannot be but a serious impediment to the development of culture.

Thirdly, quality of life in an open world requires the development of an 'open' mind. People must be exposed to the right kind of education and be conversant with relevant techniques so that their productive capacity within a world context can be increased. It is only then that they will be able to produce enough food for themselves and for all those that depend upon their labour, including the young and the old, the town-dwellers and the armed forces. It is only then that they will be able to combat with some effectiveness the diseases that do so much damage to human welfare, and to have the wherewithal to obtain other basic necessities, such as clothes and shelter.

But education does much more in the quest for a life of quality that is conducive to the flowering of culture. It stimulates imagination. It leads to a freedom of reflection unencumbered by prejudices based on ignorance. These are important elements in building a richer life, and establishing an arena in which cultural activities can thrive. Some of these elements can indeed be considered cultural activities in their own right.

If we work on the premise that the deliberate killing of a culture is as culpable as the deliberate decimation of a rare species, then any corporate or individual actions that result in an increase in hunger or the perpetuation of diseases and ignorance must be condemned with the same fervour as we condemn the inconsiderate decimators of animals. Some of us for instance are often dissillusioned by what happens at the United Nations Conferences on Trade and Development.

I have alluded above to the necessity of freedom of reflection. The reality of the freedom of reflection can only be attained in situations where the individual has his self-respect. It is not attained where, because of one's colour one is regarded not even as a second rate citizen; it is not attained where one's body

and soul is enslaved, and one is told he is not even capable of looking after the land of his forefathers. It is not attained in situations where there is arrogance, double standards, or where there is no compassion. These are the impediments to the attainment of a life of quality in whatever culture we may think.

We go back to the shepherd coming back home in the evening with his reed flute and his satisfied cattle. What is the canvas on which we should paint all that pertains to the quality of life in all the cultures? In my opinion, it is the wholesome air we breathe—the kind our forefathers enjoyed; it is the clean unpolluted waters we drink or where those creatures that are so important in the food chain live; it is the healthy and uneroded countryside with its lush grass, its forests, its green hills, its picturesque mountains, its unsilted streams, its wildlife. This is the canvas that the International Union for Conservation is dedicated, by its very name, to preserve for posterity. It is for us to remember that though a canvas is indispensable, equally indispensable are the painter and the inspiration that guides his eyes and his brush.

The world has entered a stage in which the possibilities of cultural pollution—forced or unforced—are ever present. At the same time we are committed to the development of a life with quality for all mankind. In carrying out the latter we will do well to keep clearly in view the proposition that a healthy inter-fertilization of cultures can enhance that quality.

#### **Note by IUCN Secretariat**

The term 'quality of life' has developed many connotations among those concerned with the human environment. Some view it as referring to life in an environment relatively free from toxic or polluting substances, others consider it in much broader terms. However, if this concept and the related term 'environmental quality' are to become useful for the planning of conservation programmes and the establishment of priorities for action, we must develop a much clearer understanding of their meaning and significance not only among relatively affluent and well educated people in societies of European origin, but also among those of many different economic and social levels in societies throughout the world. To this end IUCN has developed a project (Number 11-0) for which funding is being sought, and has brought this subject to discussion at this 12th Technical Meeting. The thoughtful background paper prepared by Dr. Wasawo has explored various aspects of this subject and raises the vital question of protection of cultures and ways of life in the face of an apparent world trend toward homogeneity and uniformity. There are other problems and concepts, however, which this session need also examine.

How important is wild nature to 'quality of life' among various peoples and cultures? Apart from the recognized role of plant and animal species in biosphere functioning, is it important to the psychological and social well being of all people to have wild places and wildlife available for their use and recreation? To what extent are national parks and wildlife conservation simply imposed by a minority upon others who would be actually more content with improvements in other aspects of their environment at the expense of wild nature?

How important is absence from pollution, other than that which has an effect on the physical health of man, to people of various cultures? To what degree are people willing to sacrifice quantitative economic gains for gains in environmental quality? What are the various environmental parameters that contribute to perception of a high 'quality of living' among peoples around the world?

These are not easy questions to investigate nor do they lend themselves to quick answers. Opinions change with rising affluence and leisure, and what seems most desirable to one group of people today may seem of small value to the same people tomorrow. Nevertheless, success in achieving environmental quality can only result from a knowledge of what people want and what they require. We have in the past made too many assumptions about what is good for people, but achievements in conservation and environmental improvement in the future must be soundly based. In a shrinking world conservation cannot succeed without popular support. A firm foundation for that support must now be sought and it is the hope of IUCN to attract greater interest to this problem.

## SESSION A: ENVIRONMENTAL QUALITY IN A CHANGING WORLD

### Part 2: Discussion

The Chairman, Mr **Zafar Futehally**, expressed regret that neither of the authors had been able to come to Banff, while Sir Robert Jackson, who was to have taken the chair, had been called away on urgent UN business. In the circumstances, he would simply introduce the members of the panel and the authors' deputies, and ask the latter to present the two papers.

Presenting Professor Monod's paper, Dr **Jouanin** said that he felt quite unworthy to step into the shoes of an author whose superlative prose displayed so clearly the vast sweep of his culture, and one moreover who had devoted himself among all his other preoccupations to a profound study of the moral problems of man in his relationship with nature. Perhaps he might just pick out for mention the simile drawn between certain human attitudes and what Professor Monod termed 'Ploceism', the habit in tropical weaver-birds of continuing to construct their complex nests, even outside the breeding season, when they apparently serve little useful purpose. An ornithologist could no doubt put forward a number of explanations of such conduct, but this would in no way detract from Professor Monod's comments on the addiction of modern man to productivity as an end in itself, simply because he has the technical ability to achieve it and regardless of the essentially moral judgement as to its eventual consequences.

Mr **Baba Dioum**, presenting Professor Wasawo's paper, referred to the author's illuminating and often very entertaining examples used to demonstrate the cultural diversity and, at the same time, the close links between the aspirations of different peoples. The point which had impressed him most was Professor Wasawo's insistence that the destruction of a culture was as much to be deplored as the extinction of a rare species of wildlife: perhaps, the quality of life had more than a little to do with the maintenance and interplay of diverse cultures.

Before calling on the panelists for comments, the Chairman remarked that human beings seldom base their actions on ethical principles if they see that it will conflict with their material interests. However, there is often a time-lag and he cited the cattle problem in India, where the cow had become venerated because of its value to mankind, but is still venerated although, due to over-population, it has become a destructive menace. Another difficult problem that has to be faced is that education tends to be culturally disruptive: the fisherman's son on the west coast of India who goes to College, never wants to return to his father's occupation and way of life, which has a long cultural tradition, but would much prefer to become a clerk.

Panel member Mr **Wayne Smith** said that from his own viewpoint as a lawyer and also a practical farmer, who had become very interested in international conservation issues, the major question raised by Professor Monod concerned the validity of the common assumption that 'all economic growth, all productivity is good'. In fact, scientists and politicians are jointly involved in economic, social and psychological problems, which have hitherto received insufficient attention to provide the answers. He was inclined to support the view of Michael Chisholm that psychological education of planners is the great need.

In the opinion of panel member Mr **van der Goes van Naters**, a point perhaps missed in Professor Wasawo's paper was that cultural patterns, especially in Africa, are constantly evolving and the problem is what responses can and should be made to the new and sometimes deplorable challenges to traditional attitudes. He also found himself not entirely happy about Professor Monod's thesis that the objective of the ethical revolution should be to replace 'reason' by 'life', 'quantity' by 'quality'. He felt that there was nothing very revolutionary about the comparison of these concepts as 'black and white': it could be found even in the classical marxist view on spirit as opposed to matter; the philosopher Bergson had conceived of 'the vital impulse' as the end result of all reasoning: Teilhard de Chardin looks for a combination rather than opposition of the 'biosphere' and 'noosphere'. It was implicit in the defence of 'diversity' by Professor Kuenen, earlier in the Session, that the elimination of plant and animal species is a crime against creation and that the diversity which man sees in the world around him has a place in his own soul. Biologists in fact are not and have rarely been materialists and one of the most progressive of them, Jean Rostand, in his book 'Aux frontières du surhumain' has attacked the theories which question the validity of the human personality. What the 'new morality', to the extent that it exists, should be concerned with is the constant struggle against the despoliation of our planet, against the ever increasing destruction of tropical forests, against the dogma that man is the measure of all things—the anti-cosmic, anthropocentric concept of the biosphere—against what Monod calls the cancerous phenomenon of galloping growth, and above all in its application to our own procreation. Therein lies the true 'respect for life'.

Mr **Piesse**, panel member, suggested that the force of the moral imperative evolves from the nature of the particular activity with which it is at any time concerned, citing the changing attitudes in Australia towards the controversial issue of kangaroo exploitation. As for the kind of problems which have to be solved in maintaining and improving the quality of life, this depends very much on circumstances: in Australia, again, it must take account of the fact that 70% of the people live in cities and 80% within 30 miles (50 km) of the coast, hence the emphasis there must be on the control and guarantee of a particular spectrum of recreational opportunities, and the solution of adverse consequences of population concentration and excessive coastal development.

The **Chairman** then called for comments from the floor and the following were the main points made in the ensuing discussion.

On doit souligner surtout, d'accord avec les idées de M. Monod, un réalisme écologique qui sort d'une logique scientifique. Je suis de l'avis qu'on doit trouver dans l'écologie les bases d'une moralité universelle. L'anthropocentrisme venu des religions et plutôt des philosophies, est assez enraciné dans la nature humaine, mais je rappelle que M. Monod a reconnu à l'intuition de St. François d'Assise une modernité éternelle: or, je suis convaincu que St. François se place au sommet de ce qu'il y a d'universel dans la conception chrétienne. L'écologie même nous rend attentifs à la complexité des intérêts humains. L'écologie exprime et affirme une nécessité de justice, que la justice doit s'établir entre l'homme et la nature et surtout entre l'homme-social et la nature—**V. Giacomini** (Italy).

One reason for attaching importance to the present subject is that so-called rebellious youth is in fact very preoccupied by moral questions. Perhaps for reasons of space, Professor Monod seems to lay the emphasis on monotheistic or monolithic religions, but at least St. Francis, whom he quotes, stood for a horizontal link with all creatures as well as the vertical line of responsibility of man to God—**H.O'R Sternberg** (Brazil/USA).

It should be remembered that the Judaeo-Christian morality is based on the premise that man is responsible for tending the Garden of Eden not destroying it, which could be interpreted as the law of nature itself—**P. Nogueira Neto** (Brazil).

One of the most difficult problems in safeguarding different cultures lies in the impact of tourism: there is obvious value for international understanding in exposing the visitor to other cultures, but equally a danger that a 'tourist ecosystem', based on the north American pattern with international merchandising and franchising and promoted by the desire to appear contemporary, will evolve and impose itself. Positive efforts must be made to preserve national identity and to control this type of cultural pollution. Although the point was touched upon by Mr van der Goes van Naters, it would be interesting to have further views on 'cultural suicide', as opposed to the 'cultural murder' condemned in Professor Wasawo's paper, since many people appear in overmuch haste to adopt cultural forms foreign to them—**P.H. C. Lucas** (New Zealand).

Le problème est inhérent au fait que l'amélioration des communications rapproche les cultures, bonnes et mauvaises, ainsi qu'à la division du monde en 'développés' et 'non-développés'. Il faut continuer à lutter avec acharnement pour empêcher les pressions économiques d'imposer des schémas sociaux. Comme l'a déclaré le président Senghor au Sénégal, 'enracinons nous dans nos valeurs culturelles, mais ouvrons-nous à l'extérieur; il faut savoir évoluer mais gardons notre identité.' Personnellement je compte sur la jeunesse pour trouver un moyen de conserver son individualité—**Baba Dioum** (panel member).

L'approche de ce qu'a stigmatisé le document de M. Wasawo sur la qualité de la vie, conçue dans mon pays par le gouvernement et le peuple, révèle que la conservation des ressources naturelles, leur gestion rationnelle, ne pourrait se réaliser que dans le respect absolu de la valeur sacrée de nos cultures propres. Ces cultures dont la valeur est indiscutable ont subi depuis bien longtemps une négation, une atrophisation cancéreuse, barricadée dans une forme étrange de l'aliénation mentale et je suis d'avis que cela a été un meurtre culturel. L'éducation mésologique et l'écologie devraient stimuler, fortifier et consolider ce que fait le Gouvernement Zaïrois dans le cadre du développement de son peuple tout en conservant jalousement ses potentiels pour la suprématie du bonheur—**Kabala Matuka Kashila Maweja** (Zaire)

The view that conservation essentially means the conservation of man, and is otherwise meaningless, is not a new one but it has tended to be held by a minority and receive little emphasis, so that it surely is up to IUCN to redress the balance; this has indeed, to some extent, been achieved in this Session. The implication is that in planning development, man's needs which cover quality, aesthetics and morality as well as material benefits, must be the principal consideration: the point was well brought out in our Chairman's Keynote address at the opening plenary meeting of the Assembly—**A. Dunbavin Butcher** (Australia).

Many of the difficulties mentioned in the discussion are well demonstrated in India, with all its contradictions: thus when efforts to preserve the culture and identity of a primitive hunter-gatherer group were being advocated, their leaders came to Mrs Gandhi and demanded to be modernized; or again while the ethics of the Hindu religion condemn killing, yet cruelty and disrespect for life is widespread. One trouble is that human groupings and cultures cannot be kept in isolation, as it is sometimes possible to do with plants and animals.

Perhaps conservation itself is the key to a new morality—**Zafar Futehally** (Chairman).

Pour conclure, il conviendrait peut-être de rappeler les paroles de Bergson: 'la morale a double visage: matérialiste—on cherche les conséquences de ses actes et on prend les décisions; et idéaliste—l'insatisfaction se réintroduit dans la société.' **C.Jouanin** (représentant l'auteur de document 3).

**SESSION B**

**NATIONAL AND INTERNATIONAL  
ENVIRONMENTAL POLICIES**

**Part 1**

**SESSION B: PART 1**

*Chairman:* Dr. M. E. D. Poore (U.K.): Member, IUCN Executive Board; Director, The Nature Conservancy, London.

*Authors:*

**Paper (5): Development of Environmental Policies in a Federal State.**

Mr. Christian de Laet (Canada): Member, IUCN's Commission on Environmental Policy, Law and Administration; Secretary General, Canadian Council of Resource and Environment Ministers, Montreal.

**Paper (6): De la prise de conscience au programme d'action.**

Professor Olivier Reverdin (Switzerland): Member, IUCN Executive Board; Faculty of Letters of the University of Geneva.

*Panel Members:*

- 1 Mr. W. E. Burhenne (Federal Republic of Germany): Chairman, IUCN's Committee on Environmental Law of the Commission on Environmental Policy, Law and Administration; Secretary General, Parlamentarischer Geschäftsführer, Bonn.
- 2 Mr. Baba Dioum (Sénégal): Member, IUCN Executive Board; Directeur des Eaux, Forêts et Chasse du Sénégal, Dakar.
- 3 Mr. Robert Cahn (USA): Environment Editor, *Christian Science Monitor*, Washington, DC,

*Rapporteur:* Dr. John A. Staub (IUCN)

*Secretariat Member:* Dr. Jan Čeřovsky (IUCN)

## SESSION B: NATIONAL AND INTERNATIONAL ENVIRONMENTAL POLICIES

### Part 1: Paper (5)

# Development of Environmental Policies in a Federal State

CHRISTIAN DE LAET

*Member, IUCN's Commission on Environmental Policy, Law and Administration; Secretary-General, Canadian Council of Resource and Environment Ministers, Montreal.*

### SUMMARY

Environmental issues are one of the new super problems which cut across established boundaries of subject and jurisdiction. In federal states the development of environmental policies is complicated by the division of power between the general and the regional governments. Various methods of conflict resolution have been used but coordination and cooperation seem the most fruitful solution for environmental problems. Examples from the Canadian experience indicate the variety of responses that are possible within one country and point the way to possible future trends.

### RESUME

Les problèmes soulevés par les questions relatives à l'environnement sont de ces problèmes dont la complexité dépasse les cadres traditionnels d'une juridiction et d'un domaine particuliers. Dans un état fédéral, la division des pouvoirs entre l'état central et les gouvernements régionaux rend plus difficile encore l'élaboration de politiques sur l'environnement. Un nombre de mécanismes de solution des conflits ont été mis à l'essai, mais il semble que la coordination et la coopération soient finalement les méthodes de solution de problèmes les plus fructueuses en ce qui concerne l'environnement. Des exemples tirés de l'expérience canadienne font état de la variété des réponses possibles dans un pays, et des tendances qui se dessinent.

### DEVELOPMENT OF ENVIRONMENTAL POLICIES IN A FEDERAL STATE

The current era is one of super problems which cut across previously defined boundaries of subject and jurisdiction. The realm of the environment is in the centre of this changing perspective causing governments as the overseers of resource use to rethink their approach to resource issues.

The role of government with respect to resources and the environment was for a long time seen as developer of the resource base. The role of custodian for the wise use of natural resources was only imperfectly perceived and partially implemented. Now through a variety of important steps including the UN Stockholm Conference and the IUCN meetings in Banff, governments are rethinking their policies for the environment.

In looking at environmental policies for federal states it is important to begin first with consideration of how such states function in the area of policy development. The Canadian experience will furnish some examples of response to environmental considerations and a particular Canadian innovation will point the way to future trends of environmental management.

### **Environmental quality and resource management in federal systems**

The basic principle of organization which is characteristic of federal government is the division of specified powers between regional governments and a general government. The assigned powers are exclusive to each in their allotted spheres, none is subordinate to any other government. The essence of the relationship is a system of independent and coordinate governments. Can such a system effectively cope with problems of environmental quality and resource management? How is it likely to be changed or modified? Is it sufficiently flexible?

The assignment of specific and residual powers in a federal constitution relates to environmental quality and resource management in three important respects: the ownership of property and physical resources; the right to pass legislation on various subjects and, though related to the second category, the powers to provide financial resources. Though the division varies, no federal constitution assigns exclusive powers in these three areas in such a way that either level of government has an independent and comprehensive jurisdiction for environmental management. Those who drafted the constitution did not lack wisdom or foresight. The tremendous scope and complexity of environmental problems are such that it is unlikely that a system could maintain an exclusive and comprehensive jurisdiction at one level and remain federal. The corollary of this observation is that for the specified powers, however exclusive and independent they may be in law, the exercise of them concerning environmental problems could not always be independent and effective at the same time. And it is the effective use of power which is of paramount importance.

The principles underlying federal systems and the nature of environmental problems contain several parallels. The national boundaries of most federal states embrace regions which vary greatly in geographical features, climatic conditions and resource endowments. The diversity, especially with respect to resources, creates different and usually competing economic interests among the regions. Additionally, resources such as air and water, and the effects of man's activities on the environment, are not always confined to political boundaries. Similarly, the nature of many environmental problems is such that it is not possible to act unilaterally and their magnitude often makes it impossible not to act together. The problems of environmental quality and resource development create both common interests and conflicting interests among the regions. And without common interests, a federal system of government would not be desirable; without conflicting interests, it would not be necessary.

Those same characteristics of environmental problems which support a federal system of government also jeopardize its continuation. The occurrence of one or several environmental crises is not yet inconceivable. The characteristics of the response that would be required—immediate, effective and coordinated action—are the same that, had they existed beforehand, would have avoided the situation. The assumption of the necessary powers by a general government should such a national emergency occur is unlikely to be temporary.

All federal constitutions specify and assign exclusive powers to each level of government. All federal systems include some matters where both levels of

government exercise authority and a provision that, in cases of conflict, the laws of the regional government must give way to those of the general government whenever it has the legislative competence. Despite this apparent precision, the situation is rarely clear. Concurrent jurisdiction is the source of most conflict in federal systems. It is also this area into which many environmental problems fall.

The two formal and traditional methods of conflict resolution in a federal system—constitutional amendment and judicial decision—may no longer provide an effective response to the challenge posed by environmental problems. Both consume considerable time before a decision or opinion can be obtained; time which in the case of environmental problems may be very important.

Another device of conflict resolution is the potential or *de facto* exercise of power by the general government of a disputed authority. This is not submitted to the courts because the regional governments presume the general government will prevail. Time is saved, but as with the formal methods of conflict resolution, it does not contribute to tackling the intrinsic problem of environmental management.

With environmental problems of increasing urgency and the public becoming impatient with the slowness of governmental response and largely indifferent to which level of government attempts to solve the problems, both levels of government should be less concerned with how they exercise power on each other, or restrain each other in the exercise of their own powers, and look instead to how each in his own or concurrent sphere is able to offer help to the other, or receive it. This does not alter the federal principle of independent and coordinate powers but it does provide a third choice in conflict resolution, the development of new vehicles for coordination and cooperation. It is this endeavour that may most easily bring about the required flexibility in the working of federal governments.

A critical test of any new approaches along these lines will occur in the area of public finance. Even when there is a dogged assertion and defence of exclusive powers, the allocation of function in federal constitutions rarely coincides with the allocation of the necessary financial resources. The financial autonomy of regional governments, for example, is always conditional upon a framework for currency and credit determined for the most part by the general government. Also, regional governments may lack adequate natural resources, or sufficient funds to develop them. Looking at the same problem in another way, scarce natural resources may be located in an area which should be preserved because of unique and basically non-economic values (an outstanding animal or plant community for example), and the regional government may be unable to afford not to develop them. As the pressure increases for establishing a basic right of man for a clean environment, a roughly analogous situation may eventually exist between the problems of tariffs and of environmental quality: because of regional disparities, the economic burdens of any attempts to ensure a basic quality of life will be unequally distributed among the various regions within a federal state.

The demands of environmental quality and resource management will increase the pressure for redistributing wealth among the regions. As existing mechanisms for doing so are often inadequate, with assistance being allocated on a piecemeal basis or depending on the goodwill of the general government, it may not be possible to cope with additional demands without substantially modifying the federal principle. It will become imperative to develop new methods and vehicles for this purpose which represent the interests of both the general and regional governments.

In sum, if federal systems of government are to effectively cope with problems of environmental quality and resource management, we can anticipate that the concern over appropriate jurisdictional purviews will give way to the much more urgent concern for cooperation and coordination among them. We can anticipate that conflict between the laws of man will become less important than will the extent to which they combine to conform with the laws of nature. There is sufficient flexibility in federal systems of government to cope with the demands of environmental problems. The challenge is more particularly to the goodwill, minds and imagination of men to creatively exploit that flexibility and develop new ways of coordinating and combining their efforts. Or we could, of course, remain aloof and observe with dismay the increasing irrelevance of our concern for who among us should prevail.

### **Environmental quality and resource management in the Canadian federal system**

In Canada, the case study to illustrate these theoretical remarks on federalism, the issues of resource management and environmental quality could not be foreseen in the constitutional framework of 1867. The result was that lines of jurisdiction straddled this functional area with neither the general nor the regional governments having comprehensive jurisdiction. In the years following Confederation, the resolution of unanticipated problems was attempted through a more rigorous definition of jurisdiction with the aim of exclusive allocation of powers. The result of judicial interpretation of disputes has, however, tended to maintain a balance between the two levels of powers so that this definition did not in fact take place. More recently the Canadian federal system has moved from a consciousness of boundaries to a problem-solving orientation. The two levels of government have as a consequence looked to federal-provincial cooperation as a means of bypassing jurisdictional disputes.

Canada's constitutional instrument is the British North America Act of 1867, which among other stipulations defines the powers of the federal and of the provincial governments as our general and regional governments are called. Generally speaking, and with particular reference to natural resources, they are as follows:

- (1) In terms of ownership of property and physical resources the provinces own all land and the resources on or below them, with exclusive authority to dispose of them. Federal proprietary rights are less extensive and cover such crown properties transferred in 1867 as canals, public harbours, rivers and lake improvements, as well as property acquired from the provinces and territorial land. Ownership of water is not specified by the constitution and common law applies.
- (2) In terms of legislative powers, the provinces under the Property and Civil Rights clause have jurisdiction over property they own. They also have jurisdiction over local works and undertakings, and generally, all matters of a merely local or private nature. The federal government has legislative jurisdiction over the property it owns and over the territories, also in particular over navigation and shipping, and seacoast and inland fisheries. Agriculture is a concurrent jurisdiction.

Other federal powers significantly affect the situation regarding resources: criminal law powers; jurisdiction over works and undertakings extending beyond limits of one province; works declared by Parliament for the advantage of Canada (a clause rarely used); and the residual general power to pass laws for the peace, order and good government of Canada (often judicially interpreted as subservient to provincial powers). The federal government also has

vast spending powers under the Public Debt and Property clause and the system of Grants-in-Aid.

The governments of Canada have employed a variety of approaches in modifying their administration to better manage environmental concerns. Governments proceeding from their own institutional bases and styles of doing things have fashioned a variety of devices particularly suited to regional conditions and preferences. Each has a common element of regulation but many have developed other mechanisms to handle the particularly broad nature of the environmental problem. Some of these mechanisms will be briefly highlighted. Detailed descriptions of the institutions of each government cannot be given because of the weight of information needed to give adequate coverage to eleven different governments. The Federal programme will be presented first followed by the provinces arranged chronologically by programme changes.

### **Federal Government**

The Federal Government, in June 1971, formally created a Department of the Environment, also known as Environment Canada. This department regroups into a single ministry those elements within the federal government related to the environment and renewable resources. It includes the original Department of Fisheries and Forestry and the agencies responsible for management of water resources, both inland and marine, of air and of wildlife. Advice from outside government will be furnished by an Environmental Advisory Council and several resource advisory councils. The Environmental Protection Service is a noteworthy innovation in the department. It is understood that as the public's point of contact with the department it will function as an advocate for ecological and aesthetic interests in resource development.

The philosophy of the department can be expressed by quoting the Minister: 'the protection and enhancement of the quality of the natural environment including water, air and soil quality'. The terms of reference can be identified by six major descriptors.

- (1) Carry on established management and research projects in specific resource areas—fisheries, water, forestry, migratory birds, wildlife—and continue atmospheric research and weather forecasting.
- (2) Clean up and control pollution.
- (3) Assess and control the environmental impact of large-scale development.
- (4) Initiate long-term environmental programs.
- (5) Promote and support international environmental initiatives.
- (6) Develop an environmental information and education program.

The Department of the Environment also has an important service related to policy research and planning in dealing with intergovernmental relations such as international policy, Canada/U.S. relations, and federal/provincial relations, data collection and environmental technology.

### **British Columbia**

British Columbia, our westernmost province, has a long tradition of regulation of resources through licensing. Its use of water licences, the first in Canada, pre-dates the entry of the province into Confederation in 1871. In 1967 British Columbia became the first province to issue permits for effluent discharges,

controlling pollution through permits prohibiting the discharge of untreated organic materials and regulating the inorganic discharges. This process, initially applied to water, was extended to air in 1970. It involves widespread consultation between the relevant government departments, the final authority in the Pollution Control Branch, which formulates the permit, and its director, who issues it. An Environmental and Land Use Committee of the Cabinet, which has technical committees made up of heads of departments and sub-committees made up of experts, looks at the policy aspect of permit applications and decides if the environment can accommodate the proposed industry or development without detriment, using independent evaluation and hearings.

### **Newfoundland/Labrador**

The responsibilities for environmental management are vested with the Minister of Natural Resources. The province needs industrial development and as yet pollution control is not a major consideration. An act Relating to the Conservation of Water and Control of Pollution passed in 1967, calls for a Water Authority, an Advisory Board to the Authority and the necessary support staff. Its role is the investigation and collection of data on conservation, the development, control and improvement of the proper utilization of water resources and the prevention of pollution in air, water and soil.

### **Manitoba**

Manitoba is one of the three prairie provinces. It is primarily dependent on agriculture, with some industrialization and one large urban centre. This was the first government to approach environmental management through a comprehensive, integrated structure which involved the establishment of an inter-departmental Clean Environment Commission in June 1968, to issue licences for the discharge of wastes into air, water and soil. A process of hearings initiated by the Commission for each licence application has been useful for the information it conveys to the public and to government, as well as the deterrent it provides to industrial polluters. Mandatory hearings for each licence were found too time-consuming, so amendments were made to limit hearings to contest of application. The commissioners have now been appointed on a full-time basis and the activities of the Commission widened to include research, investigation, monitoring, inspection and public information, as well as coordination. In 1971, Manitoba transferred environmental matters to an expanded ministry to be known as the Department of Mines, Resources and Environmental Management.

### **Alberta**

Alberta, the westernmost prairie province, is a prosperous area with a stress on agriculture, and oil and gas. The government developed a comprehensive program of sewage treatment and control of industrial wastes under the Department of Health. This was incorporated in 1971 into a larger Department of the Environment established to oversee conservation, management and utilization of natural resources, prevention and control of pollution, and the preservation of natural resources for aesthetic reasons. A Natural Resources Coordinating Committee made up of heads of departments has a right to enquire, to review policy and to make recommendations. There is also a Conservation and Utilization Committee, which is concerned with investigation and regulation.

A particular innovation in the Alberta program is the Environmental Conservation Authority made up of three members, one from the academic world, one

from government and one from public interest groups. It is a non-partisan corporation separate from the regular government structure. Its purpose is to protect the environment for the public benefit. Its means are a continuing review of programs and policies concerning the environment, as well as specific investigations at the request of the public, on its own initiative or at the request of the Lieutenant-Governor. It has the important power of being able to obtain information from the government.

### **New Brunswick**

A maritime province, New Brunswick is largely rural, but in search of industrial development. It faces some major problems but it is not as yet in a serious position regarding industrial pollution. A department of Fisheries and the Environment was established in 1971 to administer the Water Act, the Un-sightly Premises Act and likely the Clean Air Act now being proposed.

### **Ontario**

Ontario is the most industrialized and urbanized province of Canada, an area of steady growth, containing the greatest population concentrations. The province has had a long-term concern for environmental quality and developed strong programs in water, air and waste management, in the monitoring of pesticides, in the design of guidelines, regulations and enforcement, and in financial assistance. These were housed in different departments but linked by an interdepartmental coordinating committee. In 1971, the province established a Department of the Environment, to bring together existing programs and to develop new programs dealing with noise, heat, radioactivity and litter. It contains provisions for a Pollution Control Appeal Board. An Environmental Council is being set up to advise the Minister on the results of modern research and technological development, and to obtain expert views and advice from outside the civil service.

At the beginning of 1972, the Cabinet of Ontario was reorganized by the inclusion of three policy ministries, to coordinate policy amongst groups of related departments: in the area of the environment, the Ministry of Resources Development oversees the Departments of Labor, Trade and Development, Agriculture, Natural Resources, Environment, and Transportation and Communications.

### **Prince Edward Island**

This is a small island province which is essentially rural in character and dependent upon tourism. The government has looked at areas of housekeeping, such as unsightly premises, auto junk yards, and secondary steel yield. In 1971, it established an Environmental Control Commission, which takes over from the Water Authority. It has provision for an Environmental Advisory Council made up of people both within and outside of government. Regulation is a feature, although perhaps not of the same nature as in the more industrialized areas. Its powers are those of investigation, planning, coordination and cooperation in the control of surface, ground and shore waters, the allocation of resource use, the control of alteration of natural features and pollution control.

### **Nova Scotia**

Nova Scotia is a maritime province with similar problems to New Brunswick. In 1972, the government set up a Department of the Environment to oversee the preservation and protection of the environment through control, coordination of programs and policy, and research. The Water Resources Commission

formerly responsible for permits for effluent discharges became the Environmental Control Council with responsibilities to oversee works and discharge of wastes into water.

### **Saskatchewan**

Saskatchewan is the middle of the three prairie provinces. Its pollution problems are associated with widespread agriculture operations leading in particular to contamination from fertilizers and feedlot wastes. The government set up in 1972 a Department of the Environment, to oversee pollution from effluents as well as from poor land use practices. The government has declared its intention to regulate disposal of wastes, application of chemicals, sand and gravel operations, and noise. The department will be assisted by an Environmental Advisory Council of experts and an Inter-agency Coordinating Committee of officials.

### **Quebec<sup>1</sup>**

This province is characterized by concentrations of urban development, with the remainder of the province largely rural. It is trying to attract industry and its environmental program has stressed cooperation with this sector. It is developing regulations in conjunction with industry for pollution control and the government now is discussing the reorganization of an appropriate department to oversee this. A minister has been designated as an advocate for the environment. He has no formal power but acts as a check on government programs on an informal basis. Legislation is being proposed for industries to dispose of waste through government approved facilities.

In conclusion to this review of Canadian government responses to environmental management, it is obvious that within a general framework great variation is possible. All the responses are compatible with one another. Each is a distinctive product of local needs and traditions. There is a search for new mechanisms for environmental management, such as councils, task forces and review committees. These are beginning to be described in legislation, and are gradually being put into practice. In the future one can expect more of the external advisory mechanism, now that governments are learning to consult popular and expert opinion. The device of environmental advocate, whether internal or external to government, will no doubt also be put to greater use. This provides a solution to the dilemma of government as developer of resources and enforcer of pollution control regulations. It also removes a certain number of decisions from the purely policy sphere and allows nature a voice.

### **The Canadian Council of Resource and Environment Ministers**

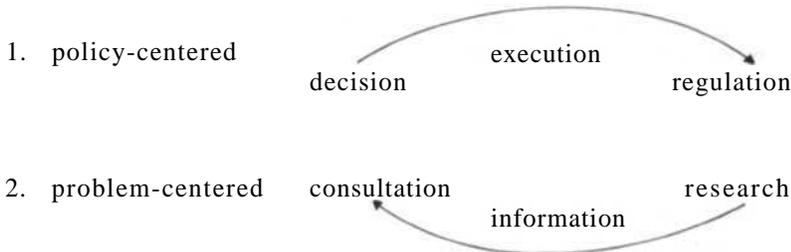
Canada has a notable device for intergovernmental consultation in the form of the Canadian Council of Resource and Environment Ministers. The establishment of an intergovernmental forum for the exchange of information and views on problems of renewable resource development in Canada was a principal recommendation of the 1961 national conference on Resources for Tomorrow. The Council was formally set up the following year with eleven Resource Ministers, meeting as equals and representing their respective Cabinets, from

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<sup>1</sup> Since this Paper was prepared, in June 1972, much of the proposed legislation has been enacted, including some to which no reference is made in this brief synopsis.

the Federal and the ten Provincial governments. A standing Coordinating Committee of senior government officials was also created to advise the Council and coordinate its programs. A permanent Secretariat was established in Montreal to conduct the work on a continuing basis. These are the three principal and only permanent groups within the organization, except for a ministerial Board of Directors which acts as a Financial Sub-Committee of Council. The legal basis and objective of Council were established in Letters Patent but they do not reflect the actual role and functions of Council. In fact, had the Council attempted to carry out some of the functions prescribed in the Letters Patent, it would soon have been dissolved. Their chief merit was the creation of a flexible institutional framework which ensured a continuous exchange of information and views among governments.

A principal strength of the Council is that it has no formal power, a fact which seems to offend the sensibilities of some students of government. To understand the role and functions of Council, it is necessary to make a distinction between policy-centered processes and problem-centered processes. The following, an admittedly simplified model of the problem-solving process, may help to clarify this:



The decisional, executive and regulatory functions and processes in the *policy-centered area* are, in a Federal system, the prerogatives of governments. It is in the problem area that Council works, focusing principally on information exchange and consultation. The area of research is ably occupied by governments, industry and universities, so Council concerns itself largely with exchange of the results, the point at which structured data becomes information.

Coordination cannot be effectively achieved among governments if they have not obtained adequate coordination within. While Council is directly concerned only with the former, its efforts would meet with little success without the latter. Besides being a topical discussion at Council-sponsored conferences and seminars, interdepartmental coordination has been assisted by national surveys conducted under Council auspices to present the institutional and administrative framework of each government in specific resource areas. The review of information for a survey has led, in many cases, to fundamental changes and new innovations. The reports are published as public documents, permitting additional comparisons of the approaches of each government. Their value can be measured by the fact that they are usually out of date within eighteen months.

The intergovernmental work of the Council depends on a common information base. In addition to surveys, the Council has an extensive information program. But meetings, conferences and seminars are the core of Council's work

for consultation, exchange of views, testing of new approaches, establishing informal and formal linkages, building on common interests and gaining confidence and ability to cope with a conflicting interest.

Council holds an Annual Meeting of the Resource Ministers. Various *ad hoc* expert committees in specific resource areas meet throughout the year. These Committees have a mixed set of references. They often start by considering problems and then receiving a mandate to organize a seminar or a conference on a relevant subject, or undertake a study. They have an advisory role but they are more particularly information gathering and study groups. The Standing Coordinating Committee of senior officials meets several times annually to review existing programs and to develop new ones.

In terms of conferences and seminars, the first major effort in this direction was the National Conference on Pollution and Our Environment, in 1966, which is now being recognized as a benchmark for inter-disciplinary assessment of the problem, and a focus for public attention. Other smaller seminars have been held in other resource areas, including one of government experts on pollution, to look at possible common government action in pollution control.

A future event of comparable scale is being planned for 1973, a National Conference on Man and Resources. This is a multifaceted undertaking to furnish a nation-wide forum for the development of guidelines for future resource management. It will focus in particular on the integration of social economic and environmental goals into the decision-making process. Implicit in the conference program, which includes local and regional meetings sponsored by governments, involvement of public interest groups and two large-scale conference meetings, is the recognition that people have a right to be heard before administrative decisions affecting their environment are made. At the last Annual Meeting of Council the ministers declared that Council should be more problem-oriented. They underlined that the role of Council was in the area of pre-policy planning. In acknowledgement of current trends and of the inseparability of resources and environment the ministers stated that the Council should be known as the Canadian Council of Resource and Environment Ministers.

Since the Resources for Tomorrow Conference in 1961, the approach to resources has changed dramatically. Many of the changes in the administrative and institutional framework can be attributed to the work of Council. Not the least of these changes is that ten years ago some resources were considered renewable as a matter of fact, today it is a policy decision. Within resource administration, governments have moved from single discipline departments to inter-disciplinary, integrated staffs. Currently there is a search by governments for mechanisms to widen the inputs into decision making through public participation. Through each of these changes Council has been a spur to parallel developments across the country. It is likely that in future moves towards increased cooperation and coordination it will continue this role of catalyst.

## Conclusion

Future institutional development in federal systems seems to be in the way of increased cooperation and coordination so that the lines of division between levels of government which are now so visible will become muted, to enable a greater concentration on the task at hand rather than the form of approaching the task. Intergovernmental consultation and negotiation have been all too frequently dominated by a concern for 'who should do what' rather than the more urgent and direct 'what needs to be done, when and how'. The emphasis in

Canada can be seen to be shifting from the constitution to the problems themselves. It may be, as in the case of the role of the Canadian Council of Resource and Environment Ministers, that information is the real intergovernmental currency and that as our views towards information exchange relax so will our formalization of intergovernmental contact.

### **Acknowledgements**

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## **SESSION B: NATIONAL AND INTERNATIONAL ENVIRONMENTAL POLICIES**

### **Part 1: Paper (6)**

## **De la prise de conscience au programme d'action**

OLIVIER REVERDIN

*Member, IUCN Executive Board; Professor of the Faculty of Letters, University of Geneva.*

### **RESUME**

L'homme à longtemps abusé de la nature sans en être conscient. C'est qu'il en croyait les ressources illimitées. Il a exterminé les fauves et les espèces qu'il qualifiait de nuisibles sans comprendre qu'il perturbait dangereusement les équilibres biologiques.

Depuis longtemps, dans certains pays, on s'emploie à inspirer à l'homme le respect de la nature. Pour cela, on fait appel à son sens de la beauté, à la valeur suprême de la vie, aux sentiments d'admiration ou de pitié que les bêtes et les plantes sauvages peuvent inspirer. Les succès obtenus attestent que cette forme d'éducation a été et demeure valable.

Toutefois, depuis deux décennies, le problème a changé de dimensions. Le milieu naturel dans lequel l'homme vit, d'où il tire force physique, santé mentale et équilibre spirituel, est dangereusement atteint. Dans les pays développés, les peuples, maintenant, le savent. La prise de conscience a été soudaine et dramatique. Des événements, qui ont fait fonction de catalyseurs, l'ont provoquée. L'Année européenne de la protection de la nature, par exemple, ou le message du président Nixon sur l'environnement. Le spectacle des eaux polluées, des grèves nauséabondes, des déchets partout accumulés, les

inconvénients provoqués par les émissions malsaines des véhicules à moteur, par le bruit des avions, ont achevé de convaincre les hommes que cela ne pouvait plus durer, que le moment d'agir était venu.

Des obstacles, toutefois, entravent l'action. Ce sont en particulier:

(1) Le fait qu'on connaît insuffisamment les causes et les conséquences réelles des phénomènes dont on constate les effets malfaisants. La science est souvent en défaut. Il y a un grand retard dans la recherche. Le combler exigera du temps. On a trop longtemps négligé des disciplines telles que l'écologie humaine, animale et végétale, l'analyse des effets de beaucoup de substances nocives sur les organismes vivants, l'étude des sols, des sédiments, des climats.

(2) Le manque de données objectives et une émotion qui n'est pas sans analogie avec la grande terreur de l'an mil ont favorisé le pullulement d'une race redoutable; celle des sectateurs de l'environnement, qui prophétisent des malheurs apocalyptiques et paralysent les énergies; celle aussi des politiciens de l'environnement qui, dans le sillage de la contestation généralisée des jeunes, accusent, dénoncent, jettent l'anathème, demandent des têtes et sèment la confusion.

(3) Les menaces qui pèsent sur l'environnement ne connaissent ni les frontières idéologiques, ni les frontières politiques. Pour les combattre, des mesures et des programmes internationaux, voire mondiaux, sont indispensables. Cela est particulièrement évident pour la protection de l'air et des mers. La Conférence de Stockholm, convoquée précisément pour élaborer de telles normes, de tels programmes, n'a été qu'un succès très partiel: ses travaux ont eu un caractère préparatoire. De manière générale, on constate que même pour un groupe d'Etats à régimes politiques semblables ayant de bonnes relations entre eux (c'est le cas de l'Europe occidentale), voire pour un Etat fédéral (comme les Etats-Unis), l'insuffisance de structures politiques est un obstacle d'autant plus sérieux que la protection de la nature est dans une large mesure un problème de législation, et que des législations non harmonisées peuvent être funestes.

Dès lors, des actions s'imposent sur divers plans:

(1) Développement accéléré de la recherche et coopération scientifique internationale dans le domaine de l'environnement.

(2) Objectivation politique et mise en évidence des succès obtenus dans la lutte contre la pollution et les émanations nuisibles; mesures législatives (interdiction à terme des véhicules à moteur polluants, des pesticides, herbicides et détergents non dégradables) pour stimuler la recherche scientifique et technologique, notamment dans l'industrie.

(3) A défaut de normes et de programmes internationaux—à l'élaboration desquels il convient de travailler avec ténacité—mesures locales ou régionales, à effets partiels, qu'il conviendrait d'harmoniser le plus possible pour faciliter la mise en vigueur ultérieure de règles et de plans d'action internationaux.

## SUMMARY

Man has long misused Nature, without being conscious of doing so, because he has believed resources to be unlimited. He has exterminated large predators,

and species which he considered as pests, not realizing that in the process he was causing dangerous disruptions to ecological balances.

In some countries efforts have long been made to teach man to respect nature. This has been done by appealing to his feeling for beauty, to his sense of the supreme value of life, and to the feelings of admiration or pity which wild animals and plants may inspire. The success achieved proves that this form of education has been and remains effective.

However, during the past two decades, the dimensions of the problem have changed. The natural environment in which man lives, and from which he draws his physical strength, his mental health and his spiritual balance, is dangerously affected. In developed countries, people now know it. This awareness, which has been very sudden and dramatic, has been induced by various events, acting as catalysts, such as European Conservation Year and President Nixon's Message on the Environment. The sight of polluted waters, of stinking beaches, of refuse accumulating everywhere, the inconveniences caused by unhealthy emissions of motor cars, and by airplane noise, have finally convinced men that this must no longer continue; that the time for action has come.

There are obstacles to such action. These include:

(1) insufficient knowledge of the real causes and consequences of the phenomena which have harmful effects. Science is often in default, for there are great gaps in research in certain fields, which will take time to bridge. For too long there has been neglect of human, animal and plant ecology, the analysis of the effects of numerous materials which are harmful to living organisms, and the study of soils, sediments and climates.

(2) The lack of objective data, and an emotion somewhat similar to 'la grande terreur' of AD 1000 (when mediaeval Europe was gripped by the fear that the end of the world was at hand), which has encouraged the multiplication of fear-mongering groups of 'doom watchers'—environmental sects who prophesy apocalyptic disasters and paralyze energies—and also of politicians who, in the wake of the generalized arguments and anti-establishment protestations of young people, accuse, denounce, hurl abuse, call for heads to 'roll' and spread confusion.

(3) The dangers threatening the environment ignore ideological and political boundaries, so that international, even global measures and programmes are needed to fight them. This is particularly obvious for the protection of the air and seas. The Stockholm Conference which was expressly convened to work out such criteria and such programmes, was only a partial success: its work has a preparatory character. Generally speaking, it appears that even for a group of States having similar political regimes and good relationships (for instance Western Europe), or even for a federal country such as the United States, the lack of political structures is an obstacle. This is all the more serious because nature conservation is largely a legislative issue—and unco-ordinated legislation may be fatal.

Action should therefore be taken at various levels:

(1) the development of research and international scientific co-operation should be accelerated in the environmental field;

(2) in order to stimulate scientific and technical research, especially in industry, there must be political implementation and evidence of success achieved in the control of pollution and noxious emissions, and the introduction of legislative measures aimed at prohibiting automobile pollution, pesticides, herbicides, non-degradable detergents;

(3) in the absence of criteria and international programmes, towards which we must steadfastly work, interim local or regional measures should, as far as possible, be coordinated with the aim of eventually bringing regulations into force and carrying out plans of action on an international basis and scale.

## DE LA FRISE DE CONSCIENCE AU PROGRAMME D'ACTION

### Origines et évolution de la prise de conscience

Pendant des millénaires, l'homme a estimé que les ressources de la terre étaient à sa discrétion, qu'il avait le droit de les utiliser selon ses besoins et ses caprices. Faisant de ce qui l'entourait deux parts, il s'est appliqué à détruire ce qu'il considérait comme importun, à multiplier ce qui lui paraissait utile ou agréable. Massacrer les fauves et les rapaces, exterminer les espèces nuisibles, pourchasser les peuples sauvages, essarter, défricher, déboiser, domestiquer les espèces utiles, les faire se reproduire à l'infini, développer les cultures, étaient à ses yeux autant d'activités civilisatrices. Cela a continué jusqu'aux temps modernes.

C'est ainsi qu'à force de déboiser, on a créé des déserts et favorisé l'érosion; qu'on a exterminé non seulement fauves et rapaces, mais, pour ne prendre qu'un exemple, la race pacifique des bisons américains, qui n'a été préservée qu'in extremis de la disparition totale. Après que ses sujets eurent massacré en Tasmanie presque tous les indigènes, le Gouvernement de Sa Majesté britannique a installé les quelques survivants dans une réserve—c'était en 1831—et multiplié à leur endroit les prévenances. H était trop tard. Et que dire des massacres d'indiens, autrefois en Amérique du Nord, récemment encore en Amazonie, ou de la manière dont les Bushmen ont été pourchassés et décimés en Afrique australe?

L'homme est naturellement myope; il n'a vu que l'utilité immédiate: les inconvénients à long terme lui ont échappé. Intuitivement, il croyait les ressources naturelles inépuisables; en Occident, il était convaincu que Dieu exigeait de lui qu'il croisse et multiplie, et ne mettait aucune limite morale ou religieuse à la prolifération de son espèce, attitude qui se perpétue de nos jours chez ceux qui s'obstinent à condamner le recours aux moyens contraceptifs.

A une époque récente, les savants ont donné l'alarme. L'homme avait rompu les équilibres biologiques et provoqué des réactions en chaîne dont il ne serait bientôt plus le maître. Son pullulement et les déchets de sa civilisation technologique étaient en passe d'enlaidir, d'empuantir le monde, de la rendre inhabitable. C'est à tort qu'il considérait les ressources de la nature comme inépuisables.

Ces sombres avertissements se sont longtemps heurtés à l'insouciance et à la surdité de peuples qui ne souhaitaient pas entendre. Il a fallu que les menaces deviennent réalité pour qu'enfin, dans les pays développés, en particulier aux Etats-Unis, au Canada et en Europe, une émotion intense secoue les hommes, ébranle leurs credo traditionnels, remette la civilisation en question. Une crise a éclaté, qui n'a pas encore déployé tous ses effets; elle a libéré des forces irrationnelles comparables à celles dont le déchaînement a accompagné la grande terreur de l'an mil; une sorte de vertige s'est emparé des hommes quand ils ont pris conscience du fait qu'ils étaient en danger de détruire le milieu naturel d'où ils tirent leur force et leur subsistance. De cette prise de conscience pourrait venir le salut, pour peu qu'elle soit génératrice d'actions adéquates.

## Les protagonistes européens

A vrai dire, si le vertige a été soudain, ce n'est pas d'hier que l'homme se préoccupe de conserver la nature et ses ressources. Depuis longtemps, des actions sont en cours; actions locales et limitées, mais souvent efficaces. Qu'on me permette de prendre l'exemple de mon pays. La conviction que la nature, ses ressources et sa beauté méritent respect y est ancienne. Jean-Jacques Rousseau a, le premier, dans le domaine français, répandu l'amour sentimental de la nature. Il a évoqué les paysages humbles et riants du plateau suisse, de ses lacs et de ses vallons avec des accents qui ont attendri l'Europe. Ses descriptions ensorcelantes du Léman, entre Clarens et Meillerie, dans *La Nouvelle Héloïse*, (elles arrachaient des larmes à Napoléon quand il se les faisait lire à Sainte-Hélène), la description plus sensible encore qu'il fait de l'île Saint-Pierre, sur le lac de Bièvre, et la manière dont il raconte l'établissement d'une colonie de lapins sur un îlot, dans la Cinquième promenade de ses *Rêveries d'un promeneur solitaire*, tout cela est une manifestation avant la lettre de ce respect protecteur de la nature, que l'on s'efforce maintenant de susciter partout. Il fut un temps, à la fin du XVIII<sup>e</sup> siècle, où l'Europe entière herborisait avec Jean-Jacques et s'émerveillait avec lui quand, au printemps, fleurissait la première pervenche. A la même époque, Albrecht Haller, de Berne, publiait son grand poème *Die Alpen*, que Goethe admira fort; de partout, on vint en Suisse communier avec la nature sauvage des Alpes. Goethe, Verdi, Victor Hugo et Lamartine, Turner, Shelley et Byron accouraient. La fatalité a voulu que, les voyageurs se multipliant et regorgeant d'argent, on ait construit près de sites les plus beaux ces énormes hôtels qui les déparent. Dans l'ensemble cependant, les Suisses, rendus conscients par l'admiration des étrangers de la beauté de leurs paysages, se sont efforcés de les préserver et de sauvegarder leurs richesses naturelles. Quand j'étais écolier, il va y avoir un demi-siècle, on m'enseignait quelles étaient les fleurs qu'il était interdit—ou déconseillé—de cueillir, car leur espèce était menacée de disparition, et la première fois que j'ai découvert un sabot de Vénus, dans un fourré, sur les flancs du Salève, près de Genève, je l'ai regardé en tremblant, sans oser y toucher, sans même avoir l'idée de le cueillir et de l'apporter à ma mère. De manière générale, on nous apprenait le respect des équilibres subtils de la nature, on nous faisait déplorer la disparition de l'ours et du gypaète, on exaltait le succès qui accompagnait la réintroduction des premières colonies de bouquetins dans nos Alpes.

Les Suisses ne sont pas meilleurs que d'autres; mais l'exigüité de leur territoire, l'accroissement rapide de sa population, l'exceptionnelle beauté aussi de leur pays ont eu pour effet qu'ils ont été parmi les premiers à comprendre que la santé physique et spirituelle de l'homme dépendait du cadre naturel de son existence; l'école, les ligues pour la protection du patrimoine et de la nature, le Club alpin, systématiquement, avec persévérance, ont éduqué tout un peuple, et cela avec un succès relatif. Aussi n'est-ce pas par hasard si l'UICN a établi son siège dans mon pays? Je m'en voudrais de donner celui-ci en exemple. Il me paraît en revanche opportun de signaler que les expériences qu'il a faites, dans le domaine du respect de la nature par l'homme, méritent qu'on les étudie. Elles montrent à quel point il y a là un problème d'éducation morale.

Toutefois, le problème que la Suisse a dû affronter est d'échelle modeste; on ne saurait le comparer à celui avec lequel l'humanité entière se trouve aujourd'hui confrontée; et la protection sectorielle des paysages, des plantes, des forêts, des animaux n'a pas empêché mon pays de polluer ses lacs et ses cours d'eau avec la plus parfaite inconscience!

### **Faiblesses du mouvement en faveur de la conservation**

Les Cassandre n'ont pas manqué: depuis des décennies, on annonce aux nations industrielles qu'à mépriser et à détruire la nature, elles se ménagent de tristes lendemains. Il n'est, par exemple, que de reprendre les débats de la Société des Nations sur la pêche à la baleine pour constater que, dans les années trente déjà, les spécialistes tenaient mêmes propos qu'aujourd'hui. Mais, à l'époque, ces propos ne suscitaient pas d'émoi collectif; ils ne pénétraient pas dans la sphère des sentiments et des passions; l'homme ignorait encore à quel point la nature était partout menacée; rien ne se produisait qui fût comparable au frisson de pitié, de dégoût et de colère provoqué par les massacres de bébés phoques, dans l'estuaire du Saint-Laurent, ou par la chasse impitoyable qui décime les léopards.

L'appel aux sentiments est désormais efficace. Surtout si on fait appel à eux pour sauver une espèce, un paysage. La motivation est alors positive; l'objectif est circonscrit. On ne met en cause qu'un nombre limité de personnes, auxquelles on demande des sacrifices limités: que les élégantes renoncent à certains de leurs caprices; que les chasseurs tuent moins et moins cruellement; que le commerce des fourrures accepte de réduire certains de ses bénéfices.

Mais, là encore, il ne s'agit que d'un aspect sectoriel de la protection de la nature, et l'on ne peut mobiliser les sentiments qu'en faveur de certains animaux; d'autres laissent l'homme indifférent. Dans les corridas d'autrefois, c'est aux chevaux que le public espagnol réservait le peu de pitié dont il était, en l'occurrence, capable. La souffrance du taureau lui était indifférente. C'est que cet animal ne nous inspire guère de sentiments; aussi sa mise à mort est-elle supportable, même pour les touristes non initiés à la tauromachie, alors que la mise à mort en public d'un cheval ou d'un chien serait un spectacle intolérable.

C'est ainsi qu'on peut émouvoir les gens en leur décrivant la manière dont sont assommés et écorchés vifs les bébés phoques, les souffrances des petits oiseaux migrateurs dans les tenderies belges ou italiennes; mais, pour le sort des crustacés et des poissons, voire pour celui des oiseaux rapaces ou des baleines, il restera indifférent. Or la survie des espèces, le maintien des équilibres biologiques est un problème global qu'il faut aborder objectivement sur la base d'études scientifiques, en faisant appel à la raison.

### **Eveil de l'intérêt en Europe: AEC**

Les problèmes dont il a été jusqu'ici question sont qualitativement importants; quantitativement, ils le sont beaucoup moins. Jusqu'à ces dernières décennies, les menaces étaient partielles, localisées. Une espèce animale ou végétale risquait de disparaître, un paysage était enlaidi, une usine polluait une rivière, une plage était couverte d'épaves et de détritiques. Aujourd'hui, le problème a changé de dimensions. Dans les pays dits évolués, la pollution tend à devenir généralisée, à la manière d'un cancer. Les sols, l'air, l'eau, sont contaminés. L'environnement de l'homme est, tout entier, compromis. Chacun—et c'est légitime—s'en inquiète, dès qu'il s'en aperçoit ou dès qu'on l'y rend attentif. La masse s'émeut. Des réactions collectives se propagent: on accuse, on demande des comptes; des obstacles nouveaux se dressent qui compliquent les solutions.

Certes, une prise de conscience collective peut être salutaire. C'est pourquoi on s'est employé à la provoquer. Tel a été le but de l'Année européenne de la protection de la nature, en 1970, 'année' que le Conseil de l'Europe avait

longuement, minutieusement préparée. Ses organisateurs aspiraient à sensibiliser l'opinion. Ils y sont parvenus au-delà de ce qu'ils avaient escompté. Ils souhaitaient que les peuples, les parlements, les gouvernements, les administrations nationales, les pouvoirs locaux de l'Europe entière prissent conscience, dans toute son ampleur, de la menace qui pèse sur les hommes et sur le milieu naturel dans lequel ils vivent. L'objectif a été pleinement atteint.

Incontestablement, l'Année européenne de la protection de la nature a suscité l'action. Dans de nombreux pays, les ligues nationales l'ont utilisée pour répandre leurs idées, pour faire connaître leurs programmes, pour obtenir un large soutien populaire; des énergies ont été mobilisées qui, jusqu'alors, sommeillaient. Il est devenu évident, pour chacun, qu'une part non négligeable du revenu national brut—2 à 3%—devrait être affectée, dans chaque pays, à la protection de l'environnement, qu'il s'agisse de la lutte contre le bruit, les émissions malsaines, la pollution de l'air et des eaux, ou de la conservation du paysage, des forêts, des animaux sauvages et des plantes.

L'Année européenne de la protection de la nature a eu également le mérite de démontrer que, dans la plupart des domaines, la rescousse ne saurait être efficace qu'à condition d'être non seulement locale, régionale, nationale, mais aussi et surtout européenne, autrement dit, à l'échelle du continent.

Voilà, certes, qui ne hâtera pas l'heure des solutions. En effet, l'organisation politique de l'Europe n'est pas encore telle que des mesures communes soient aisées à prendre. Néanmoins, d'ores et déjà, certaines pressions sont exercées sur les Etats nationaux. Ainsi dans le domaine des tenderies d'oiseaux. S'ils ne s'étaient sentis massivement soutenus par l'opinion européenne, les adversaires italiens de cette chasse barbare n'auraient pu en obtenir l'interdiction tant étaient puissantes les pressions électorales en faveur de son maintien.

Toutefois, ce ne sont là, sur le plan de l'action, que des balbutiements. L'Europe sait qu'elle ne pourra résoudre le problème de l'environnement et de la conservation de la nature dans toute son ampleur qu'à condition de disposer de structures économiques, juridiques et politiques permettant de mettre en oeuvre un programme d'ensemble. C'est donc à une action politique préalable que devrait aboutir la prise de conscience pour laquelle l'Année européenne de la nature a servi de catalyseur.

### **Eveil en Amérique: message du président au Congrès**

La situation est fort différente dans des régions telles que l'Amérique du Nord (Etats-Unis et Canada), l'Australie ou le Japon. Le hasard a voulu que je me sois trouvé à Washington le jour où le message du Président Nixon sur l'environnement a été rendu public et distribué aux membres du Congrès. J'avais des rendez-vous avec des sénateurs et avec des représentants. Dans les couloirs du Capitole circulaient de lourds chariots transportant, par centaines, ce volumineux document. On avait le sentiment que quelque chose venait d'être déclenché qui allait immédiatement avoir des conséquences pratiques. Le soir même, la radio et la télévision, et, dès le lendemain, les journaux donnaient à fond. Les commentaires étaient graves, souvent dramatiques parfois aussi, pour l'Européen que je suis, surprenants. Ainsi ce long article dans un quotidien—le *Washington Post*, je crois—à la louange et à la gloire des Cisterciens: ils avaient su, au XIIe siècle, défricher sans provoquer l'érosion des sols, utiliser la force hydraulique sans polluer les rivières, construire leurs monastères sans déparer la nature; on les donnait en exemple aux Américains du XXe siècle!

L'effet catalyseur du message Nixon a été immédiat. Une lente prise de conscience devenait brusquement certitude, s'officialisait, allait se convertir sans délai en programmes d'action. L'événement n'a pas tardé à confirmer la chose: accélération du travail législatif, notamment en ce qui concerne la pollution due aux véhicules à moteur; mise au point d'ambitieux programmes de recherche; véritables conversions dans l'activité de nombreuses institutions: bref, de quoi faire rêver un Européen.

### **L'universalité des problèmes, point de départ de la conférence de Stockholm**

Il n'en demeure pas moins que les actions européennes à venir, les actions américaines en cours, les actions déclenchées ou envisagées dans d'autres continents ne sont que des actions partielles. La Conservation de la nature concerne le monde entier. Les pollutions ignorent les frontières idéologiques ou politiques; des mesures à l'échelle mondiale sont donc indispensables, des normes internationales doivent être édictées. Nous l'avons vu: même en Europe occidentale, région où des Etats à régimes comparables entretiennent de bonnes relations, qu'ils s'efforcent de structurer, les obstacles sont sérieux; à plus forte raison est-il difficile d'amener les Etats qui se partagent la Terre à aborder efficacement le problème dans le cadre des Nations Unies.

Le but de la Conférence de Stockholm était précisément de préparer l'élaboration de normes internationales et de programmes mondiaux d'action. Malgré les incidents politiques qui l'ont marquée et qui ont presque monopolisé l'attention de la presse, cette conférence a accompli un travail utile, mais ce travail n'a encore qu'un caractère préparatoire, et une action coordonnée, sur le plan mondial, n'est, hélas, pas encore pour demain. Il y a lieu de s'en inquiéter, notamment en ce qui concerne la protection de l'air et des mers, domaines dans lesquels des mesures prises sur le plan national, voire continental, ne sauraient suffire. Les méfaits de certaines méthodes de pêche, qui détruisent frayères et habitats sous-marins, dénoncés en termes dramatiques devant le Conseil de l'Europe par le Commandant Cousteau et, de manière générale, l'activité désordonnée d'usines flottantes de diverses nationalités, dans les mers les plus poissonneuses du globe, risquent de rompre l'équilibre biologique et de dépeupler les mers; la pollution due au mazoutage, funeste pour le plancton, ne saurait qu'aggraver la situation. Aussi longtemps que se perpétuera l'anarchie internationale actuelle, le mal s'aggravera; nombreux sont ceux qui l'annoncent et le démontrent; parfois, l'opinion publique daigne s'émouvoir. Ainsi, lors de la catastrophe du Torrey Canyon: largement répandues dans la presse, les photographies d'oiseaux de mer agonisant, le plumage sinistrement pollué par le pétrole, ont provoqué indignation et pitié; mais ces sentiments, pour utiles et légitimes qu'ils puissent être, n'ont pu déclencher d'actions décisives. C'est que l'action ne dépend pas des peuples, mais des gouvernements et des administrations publiques, qui ne sont pas toujours prompts à s'émouvoir, surtout quand des intérêts nationaux risquent d'être lésés par des mesures internationales.

### **Participation de la jeunesse: attitude et rôle**

La prise de conscience brutale de ces dernières années est survenue en un temps où, dans les pays industriels et fortement urbanisés, une partie de la jeunesse, désorientée par certains aspects de la civilisation contemporaine, s'est mise à en contester avec fougue, puis avec violence les fondements mêmes. Les jeunes ont donc tiré argument de la pollution de l'air et de l'eau, du bruit des avions, des méfaits imputés aux pesticides et aux herbicides, de l'amoncellement des déchets provoqué par une consommation démesurée,

devenue une fin économique en soi. Ils ont fondé sur ces inconvénients manifestes autant de griefs contre le système capitaliste et contre la société dite de consommation.

C'est ainsi que, dans le sillage des mouvements anarchistes ou révolutionnaires, des centaines, des milliers de justiciers ont surgi; ils accusent, vitupèrent, demandent des comptes et des têtes. Quand de prétendues révolutions sont déclenchées à froid, par des gens qui ont le ventre plein—c'est là une des caractéristiques de presque tous les mouvements de jeunesse de ces dernières années—les justiciers sont particulièrement violents, particulièrement injustes. Ils rejettent sur d'autres les responsabilités du malaise qu'ils ressentent. Pour ce qui est de l'environnement, ils feignent d'ignorer que nous sommes pratiquement tous responsables de sa détérioration, que nous sommes tous, peu ou prou, des pollueurs; rejeter, comme ils le font, toute la faute sur l'industrie, sur la cupidité des 'gros', est à la fois injuste et intellectuellement déshonnête. C'est un retour aux croyances primitives du bouc émissaire; c'est dégager artificiellement de leur responsabilité des millions de coupables. Celui qui produit ou vend l'auto polluante, le détergent non dégradable est certes coupable; celui qui les utilise ne l'est pas moins. Il n'y aura rémission que si producteurs, commerçants, consommateurs font les sacrifices voulus: diminution de la rentabilité, limitation des ventes et des marges, renonciation de certaines formes de confort et d'agrément. Et ils ne les feront, ces sacrifices, que pour autant que des lois en fixent les modalités et les délais. La protection du milieu naturel est donc, à bien des égards, un problème de législation.

### **Début d'intérêt dans les milieux politiques**

Cela étant, il est naturel que le problème de l'environnement se soit politisé. Tous les partis politiques, tous les candidats aux élections font campagne, par tout, pour l'amélioration de la qualité de la vie. Théoriquement, on devrait se réjouir de ce consensus. Malheureusement, la politisation a pour conséquence d'attiser le zèle incompetent, donc redoutable, d'une légion de néophytes de l'environnement; ils parlent de ce qu'ils ignorent, ils accroissent la confusion; ils introduisent un esprit partisan là où l'objectivité est la condition même de l'action efficace. Il y a eu des élections l'automne dernier dans mon pays. Quel merveilleux sottisier on pourrait tirer de ce que partis et candidats ont dit et proclamé! Que de pseudo-vérités scientifiques dans leurs affirmations catégoriques...

### **Alarmisme et pessimisme, deux obstacles à une action efficace**

Guillot criait à tout propos 'au loup! Au loup.' Personne ne prêtait plus attention à ses appels. Un beau jour, le loup vint. Guillot cria. Personne ne se porta à son secours. Cette histoire, qu'on racontait aux enfants de France, à l'époque où il y avait encore des loups, est souvent évoquée: elle a pris valeur proverbiale.

Les Guillot sont légion parmi les pourfendeurs de la pollution et les sectateurs de l'environnement. A la légère, avec des arguments qui n'ont de scientifique que l'apparence, ils prophétisent des catastrophes apocalyptiques. C'est déplorable. Démentis ou contredits par les faits, ils perdent toute crédibilité. Au lieu d'inciter à l'action, ils poussent à l'indifférence. On ne prête plus attention à leurs propos.

Voici un exemple. Il y a quelques années, nos Guillot avaient annoncé la mort biologique définitive du Lac de Zurich. Ils opéraient avec de sinistres photographies de poissons agonisant sur les grèves, parmi les algues mortes et les

bulles verdâtres. Jusqu'à l'*Observateur* de la très sérieuse UNESCO, on avait emboîté le pas. Le Lac de Zurich était condamné à jamais; on le donnait en sinistre exemple au monde entier. Cependant, les localités qui le bordent poursuivaient méthodiquement la construction de leurs stations d'épuration et les mettaient en service. Aujourd'hui, elles fonctionnent; le Lac de Zurich est régénéré; comme il est peu profond, les eaux polluées se sont écoulées et ont été remplacées par des eaux propres, descendues des Alpes; le cloaque d'hier est redevenue le lac limpide d'autrefois. Comme quoi il ne faut jamais désespérer: la nature a d'extraordinaires ressources pour se régénérer; l'homme, qui, par ignorance ou négligence, la dégrade, peut l'aider, par la science et l'application, à se régénérer. La lutte n'est donc pas désespérée. Mettre en évidence les succès réels, plutôt que les désastres hypothétiques, est un moyen d'inciter à l'action. Le désespoir est mauvais conseiller; l'espérance stimule l'esprit d'entreprise.

Voici encore un exemple. Que de larmes n'a-t-on versé, dans mon pays, sur la disparition du cerf. Il n'y en avait plus un seul au début du siècle: les chasseurs abusant d'une législation trop clémente, les avaient exterminés. En 1914, spontanément, quelques cerfs, venant d'Autriche, ont passé la frontière. On les a protégés. Aujourd'hui, leurs descendants ont reconquis les Alpes et les Préalpes. Comme quoi il y a presque toujours de l'espoir!

### **Danger des attitudes sectaires ou passionnelles**

Dans la prolifération des ligues, des mouvements, des instituts, groupes et groupuscules qui se lancent dans la croisade pour la qualité de la vie, il y a un élément de faiblesse. On a le plus souvent affaire à des sectes, avec leurs zélés, leurs prédicateurs, leur tendance à anathémiser le reste du genre humain, si bien que de la multitude des petits prophètes incompetents qui s'égosillent ne monte qu'une rumeur confuse, lourde de contradictions. Certains groupes, toutefois, se distinguent par leur modestie et par leur efficacité. Ce sont ceux qui balaient, si l'on peut dire, devant leur propre porte. Ainsi, dans toute l'Europe, ceux qui mobilisent les jeunes pour nettoyer des plages, des forêts, pour faciliter la récupération des déchets, pour donner au public l'éducation élémentaire qui lui fait le plus souvent défaut. Ces groupes n'annoncent pas la fin du monde: ils agissent à un niveau où leur action est efficace, et ils démontrent par l'exemple que chacun peut faire quelque chose pour protéger la nature, pour améliorer la qualité de sa vie et de celle des autres.

Alors que ceux qui se bornent à dénoncer le mal et à prédire des catastrophes paralysent les énergies ou les stérilisent en les transformant en haine contre ceux qu'ils dénoncent comme étant les responsables de la dégradation de la nature.

### **Science et prospective dans la lutte contre la dégradation de l'environnement**

Nous avons dit les inconvénients de la voie émotionnelle: en faisant massivement appel aux sentiments et aux passions, on abuse et on égare. Est-ce à dire que l'émotion ressentie par les sociétés évoluées le jour où elles ont pris conscience de la menace est un phénomène négatif et dangereux: certainement pas. Nous savons aujourd'hui ce qui nous menace, nous savons aussi que nous ne sommes encore ni scientifiquement, ni technologiquement, ni politiquement prêts à la riposte. Preuve en soit l'accueil réservé à l'étude sur les *Limites de la croissance*, élaborée au MIT à la demande et sous la responsabilité du Club de Rome; il est fort probable que cette étude contienne des éléments unilatéraux et qu'il faille la reprendre, la nuancer. Elle n'a d'ailleurs pas la pré-

tention d'être un livre sacré, une sorte de Bible des temps futurs. Elle envisage simplement, de manière objective, ce que risquent d'être les prochaines échéances pour l'humanité; quelles que puissent être les erreurs ou les exagérations qu'elle contient, elle nous a scientifiquement démontré que nous ne sommes pas prêts à affronter les menaces que notre civilisation fait peser sur la vie même de notre espèce. A ce titre, elle est bénéfique et conforme aux intentions lucides de son initiateur, M. Aurelio Peccei.

Nous sommes pris au dépourvu. C'est un fait. La prise de conscience est intervenue tardivement et brusquement. Mais nous savons que nous devons nous préparer, et, autant que possible, brûler les étapes.

La menace d'interdiction qui pèse sur de nombreux produits chimiques destinés à l'agriculture ou aux ménages oblige l'industrie à intensifier ses recherches en vue de mettre rapidement au point des pesticides, des herbicides, des détergents autodégradables. L'interdiction du DDT dans nombre de pays a eu, à cet égard, un effet stimulant. Dans le passé, les guerres ont rendu l'homme inventif; sous la contrainte de la lutte et de la nécessité, il a accéléré les recherches et accompli de grands progrès technologiques. La lutte pour la sauvegarde de la nature et de l'environnement pourrait et devrait avoir des effets analogues: c'est aussi de survie qu'il s'agit!

On note d'ailleurs déjà certains signes encourageants. La conviction que, d'ici quelques années, seuls les véhicules à moteur propres (ou relativement propres) seront admis à circuler stimule l'ingéniosité des fabricants. Il en va de même pour le bruit des avions: les polémiques relatives au Concorde, à certains égards déplaisantes (la concurrence s'en mêle), n'en ont pas moins valeur de mise en garde solennelle. Le fait même qu'on ait limité de manière très sensible les essais atomiques dans le monde est également un signe encourageant.

Toutefois, de manière générale, il est évident que la recherche scientifique et technologique n'est pas en mesure de répondre de manière suffisante aux exigences de la lutte pour la régénération du milieu naturel. Sous le coup de l'émotion, les peuples demandent qu'on agisse; ceux qui devraient agir sont paralysés par l'insuffisance des données scientifiques. Il en résulte que le problème de l'environnement est aujourd'hui, largement, un problème de recherche.

Or la recherche ne s'improvise pas. Elle n'a de chances d'être efficace qu'une fois mises en place certaines structures, une fois formés en nombre suffisant savants et auxiliaires. Les Etats-Unis ont pris dans ce secteur, comme dans tant d'autres, une indéniable avance; ils ont procédé à une reconversion; d'ailleurs, on s'y emploie et on découvre qu'il ne suffit pas de faire des budgets pour créer de la bonne recherche. L'argent est comme l'eau d'arrosage: il ne fait croître que ce qui existe déjà en germe.

On découvre donc, dans beaucoup de pays, que l'écologie humaine, animale, végétale, que la taxonomie ont été malencontreusement négligées ces dernières décennies, au profit de formes dites modernes de la biologie et qu'en conséquence un rééquilibrage est à opérer; on découvre aussi, de manière générale, qu'on a formé trop de scientifiques purs et pas assez d'ingénieurs. Là aussi, il faudra rééquilibrer.

### **Rôle de la coopération internationale dans la création de programmes d'action efficaces**

Dans le domaine de la législation également, il existe un retard qu'on s'emploie à combler. A défaut de normes internationales, il serait souhaitable

qu'on se concerte, qu'on s'efforce de résoudre de manière analogue, dans les divers pays, des questions en fait identiques. A cet égard, les études faites par l'IUCN doivent être considérées comme des études pilotes. En mettant à disposition, prêtes à être utilisées par ordinateur, des informations sur l'ensemble des mesures législatives nationales relatives à la protection de la nature, elles peuvent rendre d'incalculables services.

Toutefois, qu'il s'agisse de recherche ou de législation, l'anarchie internationale, le fait que les pays agissent en ordre dispersé, qu'on fait souvent un peu partout les mêmes recherches, sans se le communiquer, sans échanger en cours de travail les résultats, est une chose déplorable. Le défi est global, mondial; c'est globalement, mondialement qu'il faudrait pouvoir le relever.

Les peuples dits développés sont désormais conscients de ce qui les attend s'ils n'agissent pas; ils sont prêts à agir; mais les conditions politiques ne sont pas remplies qui donneraient à l'action sa vraie efficacité. Tel est à bien des égards, dans l'immédiat, le défi. Mais rien ne serait plus sot que d'attendre la solution du problème politique pour engager la lutte: nombreux sont les fronts où elle peut être menée, en attendant mieux, par les moyens de bord.

## SESSION B: NATIONAL AND INTERNATIONAL ENVIRONMENTAL POLICIES

### Part 1: Discussion

In his opening remarks the Chairman, Dr **M.E.D. Poore**, said that the Session followed logically from the morning's discussion on environmental quality. Few would deny that there has been a significant change of attitude among the well-informed and educated, including many politicians and officials, about the nature of the problems and of the goals towards which we should work. But there is a great gap between knowing what to do and doing it; how to convert wishes into actions should be the essence of Session B discussions. Of the means by which ideals may be realised, the most important is the Law, but law can only move as fast as the public opinion of the electorate or of the family of Nations, though one hopes it can keep a little step ahead. The necessary support of law is therefore education, while the whole administrative set up can be greatly assisted by financial incentives, such as grants, tax concessions and international assistance. There is usually no problem when the best conservation practice is also obviously the most profitable. This has not often happened, but it can be planned to happen and legislated for.

Two final points: most nations have environmental laws, developed directly from problems that have effected them—loss of forest resources, soil erosion, public health and so on. There is therefore no intrinsic merit in standardization, but very much in using the best of other countries' experience when it is appropriate. The long-term trend should therefore be towards making state laws more concordant with federal laws, and national with international. Secondly, the model at the end of Paper (5) points to a serious dilemma. When are the 'facts' adequate as a basis for 'action'? If one waits for research to prove a case to the hilt, action may be too late. But if action is based on inadequate facts or alarmism, it may be injudicious or even downright dangerous. There is thus clearly a need for the exercise of responsible judgement, but at present the greatest deficiency is in the dialogue and understanding between scientists, sociologists, economists and administrators, who transform an analysis of problems into action. The root of the difficulty is excessive polarization of higher education.

The two Papers now to be introduced by their authors are largely concerned with these problems of transforming ideas into actions, but the problems are so large and solutions so various, that they can only deal with certain aspects. It is to be hoped that the subsequent discussion will use them as a basis for exploring some of the principles on which the experience of one nation can best be directed to helping others.

Presenting his paper **Mr.C.de Laet**, emphasized that the Canadian experience on which it was based, was not to be regarded as a model, although he had tried to develop comments which might have general relevance to a very complex set of problems. Almost all Federal countries have different styles in their political and administrative relations, particularly in the resource and environment field, and Canada was no exception. The kind of paradox which may have to be faced is whether legislation should be more stipulatory and precise, in order perhaps to avoid unduly large reliance on the judicial system (which may be slow and unresponsive), when on the other hand by their very nature environmental problems cannot be structured to the degree which

would permit the legislative and executive branches of government to cover all existing and emerging issues. In a Federal system these two senior levels of government are often found in quasi-adversary situations, in support of their respective jurisdiction, whereas resource and environmental problems require cooperative approaches based on principles of advocacy.

The finiteness of the revenue base of governments in relation to the ever larger demand for goods and services, is comparable with the limits of the environment in relation to the increasing and mostly conflicting demands on it. In each case the individual citizen must assume greater responsibility and this implies participation in the decision-making process, for which he must be aware, informed and educated. This could well involve the search for a new ethic, as discussed in the previous session; at least it calls for the study of the cyclical constraints of earlier civilizations and reconsideration of the doctrines of public nuisance and abuse of the rights of others. As Santayana has said—'those who do not read history are bound to repeat it'. The challenge will require the utmost resolve to review and revise traditional obedience to obsolete and unresponsive structures.

Professor **Reverdin**, introducing his paper, said that there was little he could add at this stage to its argument as set out in the summary. He had felt that it was necessary to stress that, contrary to the views of the authors of the *Blueprint for Survival*, there was still a long way to go in establishing facts on which action could be soundly based. He thought that the Zurich See story, quoted in the Paper, was a particularly good example of the misleading nature of many of the doubts and fears which are commonly published, and of how much more sensible it would be to cooperate in the solution of problems.

Opening the comments of the Panel Members, Mr **Burhenne** expressed full agreement with Mr de Laet concerning the diversity of federal systems, which made it impossible to generalize. Nevertheless it is useful to identify the principles which apply to certain situations. Thus, in a federal system such as that of his own country, in which the powers assigned to the regional governments and central government are not exclusive (the central government enacting the framework for regional legislation and the 'Länder' being obliged to act 'in good faith' and liable to be sued for breach of this obligation), the principle of cooperative federalism outweighs the principle of local independence. An important point is the parliamentary role. This, in a federal State, especially where the parties are all directly involved in the legislative and administrative process, is precisely to solve conflicts of jurisdiction, which usually arise at the pre-legislative stage and are resolved when the legislation is enacted. This is also relevant to new supra-national mechanisms such as the European Community. The member states are represented by their Executive Branch on the Council, which sets the pattern for European legislation on a basis of unanimity, compromise and, therefore, in environmental matters especially, minimum standards. What makes this possible is that there is not yet any legislative control at the Community level, and it is the reason why national parliaments are reluctant to enlarge Community jurisdiction, in the same way as powers in economic matters have already been extended. This shows that Executive-level coordination and cooperation may be insufficient to achieve environmental conservation, without the parallel functioning of parliamentary processes, and that further legislative action is necessary to back or control the trends. One could go further than Mr. de Laet, in his conclusion, and say that in the light of the complexity and interaction of environmental problems, all countries of the world are essentially in a federal relationship and will have sooner or later to cede part of their sovereignty, if the problems are to be tackled at their root.

Turning to Professor Reverdin's paper, Mr. Burhenne agreed that existing political structures in Europe were inadequate in the face of environmental problems, but he felt that the E.E.C., though not an ideal instrument in the absence of parliamentary control, had made a beginning in its harmonization and directives in such fields as air and noise pollution. As the Chairman had stressed, the problem of environmental conservation is closely linked with legislation and the extent of such legislation, especially in industrialized countries, is surprisingly comprehensive, although no doubt capable of improvement. The main weakness is at the level of enforcement and strict administrative action. The law establishes the general principles but often has to leave a number of decisions to the discretion of administrators, and it is at this stage that exemptions are given, which may simply mean that the administration is unable to cope with the magnitude of the task. Thus, in Germany a decision on whether to permit an industry to discharge effluent takes so long that, in the interim, unregulated discharges take place, to which the administration closes its eye. A further point is that in certain fields, such as water legislation, there is so much variation, that harmonization is virtually impossible and can perhaps only be achieved at an administrative level. The precise means of achieving harmony are relatively unimportant, provided the end result is successful.

Panel member Mr **Baba Dioum** confessed ignorance of the Canadian and European experience so far discussed, but wished to comment briefly on the general problem of translating ideas into action from the point of view of a developing country. Three stages are involved. First, at the concept level, the essential is a multidisciplinary rather than sectional approach, which requires some sacrifices and compromise: this applies also to international relations, where there may have to be partial sacrifice of sovereignty if joint management is obviously necessary. Secondly, at the stage of evolving a suitable structure, he noticed that the creation of Ministers of the Environment was now a popular approach, but he had doubts as to its efficacy and whether it was not often a vehicle for political aspirations rather than achieving its real purpose. The point is that it must be a 'super-Ministry' to be able, for example, to prohibit a particular development, so that perhaps a multi-disciplinary top-level Commission would be more appropriate. Thirdly, at the action stage, the essentials were sufficient financial backing, trained personnel and popular support. His conclusion was that, nationally, progress can only be achieved at the highest Government level, and internationally, by such initiatives as the Stockholm Conference. Finally, he suggested that not enough emphasis was placed in Professor Reverdin's paper on the necessity for '*prise de conscience*' at the economic level.

Panel Member, Mr **Robert Calm** emphasized that the environment must be considered, along with funding and engineering or technical aspects, in every major decision by government. In the USA this had been facilitated by the National Environmental Policy Act of 1969, which provides that every governmental agency must produce an 'environmental impact statement' for every major project significantly affecting the quality of the human environment. This has been a revolutionary requirement, but with the help of court decisions which have forced agencies to comply in some cases where they had been negligent, most are now observing the letter of the law, although sometimes not its spirit in that they make a policy decision first and then tailor the Environmental Impact Statement to conform to it. However, seven State governments have now followed the Federal example and introduced some form of parallel legislation and in some cases, such as California with its air pollution laws, have taken a lead. The role of economics in decision-making must not, however, be

ignored by those concerned with environmental protection, but taken into account in advocating their point of view, in order to reach a true balancing of the factors. Professor Reverdin was right in saying that a better knowledge of the latter is needed to reach sound decisions. Thus, with the controversial issue of supersonic flight, if proof could be offered of its catastrophic effects in the upper atmosphere, it would put environmentalists in a much better position to get decision-makers to change their minds.

The **Chairman**, in opening the discussion to contributions from the floor, regretted that the time available was so short. The following were the main points raised.

Suite à deux conclusions de M. Reverdin—l'utilité d'actions locales et la fréquente difficulté d'agir efficacement faute de connaissances scientifiques contrôlées sur lesquelles baser les actions: on ne doit pas oublier que de nombreuses nuisances ne peuvent être combattues valablement en dehors de programmes intégrés qui dépassent les limites des états; néanmoins, au niveau de la municipalité le contact est beaucoup plus étroit qu'au plan national ou fédéral. De grands progrès sont possibles, pour rendre les autorités locales plus soucieuses de l'amélioration de l'environnement de leurs administrés, si l'on en juge par certaines délibérations de la Conférence générale des pouvoirs locaux du Conseil de l'Europe. Dans beaucoup de pays, malgré 'l'insuffisance des connaissances scientifiques', il existe pourtant déjà de nombreuses personnes connaissant des moyens efficaces pour combattre certaines nuisances, mais les autorités locales semblent incapables de les localiser lorsqu'elles en auraient besoin. Un mécanisme devrait donc être établi mettant en contact ceux qui ont le désir et le pouvoir d'agir avec ceux qui savent comment agir—**J.-P. Harroy** (Belgique).

In Canada the existence of the two Territories as well as the ten Provinces gives a chance of assessing the performance of the Federal government where it is in the position to exercise its powers directly and indirectly. Little real difference can be detected. Secondly, Canadian experience suggests that having good laws on the statute-book is not enough; in 1958, Ontario had good water legislation, but found great difficulty in enforcing it upon the powerful pulp and paper industry, which was responsible for 50% of the pollution, until finally public opinion and Federal intervention were brought to bear. Thirdly, governments would make better progress if they placed more reliance on popular involvement and support: this is not necessarily promoted by such devices as the environmental organization at government level in Canada described by Mr de Laet or the President's Advisory Council in the USA, which are 'out on a limb' and so cannot represent public opinion directly—**D. J. Pimlott** (Canada).

Developing countries fear that over-emphasis on environmental quality will hamper their economic development programmes, so that it needs the clearest possible demonstration by IUCN that disregard for environmental management will in the long-run do actual damage to the economy, to bring about a change of attitude. The key to the multidisciplinary approach to these problems, which is essential, is somehow to get the discipline of ecology up to the same level of competence as has been achieved by such disciplines as engineering and agriculture. The scientists of developing countries must be able to show that they have a real knowledge of local ecosystems, before they can expect anyone to apply the principles they advocate—**Hunter H. T. Eu** (Taiwan).

The economic implications of conservation planning and legislation are very much a preoccupation of IUCN and it is to be hoped that the forthcoming publication of the volume entitled *Ecological Principles for Economic Development*

will to some extent meet the need expressed by the last speaker—**W.E. Burhenne** (Panel Member).

Time has been too short for the discussion, so that rather too much emphasis has been placed on regional considerations and economics in Europe and Canada, to allow the more general principles called for by the Chairman to be properly identified. One point is perhaps worth mentioning in connection with Mr Baba Dioum's remarks about the needs of developing countries: there is often a confusing difference in viewpoint between aid programmes, an expert trained in one country being hardly able to communicate with colleagues trained elsewhere. It seems essential therefore that the narrow point of view, geographically, educationally and occupationally, should be replaced as soon as possible by a broader humanism—**O. Reverdin** (author of Paper 6).



**SESSION B**

**NATIONAL AND INTERNATIONAL  
ENVIRONMENTAL POLICIES**

**Part 2**

**SESSION B: PART 2**

*Chairman:* Dr. P.Nogueira-Neto (Brazil): Member, IUCN Executive Board; President, Sao Paulo State Forest Council; Professor, University of Sao Paulo; President, Associacao Defesa da Flora e de Fauna, Sao Paulo.

*Authors:*

**Paper (7): Concepts in Development of International Environmental Policies.**

Professor Lynton K.Caldwell (U.S.A.): Chairman, IUCN's Commission on Environmental Policy, Law and Administration; Professor of Political Science, Indiana University, Bloomington, Indiana.

**Paper (8): Environment and Development: Choices for the Third World.**

Dr. James A. Lee (U.S.A.): Environmental Adviser, Office of the Director of Projects, International Bank for Reconstruction and Development, Washington, DC.

*Panel Members:*

- 1 Dr. Wolfgang Erz (Federal German Republic): Member, IUCN; Commission on Education; Deputy Commissioner for Nature Conservation, Bonn.
- 2 Professor Richard Gardner (U.S.A.): IUCN's representative in the United Nations Organization; Professor of International Law, Columbia University, New York, NY.
- 3 Dr Jaro Mayda (Puerto Rico): Member, IUCN's Commission on Environmental Policy, Law and Administration; Professor in the School of Law, University of Puerto Rico, Rio Piedras.
- 4 Professor Daniel H.Henning (U.S.A.): Political Science Department, Eastern Montana College, Billings, Montana.

*Rapporteur:* Mr Robert I. Standish (IUCN)

*Secretariat Member:* Dr John A. Staub (IUCN)

## SESSION B: NATIONAL AND INTERNATIONAL ENVIRONMENTAL POLICIES

### Part 2: Paper (7)

## Concepts in Development of International Environmental Policies

LYNTON K. CALDWELL

*Chairman, IUCN's Commission in Environmental Policy, Law and Administration: Progress of Political Science, Indiana University, Bloomington, Indiana.*

### SUMMARY

Concepts are ways of interpreting what one perceives. As applied to our subject, they are statements of belief or propositions regarding man's behavior in relation to the perceived state of the world. Until recently, environmental policies resulted chiefly from the application of established legal doctrines to conventional or traditional views of the world. But with the advancement of science, especially during the past half-century, scientific knowledge of the natural world is beginning to reshape both domestic and international law. This knowledge has been articulated through several inter-related socioecological concepts which include: (1) the biosphere, (2) the uniqueness of Earth, (3) the universality of man's natural and cultural heritage, (4) the limitations inherent in natural systems, and (5) man's obligations as custodian of Earth. Examination of international treaties, programs, and institutional arrangements adopted or proposed during the past two decades illustrates the influence of these concepts in contrast to previously prevailing policies and practices. Yet this process of conceptual growth is not complete; existing political ideologies largely pre-date the science of ecology and powerful new concepts of man-environment relationships. A restatement of political doctrine with respect to man's environmental relationships is needed. Examination of historical relationships between concepts and policies suggests the probable emergence of new political ideas and movements based on validated understandings of man's situation in the natural world.

### RESUME

Les concepts sont un moyen d'interpréter ce que nous percevons. Appliqués à notre objet, ils expriment des croyances ou des propositions relatives au comportement de l'homme par rapport à l'état du monde tel qu'il le perçoit. Jusqu'à récemment, les politiques de l'environnement résultaient principalement de l'application de doctrines juridiques établies à une vision conventionnelle ou traditionnelle du monde. Mais avec le progrès des sciences, notamment dans les cinquante dernières années, la connaissance scientifique que nous avons du monde naturel commence à modifier le droit tant national qu'international. Cette connaissance s'est exprimée à travers divers concepts socio-écologiques étroitement liés entre eux, qui portent sur 1) la biosphère, 2) le caractère unique de la Terre, 3) l'universalité du patrimoine naturel et culturel de l'homme, 4) les limites inhérentes aux systèmes naturels et 5) les devoirs de l'homme en tant que 'gardien' de la Terre. L'examen des traités,

programmes et dispositions institutionnelles internationaux adoptés ou proposés au cours des deux dernières décennies illustre l'influence de ces concepts face aux politiques et pratiques en usage auparavant. Mais ce processus de développement des concepts n'est pas achevé; les idéologies politiques actuelles préexistent de longue date à la science écologique et aux vigoureux nouveaux concepts sur les rapports homme/environnement. Une redéfinition de la doctrine politique des rapports entre homme et environnement est nécessaire. L'examen des rapports entre concepts et politiques au cours de l'histoire nous permet d'anticiper l'apparition probable de nouvelles idées et de nouveaux mouvements politiques fondés sur une connaissance valable de la position de l'homme dans le monde naturel.

## CONCEPTS IN DEVELOPMENT OF INTERNATIONAL ENVIRONMENTAL POLICIES

'Concepts' are ways of interpreting what one perceives, hence they may be considered modes of thought or of understanding. The more clearly defined and influential concepts are formulated as propositions: for example, in the area of our concern, they include statements of belief regarding the natural world and man's relationship to it. Concepts range in precision and detail from very generalized interpretations of reality to sophisticated scientific theories. Representative of familiar concepts relevant to environmental policy, at the simpler end of the range, are 'balance of nature' and 'natural resources'; more complex concepts include the 'biosphere', 'evolution', and steady state or 'dynamic homeostasis'.

### Some historical precedents

International policies relating to the natural environment were not initially based upon environmental concepts *per se*. Most international, and all global, policies relating to the protection of nature, of natural resources, and of the environment, have been developed in the twentieth century. The earlier attempts at international cooperation on behalf of environmental issues were shaped by legal rather than by ecological considerations. In the earlier treaties, arbitrations, and adjudications involving environment-related disputes, established principles of international law were extended to environment-related issues rather than legal concepts being modified or enlarged by environmental concepts.

A basic legal principle applicable to environmental controversies has been that a nation should not permit action within its territorial jurisdiction to harm the interests of other nations or, in the words of a standard treatise on international law, '... a State is, in spite of its territorial supremacy, not allowed to alter the natural conditions of its own territory to the disadvantage of the natural conditions of the territory of a neighbouring State...'.<sup>1</sup> A corollary to this principle is that a state may be held responsible for activities originating within its territorial jurisdiction, the effects of which extend beyond that jurisdiction to the injury of nationals of other states. A case frequently cited as demonstrative of this principle is that involving the destruction of two British destroyers in the Corfu Channel of the Adriatic Sea by mines placed in these waters by the Albanian government.<sup>2</sup> The International Court of Justice held that a state was obliged '...not to allow knowingly its territory to be used for acts contrary to the rights of other States.' More clearly environmental was the issue in the Trail Smelter Arbitration, initiated in

1935 by agreement between the United States and Canada, regarding damages to farmers in the state of Washington from sulphur dioxide emitted by an iron ore smelter located in British Columbia.<sup>3</sup>

A second principle, more political than legal, is that nations should cooperate to serve the mutual interests of their respective peoples. An early application of this doctrine to an environmental issue was in the Convention signed in Paris in 1902, concerning the conservation of birds useful to agriculture. This Treaty culminated an effort of almost thirty-five years, initiated by an assembly of German farmers and foresters in 1868, requesting the aid of the Foreign Office of the Austro-Hungarian Empire in obtaining international protection of birds and animals useful to agriculture and forestry. At one point in the protracted negotiations, the Swiss government (1872) proposed an international regulatory commission for the protection of migratory birds, but the other sovereign states of Europe were not interested in institutional arrangements for this purpose.<sup>4</sup> The Anglo-American Treaty of 1916 for the protection of migratory birds in the United States and Canada was based upon political thinking similar to that underlying the European Treaty of 1902, with a significant additional factor. The Treaty established or, at least, clarified the legal authority of the federal government of the United States to protect migratory birds. Under the United States Constitution, treaties between the United States and other powers become a part of the supreme law of the land, overriding inconsistent or conflicting state legislation. Prior to the ratification of the 1916 Treaty, there had been question as to the constitutional competence of the United States government to adopt or enforce policies regarding migratory birds, this function belonging, so it was widely believed, to the respective state governments.

These earlier legal precedents have not been extended to indirect damages, such as deprivation felt by people not directly affected by action originating in other states. Impairment of a unique natural or cultural treasure of world-wide significance, such as the Grand Canyon of the Colorado, Murchison Falls, or Angkor Wat, might leave many people outside the responsible sovereign state with a sense of loss for which there was no legal redress. More tangible, but less direct than pollution emanating from a specific source, is the general deterioration of climate over a large continental area because of excessive dust in the atmosphere. Central and Southern Asia may afford cases in point, the dust resulting from a variety of activities, chiefly agricultural, and spreading over several countries with consequent reductions in rainfall.<sup>5</sup>

Examples of generalized or indirect injury are especially numerous with respect to the oceans, notably in pollution of the high seas, depletion of fisheries, and threatened extermination of certain species of whales. Do inland states with no sea coast and no merchant or fishing fleet have a legitimate voice in human impact on the marine environment—upon the exploitation and pollution of the high seas? The first major attempt to establish a general legal obligation among states for the protection of common interests in the environment related to the oceans. It was the 1958 United Nations Conference on the Law of the Sea, held in Geneva, which led to the drafting of four multilateral treaties, or conventions, on the law of the sea. Among these, the one most directly related to environmental protection and the conservation of nature was the Convention on Fishing and Conservation of Living Resources of the High Seas.<sup>6</sup> This Treaty was the result of careful preparation by the International Law Commission and an international technical conference on the living resources of the sea held in Rome in 1955, under the sponsorship of the United Nations.<sup>7</sup>

The Geneva Convention on Fisheries and Conservation of Living Resources of the High Seas provides a point of illustration of the influence of concepts upon policy. Although the legal concept of obligation among states was broader than that which had customarily been applied to fisheries agreements, the concept of conservation was used in a very restrictive sense. J. A. Collier, Lecturer in International Law at Kings College, University of London, has provided the following commentary on the concepts embodied in the Fisheries Treaty:

The Convention starts with a reiteration of the right of freedom of fishing, limiting this by treaty obligations, the interests of coastal states and the provisions of the Convention itself. It then imposes on all states the duty to adopt or co-operate with other states in adopting such measures for their respective nationals as may be necessary for the conservation of the living resources of the High Seas. There may be mentioned the concept of 'conservation' with which the Convention deals; it is defined as the 'aggregate of the measures rendering possible the optimum sustainable yield from those resources so as to secure a maximum supply of food and other marine products.' Conservation programmes (it continues) should be formulated with a view to securing in the first place a supply of food for human consumption. Pausing here for a moment, it may be inquired whether this is a satisfactory definition; there may well be other objects apart from this purportedly biological one; such as social or economic goals, or a combination of all these, which may lead states to propose conservation schemes.<sup>8</sup>

The principle of mutual obligation was expressed again in the Antarctic Treaty of 1959, in which the signatory states must take reasonable efforts to alleviate pollution of the coastal waters and ice shelves, and must not set off nuclear explosions or dispose of radioactive waste material on the Antarctic Continent.<sup>9</sup> By the late 1950's, when these Treaties were consummated, ecological concepts were beginning to affect legal doctrines. It was becoming evident that an environmental impact, that could be caused to occur anywhere by a nation or group of individuals possessing the requisite technology, could not be warded off by some few nations or by a regional grouping of interested states acting wholly within their own political boundaries. Fall-out from atomic explosion offered a dramatic illustration of the issue. Universality of obligation among national states and, equally, universal international organization, where world-wide protection measures are required, are the logical political and legal conclusions to an increasing number of studies assuming the concept of the biosphere.

### **Basic environmental concepts**

During the decade of the nineteen sixties, the growth of public awareness of threats to the human environment grew rapidly and progressively. At last ecology was beginning to affect the substance of law in addition to the extension of traditional legal concepts to environmental issues.

State of the world concepts are formulations of the ways in which people see the world around them. Many of these concepts overlap one another, and some of them are contradictory; all are, in some measure, interrelated. Prominent among them, and of increasing relevance to political action are the ideas represented by the terms biosphere, ecosystem, balance of nature or equilibrium, and evolution. Under each of these terms there are, of course, numerous sub-concepts. These concepts may be considered neutral relative to man's

behavior because, although man, as a part of nature, must be assumed in all of them, they are not necessarily man-centred even though they are human interpretations.

Another group of concepts regarding the state of the natural world may be described as man-dependent. The concepts frankly classify and evaluate phenomena in the natural world from the viewpoint of their effect upon man. The most prominent among these is that of 'natural resources'. This is primarily an economic concept, categorizing the various elements of the natural world according to their usefulness to man. A second man-dependent concept, which has to some extent been used to correct or supplement a natural resources interpretation of the environment, is the natural world as a 'life-support system'. Some aspects of the life-support system concept relate to evolution, as it is now believed that the atmosphere of the Earth, the conditions of the oceans and of soils, as well as all living organisms are the product of evolutionary development and change. Some evolutionary interpretations are of course man-centered, or are at least teleological, in the sense that man is conceived as a logical, if not intended, outcome of a long process of evolution developing from relative organic simplicity to ever greater complexity.

Perhaps the most highly-developed statement of this teleological perception is found in the writings of Pierre Teilhard de Chardin, and especially in his book *The Phenomenon of Man*.<sup>10</sup> This evolutionary process, moving from inert physical matter to pure intelligence, was also developed, and in greater detail, in the writings of the Russian mineralogist V. I. Vernadsky.<sup>11</sup> From these interpretations of the state of the natural world there is a logical transition to concepts regarding the behavior of man in relation to whatever view of the natural world has been postulated. The focus of these concepts is not so much upon the substance of the world and how it is put together as it is upon how man acts, or ought to act, in relation to a particular interpretation of the world. Obviously, how one understands the world may affect one's opinions regarding the propriety or justification of human behavior in relation to the environment.

Throughout most of Western history the predominant popular view, and the one that has most influenced public policy, is of man as master of his environment. This concept places man and nature as adversaries. Man's dominance over nature has been sanctioned by the dominant current of historical Judaeo-Christian thought, although there have been counter currents in which man was seen as a custodian of nature rather than as a conqueror. Both views find support, for example, in the Book of Genesis, although as Lynn White, Jr. has argued, those biblical passages justifying man's dominance over the living world are most often the ones rationalizing human exploitation of the natural world.<sup>12</sup>

Historically less influential, but now of growing importance, is the counter-current of 'stewardship'.<sup>13</sup> Although this concept finds support in religious doctrine, it draws also upon the natural sciences for guidelines toward ethical conduct. As more is learned about the intricate and ever-changing balances among the forms and forces of the natural world, it becomes easier to delineate cause and effect relationships, and to trace out the ecological consequences of human action. Action that can be shown, in the long run, to be destructive to human welfare and to the life-support systems of the planet generally, may be held to be ethically wrong. This view, moreover, encourages the development of science in such fields as ecology; for if man has assumed the responsibility for the management of the natural world, he cannot afford to exercise his stewardship in ignorance. Responsible conduct requires informed conduct. The stewardship concept of the behavior of man, in relation

to his environment, thus has very clear implications for public policy, including, obviously, efforts toward developing public understanding of man's environmental dependencies and their relationship to the natural systems of the biosphere. A practical expression of the stewardship concept was the recommendation of the General Conference of UNESCO at its Twelfth Session (9 November to 12 December, 1962) concerning the safeguarding of the beauty and character of landscapes and sites.<sup>14</sup>

### **Emerging policy propositions**

The environmental policies of governments and international organizations are not merely interpretations of law and reflections of environmental concepts. Many other influences and events enter into the shaping of environmental policies. But environmental concepts, even when unarticulated or unrecognized, nevertheless underlie all environmental policies and, in the long run, may decisively influence their development. When these concepts are embedded in our everyday conventional assumptions about the world, we cease to be aware of them, they are taken, as we say, for granted; and to single them out as determining factors in our thinking appears to be making much out of little. Nevertheless these concepts, inchoate as they sometimes are, affect our behavior. But it is also true that many of the prevailing environmental concepts do not belong or are not fully represented in many present-day cultures; and few of them have dominated popular thinking or public policies in major political systems in the past.

Contemporary environmental policies at all governmental levels are influenced by five socioecological concepts which we will identify by the following phrases: (1) Unity of the biosphere; (2) Unique nature of Earth; (3) Universality of man's natural and cultural heritage; (4) Natural limitations of political fiat; and (5) Man's obligation as custodian of the Earth. We shall now examine the propositions through which these concepts are translated into public policies and programs. But to repeat, these policies and programs are seldom direct and conscious reflections of explicit environmental doctrines. The emergence of these propositions, and the objectives they define, can be fully understood only if their underlying conceptual assumptions are understood. Were it not for these assumptions, the policies would either have not emerged in the form they did, or they would have been aimed toward other goals. Moreover, to the extent that these concepts become universalized in the modern world through programs for environmental awareness and environmental education; and to the extent that they are reinforced by the findings of science—especially through ecology—, these concepts may be expected to weigh more heavily in the public policies of the future than they do at present. And their influence will be greater, to the extent that environmental disorders and disasters provide dramatic occasions for their being invoked.

### **Unity of the biosphere**

Although its philosophical origins are ancient, the biosphere as an operational concept has had much less than a century of practical usage. This concept, basic to global environmental policy, is multinational in origin. Its beginnings have been traced to the French naturalist, Lamarck. It was first applied in the descriptive geographical writings of the Austrian geologist, Suess, and, as we have noted, was elaborated by the Russian mineralogist, V.I. Vernadsky, into a comprehensive biophysical theory, the dissemination of which was assisted by the published writings of the French Jesuit paleontologist, Pierre Teilhard de Chardin.<sup>15</sup>

The translation of this socioecological concept into a conceptual basis for public policy was evidenced by the so-called Biosphere Conference of 1968 (the Intergovernmental Conference of Experts on the Scientific Basis for Rational Use of the Biosphere), in which sixty-four nations, fourteen intergovernmental, and thirteen non-governmental organizations were represented; and which was sponsored by UNESCO, with the United Nations, the Food and Agriculture Organization and the World Health Organization participating; and with the cooperation of the International Union for Conservation of Nature and Natural Resources (IUCN) and the International Biological Programme (IBP). The Biosphere Conference adopted twenty resolutions, all of which were in some respects policy recommendations, including specific recommendations for regional and international structures for research and for administration. Recommendation 20 involved proposals for a long-term intergovernmental and interdisciplinary program, which has since developed as a UNESCO-sponsored intergovernmental, interagency effort entitled *Man and the Biosphere*.<sup>16</sup>

The concept of the biosphere has now also found expression at the national level. The interrelationship between national policy and the global biosphere is implicit in Section 2 of the National Environmental Policy Act of the United States (PL 91-190), which declares as its purpose '... a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of man....'

The Earth as a complex, biophysical unity is now obviously implicit in a series of scientific and conservation efforts exemplified by the International Geophysical Year and the International Biological Programme, both organized by the International Council of Scientific Unions; and especially in the Union's most recent major effort, the Scientific Committee on Problems of the Environment (SCOPE), whose frame of reference embraces the entire globe. This concept of the biosphere as an indivisible unity has political implications for international organization. If mankind, as a whole, is to act effectively to protect the biosphere, all peoples and nations must be brought into a common effort. If major nations, or groups of nations, are excluded from international efforts to protect the biosphere, that effort will most assuredly be incomplete and hence, to that extent, inadequate. The logic of the biosphere is universal participation of all responsible political jurisdictions in any effort or attempt to cope globally with man-environment relationships.

### **Unique nature of the Earth**

The dramatic views of the Earth from outer space, resulting from the Apollo Program, added an emotional impact to what men had already known scientifically regarding the singular character of the Earth and its biosphere. The policy implications of the concept of the Earth as unique are qualitative rather than substantive. The Apollo flights confirmed emotionally what was already known intellectually. It had already been known that the evolutionary processes of the living Earth are irreversible, that a species once extinct can never be restored, that life itself is an extremely rare phenomenon in the universe, and that only statistical probability supports a belief that it may occur elsewhere than on the Earth. Thus the concept of uniqueness provides, at very least, a reinforced argument for conservationist and preservationist measures. It also provides a major element in the reasoning that has led to the imposition of quarantine measures on astronauts returning from outer space to avoid the possibility of back-contamination by microorganisms unknown on the Earth, and to which no immunity or resistance would have evolved.

**Universality of man's natural and cultural heritage**

Politically and ethnically, men are divided; but biologically, all are 'citizens' of the Earth. The mobility of the human species and the mixtures, ethnically and racially, of populations have led to a situation in which men may not only consider the global world as their home and natural heritage, but may also look to the past works of other men as somehow belonging to their own cultural legacies. This concept of universality has historically been confined largely to scientists, artists, and poets; and it is only in very recent times, that it has gained something like a popular recognition. The major institutional symbol of this concept today is, of course, UNESCO, the United Nations Educational, Scientific and Cultural Organization. And with respect to the natural heritage, the IUCN and World Wildlife Fund exemplify this universality.

On the cultural side, the International Council of Museums (ICOM—1946) and the International Council of Monument Sites (ICOMOS—1965) are organizational expressions of man's collective determination to preserve his common heritage. The most explicit recognition of this universality is the World Heritage Proposal, which has been advanced in several forms in recent years, particularly through the IUCN; and which, prior to the publication of this paper, will probably have been considered at the United Nations Conference on the Human Environment, meeting in Stockholm in June, 1972. The proposed World Environment Fund is closely related, at least in concept, to the World Heritage idea, although the Fund would extend financial aid to countries needing assistance for a range of activities broader than the preservation and protection of specific sites, monuments and species. It is difficult to believe that the concept now so widely shared among thoughtful people and, more particularly, among officials of government will not have a significant influence in national, regional and international policies in the future.

**Natural limitations of political fiat**

Much of the world, and certainly the United States of America, has moved a long way from the position taken in 1895 by an Attorney General of the United States who declared that: 'The fundamental principle of international law is the absolute sovereignty of every nation, as against all others, within its own territory.'<sup>17</sup> The irrationality of this doctrine becomes evident when one considers its total ineffectiveness in protecting a nation and its peoples from the consequences of environmental abuse by other nations. Sovereignty is a poor barrier against the death of the oceans, or the contamination of the atmosphere, or the impoverishment of man's global environmental heritage. Insistence on the arbitrary right of a government to determine its own internal environmental policies is contradicted by a principle of international law illustrated, as we have noted, in the Corfu Channel Case before the International Court of Justice, and by the Trial Smelter Arbitration between the United States and Canada, that a state may not legitimately permit its territory to be used in ways directly injurious to another state.

Science works in two ways to reinforce the concept of limitations on political behavior. First, as ecological interrelationships are better understood, and as the flow of contaminants and other residual products of man's activities are met in the oceans and in the atmosphere, peoples will increasingly become aware that they may be suffering environmental damage originating on the territory of other nations; but of which they have been hitherto unaware or which, in fact, had not heretofore occurred. An example of the latter circumstance is radioactive fallout, which has become a factor in international relations only since the advent of atomic weapons. But science also indicates that

an arbitrary unecological decision by a political leader cannot be realized if the natural circumstances contradict it. Unfortunately, the record shows that people and governments do not necessarily learn from past errors.<sup>18</sup> But the influence of ecological thinking appears to be growing, and governments are increasingly establishing agencies for the surveillance and protection of the natural environment. It seems probable that governments and international organizations in the future will make fewer ecological errors than in the past. Hopefully, this will prove to be the case; and the doctrine of national sovereignty, like the flag on the masthead of the ship *Pequod* in Melville's *Moby Dick*, will not flutter its last defiant gesture before the ship of state disappears beneath the waves, its destruction being the consequence of the arbitrary, unyielding perversity of its single-purposed commander.

### **Man's obligations as custodian of the Earth**

A consequence of man's pretensions to dominate and control nature is that he becomes responsible for the consequences of what he does to and through nature. Were this merely a moral conclusion, it could not be expected to have any greater influence than moral conclusions that have long been propounded by religious leaders and political ideologists. But man's obligations as Earth's custodian have been reinforced by the demands of his fellows that they be not required to suffer from the Earth-destroying activities of other men. As man undertakes to shape the environment, the environment becomes potentially a subject of social conflict. Again, the evidence of science influences perceptions and, indirectly, influences policies. As it becomes evident that some action that men might take could be disastrous to all men, prevention of this kind of action becomes a universal human concern. As danger is perceived to become more threatening, the human tendency is to seek laws, institutions, and procedures to forestall disaster. It is for this reason that the General Assembly of the United Nations convened the Conference on the Human Environment, that UNESCO and associated organizations convened the Biosphere Conference, and that the International Council of Scientific Unions created its Scientific Committee on Problems of the Environment. And the concept is the fundamental proposition underlying the purposes of the IUCN.

### **A new concept needed?**

We have seen that there is a direct relationship between the foregoing five socioecological concepts and a large number of political, scientific and institutional developments. But have we all the ideas we need to cope with modern man's worldwide environmental impact in all its complexity and comprehensiveness? This question can only really be answered with the passing of time; but it is the thesis of this essay that our present structure of concepts in relation to policies is not adequate to our need. The deficiency is principally one of synthesis. The five groups of concepts that we have just discussed have yet to be woven into a comprehensive and coherent interpretation of man and his place in nature that is fully socially and politically operational. We do not, as yet, have a body of ecological concepts that are simultaneously political concepts.

Each in his own very different way, Pierre Teilhard de Chardin and Karl Marx, provide us with illustrations of what is needed. Their work does not provide models, but rather indicators of how knowledge must be related to action. Teilhard's synthesis of scientific and cultural concepts within an evolutionary context, and related to the 'purposes' or outcomes of human effort, illustrates the kind of task that needs to be undertaken if the coherent and purposeful

philosophy of man within his environmental context is ever to be achieved. Marx illustrated how historical explanation and analysis can be developed into philosophical propositions, and moral imperatives, which can then be stated as propositions capable of being acted upon. One need neither agree nor disagree with the action-oriented philosophy of Karl Marx to recognize the power and effectiveness of the Marxist technique of action-oriented synthesis.

If, as we have argued, concepts do affect policies, and policies are the expression of political intentions, fundamental changes in human concepts may be expected in time to induce political consequences. No really great new persuasive or compelling political ideas have emerged in the twentieth century. The twentieth century brought to an end the five hundred year effort of man's exploration of the Earth, beginning with the great sea voyages of the Portuguese and Christopher Columbus, and drawing to a close with the first departure from the surface of the Earth and the landing on the Moon. The surface of the Earth at last, and for the first time in human history, was totally pre-empted by political man.

The future, whatever it may be, cannot resemble the past that man has experienced in his relationship to a seemingly endless and inexhaustible Earth. It is difficult to believe that the tremendous changes that have occurred during the twentieth century will not, perhaps even before its end, result in some new configuration of ideas, attitudes and policies. The shaping of this configuration may, indeed, be a part of our work; and if the criteria by which this work will be judged is that which has been applied to man's finest efforts in the past, we must endeavor to insure that the outcome of this work will be simultaneously valid, humane and effective.

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## SESSION B: NATIONAL AND INTERNATIONAL ENVIRONMENTAL POLICIES

### Part 2: Paper (8)

## Environment and Development: Choices for the Third World

JAMES A. LEE

*Environmental Adviser, Office of the Director of Projects, International Bank for Reconstruction and Development, Washington, D.C.*

### SUMMARY

The Third World countries, in which live the majority of the world's peoples, have chosen not to remain in their economic straitjackets of poverty. They are convinced that the poverty which shapes and limits hundreds of millions of human lives—with all their inherent potential—can only be overcome through development. But the achievement of a quality of life in accord with fundamental human dignity for the world's growing poor, is itself not without its threat to the well-being of the human environment. The developing countries are determined, however, that solutions to the world's environmental problems must be complementary to and not at the expense of their efforts to advance economic and social development. The question is not one of economic development versus the environment. The question is rather how this development can go forward in ways minimally disruptive to the life-supporting ecological systems and also promising of individual self-fulfilment and social harmony. Recent experience would suggest that the international development community—rich and poor alike—can integrate their mandate to assist in the development process with their responsibility to protect and enhance the human environment, man's only home.

### RESUME

Les pays du Tiers Monde, qui regroupent la majorité de la population mondiale ont choisi de se dégager de leur carcan économique. Ils sont convaincus que seul le développement leur permettra de surmonter la pauvreté qui façonne et limite des millions de vies humaines et toutes leurs potentialités. Mais réaliser pour la population déshéritée grandissante du monde une qualité de vie répondant à la dignité fondamentale de l'être humain ne va pas sans périls pour la santé de l'environnement. Toutefois, les pays en voie de développement sont décidés à ce que les solutions aux problèmes de l'environnement dans le monde soient complémentaires et non au détriment des efforts qu'ils font pour promouvoir le développement économique et social. Il n'est pas ici question de lutte entre développement économique et environnement. Il s'agit plutôt de voir comment réaliser ce développement avec un minimum de séquelles nuisibles pour les systèmes écologiques, bases de toute vie, en assurant en même temps l'épanouissement individuel et l'harmonie sociale. Les expériences récentes tendraient à indiquer que tous ceux qui, dans le monde, travaillent au développement—les riches comme les pauvres—peuvent concilier l'engagement qu'ils ont pris d'aider au processus de développement avec

leurs responsabilités envers la protection et l'amélioration de l'environnement, seule demeure de l'homme.

### **ENVIRONMENT AND DEVELOPMENT: CHOICES FOR THE THIRD WORLD**

By picking up a newspaper in the United States today, a reader would come to the inevitable conclusion that with the exception of the issue of war and peace, the preservation and restoration of the environment is the only issue that excites the imagination and commands the attention of mankind.

President Nixon signs an agreement with Canadian Prime Minister Trudeau whereby billions of dollars will be spent to clean up the Great Lakes; automobile manufacturers plead in the United States Congress for an extension of time before effective exhaust pollution abatement devices are made mandatory; some industries close or move because of an alleged inability to comply with anti-pollution statutes.

Interest and excitement over the peril to the environment are not confined, however, to matters affecting only the United States. Japan takes a new-found interest in improving the quality of life for its people. Newspaper articles headline the threats to the environment from all corners of the world: 'Israel Finds Rapid Development Threat to Country's Ecology;' 'Africa's Vanishing Heritage: Ecological Ruin Looms;' 'Booming Brazil Ignores the Ecology.'

'Earth Days' are commemorated, zero population growth organizations are launched, students protest, and mothers march—all in the name of ecology, of preserving the earth. The United Nations brings together more than a hundred nations to discuss ways of protecting the earth from the ravages of man and the technology he has created.

Let there be no doubt about it: the threat is real, it becomes more real each day. People do die from the misuse of mankind's resources, and the 'balance of nature' is being upset, slowly in some places, rapidly elsewhere. When rivers are so polluted with chemicals that photographic film can be developed in the water, then it is time to do something, and do something fast, to preserve our biota and resources so that we may be preserved ourselves.

It, therefore, comes as a shock to many, that spokesmen for the majority of mankind, for those people living in the developing countries of the world, often react sharply and sometimes with hostility to the urgent warnings by Western leaders of imminent peril to life as we now know it on this planet. 'Environmental degradation was caused by industrialization in the West, and now that they are rich and polluted, they want to halt the development process, leaving us unpolluted and poor,' these Third World spokesmen say.

As is usually the case, however, neither side in the discussions about the environment has a monopoly on the truth. The developed world is right to perceive that a grave threat to the world does exist in man's misuse of technology and of the living resources, and from pollution and shoddy practices upheld in the name of profitability. And the spokesmen for the developing world are right when they point out that their problems are caused not by environment—wrecking industrialization and economic growth, but by the fact that, in their homelands, there is too little industrialization and too little economic growth.

Often the rich and the poor are talking about two different things when they talk about the problems of the environment. The man from the industrialized, Western world is concerned because the automobiles choking his highways

are also choking the respiratory tracts of the drivers. That's an environmental problem to be sure, and something must be done about it.

But there aren't many automobiles in the small African nation of Upper Volta, and one World Bank official described the miseries of that country in the following manner:

'I have seldom seen a country where so many diseases are prevalent. Onchocerciasis, malaria, bilharzia, tuberculosis, Guinea worm and even sleeping sickness are more or less endemic... In the southwestern part of the country, for example, parasitic infections with Guinea worm, owing to lack of pure water supplies, adversely affect people's ability to work in the fields at critical times of the year.'

The African would describe the misery in Upper Volta as one caused by poverty. But while acknowledging that the misery may be an environmental one, he would add that beyond taking necessary health measures for which little or no funds are available, the only permanent cure for poverty must be that of development.

Development brings with it, however, changes. And changes brought about by development can often lead to further new miseries.

In many developing countries, as in Upper Volta, tens of millions of people are living at levels of deprivation that simply cannot be reconciled with any rational definition of human decency. Poor housing, poor sanitation and water supplies, malnutrition, rampant disease, endemic unemployment, increasing illiteracy, explosive population growth—all these and more characterize the plight of the majority of the world's population. The poverty that shapes and limits these lives can only be overcome by development.

Development cannot be stopped. Development should not be stopped. To decide that a basic industry should not be installed in a poor country only because its installation might bring some pollution to that poor country would be immoral. To act against that same plant, by imposing tariff penalties on its exported products because they are produced in an 'environmental sweatshop' would be counter-productive. Somehow, the positions on both sides must be reconciled, for both are, in their own contexts, correct. 'Pollution must go.' says the environmentalist from the industrialized world. 'I'd rather see some smoke coming from a factory stack than see no factory at all,' says a Third World government official.

It seems clear, at least to me, that the developed world has made a decision from which a reversal would be most difficult, if not disastrous. The more industrialized and richer nations are determined that the deterioration of the environment cannot be allowed to continue at its present pace. Something is being done. Something more will be done. Indeed, many initiatives, in many countries of the world, have already been launched. An important beginning has been made.

The developing countries have also made a choice. They have chosen not to remain in their economic straitjackets of poverty. They have chosen to develop. Development is part of their unfinished revolution. They also know that the battle for development, for a decent life for their people, will be even harder to win than their previous struggles for independence.

Fortunately, however, there are choices open to the developing world. They may, we must admit, choose to welcome those polluting industries which are now coming under increasingly stringent controls by the nations of the developed world. Or they may choose, as Singapore, for instance, has done, to welcome

only those industries which will not only make a substantial contribution to their economies, but which will not lay waste their environment as well.

There is no inherent reason today why any industry, anywhere, must destroy an environment, ruin the waters and air, or make people sick. Those that have done so, have done so because, for generations, no one ever stopped to seriously consider the alternatives. Air and water resources were seemingly without limit and their contamination was but weakly protested. Now that the finiteness of those resources has become apparent, now that so much of the earth is already affected, now that so much of the world's waterways are already polluted—only now have people stopped to think about the alternatives. Only more technology now can make technology in the future the servant of man rather than his master.

I do not suggest that the developing countries should wait until new and clean technologies and industrial processes are developed, before permitting factories and industrial complexes to be built and established on their lands.

Fertilizer plants are needed now, minerals must be unearthed now, skills and jobs must be found now for the majority of the world's people who, today, still earn substantially less than US\$100 a year, and are the victims of unending poverty.

Many of the environment-desecrating factories and mines were built in the developed world in an age when environmental considerations were not only not thought of, but were actually unknown. This is not the case today. In this day, we know, or at least know better, what the consequences of our actions might be. The industrial estate of Jurong, in Singapore, for instance, allows only 'clean' industries to be built, for the Singapore authorities know that the winds coming off the Malacca Strait are sure to blow any noxious fumes away from Jurong and onto Singapore city itself. This hazard is now presenting itself in Malaysia's industrial new town of Petaling Jaya. Malaysia's capital city of Kuala Lumpur is nestled in the hills near the new town, and the smog from its industrial neighbor is increasingly creating problems for that once-clean, immaculate city.

We know today far more than we knew about such things five years ago. And five years from now, we will know even more. Those who are concerned with the development process in the Third World cannot afford, however, to wait upon the emergence of some future knowledge such as will ensure total protection to the environment and its creatures. They perforce must act upon information and knowledge as are at hand. As you so well know, such information is inadequate and insufficient. Nevertheless, development will go forward either on the basis of it, or it will proceed in the absence of any consideration of it. The choice is clear. The developing countries have made their decision—they are determined that solutions to the world's environmental problems must be complementary to and not at the expense of their efforts to advance economic and social development.

There are those who would denounce environmental compromises, but, on the other hand, is it possible to compromise with the lives of people who are ill-fed, ill-housed, in poor health, jobless, and without hope for the future?

If the dialogue between the worlds of the 'haves' and the 'have nots' about such matters is to be at all productive, it must be based upon a frank and honest recognition that the viewpoints on both sides are different. On every count the contrast in values, in interests, in priorities, in capacities between developed and developing countries is marked. And, in matters dealing with the use and protection of the environment, it is, if anything, even more marked.

The new-found concern of the developed countries for the environment strikes no resonant chord in much of the still developing world.

Thus it is that the United Nations Conference on the Environment is rightly regarded as a milestone in man's attempt to come to some sort of consensus about what should be done, both in the rich and poor world, about the global threat to the environment.

Preparations for this Conference, which went on for more than two years, engaged the energies of contributors and consultants from 116 countries, and more than 12,000 pages of materials were distilled into the 600-page 'blueprint for international action' on the environment front.

Though the impact upon the development process posed by environmental concerns was but one of the six major topics discussed at Stockholm (the others included problems of human settlement, resources, international pollution, international environmental organization, and public education and information), it was by no means the least considered, especially when the views of the majority of the participants—those nations from the developing world—are taken into account and analyzed.

To some extent—exactly how much cannot be determined until the results of the Conference are more fully known—the dichotomy of views between the developed and the developing world over the issues of development and the environment was bridged in advance of Stockholm as a result of discussions held last year at Founex, Switzerland.

Based on the findings of economists, scientists, and development specialists from both rich and poor countries, the Founex discussions revealed that environmental problems affect all nations—but in different forms. The discussions concluded that the major environmental problems facing the developing countries are those of urban and rural poverty. They further concluded that in the developed world, industrialization and associated technology has been a major contributor to global environmental degradation. Thus, while the developed world attempts to clean up the untoward consequences of a century of rapid economic expansion, the Third World knows its environmental problems can only be overcome by the process of development.

It is important, the discussion emphasized, to make sure that the cure for rural and urban poverty does not, however, become worse than the disease; namely, that the development process itself does not give rise to serious problems for the environment, for public health and social well-being.

The preparations for Stockholm caused many of the developing countries to examine, often for the first time, the nature and magnitude of their own environmental problems. This examination has, not unnaturally, served to reinforce their own commitment to development. Hopefully, the examination has also served to provide new dimensions to the development process itself.

In the past, there has been a tendency to equate the goal of development with the more narrowly conceived objective of economic growth as measured by the rise in gross national product. It is recognized by many today, that high rates of economic growth, necessary and essential as they were thought to be, do not, by themselves, guarantee the easing of pressing social and human problems. Indeed, in many countries, high growth rates have been accompanied by increasing unemployment, rising disparities in income, both between groups and between regions, and the deterioration of social, cultural—and environmental conditions.

But the nations of the Third World, while recognizing that they have environmental problems of their own, have rightfully asserted that the environmental

'crisis', as perceived by the developed countries. must not be allowed to be viewed in terms of 'either-or'.

Last April, eight African nations, meeting in Dakar, met to draft a joint African stand to be presented in Stockholm. Those nations, in a document which was released at the end of the meeting, complained that 'far more weight' had been given, in the preparations for Stockholm, to the problems of the developed world than to those facing the poorer countries. Nevertheless, the document added, 'there should be no conflict between development and environment,' and it went on to conclude that the safeguarding and preservation of the environment should be made an integral part of general development policy.

Such an acknowledgement from the developing countries should not, I believe, be greeted with a casual yawn and a bored 'Why, of course,'. That acknowledgement would have lifted few eyebrows had it come from a spokesman in the already-industrialized world. But coming from the developing world, a world in which unemployment rates of more than 25 percent are not uncommon, where malnutrition and disease stunts the physical and mental development of more than half the children, where incomes are often less than US\$100 a year, the African statement is impressive evidence of how far we have come as a world in a few short years in raising mankind's consciousness about the environmental perils that threaten the entire planet. There is little difference in the end between the man killed by emphysema and the man dead from the ravages of intestinal worms. Both are victims of their environmental relationships. And so it is that both worlds are coming together, perhaps slowly and suspiciously at first, to join in a common effort to halt and redress what should never have been, perhaps, if man-environment apartheid had not dominated the thinking and actions of Western man.

If the visible evidence of the degradation to the environment is more apparent to the developed world than in the countries of the poor, it is also true that the former are better able to deal with the threat. The rich obviously have both the capacity and capability for alleviating the threat to a far greater extent than the poor. They have the technology needed to clean up the rivers, to clean the air, to rid the land of wastes piled up over generations—whether they indeed have the will remains to be seen. The knowledge now being gained in efforts to restore the environment may well help the Third World in its development endeavours before the threat in these countries grows too grave. But more important than this, help is needed now in the Third World's struggle against its own kind of environmental problems: rural and urban poverty.

I cannot claim that my institution, the World Bank, was the first such development institution to discover that there was, in fact, a threat to the integrity of the global biosphere, man's only home. I can state, however, that the Bank was not among the last.

The World Bank has changed greatly in the past few years. In its past, there, too, had been a 'tendency to equate the goal of development with a rise in gross national product.' Satisfactory economic rates of return were all the figures seemingly needed to justify the building of a steel mill, a giant dam, a railway network. This has changed as the Bank has increasingly concerned itself with such human and social problems as unemployment, nutrition, income distribution, overpopulation—and the environment.

Shortly before the Office of the Environmental Adviser was created in the World Bank, the President of the Bank, Robert McNamara, told the 1970 meeting of the U.N. Economic and Social Council that:

'The problem facing development finance institutions, including the World Bank, is whether and how we can help the developing countries to avoid or mitigate some of the damage economic development can do to the environment, without at the same time slowing down the pace of economic progress. It is clear that the costs resulting from adverse environmental change can be tremendous.... It is equally clear that, in many cases, a small investment in prevention could be worth many times over what would have to be expended to repair the damage.'

Though the Bank had, in the past, concerned itself with the environmental effects of its development activities, no systematic efforts existed to identify and examine those effects. *They now exist.* Criteria have been assembled to be used in the evaluation of the environment and health-related impact of many types of development projects. These environmental considerations have been incorporated into the appraisals of projects involving the construction of dams, roads, irrigation systems, sewerage works, airports, smelters, power and fertilizer plants; the development of ports and harbors; the operations and associated logging activities of the pulp and paper industry; the development of petrochemical-based industries; and the exploitation of mineral deposits, just to mention a few.

These criteria were not assembled in order to slow down the development process by erecting environmental, health or socio-cultural obstacles. On the contrary, they have, at times, speeded up the process. Environmental considerations are now included from the start in the formulation and appraisal of development projects, and thus form one, albeit an important one, of many such steps that the Bank takes in making its project appraisals. In late 1970 and early 1971, projects were literally examined at the 'eleventh hour' and, sometimes, days before financing was to be approved, when environmental problems were uncovered and studied. Now, environmental considerations undergo scrutiny in the Bank from the very start of a project's life. And, to date, we have found that when environmental safeguards are included in a project, their cost has averaged only a small percentage of its total cost. And, in a recent Bank loan made exclusively for the purpose of pollution control, economists calculated that the economic rate of return would be more than 32 percent.

The Bank, to date, has not refused to grant a loan on environmental grounds, because in every case where the Bank has pointed out to a prospective borrower the possible ecological threats inherent in a project and has called for the implementation of safeguard measures, the borrower has agreed to their inclusion.

The World Bank is, of course, in the development business; it must be concerned not only with the environment, but with the hundreds of millions of people who are today living in absolute poverty. And, likewise, it expects that its member countries must be concerned not only with the well-being of their citizens, but with the problems that may, in the future, arise from untrammelled economic growth.

For example, the Bank now makes every effort to ensure that the threat of water-borne diseases is not increased as a result of the irrigation and hydro power projects it finances. Has this environmental health consideration slowed down the process of economic development?

The Bank recently assured one borrower that necessary steps would be taken so that the success of a tourist resort would not be threatened by raw, untreated sewage from a nearby city despoiling its beaches and creating a

health hazard. Has such an environmental consideration checked that country's economic development?

The Bank wants to make sure that wastes and pollution from a smelting plant will not harm the livestock industry in one small African nation. Does this concern go against economic development? Of course not.

Development projects often touch both economic interests of those concerned with development (and who fear conservationist interests will only retard development objectives), as well as the more conservative interests of scientist and layman who are concerned over the possibility that a development project will irretrievably alter or doom a unique environment or species. But while the presumed 'trade-off between development and the environment is often proffered by both economist and conservationist, there is broad ground for common concern. For example, a hydro power dam needed by a poor African borrower would alter the hydrological regime of a downstream flood plain which forms the natural habitat of the black lechwe, a unique magnificent sub-species indigenous to the area. The Bank in considering this project will take appropriate measures to ensure that steps to conserve the delicate hydrological balance (and therefore the lechwe) will be maintained; but, moreover, that possible competition with livestock owned and grazed by local tribesmen on the same flood plain, will be relieved through proper management procedures.

There are even more compelling areas where conservationist and development interests coincide: in assistance to poor countries who can ill-afford financial and managerial resources necessary for education and training in wildlife conservation, especially as they relate to tourism development; or, for assistance in preservation of unique or important areas such as salt marshes or estuaries serving as important shell fish nurseries. These and other areas, such as forestry and water resources management, are the subject of international conventions now being prepared for ratification as are areas of potential economic interests of a Third World, who, with their limited resources at this point in time, can ill afford to correctly manage and develop them.

Stockholm was not the beginning and the end to man's concern over the environment. In a two-mile race, it was merely the summing up of the results of the first 100 yards. It pointed to strategies and tactics for the rest of the contest. It sought to give the slower contestants a head start.

Much more needs to be done, both in the world of the rich and the world of the poor. And in the last year, the two worlds have begun to talk to each other. One can only hope that this productive dialogue will continue in the years ahead. The U.N. Conference on the Human Environment could prove to be the turning point for international cooperation in averting what in some quarters is viewed as a 'grave crisis.'

But at the root of most discussions about environment and development, there is, I suspect, one rather basic question. Given the limited alternatives that nature allows without rebelling, how can we best further human enjoyment of life—for all peoples of the world? The answer is, in part, by not vilifying the efforts of the poor countries to expand their economies and modernize their social institutions, to provide themselves with an opportunity to build more individually rewarding and productive lives. We must rather ask how this development can proceed in ways minimally disruptive to the environment and in ways promising of human self-fulfilment and social progress.

Environmental protection is for lots of things—for good health, for beauty, and for safeguarding our life-supporting ecological systems. But so are many other things—like reliable and wholesome food supplies, adequate housing relevant education and health care. The question is not which of these desirable things the poor peoples of the world should have, but rather what combination is most desirable for their respective stages of development. It is a question that every society asks itself, given its particular needs and priorities.

*But what is certain is that we must make better and greater use of the financial and technological proceeds of that development and growth—both to protect and improve the environment and to attack and eradicate degrading human deprivation.*

The one pollution that threatens above all others to destroy the environment, to destroy health, to destroy the very essence and spirit of man, is the permanent contamination of poverty.

In a world so beset by human deprivations and misery our clear and unmistakable duty is to face up to mass poverty for what it really is—cruel, senseless and curable—and set about providing a threshold of human dignity and decency which is achievable. And achievable not at the price of a bankrupt environment, for I am confident that we can combine greater support for the development process with our responsibility to protect and enhance the only environment any of us possess.



## SESSION B: NATIONAL AND INTERNATIONAL ENVIRONMENTAL POLICIES

### Part 2: Discussion

Having introduced the Authors and Panel Members (of whom Professors Gardner and Henning had kindly taken the place of others who had been unable to be present), the Chairman, Dr **Nogueira-Neto** called upon the former to present their contributions.

Professor **Caldwell** said that in order to leave more time for discussion, he would not at this stage expand on the printed Summary of his Paper. Dr **Lee** felt that a suitable introduction to his Paper would be to quote a few paragraphs from his article in *Vital Issues* (Vol.xxi, No. 6, Feb. 1972), published by the Center for Information on America, Washington, D.C. In this, after summarizing the differences in attitudes on environmental problems of developed and developing countries, he had stressed that 'if the dialogue between (them) is to be at all productive, it must be based upon a frank and honest recognition that the viewpoints on both sides are different and that solutions.... must be complementary to and not at the expense of efforts to advance the economic and social development of the Third World'. However, 'the world family of nations is coming to realise.. that the issue cannot and must not become one of development versus environment. It must be rather how development can proceed in ways minimally disruptive to the life-supporting ecological systems upon which all.... depend. Policy and decision-makers in developed and developing countries alike are becoming aware of the truth of the old saying "an ounce of prevention is worth a pound of cure".' In conclusion, he had summed up his reasons for taking an optimistic view of the situation, as follows: 'the developing countries have certain advantages in integrating environmental and developmental policies that today's advanced nations did not have one hundred and more years ago. Most... are fortunately already so committed to planning that the imposition or acceptance of social controls is nothing new to them... Ecologically speaking, 1980 is the day after tomorrow and the year 2000 is next week... and if we, all of us, truly intend to become responsible stewards of the planet, we must be prepared to understand better the results of our tampering and to act with determination on that knowledge'.

Invited by the Chairman to lead the preliminary comments by panel members, Dr **Erz** said that, as one who was much involved in the application of international law and conventions, he must draw attention to the wide gap between policy and practice. Since no effective sanctions are attached to most conventions, it cannot be taken for granted that their concepts, however admirable, will be reflected in reality: there is always the factor of resistance to any intrusion into national sovereignty. This was recognized in Dr Lee's paper, but he had perhaps adopted too narrow a view of development, restricted largely to its economic and technological connotations, whereas the cultural and educational aspects were of special importance if progress is to be made.

Panel member Professor **Gardner** thought that the gap between concepts and practice depended mainly on doubt as to how to make the former operational, for example in the transfer of aid from rich to poor. Lester Pearson had called for the allocation of 0.7% of GNP by developed nations for that purpose, but nothing better than half that figure had ever been achieved on average. A new approach is needed, based perhaps on 'environment' rather than 'aid'

(which is out of date), a global approach which would replace the 'adversary' approach of many developing countries (exhibited in the great objections raised at Stockholm to third party judgements in the environmental area). The problem to be faced, if the concepts in the Papers are to have any validity, is how in fact the community of nations is to deal with non-cooperation in the field of total environmental management.

After commenting briefly, in regard to Dr Lee's paper, that he doubted the value of 'environmental impact studies', as a basis for the proper consideration of alternatives and of environmental quality, because of their tendency to be subject to mission 'orientation' and politico-economic constraints, panel member Dr. **Henning** referred to what he understood to be one of the themes of Professor Caldwell's paper, namely that the ecological concepts which emerge and interact with political ideologies and institutions are science-orientated: in reality they are or should be equally derived from ethical inspiration, human concern and irrational elements. He suggested, therefore, that a more holistic approach than Professor Caldwell's was necessary, taking into full account all the political, psychological and social aspects, while recognizing the fundamental biological factors such as the limitations of the biosphere and its species. Only in this way could full public and world support for environmental policies be won. Current failure to do so was mainly due to 'technique ideology', which puts emphasis on short term economic progress considerations rather than long-term intangibles, such as quality, and which has also tended to produce defensive-type laws and institutions (assuming 'law' to be the equivalent of a political memorandum at a given period of time). We need to replace the negative aspects of technique ideology through international technological reassessment and new political institutions.

Winding up the panelists' comments, Professor **Mayda** said that in trying to round off what had so far been said, the focus at synthesis must be *policy*, a concept which had received little mention, although most of the speakers were members of the IUCN Commission which puts it first in its title. Professor Gardner had spoken of the need of a new pattern, but notions about this, as put forward at the Stockholm Conference, had been 'fuzzy' and much will have to be done by the UN 'Environmental Secretariat' if its advisory services (Article 5 of the institutional proposal) are to be of any lasting value. Professor Caldwell had similarly emphasized the need for a philosophical breakthrough in the politics of ecology, what someone has referred to as an intellectual ecosystem, but we cannot afford to wait for an environmental Marx or Einstein: it is up to us to shape 'some new configuration'. He would now like to suggest some guidelines for this, drawn from his essay entitled *'Environment and resources: from conservation to ecomanagement'*, first issued in 1967.

The starting-point for a synthesis is the essential identity in the origins of environmental and socio-economic dysfunctions, the basic proposition that the characteristics of a sound ecosystem are its dynamic unity, complexity and interdependence. It would be interesting on this basis to investigate such hypotheses as that, for example, the human and social dysfunctions in urban environments are the result of over-simplification and the consequent fragility of these man-made ecosystems. The major obstacles to long-term solution of environmental problems are not solely political, as usually stressed, but also derive from pre-political violation of the principle of unity. Scientific specialization is at the cost of a sufficient number of generalizers—the newest specialists: predominant thinking is still fragmentary and dichotomous, and in framing UNESCO's MAB programme it was necessary to argue the case for collaboration between social and natural sciences.

Another and perhaps principal cause of the biosphere crisis is that great progress in the 'hard' technologies of production, transportation, medicine and food-growing have not been matched by progress in social management, government, law and enforcement, and value systems. Contrary to some of the views expressed by previous speakers, we must not only try to develop policy models and techniques, but think about policy-making as an apolitical expert exercise, distinct from the political decision on the particular policy option to act upon. A point that had not been mentioned is that policy synthesis and construction is covered by Recommendation 14 of UNESCO's 1968 Biosphere Conference, which advocated ensuring 'that the best possible advice from specialists in biological, physical and social sciences, technology and economics is available on a regular basis to the... decision-making... authorities at all levels.. (together with) periodic and comprehensive review of policy... based upon practical experience'. Secondly, the methodology of policy-making rests on the assumptions that (a) scientific data alone, no matter how complete, cannot yield environmental policies; (b) the decisive factor is knowledgeable action, action based on the best over-all alternative after other options have been considered, which means that the decision is political: but the political variables taken into consideration are in turn largely controlled by environmental, social and economic parameters; (c) ecomanagement is really a process of organic progression from knowledge to policy to decision, a process so complex that all available techniques (systems analysis, EPD, quantification of qualitative data, etc..) must be utilized; and (d) the modelling concept is a logical tool, already being developed in the IBP and MAB programmes, the important difference being that the natural scientists regard ecology as a completely quantifiable science, while MAB deals with human ecology and ecomanagement as an amalgam of applied life and earth sciences with human and social sciences, which will never be completely quantifiable. The goal is to remove guesswork from environmental policy and decision-making and, for example, instead of thinking wrongly of dichotomy between (over-) developed and less developed countries, to arrive at a model of upper and lower limits of environmental tolerance in the face of human technological interference, which can be used to govern further development in *any* country.

The main points made by those who, at the invitation of the **Chairman**, then joined in the discussion, were as follows.

The kinds of problem that tend to cause concern are those connected with the present opening up of the Amazonian hyloea by several South American countries and it would be interesting to have some comments from those familiar with the situation—**G. Budowski** (IUCN).

The development referred to is of great importance and cannot be stopped and the only way of mitigating its effects on the natural riches and diversity of the region seems to lie in the creation of national parks. In 20 years' time there may be nothing left of the Amazonian biotopes outside of half a dozen reserves, and even to guarantee the creation and maintenance of these will need active encouragement by international agencies such as the World Bank—**P. Nogueira-Neto** (Chairman).

Brazil has made its decision on this: there are between six and ten million more or less destitute people in the north-east of the country, who must be provided for and the only way at present in sight for doing this is through subsistence agriculture or simply moving into the forest by slash and burn methods. To stop or control this is impossible without much outside help, and that is politically unacceptable. However, further discussions are being planned, for example in connection with possible World Bank funding of feeder

roads for the Trans-Amazonian Highway, and this should allow some reassessment of the situation, since the World Bank must approve the methods and the safeguards against adverse consequences to be applied in such projects. The policy can be summed up as 'minimum environmental destruction, maximum human benefit'—**James A. Lee** (author of Paper 8).

Au sujet de la situation évoquée par M. Erz (panéliste), on peut citer le fait que, faute d'une possibilité internationale de sanction, la Belgique, signataire de la Convention condamnant cette pratique, continuait depuis près de 20 ans à autoriser sur son sol la capture annuelle de millions de petits oiseaux. Mais enfin, en juillet 1972, grâce à l'intervention courageuse d'un nouveau ministre de l'agriculture, le gouvernement belge vient d'abolir officiellement et complètement la tenderie—**J-P. Harroy** (Belgium).

Since pollution is not limited by national boundaries, it follows that international environmental institutions must also not be limited by such boundaries. But because there is no hope that, in the near future, truly international institutions can be developed, we must look to see what interim arrangements can be designed to meet the situation. Specifically this involves the question whether a 'two-tier approach' can be made to work, this is an approach in which an international advisory body, a 'blue-riband committee', is established but the actual execution of environmental policy is left to nation states—**Albert E. Utton** (USA).

Wherever possible we should try to provide 'third party control', although it may not be effective except in rather specialized sectors, for example the activities of IMCO vis à vis oil-pollution of the sea. There is a welcome trend, however, towards expanding the powers of international executives, such as those of the post-Stockholm secretariat and its Director: at the very least such bodies should have the power to call the representatives of nations together, rather on the lines of the operation of the U.N. Security Council—**Richard Gardner** (panel member).

One of the problem areas in environmental management concerns human technology and industrial activities, and some of the assumptions about these in Mr Lee's paper can be questioned. For instance, to say that people who earn less than \$100 a year are straitjacketed by poverty, is defining poverty on very narrow criteria. The early North American Indian and peoples of Africa enjoyed life and a standard of living in no way inferior to that of today's Los Angeles commuter, a point brought out by the comparisons drawn in Paper (4), Session A. 2, by Dr. Wasawo. Again, while it may be true that industrial development provides a basis for partially eliminating some diseases, such as malaria, it merely replaces them with others like emphysema and cancer. Another complication referred to by Professor Kuenen in Paper (1), Session A. 1, is the danger that 'in seeking to better their material circumstances... men will continue to make the same mistakes that have been made in industrial countries'. Previously men were so few that earth could assimilate or recycle their destructive activities, but now pollution control technology is far behind industrial technology, and moreover requires a high degree of skill and attention to be effective. In Canada, with some of the world's strongest pollution control laws, when industry must make a choice, profits are still preferred to environmental protection, witness the case of the largest coal strip mine, a hundred miles south of Banff, where operations on slopes as steep as 49 degrees, combined with the rugged terrain and severe weather conditions, compound the damage in the as yet unfulfilled hope that they will be profitable. If control cannot be achieved here, because of a too narrow cost-benefit analysis, what are the chances in developing countries? This does not

mean a zero growth policy for the latter, but the World Bank and IUCN approach does not reflect the immediacy and severity of the problem. A meaningful environmental impact assessment is essential and development of a new industry must not be allowed without the company concerned first abiding by internationally established pollution control regulations—**Gary Gallon** (Canada).



**SESSION C**

**ECOLOGICAL MULTI-DISCIPLINARY  
APPROACH TO DEVELOPMENT PLANNING**

**Part 1**

**SESSION C: PART 1**

*Chairman:* Mr. R. G. Fontaine (FAO): Director, Forest Resources Division, Forestry Department, FAO, Rome.

*Authors:*

**Paper (9): Conservation as a long-term Development Tool**

Professor A. G. Bannikov (USSR): Member of IUCN's Survival Service Commission; Department of Zoology, Academy of Veterinary Sciences, Moscow; and

- \* Mr B.N.Bogdanov (USSR): Member of IUCN Executive Board; Head of the Central Board for Hunting and Nature Conservation, USSR Ministry of Agriculture, Moscow.

**Paper (10): Ecological Principles and their Application in Economic Development**

Dr Raymond F.Dasmann (IUCN): Senior Ecologist, Morges.

*Panel Members:*

- 1 Mr. E.N.Akah (Nigeria): Member, IUCN's Commission on Environmental Planning; Senior Landscape Architect, Landscape Unit of Ministry of Lands, Survey and Urban Development, East Central State, Enugu.
- 2 Dr Dale W. Jenkins (USA): Director, Ecology Program, Smithsonian Institution, Washington, D.C.
- 3 Professor M.Kassas (Egypt): Professor of Botany, Faculty of Science, Cairo University, Giza.
- 4 Ing. Edgardo Mondolfi (Venezuela): Presidente de la Asociación Nacional para la Defensa de la Naturaleza, Caracas.
- 5 Mr. Kirk P. Rodgers (USA): Director, Office of Regional Development, Organisation of American States, Washington, D.C.

*Rapporteur:* Miss Mona Björklund (IUCN)

*Secretariat Member:* Mr. Alfred Hoffmann (IUCN)

## SESSION C: ECOLOGICAL, MULTI-DISCIPLINARY APPROACH TO DEVELOPMENT PLANNING

### Part 1: Paper (9)

## Conservation as a Long-Term Development Tool

A.G.BANNIKOV

*Member, IUCN's Survival Service Commission; Professor, Department of Zoology, Academy of Veterinary Sciences, Moscow.*

B.N. BOGDANOV

*Member, IUCN Executive Board; Head of the Central Board for Hunting and Nature Conservation, USSR Ministry of Agriculture, Moscow.*

### SUMMARY

We regard nature conservation as rational management of natural resources under optimum environmental conditions.

The main tool for providing long-term rational management of natural resources and maintenance of a high quality environment is a planned use of nature, involving, essentially, the scientific prognosis of long-term consequences which human activity may cause in the biosphere both at a national and global level.

In order to fulfil this task certain conditions have to be met. To our mind, the most essential of them are: proper national legislation; scientific recommendations and their strict observance by different groups of nature users; control of environmental quality by the State; orderly allocation of responsibilities for taking all necessary nature conservation measures; information and education of young people. All measures for environmental improvement and conservation should be integrated with general economic and social progress.

In the USSR nature conservation is an inseparable part of a long-term programme for social progress. The fact that all land, including the substrata, forests and natural resources, as well as industrial enterprises and urban economy, are owned by the State, constitutes the legal basis for planned and rational use of natural resources and for nature conservation. The laws of the USSR concerning nature conservation, specifically cover the planned and complex management of natural resources and measures for environmental improvement. The planning of nature conservation is a component of programmes for industrial development, the development of agriculture, forestry and of cities and towns.

A brief account is given of the experience gained in the Soviet Union in solving the problems of nature conservation and of applying general principles of planned nature use at both the national and regional levels.

The authors believe that international cooperation must play a leading role in solving what is now a global problem, namely the conservation of nature. The greater the number of participants, the more fruitful will be the cooperation. Equal and comprehensive international cooperation is especially important in the elaboration of those long-term programmes on nature conservation of which the ultimate objective is to raise the living standards of mankind.

## **RESUME**

Nous définissons la conservation de la nature comme la gestion rationnelle des ressources naturelles assurant le maintien de l'environnement dans des conditions optimales.

La base d'une gestion rationnelle à long terme des ressources naturelles et du maintien d'une qualité élevée de l'environnement est l'utilisation planifiée de la nature fondée sur la prévision scientifique des conséquences lointaines que les activités humaines peuvent avoir sur la biosphère, tant à l'échelon national que global.

Un certain nombre de conditions doivent être réalisées pour parvenir à ce but. Les plus importantes sont, à notre avis, les suivantes: législations nationales adéquates, recommandations scientifiques strictement observées par les différents groupes d'utilisateurs de la nature, contrôle de la qualité de l'environnement par l'Etat, répartition des responsabilités pour l'adoption des mesures de conservation nécessaires, information et éducation des jeunes. Toutes les mesures prises en vue d'améliorer l'environnement et de conserver la nature doivent être intégrées au développement économique et social.

En URSS, la conservation de la nature fait partie intégrante d'un programme à long terme de progrès social. Le statut nationalisé de l'ensemble des terres, y compris du sous-sol, des forêts et des autres ressources naturelles, ainsi que des entreprises industrielles et de l'économie urbaine, constitue la base légale de l'utilisation rationnelle et planifiée des ressources naturelles et de la conservation de la nature. Les lois soviétiques relatives à la conservation de la nature concernent spécifiquement la gestion planifiée et polyvalente de ressources naturelles et les mesures destinées à améliorer l'environnement. La planification de la conservation est un des éléments des programmes de développement industriel, agricole, forestier et urbain.

L'expérience acquise en Union soviétique en ce qui concerne la résolution des problèmes de conservation de la nature et l'application des principes généraux de l'utilisation planifiée de la nature à l'échelon national et régional est brièvement exposée.

Les auteurs estiment que la coopération internationale doit jouer un rôle prépondérant dans la résolution de ce qui est devenu un problème planétaire, c'est à dire la conservation de la nature. Plus les coopérants seront nombreux, plus la coopération sera fructueuse. Il est particulièrement important que les pays collaborent tous à l'élaboration de programmes de conservation de la nature à long terme dont l'objectif ultime est d'élever le niveau de vie de l'humanité.

## **CONSERVATION AS A LONG-TERM DEVELOPMENT TOOL**

One of the most important problems of the present time, not only in its policy but also in its organizational implications, concerns the planning of the kinds and impacts of human actions affecting the biosphere, both in the near and more distant future.

The wise use of non-renewable natural resources should make it possible to ensure that they will last for a long time to come, including sources of energy. In any case, it should satisfy human needs if coal, oil and gas are replaced by the energy derived from thermonuclear reactors, ocean tides, geothermal and

other new sources of power such as those of cosmic bodies and planets. Initial research and experiments in this field inspire confidence in the might of human labour and intellect.

In our view a much more complicated task is to ensure the rational use of biological resources, including soil, plants and animals, and also atmosphere and water, which are the basis of the existence of biological resources and at the same time the elements most vulnerable to pollution.

Hopes are pinned on devising methods of increasing the biological productivity of ecosystems (beginning at the photosynthesis level), and of stimulating the general cycle of matter, particularly those biotic elements capable of building up the resources needed by man. Such elements may have a favourable influence upon the ecosystem, an example being the introduction of phytophagous fishes into man-made reservoirs, especially those exposed to thermal pollution.

The difficulty in the general problem of biological conservation is that every biogeocenosis or elementary structural unit of the biosphere, has acquired, during the process of evolution, a wonderful capability for self-regulation, which however is 'programmed' to operate only within the limits of the natural changeability of the environment. Man, by helping to bring about major changes in biogeocenoses, often deprives them of stability, which leads to their transformation or radical alteration and, at times, to undesirable global consequences. There is no need to cite here any of the numerous examples of this regrettable phenomenon.

The increasingly negative influence of humanity on the structure and functioning of the biosphere evokes alarm among scientists, statesmen and public leaders. It has become quite evident, that any development in agriculture and forestry, industry and construction, especially if it engulfs extensive areas, must be carried out in a rational manner: it must be based on the principle of sustained yield of resources and on the obligatory application of scientific forecasting of long-term consequences for the biosphere of their exploitation, at the national and global level.

Within these conditions the main instrument for ensuring long-term or, ideally, infinite rational use of natural resources is a planned utilization of nature, both in the short-term—the next five years or thereabouts—and also over a much longer period of time into the more distant future. If management is unplanned and spontaneous, conservation of nature will inevitably be incomplete and at the mercy of an uncertain market. It is important to note that properly drawn-up long-term plans also make it possible to forecast future impacts on the natural environment. This in turn provides a real opportunity to plan concrete measures for particular regions, aimed at neutralizing and even maybe completely eliminating negative influences on the environment. However, in order to accomplish such long-term planning programmes with a view to raising the standard of living of present and future generations, we believe that certain prerequisites have to be fulfilled. Thus, it is necessary to have adequate national laws, scientific recommendations with the force of compulsory regulations governing the conduct of resource-exploiting enterprises, the various appropriate control bodies, adequate financing of conservation activities by governmental and public agencies and, finally, the relevant publicity and the training and education of young people. Moreover, the approach to the natural environment must be integrated with development in general and treated as part of overall economic and social planning.

Many governmental and other bodies in different countries, which are making

use of scientific recommendations in the course of their studies and assessments of national economic and social conditions, are in fact attempting to evolve integrated systems of the kind outlined above.

We hope that during the discussion of this problem, participants in the 12th Technical Meeting of IUCN will share the experiences of their various countries on ways and means of solving the problem of effective conservation of renewable natural resources. The present paper aims to describe the situation now reached in the USSR, where the experience of a major industrial and agricultural state undoubtedly shows that rapid planned development is quite compatible with the rational use of natural resources and with keeping the natural environment within the parameters which are optimum for the life of man.

The national, people's ownership of the land, its mineral wealth, forests and other national resources, and also of industrial enterprises and city establishments, provides the judicial basis for long-term scientific planning of the rational use of natural resources and for environmental conservation in the Soviet Union.

Special laws on the conservation of nature promulgated in the Republics of the Union, at the beginning of the 'sixties, envisage the planned utilization of natural riches. They take into account the mutual ties between natural resources, with a view to ensuring that the exploitation of some resources will not do harm to others. In providing for the use of renewable resources, the purpose of the legislation is not only to satisfy the current needs of the country's economy, but also to cover the care and restoration of these resources, and their increased productivity. The laws also envisage a regular, planned allocation of funds and other material support for conservation of natural riches. Responsibility for adhering to these laws lies with the corresponding organizations. For certain natural resources there are special state norms, which control the levels of exploitation and conservation on a planned basis.

Modern planning of nature protection in the USSR is part of the scientific concept of long-term forecasting (25-30 years); an element in the master plan for developing and distributing the productive efforts of the USSR over the shorter term (up until 1980); and is also integrated in the district planning network, which is a type of area planning. The latter is derived from the master plan and provides the necessary parameters for the concrete solution of questions of the rational disposition (having due regard for nature conservation requirements), in any given area, of industrial and agricultural enterprises, cities, engineering installations, power units, water works and so on. As from 1969, nature conservation plans have been worked out as a component part of the current five-year plans for developing the national economy of the republics.

Turning now to the actual state of conservation and how utilization is managed and how the principle of planning the conservation of certain natural resources in the Soviet Union is applied in practice, the first point to note is the *land* in the USSR is diversified. Soils vary from the rich black to the poor permafrost, alpine and arid, and therefore demand equally different approaches to their utilization and conservation.

As in other countries, one of the most important problems of soil conservation in the USSR is the prevention or remedy of the results of water and wind erosion. It should therefore be a corollary of the advanced technical equipment of modern agriculture that high importance is attached to long-term planning of soil conservation measures. In the USSR the programme has now been

worked for the decade 1971-1980. It envisages the planting of more than a million hectares of new field-protecting forest belts; a further 3.4 million hectares of ravines, river banks and other difficult terrain will be stabilized by afforestation, and 174,000 hectares of steeply sloping land will be terraced. It is planned to allocate 23,000 million roubles for these purposes.

Strict rules for the application, storage and transportation of mineral fertilizers and pesticides have been adopted in the USSR. The use of DDT on fields carrying food crops, zinc phosphide in combating rodents and some other pesticides is forbidden. Much work is being done in studying biological methods of combating pests.

During the last decade special attention has been paid in the USSR to rehabilitating land so that it can again be cultivated. The Principles of Land Legislation oblige enterprises exploiting minerals by open cast or underground mining, or engaged in various other types of construction or industry, to restore at their own expense and as soon as possible the land they have affected, so as to make it suitable for agricultural, silvicultural and similar uses. Restoration work of this kind is being undertaken in many parts of the Ukraine, Estonia, Moscow region and elsewhere.

*Forests* occupy a third of the total area of the USSR. For the purpose of rational utilization and conservation, all forests are classified into 3 groups. The first group consists of forests excluded from industrial exploitation. They include forests which serve as water, soil and field-protecting barriers, woodland in city suburbs and the neighborhood of resort zones, especially valuable stands of cedar, pistachio and other nut-bearing trees and many others, and also forest reserves and natural parks. The forests of Group II may be exploited only to a limited extent, as they are situated in sparsely-wooded areas: the rate of cutting is not allowed to exceed the rate of new growth. Group III comprises forests used for industrial purposes, situated in densely-wooded areas and mainly in Siberia. But even in this group, the amount of felling must not surpass a certain calculated volume.

Planting of trees and reforestation measures are being carried out throughout the country on a scale corresponding to the cut. Thus, tremendous afforestation work is being carried out on the mountainous slopes of the Crimea, Caucasus, Carpathians and elsewhere, and also on large sandy tracts in the Ukraine and the Volga regions. There is a coordinated long-term programme for large-scale planting of protective trees in steppe and woodland-steppe zones. Altogether, there is no doubt that the most important and best measures worked out in the past few years have been those involved in establishing optimum forest and woodland densities for various regions of the country.

*Wildlife* in the Soviet Union is considered as a necessary component of the natural environment, requiring conservation and rational utilization. Protection is withheld only from animals which are causative agents of communicable diseases, carriers and vectors of infections, or pests of agriculture and forestry.

*Wild animals and birds* are exploited according to special legislation. The number of animals and birds allowed to be hunted is determined for the country as a whole, and also for separate regions, on the basis of a population census for each species and of the establishment of biological norms of permissible annual off-take. Hunting in the USSR is a branch of the national economy. The state monopoly on purchasing hunters' trophies and the licensing system covering the hunting of most fur-bearing animals and all wild ungulates, make possible the effective control and planning of hunting throughout the country.

The basic consideration governing the protection of rare animals is how to restore their numbers to a level, where it will again be possible to allow them to be hunted. For example, among the animals which were once rare but have been restored and can now be hunted in limited numbers are sable, sea otter, saiga, moose and beaver. Several other rare species such as the desman, tiger, spotted deer, onager and bison have been increased to numbers which should guarantee their preservation as a genetic stock. At the present time, a complete ban for the purpose of preservation, is placed on the hunting of 18 species of mammals and 26 species of birds.

Protection is extended to other animals in addition to game. For example, there is special legislation to protect birds of prey, song birds, bats, wild bees, certain species of ants and some other insects. In the past few years a limit has been put on the number of snakes which may be caught for the purpose of milking their venom for medicinal purposes.

As a natural resource of the animal world *fish* play a most important role. Unfortunately, the construction of power stations and river pollution have had a negative effect on productivity of reservoirs especially with respect to anadromous and semi-anadromous fish. In this connection artificial pisciculture is widely practised in the USSR. For example, annual production of hatcheries includes over 50 million young sturgeon and over 7 billion fry of whitefish, salmon and carp, raised to the adolescent stage.

*Nature reserves* in the USSR ensure the conservation and study of typical samples of all basic as well as exceptional kinds of habitat. The reserves are complex in the sense that all elements of the biogeocenosis without exception are conserved—animals, plants, soil, minerals, water, etc. The areas included in the reserves are completely withdrawn from economic use and all activities liable to disturb the course of natural processes of the ecosystem, are strictly banned.

The investigation and research programmes of reserves are directed to studying ways and methods of preserving the biogeocenoses and their individual components, and also to studying the biological productivity of the ecosystems. The reserves therefore constitute scientific laboratories for the purpose of conservation. Much of the USSR contribution to the International Biological Programme, which aims to enhance the biological productivity of the Earth for the benefit of Man, has been carried out in the reserves.

At present (1 January 1972) there are 92 nature reserves in the USSR with a total area of 7, 200, 000 hectares. The network of reserves is constantly being expanded, a process which is facilitated by state ownership of all land. In 1968-1972, 13 new reserves were established with an area of nearly 500,000 hectares.

In the past few years a comprehensive inventory of 'natural monuments' has been under preparation, with the aim of conserving individual examples of rare natural phenomena, such as caves, geysers, ancient trees, geological faults and palaeontological deposits. Finally, a number of 'natural parks' are being set up in the USSR, similar in status to the national parks of some other countries, that is aimed at combining the conservation of the landscape with provision for mass tourism and fulfilment of aesthetic and recreational needs. The Scientific Centre for the Conservation of Nature is drawing up advance plans for developing the network of all types of protected areas, which will cover the next ten years or more.

Major attention is being given to the *conservation of water resources*. The legislation envisages planned and multi-purpose use of water resources,

obligatory protection of these resources from pollution and exhaustion, and also the planning of the water economy for a long period of time. It takes into account the fact that within the next 15 years water consumption is estimated to increase by 1.7 times and in 30 years by 2.5-3 times.

Water resources are somewhat unevenly distributed in the USSR. For example, the largest part (86%) of the annual flow occurs in sparsely populated regions of the North and Far East. It is assumed in the planning programmes that, for the next 10-15 years, the water supply for the so-called 'Southern slope' can depend on its own resources. However, after 1985, it will be necessary to supplement the resources of the Caspian, Azov and Aral Seas basins and, in order to accomplish this, plans have been made to divert the flow of northern rivers of the European part of the USSR into the basins of the Caspian and Azov Seas and of certain Siberian rivers into Kazakhstan and Central Asia (the Aral Sea basin). These programmes are of a truly continental scale.

The complex and planned utilization of water resources implies greater protection from pollution: for this purpose, production technology is being modernized, closed water-rotating cycles are being introduced, technological processes which can do without water are being elaborated, water cooling is being replaced by air cooling, effective purification equipment is being installed and new methods of purification are under investigation.

Although, between 1966 and 1970, water consumption in the USSR increased by 40 per cent, there was a considerable increase in waste water treated. An example of the real success that has been achieved in protecting water from pollution is afforded by the Moskva River. In the recent past it was heavily polluted but now, even within the city limits of Moscow, it has become fit for sport-fishing and swimming.

Conservation of the *atmosphere* is becoming an acute problem and the government is making ever-increasing capital investments in combatting air pollution. Health legislation recognizes the necessity for having exactly forecasted calculations of the degree of atmospheric pollution which may be brought about by the construction of industrial plants. National standards of air quality have been established. Research into new types of motor vehicles has been started. Extensive measures are being undertaken to develop electrically driven public transport and, in general, to discover ways of decreasing CO<sub>2</sub> content in the atmosphere.

The problem of environmental conservation is closely connected with the problems of *locating industrial enterprises, cities and populated centres*. The population of the USSR has risen from 194.1 million in 1940 to 241.7 million in 1970, and the urban population during these 30 years has increased more than two-fold and now comprises 136 million or 56% of the total population.

The management of urban construction and the regulation of population distribution are not left to take their own course in the USSR, but are incorporated in governmental plans for developing the economy against a background of no private ownership of the land. This makes it possible to disperse centres of production and city networks, with due consideration for the natural environment, on the basis of setting aside appropriate zones for agriculture and forestry, for natural reserves, water conservation, sanitary-protection and other purposes. The cities have master plans covering the period up to the year 2000, which include suburban-zone planning and provide a good basis for solving the problem of conserving the natural environment. Of major importance for protecting the environment from pollution are the principles of urban construction which have been adopted in the USSR and include moving

installations which pollute the atmosphere away from the city, creating health-protective zones between populated districts and the industrial enterprises, rigid rules for permissible population densities in city blocks, maintenance of standards of natural lighting, tree planting, and the planning and organization of public services. As the size of the cities continues to expand greatly from year to year, the plans also provide for the establishment of mass recreation zones in the form of parks in natural areas.

It should be stressed that, in solving the problem of environmental conservation, measures for improving general conditions and the comfort of people have played an important role. For example, 33 million new flats have been built in the past 15 years and are inhabited by 120 million people, or half of the total population of the country. The plan is to provide for a 12% greater addition of residential accommodation in 1971-1975 than in the previous 5 years, and major development of the electricity and heating supplies for cities will also be undertaken. In particular, work will continue on the construction of a national power grid, which should do away with the location of power stations in cities and thus radically reduce the pollution of their air. The change-over of thermal stations from solid fuel to gas serves the same purpose.

Of prime importance in solving the problem of conservation of nature are long-term forecasts of changes in population numbers and distribution. The population of the USSR by the year 2000 will be 320-350 million persons, of which the urban population will account for 70-75%, representing an increase of 100 million. This will necessitate the elaboration of major measures for environmental conservation. In this connection, the national plan envisages the regulation of the growth of great cities, the development of small ones and the establishment of effective control of new settlements. For example, a ban has been placed on new industrial enterprises in big cities (with the exception of those essential to public services and the urban economy). Construction of new industrial enterprises will largely be decentralized to towns of medium and small size, situated in favourable conditions for industrial development. Simultaneously, the network of rural population centres is being steadily reconstructed and replaced by major well-built towns, well provided with a full range of public and technical services.

A programme of new community settlements is currently being planned and implemented, with particular reference to the widespread development of the eastern and northern regions of the country. The system of group settlement has tremendous possibilities for new urban construction, while ensuring the conservation of nature according to a coordinated regional and national long-term plan. At the same time it contributes to the solution of the problem of bringing living standards of urban and rural populations closer together, and also of creating optimum anthropogenic landscapes.

Much is being written today about the horrors of urbanization and octopus-towns. Nevertheless, experience in the Soviet Union clearly shows that we must not be afraid of the growth and appearance of new cities. What we must avoid is spontaneous, uncontrolled, unplanned growth of cities. It is growth of that kind which turns a city into a difficult or even completely uncontrollable megapolis, swarming with unsolved problems of psychological disturbance, suburban slums, insanitary conditions, etc. Clear-cut planning of inter-urban distribution of population and enterprises and, what is most important, long-term planning for redistribution and growth of the cities themselves, together with due consideration of all that is needed to ensure rational use of natural resources and the purity of the natural environment—these, to our mind, are the key to solving the problems of urbanization.

Conservation of nature, understood as the utilization of natural resources in the manner most favourable for human society, is therefore considered as a component part of the long-term programme of development of Soviet society and the Soviet state. The essential unity of nature demands that mankind, though divided into states, peoples and nations, should cooperate in solving what is a global problem of modern times, namely the conservation of nature. At the same time it is a problem that cannot be isolated today from the solution of the basic political problem, namely the establishment of durable peace and international security.

Our country is ready to participate in joint international action for the conservation of nature and rational use of natural resources. The more countries that participate, the more fruitful will that cooperation be. The Soviet Union gives paramount attention to cooperation with all interested states, regardless of their social systems or the level of their economic, scientific and technical development.

Equal and diversified international cooperation is especially important in solving long-term problems of conservation, such as those involved in the protection of the World's air and oceans from pollution, and in the regulation of the mutual use of birds and mammals migrating across national borders.

As experience has shown, long-term bi-lateral and international agreements on the conservation of nature are of major importance in successfully solving the problems of rational utilization of natural resources whether today or for the distant future. One could quote as examples the bi-lateral agreements on regulating fishing that the USSR has concluded with Japan, USA, Canada, Finland, Norway and other countries, the agreement between the USSR and Canada on prohibiting pollution of Arctic waters, the protocol on combatting pollution of the Baltic Sea, signed by the USSR, GDR, Denmark, Sweden, Finland and Norway, the agreement on the conservation of nature in the Antarctic and many others.

The USSR attaches high importance to international cooperation in joint studies of problems of the conservation of nature and the rational utilization of natural resources. For example, within the framework of the Council for Mutual Economic Assistance of the socialist states there is a detailed programme for 'The Working Out of Measures on the Conservation of Nature', which covers: (1) health aspects of nature conservation; (2) conservation of ecosystems (biogeocenoses); (3) protection of the atmosphere from pollution; (4) conservation of water resources; (5) disposal and re-cycling of domestic and industrial wastes; and (6) socio-economic, organizational and judicial aspects of the conservation of nature. In accordance with the Rules of the CMEA any country, whether or not a member of the CMEA, can be a full or partial participant in this agreement.

Soviet scientists are taking part in the activities of many non-governmental international organizations studying various aspects of the conservation of nature, and also in the activities of the UN and its agencies, the IUCN, the International Biological Programme, UNESCO's 'Man and the Biosphere' programme, long-term oceanic studies and many other programmes.

The Soviet Union has tabled a number of proposals for the adoption of long-term programmes for the study of nature conservation problems—for example, at the forthcoming All-European Conference on Security and Cooperation—and also for even longer-term programmes on the use of the Moon and other celestial bodies for peaceful purposes.

It is essential that the exchange of information on national achievements in the field of nature conservation, rational use of natural resources and long-term development plans, should be further expanded, with a view to creating optimum mutual relations between nature and man. International efforts of scientists, statesmen and other leaders, directed towards the elaboration of comprehensive development plans on a regional and global scale, must play a vital role in the betterment and conservation of nature on our planet.

## SESSION C: ECOLOGICAL, MULTI-DISCIPLINARY APPROACH TO DEVELOPMENT PLANNING

### Part 1: Paper (10)

# Ecological Principles and their Application to Development Planning

RAYMOND F. DASMANN

*Senior Ecologist, IUCN, Morges, Switzerland*

### SUMMARY

In co-operation with the Conservation Foundation of Washington, D.C., IUCN has prepared a volume entitled *Ecological Principles for Economic Development*. This will be the first major product of a series of efforts being carried forward by IUCN to ensure that ecological knowledge will be taken into account in development planning in order to minimize or eliminate the adverse environmental effects of economic development activities. Since some financial support has been forthcoming through the Swedish International Development Authority (SIDA), IUCN plans to continue work to prepare and distribute other materials that may be useful in the preparation of ecological guidelines for use by development planners. IUCN will work closely with other nongovernmental and intergovernmental agencies in an attempt to provide further ecological inputs to the economic development process. The recently launched Man and the Biosphere Programme offers opportunities for IUCN to work in close co-operation with UNESCO toward this goal.

### RESUME

L'IUCN, en collaboration avec la Conservation Foundation de Washington, D.C., a préparé un ouvrage intitulé 'Ecological Principles for Economic Development' (Principes écologiques à l'usage du développement économique). Cet ouvrage sera le premier résultat important d'une série de travaux entrepris par l'IUCN pour faire intégrer les notions écologiques dans les plans de développement, afin de minimiser ou d'éliminer les effets adverses du développement économique sur l'environnement. Une aide financière lui ayant été fournie par l'Autorité suédoise pour le développement international (SIDA), l'IUCN envisage de poursuivre la préparation et la diffusion d'autres documents qui pourront servir à l'élaboration de directives écologiques à l'usage des responsables de la planification économique. L'IUCN travaillera en étroite collaboration avec d'autres organismes non gouvernementaux et intergouvernementaux à accroître l'apport de l'écologie dans les processus de développement économique. Le programme sur l'Homme et la biosphère, entrepris récemment, offre à l'IUCN la possibilité de travailler avec l'UNESCO à cette tâche.

### ECOLOGICAL PRINCIPLES AND THEIR APPLICATION TO DEVELOPMENT PLANNING

The reconciliation between conservation and economic development provides a focus and an aim for the 12th Technical Meeting of IUCN and has been a

goal toward which much of IUCN's activity has been directed over the past several years. Economic development is a condition of life under which we all must live so long as the means for its continuation can be found. It is not an activity confined to the so-called developing countries. Indeed many of these are developing little. Rather it is an activity in which all nations are participating. Whether or not it is to be successful in improving the well-being of mankind, and this must surely be its legitimate purpose, depends on whether or not it takes into account the means and ends of its necessary partner—conservation.

Conservation is defined as the rational use of the human environment and its natural resources to attain the highest sustainable quality of living for mankind. This same definition could apply equally to economic development although the latter has, until recently, been far more concerned with quantity of material production rather than with the more elusive characteristic called quality of life. Nevertheless, over the long run, economic development must be equally concerned with the quality of the human environment and with improvements in the quality of life.

There should, on the face of it, be no conflict between conservation and development. That there is conflict lies in part in the time scale of human affairs that is used to measure success or failure. The economic developer tends to be concerned with today's problems and today's human suffering. He is prepared to sacrifice certain long-term prospects and values in order to meet short-term needs. The rationale behind this willingness includes what some consider to be a naive faith in the ability of science and technology to develop new resources, and even new environments, to replace those which are sacrificed to meet today's needs. The conservationist has his vision directed more consistently toward the long-term future, and may show what some believe to be an undue concern for future generations combined with a callousness toward the human suffering that surrounds him today. The conservationist further displays a distinct lack of belief in the ability of science or technology to find replacements for what he regards as irreplaceable values associated with species, biotic communities, and other living resources that are now being sacrificed in the name of development.

Despite these differences in opinion, the partnership of conservation with development is now well established and accepted in certain areas. Thus it is taken for granted that agricultural development cannot long succeed if the basic rules for soil conservation are ignored, the development of forest resources becomes a short-term proposition unless forest conservation is also considered, water resource development requires consideration of water resource conservation, and so on. Such aspects of conservation are recognized, in principle at least, by even the most economically oriented development agency. In practice, on the land, they are still often ignored in the pursuit of short-term economic gains. This role of conservation as a partner in development is explored by Bannikov and Bogdanov in paper no. 9 in this session and will not be repeated here.

Conservation is not only a necessary partner in development, but activities carried out in the name of conservation may in themselves be a form of economic development. An example is provided by the international convention affecting the conservation and exploitation of the northern fur seal. The convention was a conservation device intended to protect and re-establish the rapidly dwindling stocks of fur seals breeding on the Pribiloff Islands. Because the convention was respected the fur seal herds were restored and a highly profitable industry is now based on their controlled exploitation. Without the convention the fur seal might now be extinct or at best would not sur-

vive in numbers adequate to sustain economic exploitation. By contrast, failure to apply conservation to the economic development of the whaling industry led to the depletion of the right, blue, and humpback whales and the loss of income that could have been continually produced by their sustained and controlled exploitation.

One of the obvious examples of 'conservation as development' is to be found in East Africa's national parks. These were originally established to protect and preserve the wild animal life of this region. In their early years they were regarded as an economic debit—they withdrew land from profitable economic activity and they cost money to maintain. Over the years, and particularly after the East African nations achieved independence, this role changed. With some further initial cost in the development of roads and visitor facilities they began to attract an increasing flow of tourists, not only from Africa, but from all over the world. Tourism brought a flow of foreign exchange into East Africa and gradually rose to a first rank position as a producer of income—amounting for Kenya alone in 1970 to 18.5 million Kenya pounds. This East African success has caused many other countries to consider conservation, in the form of establishment of national parks or the protection of other resources of interest to visitors, as a means for economic development.

The value of protecting areas of natural or cultural importance as a means for promoting a tourist industry is obvious enough. The dangers of overdevelopment of tourism at the expense of those resources that originally attracted tourists to the locality, are becoming ever more obvious in those countries with a burgeoning tourist industry—not only in East Africa, but various Caribbean and Pacific islands, sections of the Mediterranean coast, and so on. Conservation, in its role of economic development, breaks down, just as other forms of economic development break down, through failure to examine such basic ecological rules as those concerning the carrying capacity of environments.

In fact neither conservation nor economic development can achieve success in attaining their goals if they fail to take into account the 'rules of the game' that govern all human activities within this planet's biosphere. These rules are in the process of being spelled out by the science of ecology. Many are already known, but are too frequently ignored by both developers and conservationists. When they are ignored they result either in the failure of the conservation or development activity—or they result in environmental side-effects which either subtract from or cancel out the benefits expected from this activity.

In 1968, a meeting was held at Airlie House in Virginia on the subject of ecology in international development (Farvar and Milton, 1972). At this gathering, experts from various parts of the world presented and discussed case histories illustrating the environmental impact of various international development projects. The total effect of these transactions can be described as shocking since they show clearly the extent to which ecological and sociological considerations had been ignored in the planning and execution of major economic developments. The consequences of this neglect were in some instances a failure to accomplish the desired development objective—a waste of time and money. In other cases, although the stated objective was obtained, the negative social and environmental effects detracted markedly from the benefits the development was expected to confer.

'Never look back, something might be gaining on you!' emerged as an operating procedure in many economic development projects. The development agency

carried out its project and then moved on to the next job. Nobody, apparently, was responsible for observing whether or not the well being of the people affected had really been improved by the development activities. In fact in many projects the long-term consequences for people as well as environment were largely ignored.

It became necessary to question, during the course of the 1968 meeting, the reason for economic development, and to attempt to reach some definition of its purpose. If we regard economic development as a process through which nations seek to improve the well-being of their citizens, then economic development must be judged according to whether it does in fact improve this well-being.

Many papers were presented and much discussion took place at Airlie House on the subject of development of the River Nile. The consequences, good and bad, of Nile development starting with the first barrages, over a half-century ago and culminating with the Aswan High Dam, were examined. When all the facts were in, however, one felt compelled to question whether or not the economic, social, and environmental well-being of the average Egyptian had indeed been improved by the expenditure of these hundreds of millions of dollars in major engineering efforts. Nobody answered the question. But, if in fact the answer were negative, or only marginally positive, then one would be free to wonder, particularly in view of the adverse environmental consequences of Nile development, whether or not the people of Egypt might not have gained more had the money been spent in building a new and larger set of pyramids in the desert. Such a project equally would have put people to work and glorified the rulers in power when the building was undertaken. Such pyramids, at least, need not have had adverse environmental effects.

Such remarks may not be justified in relation to Nile development—at least one can argue pro and con. However, in relation to various other developments that have taken place there is no doubt that if the money involved had been spent in some frivolous and harmless pursuit the people and the lands involved would be better off today.

One of the great wasters of money, land, and people, for example, has been the development of water in dry areas for the benefit of live-stock husbandry and to settle and stabilize nomadic peoples. Perhaps, such developments could be beneficial to the areas and people concerned, if provision were made for the control of livestock numbers and their forage utilization. Such control, however, must be real—it must be accepted and carried out by the people affected, and not just for a short time. If the control is lacking, or poorly enforced, the inevitable consequence is destruction of the forage resource, commonly followed by increased erosion or in some areas by rapid desertification. The effect of the development is thus negative. It destroys the resource base and productivity on which people depend.

This seems elementary, yet in many places today development agencies continue to support water development in semi-arid lands where there is at best a pious hope that the numbers and distribution of livestock and their use of forage will be controlled. One cannot help but wonder why such potentially disastrous activities are continued? The answers obviously involve political, social, and short-term economic considerations. However, if one believes that some degree of ecological ignorance is involved it becomes imperative for those with greater ecological knowledge to make it available to those making development decisions.

It is not the purpose of this paper to attack those concerned with economic

development except to the extent needed to show that real problems exist. It has been the objective of IUCN to explore means for working with governments and development agencies in order to minimize or at best eliminate the adverse environmental and social effects of economic development activities. Toward the goal of incorporating ecological knowledge in conservation and development, IUCN has sponsored one international meeting and has played an active role in other meetings called to examine this problem. In response to the consensus of opinion expressed at an initial meeting held in Rome in September, 1970, IUCN joined with the Conservation Foundation in producing a volume entitled *Ecological Principles for Economic Development*. This volume, which is now in press, was circulated in draft, in the summer of 1971, to representatives of development agencies and other experts concerned with economic development. The final version takes into account the suggestions of these reviewers.

Recognizing that it was not possible to cover in one book all possible situations in which economic development could have an impact on the environment, efforts have been concentrated on tropical and subtropical forests and on semi-arid grazing lands, since these are areas being most seriously affected by development. Attention is paid to problems associated with the development of agriculture, pastoralism, forestry and tourism in these areas, along with the more general problems associated with river basin developments.

The book attempts to present basic and well tested ecological concepts that have relevance to development, and to explore various development problems from an ecological viewpoint. It can serve as a guide to development agencies that need to examine the consequences of proposed activities before providing funds or expertise for their pursuit. More importantly it can serve as a guide to the man on the ground who needs to consider ways in which a particular area or resource can best serve the long-term interest of the country.

Ecological research goes forward in all of the areas with which this book is concerned and no doubt tomorrow we will be able to provide much better advice than was available yesterday. However, ecology is not a new science and much practical information, already well tested, has become available from the many fields of applied ecology. It is this information that is stressed in the book. Thus grassland research goes forward under IBP and MAB, but deserts continue to spread through failure to recognize the basic principles of rangeland ecology that have been developed and tested over the past sixty years. A major research programme on humid tropical forests is being launched by the Inter American Institute of Ecology and by MAB, but meanwhile the speed at which these forests are disappearing indicates the acute need to apply the best knowledge we now possess.

Production of a book on ecology and development, however, does not necessarily lead to an improvement of the situation. The book is least likely to be read by those who would benefit most from its message. Other means for ensuring that environmental considerations will receive attention in the planning and execution of development projects must be found.

Admittedly there has been progress among development agencies toward giving more than lip service to the environmental impact of their projects. The World Bank now has a full-time ecologist on its staff, and along with other agencies is preparing ecological guidelines for use in the evaluation of proposed development schemes. However, environmental deterioration continues at an accelerating pace in many parts of the world, and much of this occurs through no fault of any international development agency. The rapid destruction of rain forests in Southeast Asia, for example, appears to be carried out

by North American private enterprise with full approval of the governments concerned. Ecological principles are unlikely to be given any more consideration by the companies involved than are the forestry principles which some of them presumably accept.

There is, of course, a limit to what IUCN can do. The best prospects lie in our working with other, more prosperous, agencies in order to urge them to further action. Thus, we have assisted Unesco toward the development of ecological guidelines which can be accepted by its member states and hopefully used to improve their attitudes toward the environmental consequences of national economic development. We were pleased to see the acceptance also by the Intergovernmental Coordinating Council for the Man and the Biosphere Programme of a project related to the ecological consequences of major engineering schemes—since we had worked to have this included. Similarly we have a joint project with FAO for the preparation of case histories of international development. These have already been used as a basis for seminars within FAO and as teaching tools in various other meetings. We have in 1972 received a grant from the Swedish International Development Authority for a programme to be carried out in co-operation with the Conservation Foundation. This will also involve the preparation of further written materials including a series of short publications concerning specific aspects of economic development which can be widely distributed among those who are working on these aspects. We expect to prepare guidelines for reconciling conservation and development in the coastal and estuarine region. In part as a result of the Regional Symposium on Conservation of Nature—Reefs and Lagoons held at Noumea, New Caledonia, in 1971, we believe that ecological guidelines related to island development are long overdue, and will concentrate further efforts in this direction. We look forward also to working closely with Unesco to elaborate and carry forward the aspects of Man and the Biosphere programme related to the environmental aspects of development.

There is a particular need to present case histories of land and resource developments that have been truly successful, and have enhanced the well-being of people without adverse environmental effects. Such a project has long been under consideration by both IUCN and the Conservation Foundation but has thus far not moved forward for lack of personnel and the necessary financial support.

We see a continuing duty for conservation organizations to help provide the ecological input that may make the difference between development success and development failure, and to move forward from their role of non-constructive opposition to development schemes. Opposition will remain essential when ill-conceived developments are proposed, but in itself it is not enough and in the absence of alternative, constructive proposals it can be self-defeating. IUCN must continue to work with governments and development agencies in a positive way to ensure that development leads ultimately toward the improvement of the quality of life for a balanced world population in a stable environment.

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## SESSION C: ECOLOGICAL MULTI-DISCIPLINARY APPROACH TO DEVELOPMENT PLANNING

### Part 1: Discussion

Having first introduced the authors and panel members, the Chairman, Mr **R. G. Fontaine**, said that he was particularly honoured to chair the meeting, in view of FAO's concurrent efforts to inject more environmental considerations into its field projects. As a result of recent meetings on the human environment and the search for a new quality of life, the ecological approach had been broadened to include human ecology and this involved the definition of the various components in the proposed model for a new society, in which the statements made at the Stockholm Conference would certainly assist. All the more necessary, however, was a further effort to evaluate some of the indirect benefits of natural resources and, as a forester, he would quote the value of forest resources for recreation, noise abatement, pollution control, wildlife habitat and the water regime. But in such an evaluation, it must always be remembered that quality of life and environmental conservation mean different things to different people; the viewpoint of the underprivileged should never be disregarded. The problem was always one of assessing biological possibilities and limitations within the economic and social framework, which meant taking into account costs and benefits, capital outputs, job opportunities, foreign exchange and balance of payments, and the whole range of social objectives. All these and many other parameters must be incorporated in the model, and the elaboration of a proper methodology for building this should continue to be a principal aim of research.

Among the pertinent conclusions of the Stockholm Conference were the recommendations for the establishment through interdisciplinary effort of environmental criteria, concepts and terminology; the monitoring, assessment and regular reporting of tariff and other barriers resulting from environmental policies; and the recognition that the burden of such policies in industrialized countries should not be transferred directly or indirectly to developing countries. To this one might add the general conclusion from what has been said that, in any interdisciplinary approach to development, we have not only to pay due attention to the interrelation between the various components of natural or man-made ecosystems, but also to man, as an individual who wishes to satisfy his consumption needs, as a member of a population interested in the quality of life and as a species which needs to reserve resources for future generations. The two authors, whom he would now call upon to introduce their papers, looked at these problems from different angles: one emphasizing the importance of national objectives, the institutional framework and legislation, the coordination of the various sectors; the other more project-orientated and relying on case studies as a means of attaining a multi-disciplinary approach in development planning.

Introducing the paper prepared jointly by Mr. Bogdanov, who had been unable to attend the meeting, and himself, Professor **Bannikov** drew attention to the points which were high-lighted in the Summary and emphasized that the importance of the conservation problem rested simply on the increasingly negative influence of humanity on the structure and functioning of the biosphere, which now evoked alarm among scientists, statesmen and leaders of the public all over the world. The present meeting was above all an opportunity for sharing experience and he felt that that of his own country was encouraging, since it

showed that rapid planned development was compatible with the rational use of natural resources and the maintenance of an optimum natural environment for man. This did not mean that everything was all right with nature conservation in the USSR; scientific principles still had to be worked out for a number of urgent situations, there were still the after-effects of disturbance of several ecosystems, dating specially from the war and early post-war years, and shortcomings in the education of those directly concerned with the use of natural resources. However, all the prerequisites for establishing an optimum man/nature relationship were present. Finally, he would like to emphasize the high importance attached by the Soviet Union to international cooperation, illustrated, for example, by agreements on environmental protection recently concluded with the USA or the agreement with Canada aimed at preventing the pollution of Arctic waters. The cooperation of Soviet Scientists in governmental and non-governmental conservation programmes and initiatives by the USSR in establishing further programmes, especially of a long-term nature, as in connection with the forthcoming European Conference on Security and Cooperation and with space exploration, could always be relied upon, although it must be recognized that the problems involved cannot be isolated today from the solution of the basic political problems of establishing durable peace and international security.

Dr **Dasmann** said that his paper had been criticized by one of his colleagues for not really mentioning 'ecological principles'. This was partly because he had expected the joint IUCN/Conservation Foundation book bearing much the same title and subject-matter, of which he was one of the joint authors, to have been published by the time he came to present the paper. The ecological principles to which he was referring were not new and many had been long tested. For example, early this century the plant ecologist Frederick Clements and the range ecologist Arthur Sampson, of the US Forest Service, had established the principles governing the use of grazing lands in more arid regions. One of these is that a grass plant can provide food for animals indefinitely provided that too much of the foliage is not devoured in any one year. If too much is taken, the plant is weakened. If the process is repeated, the plant dies. If too many plants die, the soil is left bare, exposed to wind and water erosion. When the soil disappears the productivity of the site declines and, if the process continues, a formerly productive area of rangeland will become a desert. The process can be arrested and reversed by controlling animal use, provided it has not reached the threshold of irreversibility. Equally, unless the grazing pressure, is controlled, the process cannot be arrested or reversed. This is an ecological principle. It follows, for example, that water development in dry rangelands, unless effective controls can be instituted, from the beginning, on the number of grazing animals, can be a risky business. Yet millions of dollars have continued to be spent in developing water supplies in dry areas where no provision was or could be made for the control of livestock. The results have been disastrous and can be seen in the spread of desertification from Senegal to Somalia as well as in so-called developed countries, such as Australia and the United States.

Ecological principles are therefore simply statements of the rules of the game. If they are ignored, the environment deteriorates and eventually may become uninhabitable. Thus no pleas about the need to feed the starving can justify ignoring them, since when they are ignored things will get worse and tomorrow still more will starve. It is difficult therefore to understand why simple truths, some of which have been well-known for many decades, continue to be ignored. In Session B: 1, Mr Lee's paper (No. 8) had the sub-title 'Choices for the Third World'. Perhaps our ecological principles book should

be entitled 'Guidelines for the Fourth World'. The Fourth World, a world which strives towards ecological balance, will emerge when narrow self-interest and the destructive behaviour that has thus far characterized the three worlds, are rejected by people whose leaders are gambling with the future in a game they cannot win because they fail to follow its rules. If humanity is to find its way past the 20th century, the Fourth World must emerge very soon.

The Chairman having next called for preliminary comments by Panel Members, Professor Kassas said that both the papers which had been presented dealt with conflict between development and environmental conservation and suggested that the answer to it somehow lay in the consideration of the long-term future. These concepts needed clarification. E. S. Zimmerman (*World Resources and Industries*, Harper, 1951) long ago remarked that 'resources are not, they become'. He took this to mean that production, or the elements of wealth, is the result of an interaction between man, knowledge and environment, both its quantity and quality being governed by the impact of these elements. On this basis, there had been three phases in human history: in the first, almost all the input was from the environment, the gifts of nature which man collected; in the second man emerged as a major contributor, through domestication of animals and cultivation of crops, or in other words changes to the structure of animal and plant life: in the process, knowledge began to be gathered and applied, while impacts on the environment became obvious. In the third phase, the accumulation of knowledge transferred it into power: from the moment when man used fire till he used nuclear fission, man gradually gained the ascendancy in the tripartite formula for production, while environment got pushed into the background. Now, perhaps, in an age of automation, the input of man's activity is falling away and knowledge, or what we call science and technology, has become the principal component. Two conclusions must be drawn from this story, namely that some disturbance of natural processes, upsetting of precariously maintained balances, is inevitable, but, secondly, that development should not aim at single-purpose production but at a system of replacements that maintains a dynamic equilibrium. This is probably identical with what Dr Dasmann has called 'following the rules of the game'.

Understanding of these rules has certainly improved and this has been the great value of the biome studies in which the International Biological Programme has culminated. If we want our planning to be truly long term, as advocated in the Bannikov/Bogdanov paper, the kind of understanding of the very complex interactions within ecosystems now emerging from IBP, is essential. One final comment arising from Dr Dasmann's paper and particularly his reference to the Aswan 'High Dam', is that scientists must be careful not to create a credibility gap between science and society. In fact the problem of evaluating the impacts of river-control schemes is a global one: up to 1966, the number of dams over 15 m in height that had been constructed was 8316 (2810 in the USA), so that Dr Dasmann's comparison with pyramids in the desert is not very appropriate. The fact is that the ecological consequences of these schemes have, in the case of Egypt, made it possible for the human population to increase from 5 million in 1850 to 35 million in 1972, so that nothing will stop these projects from continuing; even vaster ones are in prospect, such as those for diverting the rivers of Siberia mentioned in Paper (9) or the similar ones planned in North America. In these circumstances, certain environmental hazards must be accepted, such as the one in five deaths attributable in Egypt to the bilharzia spread by irrigation schemes, or the annual death-toll of 50,000 on USA roads, while our efforts to mitigate and reduce them continues; but the over-all aim of the scientist should be to

provide the knowledge which will identify the alternatives and allow the one with the least detrimental ecological consequences to be chosen.

Panel member Mr. **Akah** then commented primarily on Paper (9) by Prof. Bannikov and Dr Bogdanov, pointing out that the USSR had one significant advantage over most other countries, especially in Africa, in that the ownership of land was fully vested in the State. In a developing country, such as Nigeria, conservation is no new concept: fear of the Unknown, now called God, is the bedrock of the country's culture and 50% of the land, many streams and rivers, the terrestrial fauna of the sacred groves, have long enjoyed the status of complete sanctuary. This was swept away by the invasion of destructive forms of civilization, only recently beginning to be replaced by a conservationist form; but, meanwhile, other factors such as population growth, soil erosion and poverty, both urban and rural, are taking a hand in the situation. Hence in his own home area of the East Central State, where only about one percent of the land is government-owned, mainly forest reserve, the approach has been to create a landscape Unit in the Ministry of Lands, Survey and Urban Development, to advise the Chief Town and Country Planning Officer on the rational use of the land: at the same time, an Open Spaces Commission is proposed, of which the head of the Landscape Unit will be Executive Secretary and representatives of Government Divisions and of the public with a stake in the land will be members, having the responsibility to see that rational land use practices are extended to all land. The most appropriate international support for such a conservation machinery would be through technical assistance and, particularly, the allocation of at least 30% of the training programme to conservation and its allied disciplines: secondly, as was stated at the Stockholm Conference, 'the extent to which developing countries pursue a style of development that is more responsive to social and environmental goals, must be determined by the resources available to them'.

Dr **Dale W. Jenkins**, panel member, said that although, as Dr Dasmann had stressed, many ecological principles have been known for a long time, their analysis and use are comparatively new. Analysis is a highly complex and difficult job, requiring coordinated studies by many diverse specialists and such techniques as systems analysis, mathematical modelling and computerization. As Dr Kassas mentioned, great progress in this has been achieved by the IBP biome studies, but the present state of knowledge still does not enable most problems to be covered by a proper evaluation of the ecological, environmental and socioeconomic effects of large-scale technological development. Another difficulty is that most 'principles' have been established through studies in the north temperate region and may not be directly applicable to the tropics. The extension of analytical studies to developing countries is one of the aims of the Smithsonian, with the support of the U.S. AID programme. Examples are to be found in the Volta Dam of Ghana, the Nairobi national park in Kenya, off-shore oil-drilling and spills in Sumatra, and the rapid and unplanned growth of the city of Seoul in Korea. These studies are based on collating all the available data, and sending specialists into the field to fill the gaps, the eventual report being prepared jointly with the experts of the country concerned. For instance the Volta Dam study seeks to answer such questions as why the agricultural resettlement project was unsuccessful, the large migration of people back to the lake unforeseen, and the annual fish yield estimated at 20,000 metric tons, when in fact it is already over 80,000 tons. It is hoped that the results of such studies will not only be of local value but also of relevance to similar development planning elsewhere.

A Committee on Ecological Research under the Council on Environmental Quality and the Office of Science and Technology of the United States is also

undertaking a broad study of technological changes now occurring or foreseen within the next twenty years, the problems likely to emerge and the type of ecological research required. IUCN should follow the same pattern and establish a global ecological survey, to be undertaken by national governments under IUCN direction and coordination. Following the pattern of the ecological survey planned in the US, the objectives would be to gather all the data on vegetation, land use and aquatic areas relevant to biological productivity, as a basis for national policies on land and vegetation management: IUCN's main role would be to initiate such surveys on the basis of standardized nomenclature, methodology and presentation of results, and of assistance where needed in such matters as remote-sensing technology.

Panel member Mr **Mondolfi** said that both papers defined conservation in the same way and stressed the necessity of sound ecological planning, proper national legislation and environmental education, in order to avoid serious conflicts between conservation and development. His own country, Venezuela, could supply a vast series of relevant case histories. To take two examples: the lake of Maracaibo, the largest in South America and partly freshwater, partly brackish where it communicates with the sea, has a rich aquatic fauna of great economic importance, the basis of thriving shrimp and other fisheries. But oil-drilling in-shore and off-shore is gradually polluting the lake environment through leakages and spillage, and is aggravated by pollution from various kinds of waste disposal. Now a major petro-chemical complex is under construction, which may add mercury and other noxious by-products to the inflow. A somewhat similar situation prevails in a second Venezuelan example, the Lake of Valencia, into which no less than three cities discharge their domestic and industrial wastes, while, on the periphery, burning and deforestation are reducing the water supply and agriculture is increasing salinization. Reference was made by Dr Budowski and others in Session B. 2 to yet a third example of development impact, the so-called 'Conquista del Sur' project in the Amazonian Basin, in which there has been no ecological planning whatsoever: the approach has been exclusively one of constructional engineering and it can only be described as highly dangerous in what is still a little known but probably fragile ecosystem. Warnings have been given but little notice has been taken and one can only hope that IUCN will add its voice and influence in calling for and promoting ecological planning as an indispensable tool for government officials, legislators and industrialists, and above all for ecological education at every level of school, university and professional training centres.

Finally, Mr **Kirk P. Rodgers**, panel member, pointed out that, although as stressed in Paper (9), good sectoral planning of resource development is vital, just as we need good sectoral policies within overall national environmental policies, it is not enough. In most countries, what is needed is better regional or multi-sectoral planning. It is only within the spatial context that we deal with the full range of environmental relationships, with total ecosystems rather than parts of them. It involves an integrated approach cutting across the grain of traditional academic disciplines and institutional structures: this is the meaning of an ecological approach to development. In Paper (10), Dr Dasmann referred to the 1968 Airlie House conference: the case studies, which were the focus of that conference, in many respects constituted a series of horror stories of development: a recurring theme was that narrowly focussed development, which did not take adequate account of the natural environment, resulted in failure. In other words sectorally-orientated projects, or piecemeal manipulation of the environment, frequently result in environmental degradation.

Dr Jenkins had already commented on some of the basis elements of the ecological approach to development planning, but some of the institutional

training and research implications should also be pointed out. Massive re-organization of present institutional structures within governments or international organizations assisting governments, is not necessarily called for, but rather coordinating mechanisms such as interagency working groups and task-forces, and exchange of information on activities. In some cases it may be convenient to establish new institutions with a *functional* focus, such as those set up for the integrated survey of natural resources, or with a *geographic* focus, such as river basin authorities. The integrated approach to training implies improved methods, particularly at university level, which would include the use of techniques such as systems analyses and mathematical models as part of all scientific and engineering curricula. The basis objective should be to promote a greater awareness of the interaction and integration which are required between disciplines which treat environmental problems, because of the interactions within the environment itself. Finally, under the research head, much more work is needed on techniques of integrated resource management. Too little attention has been devoted to systematic analysis of completed projects to determine why some have succeeded and some have failed in environmental terms. It is vital that the results of post-audit research should be fed back into the whole process of development planning and it is to be hoped that the book referred to by Dr Dasmann will stimulate this kind of research, which is a very practical means of improving development planning techniques.

In the short time remaining for general discussion the **Chairman** called for three further contributions, as summarized below.

A propos de la communication du Dr Dasmann, il y a l'exemple du Rwanda, d'abord le Parc national des Volcans. Or, le Fonds européen de Développement (F.E.D.) a défriché ce parc à moitié. On a chassé les gorilles en haut—où il est douteux que leur habitat suffise à leur survie, et dans la partie défrichée une vaste érosion s'annonce déjà. Le F.E.D. n'avait consulté aucun écologiste. A l'est, dans le vaste Parc national de la Kagera, le P.N.U.D. (UN Development Program) s'est proposé de 'normaliser' la Kagera—et normaliser veut dire rendre anormal, avec des conséquences désastreuses pour le parc entier. Le PNUD n'a engagé aucun écologiste. Dans le sud-ouest du pays se trouve encore la dernière forêt primaire de toute cette partie de l'Afrique centrale, la forêt de la crête Congo/Nil. Elle constitue le 'château d'eau' d'une vaste région et (le Dr Kassas l'a rappelé) même du Nil. Or, l'Aide suisse a lancé un 'plan pilote' pour remplacer la forêt primaire par une forêt artificielle: on a commencé par l'établissement de deux scieries et on se propose de permettre à la population de cultiver dans les clairières, avant leur reboisement, leurs haricots et fèves. L'Aide suisse n'a pas encore soumis ce plan—ni à Berne ni sur place—au jugement des écologistes. On conclue—(1) que les organismes de développement, sauf la Banque mondiale, selon M. Lee, sont dominés jusqu'à maintenant par les ingénieurs qui ont omis de signaler aux gouvernements les désavantages et même les dangers de leurs projets; (2) qu'il nous faut donc convaincre ces organismes et les autorités auxquelles ils sont soumis qu'à l'époque du 'quatrième monde' dont a parlé Dr Dasmann, une politique de développement qui ignore les données de l'écologie n'est plus admissible—**M. van der Goes van Naters** (Netherlands).

It would be interesting to know the effect on employment of the 23, 000 million roubles which Dr Bannikov says is spent annually on forestry in the USSR. It might be the answer to some unemployment problems in southern Asia. The reference to the Siberian tiger's status was also of interest and one wonders if any actual censuses have been undertaken. Commerce and industry

are dependent on balance sheets, so although Dr. Dasmann's 'ecological principles' book is important, one hopes that it or other sources will give some definite projections of the economic gains to be derived from certain conservation activities, since it is these that will be of real help in discussing land use with administrations—**Zafar Futehally** (India).

It is not clear how 'ecological principles' will actually ensure that development is orientated towards long range and quality aspects. It is the profit motive which is basic to development or, in socialistic countries, business-type competition and growth between agencies, in which there is little room for ecological ideals. Another point overlooked is that the public itself may really want to protect a given habitat or familiar wildlife, but is given no real say in decision-making. Too many economic development plans and projects, even if approached on an interdisciplinary basis, are doing no more than paying lip service to ecology and the social sciences—**D. Henning** (USA).

The 23,000 million roubles expenditure mentioned, have been allocated for the soil conservation programme, which include forest shelter-belts, over the period 1971-1980. The programme is mechanized as far as possible and not aimed at employment, since under the Soviet system unemployment does not exist, but this does not mean that Mr Futehally's suggestion would not be valid elsewhere. The estimated tiger population in the Ussuri and Amur regions of the Soviet far east is between 120 and 130 and seems to be stable. Human population increase and pressure, which Mr Futehally also mentioned, are variable in different parts of the USSR: the general policy is one of a moderate steady increase, but with emphasis on particular regions such as Siberia and the north; at present there is enough space for both forests and people—**A. Bannikov** (author of Paper 9).

It is worth emphasizing again that the knowledge *we already have* is not being applied, so that perhaps the main problem on which the help of sociologists is needed, is to discover how to get the message across to governments and the public—**R. F. Dasmann** (author of Paper 10).

In summing up, one might say that although systems analysis and modelling may be useful and intelligible to the specialists, the key to progress still is to secure understanding and participation on the part of those who are actually affected—**R. G. Fontaine** (Chairman).



**SESSION C**

**ECOLOGICAL MULTI-DISCIPLINARY  
APPROACH TO DEVELOPMENT PLANNING**

**Part 2**

**SESSION C: PART 2**

*Chairman:* Mr V. C. Robertson (UK): General Manager, Land use and Agricultural Consultants, Hunting Technical Services Limited, Boreham Wood.

*Authors:*

**Paper (11): The Impact of the Rural-urban Relationship in Landscape Planning.**

\*Mr Adolf Ciborowski (United Nations Organization): Deputy Director, Centre of Housing, Building and Planning, UN., New York City.

Presented by: Mr Hanno Henke (Federal Republic of Germany): Federal Institute for Vegetation Research, Nature Conservation and Landscape Management, Bonn-Bad Godesberg.

**Paper (12): Economic Growth: Bane or Blessing**

Professor P.H. Pearse (Canada): Professor of Economics, University of British Columbia, Vancouver.

Panel Members:

- 1 Dr J.P. Doets (Netherlands): Member, IUCN's Commission on Education; Head, Department of Nature and Landscape Conservation, Ministry of Cultural Affairs, Recreation and Social Welfare, The Hague.
- 2 Professor W. Douglas Harper (Canada): Member, IUCN's Commission of Environmental Planning; Professor in School of Agriculture, University of Montreal.
- 3 Mr. Tetsumaro Senge (Japan): Member, IUCN's International Commission on National Parks; Chairman, National Parks Association of Japan, Tokyo.

*Rapporteur:* Mr. Joseph Lucas (IUCN)

*Secretariat Member:* Dr Jan Čeřovský (IUCN)

**SESSION C: ECOLOGICAL, MULTI-DISCIPLINARY  
APPROACH TO DEVELOPMENT PLANNING**

**Part 2: Paper (11)**

**The Impact of the Rural-Urban Relationship in  
Landscape Planning**

ADOLF CIBOROWSKI

*Deputy Director, Centre for Housing, Building and Planning, United Nations<sup>1</sup>,  
New York, N.Y.*

**SUMMARY<sup>2</sup>**

Landscape planning has changed from maintenance of natural, especially aesthetic, values of the landscape, to being a component of complex environmental planning which includes economic, social and physical objectives of development within a broad framework of human activities. Growth of human populations and changes in ratios of rural and city dwellers have dramatic impact on landscape. During the 20th century 'great cities' have evolved from populations of only 100,000 people to vast systems containing more than 50 million. The flood of migrants to cities aggravates existing socio-economic and environmental problems and creates new ones. Such migration must therefore be channelled, using the development and location of production—primarily in manufacturing industries.

The main environmental and developmental problems of the next 25 years already exist, and most workers needing jobs in the year 2000 have already been born. The planner, therefore, has the task of redistributing today's children and the productive pattern of national economics.

Urban and rural areas are interdependent; badly developed and managed towns, and uncontrolled suburban sprawl, do untold damage to the rural landscape and to its human and wildlife inhabitants. The standard of living of the majority of country folk is relatively decades or centuries behind that of the affluent city. Modernization of agriculture is essential, but mechanization must be highly selective. The ultimate goal is equality of living conditions in town and country; until this is achieved migration to towns will result in growing slums and shanty-towns.

There are two approaches: micro and macro. The broader the scale of planning the more will conflicts between interests of the individual and society arise. Subordination of individual to social interests will ensure that some individual rights and interests will be protected.

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<sup>1</sup> The views expressed in this paper are the personal views of the author, not of the United Nations Organization.

<sup>2</sup> Prepared by IUCN Secretariat.

**RESUME**

L'aménagement du paysage, dont l'objectif initial était le maintien des valeurs naturelles et, en particulier, esthétiques du paysage, a évolué pour devenir une composante de l'aménagement du territoire qui recouvre les objectifs économiques, sociaux et physiques du développement dans le cadre général des activités humaines. La croissance de la population humaine et le renversement du rapport population rurale—population urbaine ont un impact profond sur le paysage. Au cours du XXe siècle, les 'grandes villes' sont passées de quelque 100, 000 habitants à d'immenses complexes se chiffrant à plus de 50 millions d'habitants. Le flot des immigrants vers les villes aggrave les problèmes socio-économiques et mésologiques (c'est-à-dire de l'environnement) existants et en crée de nouveaux. Ces migrations doivent donc être dirigées en développant et en localisant la production—essentiellement dans les industries de manufacture.

Les grands problèmes relatifs à l'environnement et au développement pour le quart de siècle à venir existent déjà, tout comme sont déjà nés la plupart des travailleurs qui auront besoin de travail en l'an 2000. Le planificateur a donc la tâche de 'redistribuer' les enfants d'aujourd'hui et les schémas de production de l'économie nationale.

Les zones urbaines et rurales sont interdépendantes; des villes mal développées et aménagées et l'étalement incontrôlé des banlieues urbaines causent d'incommensurables dommages à l'espace rural et à ses habitants—hommes et animaux sauvages. Le niveau de vie de la majorité des gens de la campagne est en retard de dizaines d'années si ce n'est de siècles, sur celui relativement aisé des villes. La modernisation de l'agriculture est indispensable, mais la mécanisation doit être extrêmement sélective. Le but à atteindre est l'égalité du niveau de vie entre ville et campagne; mais avant qu'on y parvienne, les migrations vers les villes continueront d'engendrer des taudis et des bidons-villes.

Il y a deux modes d'approche possibles: micro et macro. Plus l'échelle de la planification sera grande, plus les conflits entre intérêts de l'individu et intérêts de la société seront nombreux. En subordonnant les intérêts de l'individu à ceux de la société, il sera possible d'assurer la protection de certains droits et intérêts de l'individu.

**THE MEANING OF LANDSCAPE AND LANDSCAPE PLANNING**

Landscape is a feature and a component of the earth (as well as of every other celestial body) and is, therefore, as old as the globe itself; but it is under continuous natural evolution: creative and destructive interventions of man into the landscape began with the first conscious activity of homo sapiens; some of the older broad-scale achievements in monumental landscape planning in the Nile Valley are almost five thousand years old. Yet it is still rather difficult, given the complexity of the subject, to find a satisfactory definition of landscape as well as the human activity called landscape planning.

According to Charles Eliot (*Encyclopedia Britannica*—Volume 13, 1970 Edition) '*Landscape Architecture* is primarily a fine art; and as such its most important function is to create and preserve beauty in the *surrounding* of human habitation and in the broader natural scenery of the country; but it is also concerned with promoting the comfort, convenience and health of urban population.'

The dominant role of aesthetic issues and values in landscape planning was developed through centuries by focusing landscape planning on design of gardens and parks, by using the greenery to create an enjoyable scenery for the primary benefit of selected and limited social groups.

The aesthetic aspect of landscape planning is still so prominent in contemporary professional understanding that even the recent draft of the Glossary on Physical Planning<sup>1</sup> states that 'Landscape preservation is a planned and continuous action aiming at the maintaining of the natural values of the *Environment*, especially from the point of view of *aesthetic* values of the landscape.'

It appears to me, however, as well as probably to many modern landscape planners, that the *recent development of awareness of ecological and social issues related to the Environment and, therefore, to the landscape, expands and widens both the meaning and scope of landscape planning.*

For the purpose of this paper, the following crude definitions and distinctions of some 'types' of landscape are proposed:

*Landscape:* the three-dimensional physical shape of the Earth's environment.

*The Natural Landscape:* elements created by nature and natural forces.

*The organized landscape:* landscape altered by man, consisting mostly of natural components but influenced or arranged in a purposeful way by man.

*The man-made landscape:* a mixture of natural and man-made components, with the latter playing a substantial role.

*The city-scape:* the ultimate in man-made landscaping, where man-made components (mostly structures) have the dominant role.

Landscape planning could be seen, therefore, as one of the ways of approaching the challenges of continuous evolution of the human environment and of development processes, and of guiding this evolution toward socially formulated aims. It is a component of a complex environmental planning which encompasses the economic, social and physical objectives of development within a broad, intersectoral framework of human activities. Its ultimate goals should be to achieve:

—harmony in the development process between the man-made and natural components of the environment

—harmony between the social and economic aims and physical forms of development.

The physical forms obviously have their strong aesthetic aspects, which have to correspond with the spiritual needs of a given society in the same way as biological or ecological values of the physical environment influence social well-being and satisfaction.

Safeguarding environment qualities and harmonizing them with the complex processes of social evolution and development is a continuous challenge. Many development issues are of a long-range character and the results will be appreciated even decades ahead of the beginning of implementation. For such reasons comprehensive development planning must also be of long-range character, although sub-divided into shorter periods corresponding with stages of development.

Landscape planning must therefore be conducted in both time and dimensions. It has to take into account the predictions of social and economic change, trans-

late them into physical forms of the landscape and assume that the final result will correspond with human biological and spiritual needs.

The landscape planner must be an active member of an Environmental Management Force which has to protect humanity and the globe against self-imposed disaster which could result from further unco-ordinated development or spontaneous disruption of environmental and landscape qualities.

**CHALLENGE OF POPULATION GROWTH AND DISTRIBUTION**

**1. Scale of growth**

Accelerated growth and increasing concentration in major metropolitan areas are the two most important facts characterizing the world's population situation in the twentieth century.

The accelerated growth results in the first place from generally improved health conditions and, therefore, expanded life expectancy, while the urbanization process results from increasing social awareness and initiative in search of better living conditions, reflected in more migration from rural to urban areas. Disparity in living conditions and opportunities offered by a city and a rural settlement is the main force behind this ever growing trend. This is especially true in developing parts of the world, but also in many developed countries, where a similar process started in the mid-XIX Century as a result of the Industrial Revolution. It is still underway, though on a lesser scale.

Population growth in the second half of the twentieth century is illustrated in Table 1:

TRENDS IN POPULATION GROWTH (in millions)<sup>(2)</sup>

Areas and Kind	1950	1960	1970	1980	1990	2000	$\frac{2000}{1970} \times 100$
World Total	2,486	2,982	3,635	4,467	5,456	6,515	179
Urban Population	704	935	1,352	1,854	2,517	3,329	246
Rural population	1,782	1,997	2,283	2,614	2,939	3,186	140
More Developed Regions							
Total	858	976	1,091	1,210	1,337	1,454	
Urban	439	582	717	864	1,021	1,174	
Rural	418	394	374	347	316	280	Decrease in both number & proportion
Less Developed Regions							
Total	1,628	2,005	2,545	3,257	4,120	5,061	
Urban	265	403	635	990	1,496	2,155	
Rural	1,363	1,603	1,910	2,267	2,623	2,906	Decrease in proportion. Increase in number.

The figures show that the main environmental challenge stemming from population growth and distribution to our generation and the next, will be in less developed regions of the world.

Thus regions of the world with the highest rate of population growth, migration and urbanization are simultaneously the regions with the lowest gross national product *per capita* the highest concentration of poverty in both rural and urbanized zones, and often with outmoded social and legal structures and inefficient managerial skills and machinery. They are also the regions where the most substantial changes in the landscape will take place.

## 2. Trends in migration

There is a wide difference between more and less developed regions of the world in respect of the level of urbanization. In the more developed regions, more than half the inhabitants were already urban in 1950, the figure is now over 65 per cent and by 2000 A.D. will be about 80 per cent. Some of the rural population will also in fact be commuters.

In the less developed regions, only about a fourth of the population is urban. By the year 2000, the proportion will be over 40 per cent. But although the majority of people will still be rural, existing and new cities will have to accommodate, during the next 25 years, 1,520 million additional citizens, a figure higher than the urban population of the entire world in 1970!

Simultaneously, an additional billion people will be added in less developed regions to the present rural population. To ensure their survival, far reaching changes in rural economy, in agricultural technology and rural settlements must take place, which will have as dramatic an impact on landscape as the process of urbanization.

This impact must be foreseen and channelled through the planning process, towards an organization of the environment, in both spatial and functional terms, which will enhance living conditions and not necessarily disrupt the fragile ecological balance.

From an environmental standpoint, the immediate important issue in the process of urbanization appears to be the level of concentration or size of each urban settlement. The physical scale of large urban settlements has enormously increased, especially during the present century. At the end of the XIX Century statisticians regarded cities of 100,000 inhabitants as 'great cities' Except in sparsely settled parts of the world, a city of 100,000 can now no longer be considered as of exceptional size. Moreover, the number of cities ten times that size is already substantial. In 1970 there were about 174 cities of 1,000,000 or more inhabitants. Fifty of these have at least 2,500,000. <sup>(3)</sup>

In 1920 large cities were still a rarity in less developed regions: only 20 per cent of their urban populations were concentrated in cities of over 500,000 inhabitants. In the more developed regions, the corresponding percentage was already 47. By 1960 the percentage of urban population residing in cities of 500,000 or more in the less developed regions had risen to 43, so that it does not differ markedly from the more developed regions (49 per cent). <sup>(4)</sup>

The scale and intensity of urban concentration goes far beyond the peripheries of individual agglomerations. The spaces between some major urban agglomerations are becoming filled with satellite towns and other dense settlements in a pattern which is now called a megalopolis, although some specialized agriculture may still remain to supply produce directly to the cities. No megalopolis has as yet been defined as a political administrative unit with definite territorial boundaries.

A very impressive example is the 'Tokaido Megalopolis' which contains approximately half of Japan's total population. The Tokaido Megalopolis is a

coalescence of Japan's three largest metropolitan areas (Tokyo, Osaka and Nagoya). There is also the 'Atlantic Seaboard Megalopolis' in the U.S.A. which extends from Boston through New York, Philadelphia and Baltimore to Washington. A third urban conglomeration of a different shape but similar extent exists in Europe around the confluence of several rivers (Rhine, Ruhr, Maas, Scheld and Thames).

Thus, in the course of this century we have gone from a world in which cities of only 100,000 could be listed as 'great cities' to a world in which urban systems in excess of 50 million inhabitants have come into being.

The same trend toward concentration and unlimited growth of major metropolitan areas appears in many developing countries, although on a somewhat more modest scale. In the last twenty years Calcutta has grown from 5.1 million inhabitants to 7.35, Karachi from 1.1 to 3.2, Bombay from 3.3 to 5.1, Hong Kong from 1.6 to 4.1, Djakarta from 1.45 to 4.5, Sao Paulo from 2.5 to 8.4, Buenos Aires from 5.2 to 9.4 and Caracas from 0.7 to 2.15.<sup>(5)</sup>

Therefore, two fundamental problems in population movements are:

- the rapidly changing proportion between rural and urban population;
- the trend to concentrate in major urbanized zones.

The flood of migrants to cities unprepared to accommodate newcomers, and congestion within overgrown megalopolises aggravate many existing socio-economic and environmental diseases and add some new ones. Poverty, social unrest and unhappiness, the breakdown of city budgets and epidemic diseases in congested areas, are only a few examples of growing difficulties.

### **3. Channelling of migration**

Appropriate distribution of population within the whole country appears to be the first condition for achieving a better human environment. To avoid over-concentration of population in the larger existing cities it will be necessary, therefore, for many countries to develop new, nation-wide settlement systems which will include the creation of new urban growing points and also the modernization of rural centres.

The motivation of migration movements must be recognized in order to plan the process of settlement. The prime motive is the search for better opportunities for biological survival and social advancement. In modern society, such opportunities are interrelated with job opportunities. When the countryside is overpopulated and agriculture cannot offer further jobs, the surplus population will migrate to the city in search of employment.

The process of industrialization and the creation of new factories results in new jobs, either directly in industry or in secondary activities, services and so on. Therefore, the development and location of production (primarily in manufacturing industry) is the pre-condition and incentive for population movements and should be used as the main tool in channelling migration in environmentally and functionally desirable directions and geographical areas. The secondary condition is a balanced labour market. When this is unbalanced and the rate of unemployment is high, the surplus labour force will tend to go first to the biggest cities where a chance for even a part time job is greater than in a small town.

The intellectual foundation of any planning for future development and, therefore, also for the extremely delicate and sensitive physical structure of the

landscape, must consist of full appraisal of the magnitude of growth and awareness of needs and ways for the distribution of growth. The scale of population growth has been discussed above. Means of delaying further growth are under study by experts and politicians, and will probably be introduced sooner or later, if not immediately on a global scale. At best, they will start to have a recognizable impact on population structure sometime towards the end of the present century.

The main environmental and development problems of the next 25 years will remain more or less the same regardless of the effectiveness of new population policies. *Most workers who will need jobs in the year 2000 in expanded and newly built towns and in modernized rural settlements are already born.* The environmental planner therefore has the task of redistributing today's children—tomorrow's workers and *patres familiae*—and the productive pattern of national economies in such a way that the natural environment and landscape will not be totally damaged and the city-scape will not grow indefinitely to the scale where it will psychologically and biologically destroy its own creators.

## RURAL-URBAN INTERRELATIONS

Any policy for an environmentally and socially sound system of settlement, which recognizes its impact on environmental and landscape quality and provides guidelines for the urbanization process, must necessarily examine the interaction between rural and urban areas and comprehend its importance.

### 1. Urban and rural interaction

*Rural areas* are practically the only producers of food for the entire population and also the main source of labour surpluses and migration. *Urban areas* are the places where technological, economic and social progress flourish, and the source of the streams of modernization and progress which flow, sometimes very slowly, towards backward rural zones. They are also receptacles for waves of poverty and unskilled rural migrants.

The survival of cities depends on rural production, but at the same time the expansion of cities and of urban poverty results from rural poverty, backwardness and population movements. Rural agricultural progress depends on urban production (tools, fertilizers) and rural culture on a cultural feed-back from the city. The city depends on the countryside, its forests, rivers and lakes, for biological survival because only they can cleanse polluted air and supply requirements of oxygen and fresh water.

On the other hand, the city, when badly developed and managed, pollutes air, soil and water in its environs and often exterminates the life of the countryside. Uncontrolled suburban sprawl consumes former farmland, deprives its inhabitants of work, and destroys the beauty of the landscape.

Finally, and as a result of socio-economic development, the city is increasingly interested in surrounding open spaces for recreation, while villages need the city for educational, cultural and marketing facilities.

In short, the city needs rural settlements and open areas, and rural settlements need the city. Both need strong connecting bridges to establish more efficient co-operation. The ultimate goal is equality of living conditions in town and country, but very few countries are yet near to achieving this objective. The immediate aim is to co-ordinate the development of cities and countryside,

but only some of the more advanced countries have efficient machinery for the purpose.

## **2. Transitional zones of suburbia**

The most spectacular consequences of current population movements will be seen in intermediate or transitional zones between city and country, and especially around the biggest cities or as a component of metropolitan areas. In countries where modern economic and social development is at an early stage, these are the zones which attract migrants from rural areas.

In physical and economic terms they are characterized by poverty, the worst hygienic conditions, and the most dramatic and tragic city-scape. They represent, indeed, one of the most serious of environmental and social maladies. The luckier newcomers, who succeed in gaining a position in urban society, will start to improve their dwellings or, better, to move towards the city centre. The individual's promotion in socio-economic status will be reflected in his change of habitat.

On the other hand, in richer cities and societies the suburban zone attracts migrants from the city. They comprise the most well-to-do social groups of the urban population, escaping from environmental nuisances of sometimes out-dated, often overcongested, functionally inadequate central city areas. These wealthy newcomers promote protective zoning laws and expand their possessions ever more widely around the city, isolating the city's core from contact with rural areas and aggravating social and environmental disparities within the community. The resulting city-scape is often enjoyable, although sometimes arrogant in its 'nouveau riche' attitudes and possibly a reflection of a different environmental and social malady.

Between the two extremes discussed above, there are, of course, intermediate situations. Thus, in some advanced countries, with more equal distribution of wealth, the suburbs represent a structural expansion of the city. They are often the site of popular housing programmes where distance from the city's central amenities is offset by efficient social and other facilities. In many cases, rather rigid zoning by-laws and density standards safeguard sound land use and rural sectors from leprous invasion. Examples of such, more balanced, approaches to physical development could be found, for instance, in Scandinavian and Eastern European countries.

## **3. The growing crisis in major cities**

In most developing countries, the main stream of migration is into major cities unless it can be channelled elsewhere by creating new job opportunities and new growing points. In such cities some change of a job often exists, although mostly part-time or in services. The population of the largest cities of the Indian subcontinent or West Africa has a curious professional structure. The vast majority of 'professionally active' people are found in service jobs and, especially, domestic services.

By contrast, in countries with a balanced labour market and urban-rural relations, the most important sector of the urban population is involved in production and, in major or capital cities, in social services and business of nationwide importance, higher education, public administration and economic management.

Many cities, not necessarily only in developing countries, are unprepared for the ever growing influx of immigrants. They simply cannot provide working

places, housing accommodation, transport, marketing and social services, the finance and even administrative efficiency and managerial skill to cope with increasing numbers of citizens.

The basic social machinery and tools to handle the consequences of the spontaneous inflow of population are inadequate and outdated. Systems of land-tenure, of free land market and of urban-legislation are often serious obstacles even when local authorities are interested in making land available to newcomers.

Immigrants themselves are often unprepared to meet the challenge of new urban ways, a new and seemingly hostile environment and different social interactions. Penniless, without professional training or skills, they are mostly illiterate and, as a rule, hungry. They bring to the city only their eagerness to work, to improve their own lives and, if possible, those of their families, left behind and perhaps starving.

From such a socio-economic background, the process of 'urbanization' develops. Unable to meet the challenge in a straightforward manner, both major participants, the city administration and new settlers, try to avoid direct confrontation. This results in spreading slums, *barriadas*, *bidonvilles*, *favelas* and shanty towns. They grow in an almost clandestine way; they occupy land illegally; their land-use is usually ignored in every development plan. If another land use is proposed in such a plan, no provision is made for resettling present occupants.

To protect themselves against expulsion by city authorities or offended landlords, the newcomers choose the less favourable and most unattractive areas: lagoons (Calcutta, Lagos), swamps (Djakarta, Maracaibo), inaccessible hillsides (Ankara, Caracas), or areas under the direct impact of noxious industries (Chimbote). This makes for the worst possible natural environmental conditions, which are further aggravated by lack of water and waste disposal facilities, by overcrowding and lack of any social services. In addition, the technical quality of buildings is mostly below any reasonable standards, due to shortage of building materials and skills, and also the inhibition of capital investment by the owner's insecure tenure of 'his' piece of land. According to UN sources 1/3 of the present urban populations of developing regions or some 210 million people are shanty town dwellers. Table 2 presents some examples©

City	Year of Stat. data	City Population	Population in shanty-towns	
			Total	as % of city pop.
Africa:				
Dakar	1969	500,000	150,000	30%
Dar es Salaam	1967	272,800	93,000	34%
Asia:				
Calcutta	1961	6,700,000	2,220,000	33%
Karachi	1968	2,700,000	600,000	27%
Manila	1968	3,000,000	1,100,000	35%

(continued)

City	Year of Stat. data	City Population	Population in shanty-towns	
			Total	as % of city pop.
Middle East:				
Ankara	1970	1,250,000	750,000	60%
Latin America				
Rio de Janeiro	1961	3,326,000	900,000	27%
Brasilia	1962	148,000	60,000	41%
Guayaquil	1968	730,000	360,000	49%
Mexico City	1966	3,287,000	1,500,000	46%
Lima	1969	2,800,000	1,000,000	36%
Caracas	1964	1,590,000	556,000	35%

The dynamics of growth of what we euphemistically call 'marginal areas' is astonishing. While the population in developing countries typically grows at 2 to 3 per cent annually and many city populations grow at rates exceeding 6 per cent, shanty settlements in urban areas commonly grow at rates of from 12 per cent to over 20 per cent per annum. At 12 per cent, population doubles in four years.

Does any remedy exist for this cancer-like development of major cities? The severity of their environmental problems has provoked sporadic cosmetic actions, which do not take into account the conditions that caused the settlement to be established and to grow. For example, governments have responded by expelling squatters and by costly and disruptive slum clearance, resulting in a net reduction of housing available to the lowest income group, social dissatisfaction and unrest. Where rehousing has been attempted, it has generally resulted in rather unproductive use of scarce public resources, meagre improvements, if any, and inequitable treatment of families affected.

The question is whether the growth of transitional urban settlements in the future must mirror the environmental deprivation and human misery hitherto associated with them. Fortunately, there is reason to believe that it can be guided and converted into a positive development factor rather than remaining an impediment. In a number of developing countries, people living in these settlements have demonstrated remarkable vigour and ingenuity in improving their living conditions, despite enormous obstacles. All the evidence indicates that when they obtain minimally secure employment and some security of tenure, they act to improve their environment through investment in substantial 'popular sector' <sup>(7)</sup> resources, money and labour. In a number of cities, they have evolved into being significant social and economic assets to the community. <sup>(8)</sup>

#### 4. The growing crisis in rural areas

In some industrialized countries, where development has been a gradual process, distinctions between rural and urban life are disappearing, both being integrated in a society in overall balance with its environment. In developing countries, on the other hand, the dichotomy between the two engenders frustration at the unequal opportunities for the rural population. The standard of

living of villagers, peasants and small land-holders, who constitute the majority of countryfolk is decades, sometimes centuries, behind that of the relatively affluent city. This imbalance undoubtedly contributes to tensions and political instability in the rural population.

Investment in urban areas is usually a matter of prestige and a result of political pressure. By contrast, lack of investment in rural development deprives people of hope. Subsistence conditions prevail where a market economy has not yet developed. There is an imbalance in development investment. This situation is quite typical of developing regions, and it stimulates the exodus, which in turn aggravates the social and economic shortcomings of rural life.

The great majority of emigrants are young adults near the age at which they seek their first employment. The consequence is a considerable strengthening of the young adult work force in urban areas, especially in countries still having a low degree of urbanization, and the depletion of the force in rural areas. It is reflected in the aging of the farming population, dilapidation of villages and disruption of landscape.

Lack of a realistic and appropriate agrarian policy results in strange and disastrous developments. Some developing countries, though possessing all the natural conditions to increase agricultural production, are importing the majority of their food supply, while the rural population migrates to the cities, creating unemployment, slums, *barriadas* and '*ranchos*'.

## 5. Green revolution versus urban evolution

A commonly argued syllogism on the subject of rural-urban relations runs as follows:

- Population growth calls for higher food production;
- Higher production depends on modernization of farming;
- Modernization means more efficient production technology;
- More efficient technology reduces the labour force needed per unit of land;
- A decrease in the labour force results in growing rural unemployment (since continuous expansion of cultivated areas is limited by the need to protect ecological balance);
- The surplus labour must migrate to cities;
- Because big cities offer, at present, relatively higher chances for survival, their growth is a mathematical function of both the overall growth of population in the country and of technological progress in agricultural production.

Although all this may sound logical, if somewhat fatalistic, it is open to several criticisms. One of these relates to the conventional statement that modernization of agriculture must create large-scale emigration from the countryside. It may have been typical of the U.S.A. and other largely developed countries, because of the extremely broad and effective mechanization of the farmer's life and activities, and a system of welfare directed mostly towards urban populations. At present, in the U.S.A., only 5 per cent of the labour force is engaged in farming and ranching. By contrast, in developing countries, represented by most countries in Asia and Africa, 70 to 80 per cent of the population is engaged in agriculture, primarily at subsistence level.<sup>(9)</sup>

The modernization of agriculture chiefly involves:

- improvement of soil fertility by regulation of the water-regime (irrigation, drainage) and by the use of fertilizers;
- improvement of plants and seeds to achieve higher yield under specific climatic and soil conditions;
- improved protection against disease and insects by use of pesticides, etc.;
- improvement in technology of soil preparation and harvesting through modern, mechanized equipment.

Of these, the first three call for increased skill and know-how and for substantially increased supplies of seeds and chemicals, as well as improved farmland structure (land reform and consolidation of community land tenures) and, in the initial stages, expanded financial support. None of these factors necessarily have a direct and very strong impact on reductions in labour consumption.

Mechanization, however, has two ends—to save labour and time, and to improve soil or plant treatment. It usually results in replacement or less need of human labour. Therefore, a key question for a developing country facing food shortage and population problems in its towns and countryside, will be—*how to manage both the kind and scope of mechanization of agriculture as an element of the green revolution, so that it will harmonize with the overall policy of economic development and population distribution.*

Some students of the problem have suggested that the answer is essentially biological, and lies in the development of high-yielding varieties and stimulating growth by fertilizers. Mechanization should also play a part, but must be approached carefully, taking into account labour market conditions and the first principle in modernizing agriculture—to multiply yield and reduce the labour intensiveness only insofar as justified by demand for labour from other sectors of the economy.

'The dictates of economics, social justice, political tranquility and better rural-urban balance, all converge on the same point and reinforce the same conclusion: mechanization there must be, but on a highly selective basis; its sole purpose must be to maximize productivity *per unit of land*, not per tractor or per man-hour, nor per farm or per farmer.'<sup>(10)</sup>

If, as suggested, agricultural modernization is based on biological measures and on very carefully planned mechanization, migration from country to town could be slowed down. A further condition is improved marketing organization to cope with the results of the green revolution.

Present marketing, transport and storage facilities, in the majority of developing countries, are inadequate to handle increased yields and distribute them to the urban population, and to channel industrial products necessary for intensive agricultural production to every farmer. Furthermore, biologically intensive agriculture demands new farming skills. The transmission of know-how from research centres to the farmer and exchange of experience at all levels are essential.

To cite only one example of the present critical situation, there were in 1961, 1, 927 small and medium-sized towns in India and also 564, 718 villages, representing one town per 293 villages.<sup>(11)</sup> In Poland, an average of seven rural communities are linked to one small town, which plays the role of a technological and cultural centre.<sup>(12)</sup>

These figures illustrate the enormous urban depression in India, as a result of which the country is unprepared to process higher agricultural yields and Streamline urban assistance to rural zones. The National Council of Applied Economic Research in India advocates one market-town per 40-45 villages, which would imply about 12,500-14,000 new towns. The need is both functional and economic. Towns must provide marketing and storage facilities in both directions, and also act as educational and cultural centres. Concurrently there is a need for transportation networks for both physical and intellectual goods which are themselves a condition and a result of the green revolution.

The Green Revolution should never be a synonym for further, unlimited migration to and growth of major cities, but on the contrary, calls for a very, complex activation of the whole country, which will tend to produce a more even population distribution. But one additional condition for attaining that goal is gradual equalization of social, economic and technological conditions of life in town and countryside. In many countries this will take a long time, but it must be initiated as soon as possible, creating opportunity and hope for the young generation. *There is a need for a trade-off between improvement programmes in town and country. If townspeople desire more food and less pressure from newcomers, they must channel some of the national income toward modernization of rural life.*

Many steps can be taken. By grouping families it is possible to improve environmental conditions, provide basic services and establish a hierarchy of settlements, which allows amenities to be concentrated to serve minor clusters. This opens up the choices available to countryfolk, for cultural and material contacts and services and employment opportunities. Simultaneously such a process of development must recognize, retain and when possible, enhance the biological and aesthetic quality of the rural landscape.

## SOMETHOUGHTS ON STRATEGY

### 1. Macro versus micro approach

There are as many scales and dimensions in the approach to landscape planning as there are in the issues related to environmental development. If the reader's attention has been directed to broader issues, it does not mean that the micro-scale is any less important, especially in organizing the daily environment for an individual human being. Nevertheless, emphasis on macro-scale problems is due to the tempo of growth of human population and activities, and the magnitude of environmental and landscape changes that must be foreseen on our globe. No single limited micro-activity will give protection against the unco-ordinated and self-destructive evolution which could result from damage to global ecosystems.

It is essential, therefore, that awareness of environmental development issues and expansion of planning activities must proceed simultaneously at both levels: the macro-level of geographical, national and functional regions and the micro-level of a single settlement or component of a settlement. Environmental micro-planning extends to problems of a single dwelling, single classroom or working place. Its challenge is much better known, has a much longer tradition and the need for it is much more widely accepted in the popular consciousness.

One further aspect of a moral and philosophical character is strongly affected by the scale of planning. The broader the scale of planning and co-ordination of human activities within the environmental framework, the more conflict

between individual interests and those of society tends to arise. Again, the bigger the society and the greater its impact on environmental quality, the more necessary it becomes to subordinate some elements of individual interest and freedom to the global interest and well-being.

It needs to be understood that precisely by such a subordination of individual to social interests, some fundamental individual rights and interests will be protected, since planned rather than haphazard environmental conditions will eventually ensure a much better life for everyone.

## **2. Growth or stability**

The crucial factors in development that have a direct impact on the environment are population growth and the growth of human economic activity whose ultimate aim is the improvement of living conditions. This growth is continuous and, therefore, the qualities and the shape of the environment and the physical shape of the landscape is undergoing a permanent process of evolution.

The question whether this evolution can and should be controlled is one of the most controversial issues of society today. Personally, I expect that at least for the next 20 to 30 years the population of the world will continue to increase despite population control efforts, which although apparently crucial in some regions may still seem of doubtful value in under-populated regions. The views of various nations differ very much with their specific local conditions. For many reasons, the rate of growth seems likely to be much higher in developing countries and this will deepen their social, economic and environmental problems.

Secondly, to stop or slow down the process of social and economic development would be contrary to human nature and ambitions, and moreover would mean retaining and reinforcing existing social injustice and inequality in the distribution of opportunities and conditions of life between different countries or between different social groups within a single country. Therefore, the process of growth in general must be maintained but, at the same time, it must be stimulated and guided in a purposeful and planned way. In some more advanced countries, the need will arise for a conscious trade-off between various aims and results of growth, for example within the field of the growth of consumption as against the growth of opportunities for intellectual and spiritual development. In other less developed countries, the immediate objective will remain economic growth aimed at gradual equalization of satisfactory living conditions.

The process of development is directly interrelated with the process of urbanization. The growth of population and concentration of people in urban zones present the most crucial environmental challenges ever faced by man. If harmony is to exist between the man-made and natural components of the environment, it will require a conscious and balanced development effort to ensure the appropriate distribution of the population within every region. The basic forces which determine population movements and which should therefore be used as the tool for population redistribution, are the development and location of productive enterprises. In this, cities and villages play an essential part. Nevertheless, they can make an optimal contribution to development only if planned and built in a functional way. Failing this, cities not only suffer from threatening internal problems, but often create major perils to human well-being. Moreover, they can become dangerous centres of dissension if they do not provide positive opportunities for the poor to improve themselves and

do not create conditions for equal distribution of biological, functional and aesthetic opportunities.

Because of the paramount importance of the environmental condition of human settlements for human satisfaction and well-being and because of the complexity of environmental issues inherent in the single settlement and in settlement networks, there is an urgent need for comprehensive planning which co-ordinates economic, social and environmental aims with the physical shape of development. Such planning transcends the interests of any individual or group, and should therefore be the responsibility of government. The scope of this responsibility should include formulation of long-range goals for social and economic development and of guidelines for environmental development, supported by the necessary administrative and legal tools for planning and implementation.

The accumulated professional knowledge and experience in the world are sufficient under most circumstances to plan settlements with satisfactory environmental conditions, and protect the basic biological, social and spiritual needs of their inhabitants. However, this know-how and experience could be applied more effectively if politicians and governments were more deeply committed to the long-range planned development of their countries. To this end, it will be necessary in many cases to change the present attitudes of politicians from their preoccupation with short-run effects to concentration on long-term planning. Furthermore, improvements must be made in administrative and legal structures in order to facilitate interdisciplinary co-ordination of development processes, in keeping with the scale and character of the problems of population, urbanization and overall environmental development.

### **3. Redecoration of 'Spaceship Earth'**

The extent of man's activities and growing needs must be reflected in the new quality of the global environment, including the natural as well as the man-made landscape. The process of 'redecorating' is proceeding constantly and the fundamental question is to what extent it will be piecemeal and unplanned, or, alternatively, will be based on co-ordinated efforts to achieve an environment which will retain all the necessary qualities for biological survival and, at the same time, provide more social satisfaction and better living conditions.

Obviously if the development process proceeds further in the spontaneous way it has done in developed countries as a result of the Industrial Revolution, many aspects of environmental structure and landscape in every city, country or geographical region will deteriorate. Forests will give way to man-made deserts, refuse heaps and the concrete landscapes of expanding cities. Overcrowding in some areas will increase not only biological difficulties, but also social tensions and dissatisfaction. The unlimited use and dispersal of energy will change climates and hide blue skies in clouds of smog and vapor. Beaches will be framed by rows of skyscrapers where the visitor will be isolated from any contact with nature and its beauty. Slums and favelas will spread, occupying agricultural areas or climbing slopes of hills. Rivers will be polluted and their function as waterways replaced by networks of multi-level highways which will start to strangle not only cities but whole countries. In short, conflicts between man-made and the natural components of the landscape will grow to the extent that humanity is deprived not only of beauty, but also of the most essential elements for his life, such as fresh air, fresh water, sunlight and tranquility.

Must this apocalyptic picture be the heritage of our children and grandchildren?

This paper has aimed at identifying some of the development problems and emphasized the necessity and possibility of their solution. Modern technology and science should be used not to create further environmental damage by incorrectly understood processes of development and urbanization, but for a conscious redecoration of 'spaceship earth'. Awareness of the problems and of the need for answers has been growing especially in the last few years. It is still possible to regulate population movements and urbanization, to design sound land-use and development projects for every growing city, to protect the natural landscape from the devastation of strip-mining or similar activities, and to undertake the task of levelling up living conditions and opportunities in town and country all over the world. But, for planning and implementation to be successful, there must be broad popular understanding of aims and of necessary trade-offs. This must be developed with the full and honest co-operation of professions from different fields working toward the common goal of better landscape in which man and his artifacts will be harmonious and integral components.

Comprehensive planning is so broad in scope that only a highly competent interdisciplinary team could handle it. The landscape planner must co-operate with the economic planner and with sociologists, and everyone of them must understand the aims and philosophy of the others. Problems of aesthetics are a part of the social problems since they are relevant to health. Many social problems are synonymous with economic ones. The professional responsibility of each participant in the new and complex task, should no longer be towards an individual client, but society as a whole. Our ultimate challenge is to reshape the landscape of our Earth in harmony with global social needs.

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## SESSION C: ECOLOGICAL, MULTI-DISCIPLINARY APPROACH TO DEVELOPMENT PLANNING

### Part 2: Paper (12)

## Economic Growth: Bane or Blessing

PETER H. PEARSE

*Professor of Economics, The University of British Columbia, Vancouver.*

### SUMMARY

An economy, like an ecosystem, consists of a great number of interrelated processes which together produce a complex, resilient organism highly responsive to external stimuli. It takes its direction from human incentives, is constrained by institutions, resources and technology, and is entirely amenable to control.

In a hospitable environment the system expands. Economic growth can be traced to increases in the basic inputs of labour, land, or human and natural capital, or to technological advances that enable these inputs to be transformed more efficiently into valuable goods and services.

Throughout its history economic science has been concerned with the process of growth and prospects of its ultimate end. But the dismal Malthusian 'stationary state' to which classical economists believed we would eventually be driven has not materialized, and modern economists have been more concerned with the sources and form of economic growth than with the threat of its inevitable cessation.

Our existing measures of economic performance do not adequately measure changes in human welfare, and many of the adverse effects associated with increases in measured production are unquantified. Adverse environmental effects result largely from failures in economic organization and institutions. Recognizing the increasing gravity of these side effects of economic activity,

some have advocated termination of economic growth or of some component of it—such as population, output, or technology. But these no-growth proposals are probably too simplistic and are unlikely to be practicable policies even if they did promise to alleviate the environmental problem. Effort might be directed more profitably to correcting the specific failures in the existing economic system that are the sources of environmental degradation.

## RESUME

Une économie, à l'image d'un écosystème, est constituée d'un grand nombre de processus interliés qui composent ensemble un organisme extrêmement complexe et résistant, réagissant de façon très sensible aux stimuli extérieurs. Elle s'oriente en fonction des intentions humaines, est conditionnée par les institutions, les ressources et la technologie et est entièrement contrôlable.

Dans un milieu favorable, le système prospère et s'étend. La croissance économique peut provenir d'un accroissement de l'apport de base de main d'oeuvre, de terres ou de capitaux naturels ou humains, ou de progrès technologiques permettant de transformer plus efficacement ces apports en biens et services utiles.

Tout au long de son histoire, la science économique s'est intéressée au processus de croissance et aux perspectives de son aboutissement ultime. Mais la déprimante perspective de l'"état stationnaire" malthusien auquel les économistes classiques pensaient que nous aboutirions finalement ne s'est pas matérialisée et les économistes modernes se sont plus préoccupés des sources et des formes de la croissance économique que des menaces de son arrêt inéluctable.

Les systèmes actuels de mesure des performances économiques ne permettent pas d'évaluer de façon adéquate l'évolution de bien-être humain; de ce fait, un grand nombre des effets négatifs liés à des augmentations de la production quantifiée ne sont pas mesurés.

Les effets négatifs sur l'environnement proviennent en grande partie de défauts dans l'organisation et les institutions économiques. Conscients de la gravité croissante de ces effets secondaires de l'activité économique, certains ont préconisé l'arrêt de la croissance économique ou de certaines de ses composantes—population, production ou technologie par exemple. Mais ces propositions de non-croissance sont probablement trop simplistes et il est peu vraisemblable qu'elles puissent devenir praticables, même si elles devaient promettre d'alléger les problèmes de l'environnement. Il serait plus profitable d'orienter les efforts vers la correction de défauts spécifiques dans le système économique existant, défauts qui sont à la source de la dégradation de l'environnement.

## ECONOMIC GROWTH: BANE OR BLESSING. **Introduction.**

Ever since economic statistics have been collected, the progress of nations has been judged primarily in terms of their rates of economic growth. Statistical measures of economic growth have reached a high degree of sophistication, but they are always more or less imperfect, as economists have been quick to point out. Recent years, however, have witnessed a growing concern

about the degree to which changes in the established indices of economic performance reflect the real changes in human welfare, and hence a questioning of continued increases in these indices as a social goal. Moreover, there are doubts that continued economic growth, as traditionally measured, is possible even if it is desirable.

These doubts about the possibility of continued economic growth and its relevance to human well-being take a wide variety of forms, as do the prognostications they produce. The proposed solutions range from measures to mitigate specific adverse effects to a completely regulated social order. It is the purpose of this paper to explore the background to this debate, and to attempt to clarify the implications of economic growth in the context of alternative social objectives. Of particular interest here are the implications of continued economic expansion for the natural environment.

### **The economy and the environment**

The purpose of economic activity is to satisfy human wants by applying man's labour and ingenuity to transforming natural materials into useful goods and services. The economic processes of extracting and transforming raw materials and consuming the finished products puts heavy demands on the natural environment's supply of basic resources and on its capacity to absorb residuals. Appreciation of the nature of our economic dependence on the natural environment is essential to an understanding of the implications of continued economic expansion.

Western market economies derive their basic direction from the pattern of consumer demands. Consumers register their wants by offering to purchase goods and services in the market place. Producers respond to these demands in order to make profits, and in producing the goods and services demanded they generate demands for productive inputs such as labour, man-made capital equipment, and natural capital in the form of land and natural resources. In purchasing these inputs, they provide incomes to those that sell them, and this process determines, in the first instance, how purchasing power is distributed. These interrelated processes take place more or less automatically, without central control. The existence of government production, taxation and income transfers, foreign trade and other features of complex economies complicate these flows of income generation, production and spending, but they remain the basic components of the economic system.

The available supply of inputs and the state of technology that governs the efficiency with which they can be converted to useful products determines the capacity of the economy to satisfy consumer demands. Under competition, producers are forced to produce at lowest possible costs, and hence to use resources efficiently. Esoteric economic models have been constructed to prove that, under highly restrictive assumptions, this system, operating without central control, can achieve an optimum result; namely that the welfare of people will be maximized given the resources and technology available. Imperfections in markets and institutions prevent the optimum from being realized, and much of the study of economics is devoted to identifying these sources of failure and the means for correcting them.

An economy, comprised of these interrelated flows, each made up of countless individual actions, has much in common with an ecosystem. Each activity operates within the system, constrained by other activities and the total capacity of the environment; the system's complexity provides checks and balances

that produce a high degree of resilience; and its dynamic structure makes it adaptable to changes in external influences such as shifts in consumer demands, relative scarcity of resources, and technology.

Indeed, ecologists and economists probably have more in common than they usually realize. The names of their disciplines have the same origin: economy is derived from a Greek word pertaining to the management of households, while ecology is a more recent combination of the 'eco' of economics with the '-logy' of biology. Both words today refer to the interrelationships of activities within systems.

Much of the long history of economic enquiry has been concerned with man's relationship to his physical environment. One of the earliest schools of economists in 18th century France were the Physiocrats—technocrats of the physical environment—who developed the foundation of our economic theory of resource use. The Reverend Thomas Malthus, an early English economist who influenced Charles Darwin considerably, laid the groundwork for modern studies of economic demography, which have paralleled the work of biologists and medical philosophers like Huxley and Dubos.

It was the school of European forest economists dating from the 17th century that provided Gifford Pinchot with the background he needed to launch the great conservation movement which swept the United States early in this century. That movement was concerned primarily with the rate of depletion of specific natural resources and their availability for future economic growth; and while it was a confused and inconsistent popular force, it achieved tremendous political strength and influence (Scott, 1955). Today, that movement has been replaced largely by a concern for rationalizing conflicting demands on the resource base and for protection of resources and the quality of the environment in the face of continued economic growth (Scott, 1968). The new concern about the relationship between economic activity and the environment has generated renewed interest among economists and natural scientists in each other's disciplines.

### **Economic performance and human welfare**

Any economy is more or less imperfect, and imperfections reduce the extent to which human wants are satisfied. In market economies, competition, which is essential for productive efficiency, frequently breaks down, resulting in a pattern of production and consumption that lowers its aggregate value to society. Ignorance and uncertainty distort production decisions. Sometimes labour and other resources are under-employed, and at other times inflation causes instability. Further, there is no guarantee that the distribution of income and wealth that results from market activity will be equitable. In addition, there is a category of 'public goods', such as national defence, institutions of law and order, and general environmental amenities, which must be produced by governments, if at all, because their benefits cannot be parcelled and sold to separate individuals.

But the imperfection of market economies that is of special interest here is its failure to take account of certain benefits and costs that accrue to society. The most common examples of environmental degradation arise out of situations in which producers or individuals can impose costs on others without having to compensate them. Where a meat processor has his wastes trucked away and buried, he bears the cost of waste disposal and these costs are reflected in the price of meat sold. If he is free to dump them in the river,

however, he bears no cost of disposal. The cost may be borne by others downstream, but if the producer is not required to compensate them, the cost of waste disposal will not enter his production accounts nor affect the price of his product. Such 'external costs' represent market failures that distort the patterns of production and consumption. In the above example, the costs of meat production perceived by producers will be too low, hence the price of meat will be too low and the quantity produced and consumed too great. The quantity and quality of the water will be correspondingly too low.

Wherever the action of one affects the welfare of another but the process is not registered in a market transaction, 'external costs' emerge and the market system fails. Almost all our pollution problems take this form. It is the absence of a market transaction that is critical. If the party that inflicted the damage fully compensated the losers the problem would be eliminated and the action would occur only to the socially optimal degree—only to the extent that the benefits accruing to some exceed the costs imposed on others. 'External costs', and a corresponding array of 'external benefits' (beneficial effects experienced by others for which they do not pay), are so pervasive in modern industrial economies that the pattern of production and consumption is significantly different from that which would maximize human welfare. Environmental deterioration is a result, in large part at least, of these uncompensated spillover effects of the actions of producers and consumers.

Adverse 'external effects' appear to be increasing in variety and magnitude for a number of reasons. First, human populations are not only increasing, but they are becoming concentrated in urban centres. While few actions of one individual in an agrarian economy are likely to impinge on others, his activities in a crowded city affect others in a wide variety of ways. His noise, the construction of his house, the exhaust from his car and the space it requires for movement and storage, his smoking, his litter, his addition to congestion all add to the discomfort of others for which they are not directly compensated.

Second, the growth of the economy generally, while it enhances our standard of living measured by our marketed output and consumption, puts a relentlessly growing demand on the natural resource base. Industrial exploitation of resources often has the incidental result of reducing the aesthetic and recreational value of the environment.

Third, our modern economic development is characterized by increasing scale of operations and growing technological sophistication. The impact of industrial operations is felt over wide areas and large numbers of people. Huge engineering works, massive strip mining and oil transportation facilities can, because of their scale, affect the environment of extensive regions. Modern technology of production involves complicated processes which often produce alarming side effects—such as mercury wastes and radioactive residues. Even the weapons of war, which a few decades ago were incapable of causing lasting damage to the environment, can now destroy it entirely.

Ecologists emphasize that nature's balance is not usually as frail and delicate as many naturalists would have us believe; it is on the contrary highly resilient, and capable of absorbing great shocks. But there is a limit to this resilience; and the sheer magnitude of man's modern technological capacity is capable of pushing the natural balance beyond its capacity to absorb, assimilate, and cleanse itself. Thus a water body can be turned into an aquatic desert through excessive injections of effluents. And it appears that our present levels of use of hydrocarbon fuels are producing carbon dioxide faster than nature

can reconvert it to other compounds. These are all modern phenomena, because earlier technology, and the scale of industrial processes, were relatively innocuous.

Finally, the gravity of environmental damage is increased by the evolution of public values. As other wants are satisfied, people value more highly a clean environment, and want more unspoiled nature available and secured for recreation and enjoyment. Thus, at the same time that industrial demands are encroaching on the resource base at an unprecedented rate, the evolution of public tastes and preference is resulting in an increasing demand for unspoiled nature (Clawson and Knetsch, 1966).

These external effects interfere with the market's efficiency in using the available resources in a way that will maximize the satisfaction of society's wants. And it is for these reasons, among others, that even the most capitalistic economies involve a good deal of government intervention to assist the system in achieving a level of performance closer to its potential.

The shortcomings of the economic system contribute to the difficulty of measuring economic performance. Ideally, we should like to measure all the satisfactions that people derive from economic and non-economic goods and services. Identification of all the benefits, however intangible, and of all the costs or discomforts that are generated in the process, would enable calculation of the net gains from economic activity. Knowledge of the population size would then permit calculation of the benefits *per capita*. There would remain, of course, the question of the equity of the distribution around the average.

But our actual measures fall far short of this ideal. The most widely used index today is the Gross National Product, which attempts to measure in dollar terms the value of all the goods and services produced in a given period. But even the most sophisticated measures of this index leave many things unmeasured or measured only very crudely. Important factors such as depreciation of capital and depletion of natural resources can be estimated only roughly. No market values are available for national defence, the services of teachers and policemen and other public services, and so (for want of a better indication of value) their cost is used as a measure of their contribution to GNP. Services that are not purchased in markets, such as those performed within a household, are mostly ignored altogether. And all the satisfactions that are passively derived from the natural environment—its aesthetic and free recreational benefits and its value in assimilating residuals—are unquantified.

In short, while we now have highly sophisticated statistical measures of production and income, they are, at best, only partial measures of economic performance and inadequate measures of welfare.<sup>1</sup> In addition, because the GNP measures only some of the things that contribute to human well-being, and an increase in these may be accompanied by a decrease in unmeasured values, there has been growing scepticism about the value of statistical growth. E. J. Mishan, among others, has argued that the social costs—unquantified or perversely quantified—associated with economic growth as we usually measure it are so great that they outweigh the benefits (Mishan, 1967). Kenneth Boulding has criticised the GNP's conceptual foundation as a primitive measure of throughput, whereas we require a measure of the state of human well-being which will record the throughput not as a gain but as a cost (Boulding, 1966). Other recent investigators have argued that, regardless of the benefits, the

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<sup>1</sup> See Notes at end.

environmental repercussions of continued economic expansion presage Armageddon. Obviously, if growth is not worth it, or if it makes us worse off, or if it will destroy us, it should be stopped.

### Sources of economic growth

Throughout the history of economic enquiry, economists have been concerned with the factors that cause, or permit, increases in aggregate economic output. Conceptually, an economy grows as its resources of labour, capital and land are expanded and as producers learn to use them more efficiently. The supply of labour is closely related to the size of the population, which is governed by demographic forces. Capital includes not only physical structures and machines useful in production, but also the capital embodied in people through investment in education, training and health. Both physical and human capital are augmentable by diverting resources from production for current consumption to investment in capital, which enables greater production and consumption in the future. Many natural resources have the characteristics of capital, insofar as available supplies can be augmented by investment in development (such as forests) or exploration (minerals, oil). The principal characteristic of land is that, like the atmosphere and oceans, it is not augmentable, although its characteristics can be altered.

Apart from any change in available resources, an economy can grow through technological advance. Through applied research and development, basic knowledge leads to technical improvements which permit resources to be used more efficiently. Expansion of resources and improved technology enable an economy to grow, and *per capita* growth occurs when technical knowledge or other resources expand relative to labour.

With such a variety of possible sources of growth, it is not surprising that economists have held different opinions on the major historical engines of growth. The eighteenth century Physiocrats attributed the source of all wealth to the land, and the level of aggregate production depended, ultimately, on the amount of labour applied to land. Later, economists of the classical school, such as Adam Smith and David Ricardo, saw the accumulation of capital as the foundation for growth. A society beginning with an abundance of resources relative to its population could produce more than the minimum requirement of food, so that some labour could be devoted to production of machines and other capital equipment. Since the productivity of labour is increased by these complements of capital, more and more resources can be diverted from producing immediate necessities into capital investment, so that growth continues.

But while the classical economists saw this economic growth as a means of contributing to the wealth of nations, improvement in the level of human welfare could be only transitory, because of inevitable demographic response to the increased 'carrying capacity' of the economy. Adam Smith recognized that 'every species of animals naturally multiplies in proportion to the means of their subsistence', so that incomes would tend to be reduced '... to this lowest rate which is consistent with common humanity' (Smith, 1776, p. 71, 79). This dismal equilibrium between population and production was embodied in the doctrines of the earlier Physiocrats, and later formalized in Thomas Malthus's famous principle of population.

Nor could growth continue forever. The increased population and production would be forced onto resources of ever-diminishing quality, so that additional increments of output would require more and more labour. Ultimately, all

resources would be required to produce for immediate consumption, and with no excess available for further capital creation growth must cease. Thus economic growth was a process by which a nation moved from an initial, primitive condition to an expanded equilibrium state of stagnation in which the mass of humanity, though larger, was not better off. There was plenty of historical evidence among older nations, of course, to support this classical doctrine.

Modern economic theory and recent history offer convincing bases for rejecting Malthusian stagnation as the inevitable prospect for growing economies. Many modern theorists, such as R. F. Harrod, Evsey Domar, Paul Samuelson and James Tobin continue to stress the importance of physical capital in generating economic growth (Harrod, 1939; Domar, 1946; Samuelson, 1969; Tobin, 1969). Others, however, have emphasized the role of other factors in the growth process. Theodore Schultz and Garry Becker, among others, have emphasized the value of investment in human capital to keep pace with growing technology and physical capital (Schultz, 1969; Becker, 1969). Still others stress the role of research and development in expanding society's technological command over nature to increase production efficiently (Machlup, 1969; Mansfield, 1969).

Notwithstanding these divergent views, there is an emerging consensus among economists that the sustained growth in measured *per capita* income during recent decades is due primarily to continued expansion of knowledge and applied technology. Persistent technological advance relaxes the 'limiting factors' on economic activity by enhancing the productive power of labour and capital. In addition, they have, so far at least, staved off the spectre of a depleted natural resource base by improving the productivity of resources, by increasing known supplies and by reducing economic dependence on particular resources through development of substitutes. Viewing technological advance as the ultimate source of growth, many economists have entertained the view that *per capita* incomes could go on rising forever in an expanding, progressive Golden Age (Neher, 1971). That optimistic view is now being questioned.

### **Concepts of the stationary state**

The history of investigation into the nature and sources of economic growth is punctuated with speculations on the nature of a stationary state. Adam Smith, in his monumental *The Wealth of Nations* of 1776, concluded that nations must at some time reach a stationary state. Such nations, '... which had acquired that full complement of riches which the nature of its soil and climate ... allowed..., fully peopled in proportion to what either its territory could maintain or its stock employ ..., fully stocked (with capital) ...' could no longer expand (Smith, 1776, p. 94).

David Ricardo, a brilliant economic theorist of the early 19th century, developed a concept of an inevitable stationary state which resembles in many respects the predictions of conservationists and modern pessimistic 'environmentalists' (Ricardo, 1817). Like Adam Smith, Ricardo saw capital accumulation as the source of economic growth. But as population increased, an agrarian economy would be forced onto land of ever diminishing fertility, until the cost of agricultural production rose to the value of the harvest. With no further prospects for profit, both capital accumulation and population would cease to accumulate, producing a stationary state. Modern zero-growth advocates

broaden Ricardo's land constraint to the environment as a whole. They differ from these Classical economists also insofar as their stationary state is not one to which an economy is inexorably driven, but rather one which should be contrived through public action. In this they were anticipated by J. S. Mill a century ago.

John Stuart Mill's provocative approach to social issues differs so much from the other classical economists that even Karl Marx refused to classify him among 'the herd of vulgar economic apologists'. He held a much more optimistic view of the possible condition of mankind in the stationary state, partly because he had an astonishingly modern distaste for economic 'progress'. 'I confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, elbowing, and treading on each other's heels, which form the existing type of social life, are the most desirable lot of human kind, or anything but the disagreeable symptoms of one of the phases of industrial progress ... It is only in the backward countries of the world that increased production is still an important object: in those most advanced, what is needed is a better distribution.' (Mill, 1848, p. 748, 9).

Mill saw the possibility of a stationary state that was not the final dismal equilibrium toward which all economies tended, but rather a society that was deliberately controlled at a population and distribution of wealth that would permit '... a well-paid and affluent body of labourers; no enormous fortunes, except what were earned and accumulated during a single lifetime; but a much larger body of persons than at present, not only exempt from the coarser toils, but with sufficient leisure, ... to cultivate freely the graces of life.' (p. 750). He was much concerned about the destruction of the natural environment that accompanied unrestrained economic growth and concluded 'If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a better or happier population, I sincerely hope, for the sake of posterity, that they will be content to be stationary long before necessity compels them to it.' (p. 750). These sentiments, if not the language, carry a striking similarity to those of modern environmentalists.

Mill's happier conception of the stationary state derived from his explicit recognition of the implications of technological advance, so that his '... stationary condition of capital and population implies no stationary state of human improvement.' (p. 750).

By the late nineteenth century, economists such as the eminent Alfred Marshall had developed the concept of a stationary state as a theoretical construct for economic analysis (Marshall, 1890).<sup>2</sup> In the present century, this model has been developed to a high level of sophistication. Frank Ramsey was able to derive the optimum approach toward a stationary condition of 'bliss' (Ramsey, 1928). About the same time, however, Professor A.C. Pigou pointed out that the condition of keeping capital intact in a stationary state was incompatible with the use of non-renewable natural resources (Pigou, 1935). The implications in Pigou's model of depleting stock resources, or of using more than the sustainable yield of renewable resources, was consistent with the pessimistic predictions of conservationists of the time. But unlike John Stuart Mill, both Pigou (explicitly and hypothetically) and contemporary conservationists

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<sup>2</sup> See Notes at end.

(implicitly) assumed that technical knowledge was constant—an assumption that economists could not accept as realistic (Goundrey, 1960).

During the last few years, the idea of a stationary (or 'steady' or 'equilibrium') state has attracted the attention of a growing number of natural scientists. Recognizing the damaging environmental effects associated with growth, and contending that nothing can continue to grow forever, they have proposed the design of a stationary state not unlike that conceived by John Stuart Mill (Dubos, 1970). Highly complex computer simulations have been used by scientists such as Jay Forrester and others of the Club of Rome to investigate the dynamic interrelationships among global populations, production and pollution, and to project their future pattern (Forrester, 1971; Meadows *et al.*, 1972). But the analyses upon which their dire warnings are based have some of the same limitations as those of Thomas Malthus. Not surprisingly, in view of the exponential rates of growth and fixed natural resources built into their models, they predict that growth cannot be sustained. The only alternative to doom is a society closely controlled '... in a steady state of economic and ecological equilibrium...' (Meadows *et al.*, p. 196). The major shortcoming of these mathematical simulations is their failure to provide for the responsiveness of people, economic activity and technology to changing relative scarcities. The projected failure of technology inherent in these conclusions is no more reasonable than was Malthus's assumption of its constancy. And by focusing attention on the imperious need for nothing short of global control, they tend to divert attention from the specific sources of environmental decay and the more promising opportunities for correcting them.

### Partial anti-growth proposals

Apart from these global proposals, there has been increasing popularity for proposals aimed at controlling specific components of growth. The factor chosen for control reflects, presumably, the proponent's assessment of the ultimate source of the 'growth problem', such as population, production, technology or energy consumption.

The most straightforward and popular 'partial' proposal is that of zero population growth. The proponents of ZPG base their argument on the observation that continued expansion of human population necessitates at least a proportional growth in output, if standards of living are not to decline. And so, cessation of population growth is a *sine qua non* for any other restraints. Eminent biologists such as Garrett Hardin and Paul Ehrlich have emphasized the critical role of population in generating the general environmental crisis (Hardin, 1968; Ehrlich, 1970).

But because population is only one of several components of general social expansion, it is also only one of the factors that influence human impact on the environment, as we can infer from the lack of correlation between population density and environmental degradation around the globe. With few exceptions,<sup>3</sup> however, economists now agree that regardless of its role in stimulating economic growth, population growth dampens the beneficial effect of that growth on human welfare.

The concept of the optimum population has long been a subject for economic speculation and has recently attracted the attention of biologists such as Paul

<sup>3</sup> See Notes at end.

Ehrlich (Ehrlich, 1970). With other factors fixed, there is probably some population density below which income per head would be less because economies of scale and specialization could not be fully realized; and above which congestion and scarcity of other inputs relative to labour would also depress income per head. The optimum population is likely to change, of course, as conditions alter through time. Technological advance may have the general effect of lowering the size of the optimum. A policy of zero population growth, therefore, is at best an exceedingly blunt instrument for controlling the adverse effects of economic expansion, because zero is only one of an infinite number of positive and negative rates of change that might lead to the optimum in different places or times. Nevertheless, in view of the randomness of historical demographic expansion, we can probably concur with Stirling Brubaker's conclusion that 'if we value environment, other forms of life, income, or the maintenance of options, there is everything to be said for early restriction of population growth and hardly anything to be said for its continuance' (Brubaker, 1972, p. 181).

Another partial proposal is to check further expansion of economic output, by which is usually meant the conventional Gross National Product. The difficulty with the arguments against growth in production is that they are, in large part, an indictment (or misunderstanding) of the measured GNP as an index of human welfare. If the GNP provided a perfect assessment of all the benefits and costs of economic activity, much of the concern would be allayed. Just as some writers oversimplify the problem of blaming population, others assume that environmental degradation follows directly the level of production (Barkley and Seckler, 1972). But the choice is not simply between production and the quality of life, but rather among different patterns of production with varying environmental effects. Environmental damage depends not only on how much is produced, but also on what is produced and how.

It is the methods of production that have led a third group to identify technology as the culprit that warrants closest control. Barry Commoner, for example, has concluded (on questionable evidence, in the opinion of this writer), that population and output growth have accounted for an almost insignificant share of environmental deterioration in recent years and that almost all of it can be traced to developments in technology (Commoner, 1971). His arguments lead to the conclusion that fixing technology is the necessary condition for preventing environmental collapse.

But growth in technology is probably the last factor that we should want to stop. Certainly, technological developments have led to many of our most conspicuous environmental problems. But it is no more helpful to blame technology for the result than to blame those who purchase the offending products. The problem is not with technological advance *per se* but rather with the priorities it often assumes and how it is employed. Indeed, a moment's reflection will reveal numerous examples where encouragement to technological advance is likely to yield high returns in alleviating environmental problems.

As mentioned earlier, technological advance is believed by modern economists to play a special role in long-term economic growth. Knowledge and technology, unlike the other requirements of production, do not diminish or depreciate through use. On the contrary, use enhances them, and they become obsolete only if superior technology is developed. It is thus augmentable and self-generating. Technological advance has not only enabled us to break free of the grinding poverty that has characterized most of human history, but it has almost certainly provided us with the means for solving our environmental problems. That we do not solve these problems cannot be blamed on technology.

Some zealous conservationists, frustrated by the economic system's failure to protect the environment, see a solution only in complete economic and social reorganization, as a prerequisite, at least, to global technocratic control of economic activity. Sometimes they reject contemporary economics as irrelevant, because they fail to distinguish between economics as an analytical science and particular economic systems.

We can identify distinct categories of economic organization in the world today; the subsistence economies of less developed countries, socialist economies characterized by central control, and the western mixtures of capitalism and government control. In addition to these existing systems, a variety of economic utopias have been proposed, ranging from those of Marx and the theoretical socialists to those of the *laissez faire* philosophers from Adam Smith to Milton Friedman, and including some of the steady state proposals.

It is not surprising that in western countries critics of the market economy blame 'the free enterprise system' for environmental degradation. But it should be pointed out that no form of economic organization has a monopoly on pollution. Soil erosion and rape of the land is most serious in the primitive, familial or feudal economies where the market system is not developed, such as in North and East Africa, the Middle East, Crete, Afghanistan and Canadian Indian Reservations. On the other hand, the most spectacular projects of land reclamation and rehabilitation are to be found in the American South and Southwest, Holland and Italy where the market system predominates. Water pollution is serious in socialist Russia and Eastern Europe, notably Lake Baikal and the Moskva and Don Rivers, whereas the leading example of water pollution abatement is probably the Ruhr, in West Germany. While examples of serious air pollution can be found around the globe, Los Angeles to Moscow and Tokyo, the most impressive projects of air quality improvement are to be found in London, Manchester and Pittsburgh.

It is useless, then, to suggest that our environmental problems would be overcome if we adopted a different kind of economic system. Nor is it helpful to concern ourselves with theoretical utopia. We can most constructively direct our attention not toward revolutionizing the social organization in which we find ourselves, but rather toward reforming our existing institutions and policies. As in biology, stable survival depends more on adjustment than on aggression.

### **Ends and means**

This paper has been critical of generalized zero-growth proposals for dealing with the environmental crisis. This is not to deny the gravity and urgency of many emerging environmental problems. It implies, rather, a suspicion that global approaches may be impracticable and inefficient in dealing with the causes of the problem.

There is a danger, in an affluent society, of underestimating the immense benefits that have flowed from economic growth. Millions of human beings are now essentially free from the grinding poverty that has beset mankind through most of his history, and enjoy intellectual, cultural and physical health and liberty that earlier generations would have found unimaginable. These advances, appropriately channelled, almost certainly provide the means of solving environmental problems. The problem is really one of making our system respond more effectively to the need for a better environment. To deliberately

stop the foundations of growth is likely to constrain the means for improvement. If careful analysis reveals that it is not growth *per se*, but rather the form of economic activity that gives rise to environmental degradation, effort would be better directed toward the specific sources of the problem.

Some observers see the limits of science as the obstacle to improvement, and look to new technology to solve our environmental problems. While much obviously remains for science to uncover, this is probably the least serious constraint on progress.

Others blame social attitudes as the fundamental problem. If only people would become less selfish, acquisitive and aggressive, our problems would not arise. Their solution is education. But while there is much to be said for improved knowledge and understanding, the changing of basic human attitudes is likely to be a slow and uncertain means of dealing with our environmental crises.

A third candidate for environmental culprit is the institutions within which our social and economic system operates—the legal system, social institutions, economic organization, property rights, and so on. Most actions in society, including the destructive ones, occur because our institutional order provides incentives for those actions. If we have too much pollution, it is because it is profitable to pollute where producers are not compelled to include the cost of pollution in the price of their product. If we consume too much energy, it is because its price is too low, relative to other things. If we use too much harmful insecticide, it is because they yield the highest private return. If we have unwanted population growth, we should reassess our restrictions on birth control, and reverse the incentives we provide through tax deductions and transfer payments for having children. If we observe that private users fail to protect the ecology of rangelands, of public recreational areas and of ocean fisheries, we should re-examine existing private and public property rights. If we decide that our non-renewable resources are being exploited too fast, we should abandon depletion allowances in favour of depletion taxes. And if our measurements of economic progress are perverse, we should re-design them. There is immense scope for institutional reform that would reverse existing private incentives for socially undesirable actions.

In other cases, direct governmental regulations and controls provide a means of preventing adverse effects. Laws prohibiting the use of dangerous chemicals, littering of highways and dumping of untreated sewage are often administratively preferable to contrived economic disincentives.

A means of control which is particularly popular among economists is through fiscal incentives. By levying taxes on the consumption or production of anti-social goods, and subsidizing things that are beneficial, economic behaviour can be manipulated to avoid many adverse spillover effects.

We already use taxes and subsidies to a considerable extent, and there is no doubt that they work. What is important about them (in this context) is not the revenue they produce, nor the penalty or reward they impose on consumers, but the way they induce people to change performance. A heavy tax on the dumping of effluent into waterways or the air will encourage recycling or alternative means of waste disposal (which might warrant a subsidy). A tax on phosphates would encourage the manufacture of less noxious detergents. It is also feasible to tax goods like energy and paper, that in the process of their manufacture cause pollution or other ill effects. This measure would discourage consumers from buying goods that cannot be manufactured without harmful effects, and encourage them to substitute goods that are the product of less damaging processes. At the same time, taxes and subsidies can per-

suaide manufacturers to change their production processes, materials, or degree *at* effluent discharge.

For these reasons economists argue that the development of private and public property rights and the judicious use of taxes and subsidies can do much to overcome the existing sources of environmental deterioration. Such measures already exist, but we have hardly begun to exploit their potential in solving environmental problems. They are much less dramatic solutions than those proposed by the modern advocates of a stationary state. But to make a turn in the right direction is surely more constructive than to confine ourselves to an uncertain ideal which may prove impossible to achieve.

The economy is too often regarded as an independent system impelled by obscure forces beyond human control. In fact, it is shaped by man-made institutions and is propelled entirely by human incentives. Obviously its growth has been imperfect, so that its blessings have been mixed. But its faults should lead us neither to fear its further development nor to attempt to disguise them by simply accelerating growth. Instead, we should systematically correct the sources of failure in our economic processes and institutions so that they will provide mankind with the goods and services—including those of the natural environment—that will best meet his long-run interests.

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#### NOTES

- <sup>1</sup> Many components of the GNP make inferences from it exceedingly difficult. An increase in consumption of travel expenditures, for example, will boost the GNP, but if it is the result of increased commuting because of a flight from ugly cities it could better be interpreted as a worsening of welfare. A similar argument applies to expenditures on pollution control and police services.
- <sup>2</sup> Marshall's stationary state, like Mill's, was a dynamic one in which growth might occur, but the patterns of production and demand were constant and in perfect equilibrium.
- <sup>3</sup> Notably Colin Clark (1957).

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## SESSION C: ECOLOGICAL MULTI-DISCIPLINARY APPROACH TO DEVELOPMENT PLANNING

### Part 2: Discussion

After explaining that the designated chairman, Mr. R. J. Benthem, had unfortunately been taken ill and that the author of the first paper, Dr Ciburowski, was also unable to attend, so that their places had to be taken, respectively, by himself and by Mr Hanno Henke, the Chairman, Mr V. C. Robertson, introduced the remaining author and panelists. He regarded this second part of Session C as aimed at rounding out the subject by taking a look at the importance of social and economic planning, and their more effective integration, which had hitherto tended to be inhibited by time-scale differences.

As Professor Pearse pointed out early in his paper, ecologists and economists have more in common than generally recognized, though he went on to clarify the divergencies in their outlook. Dr. Ciburowski's paper made the point that regions with the highest population growth rate, migration and urbanization are also those with the lowest per capita GNP, often characterized by urban and rural poverty, outmoded social and legal structures, and inefficient managerial skills and machinery. They are also where the most substantial landscape changes are taking place, and include both developed and developing countries. Secondly, it stressed that the city *needs* the country and *vice versa*: strong connecting bridges are vital. In some countries, such as Malaysia, special attention is being given to this by the development of 'urbanized rural areas'.

Presenting Mr Ciburowski's paper, Mr **Hanno Henke** drew attention to the fact that the author also stressed that to stop or slow down the processes of social and economic development would be contrary to human nature and ambitions; it would mean retaining and reinforcing existing injustice and inequality, and the existing distribution of opportunities and conditions of life between different countries and between different social groups of a particular country. The other point emphasized was the value of long-range planned development, aimed no longer at the individual but at society as a whole, which must lead to gradual improvement of living conditions in town and country.

Introducing his paper, Professor **Pearse** began by saying that, exactly like an ecological system, an economy consists of millions of interrelated processes, inputs and outputs, feedbacks, reactions and counter-reactions. Raw materials are drawn from the environment, processed, converted into usable goods and services, consumed and returned to the environment as wastes: according to the law of conservation of matter, the amount of wastes put back into the environment must be equal to the resources taken from it. But unlike natural systems, the economy is entirely a product of human design and sometimes goes wrong. The trend of popular attitudes is towards stressing the adverse effects of the economy on the environment: some believe that economic growth will not make people better off because the side-effects will offset the benefits of more goods and services; others predict that further expansion in global economic inactivity cannot be sustained, because it will destroy the natural base on which the economy depends for its supply of material inputs and the disposal of wastes. It was the purpose of his paper to examine the shortcomings of economic systems that give rise to such fears.

Panel member Dr **J.P.Doets** said that although there are three stages in

planning—the concept, the drawing-board and the implementation—it is in the transition from macro-planning to micro- or regional planning that the public usually comes into the picture and that people must have a say. Dr. Ciborowski's paper highlights not only the need, therefore, to change the attitude of politicians and decision-makers, but also to improve administration, that is to promote concerted action in which those who administer and those who are administered take an equal share.

Also referring to Mr Ciborowski's paper, panel member Professor **Harper** thought it was unfortunate that the aesthetic factor was allotted such a small place in environmental planning. He also felt, while agreeing generally with the argument in favour of the long-term character of comprehensive planning, that it was essential to have the tools for continuously monitoring the physical and social well-being of the human environment so that we could, if necessary, modify the plan at any given point in time. In other words, the environmental planner needs to be an active member of the environmental management force. For this to be possible, a better understanding of the roles of members of that force is essential, which means primarily a common language and new means of communication, extending to citizens directly affected by management decisions. Another point missed in the paper is that settlement and migration patterns are determined not only by manufacturing industries but also by secondary and tertiary industries, witness the new settlements opening up in the Canadian north. He added one comment on Professor Pearse's paper: when considering the application of economic theories to consumptive resources development, account should be taken also of developments that derive their benefits not from the exploitation but from the conservation of resources.

Mr **Tetsumaro Senge**, panel member, said he had only one brief comment to make from the point of view of someone who was not an expert on economics, with special reference to the situation in his own country. In Japan the urban population was expected soon to reach 70% of the total population, an expansion which has caused endless problems—material benefits but also disruption. It had made the basic task of landscape planning, both in the cities and rural communities, to draw up a wise land-use programme. The national development programme of 1968, had been designed primarily to promote industry and tended to ignore environmental conservation problems. These had now been broadly covered by the environmental conservation law of 1972, but there was still much to be done, particularly in the transitional zone of city environs.

The **Chairman**, in opening the papers and panelists' comments to general discussion, said that he would like to make one remark himself. This and the other contributions, which followed, are summarized below.

Referring to Professor Pearse's statement that population is only one of the factors that influence human impact on the environment 'as we can infer from the lack of correlation between population density and environmental degradation around the globe', the lack of correlation can be accepted, but not the inference. Population impact must surely depend on the sensitivity of the environment in any given area—**V.C. Robertson** (Chairman).

I agree, but it does not affect the argument that human density is only one of the factors. Sensitivity of the environment is another one and also, of course, the level of economic activity of the population—**P. H. Pearse** (author of Paper 12).

Mr Ciborowski's comments on migration from rural to urban areas are most

important for us in the developing world; they mean, for example, that much existing planning for Calcutta and Bombay is unsound. A recent World Bank paper on the subject of urbanization stated that maintaining an unemployed person in a rural area is much cheaper than doing so in a city. Surely, then, from the point of view of conserving and improving the human environment, as well as economics, foreign aid programmes should pay greater attention to rural areas. Another point, stressed by Dr Doets in his comments, has been that public participation is desirable. This may be so in a sophisticated community, but in conditions like those of Bombay, where the vast majority are totally uninformed about planning, any attempt to involve them could be disastrous—**Zafar Futehally** (India).

Although I have not seen the World Bank paper referred to by Mr. Futehally, the cost of maintaining someone in a rural area must depend on the standard of living of that area, although perhaps it would be true to say that rural standards, generally, tend to be lower than those of cities, hence of course the migration to the cities—**V.C.Robertson** (Chairman).

Economists are the only people likely to be able to get environmental issues understood by the majority of politicians, regardless of the governmental system concerned, since they can or should be able to give firm figures for factors like pollution damage. They should be constantly encouraged to interest themselves in quantifying such factors—**Peter F.R.Dohrn** (Italy).

Another way of putting this would be to say that economic data are an important means of environmental education in the political sphere—**Richard M. Leonard** (U.S.A.).

Panelist Harper referred to so-called non-consumptive or non-extractive resource use as an economic or profit-making activity. The recreational use of reserves is usually classified under this head, being based on qualitative and experiential values. But in fact it is definitely consumptive and quite capable of threatening the future existence of the areas concerned. With regard to Mr Futehally's point about citizen participation, what we have to realize is that this can only grow out of a delicately guided process of mutual education and enlightenment on the part of both citizens and administrators—**Richard R. Forster** (Canada).

The last speaker refers to the problem of the effects of uncontrolled use in national parks. I believe that it is possible to encourage economic growth in a region in which a park is situated, without allowing it to affect the park. Green belt zones are one method of control which seems to be working well in Canada, for instance around Ottawa, but the key to control lies in land ownership—**W. Douglas Harper** (panel member).

The use of pricing, e.g. high entry fees, as a method of control is regarded as highly discriminatory in Australia and New Zealand. We feel that many parks are already too much designed to cater for more affluent members of society—**P.H.C.Lucas** (New Zealand).

The answer to the last point is that in fact the vast majority of visitors to wilderness parks are not poor but in a high earnings bracket, so pricing usually effects people who can well afford it. Certainly in any scale of social priorities, free national parks for the poor would come very low. Which leads to my final point, namely that what the economist is talking about in the dialogue with the ecologist is, in reality, concerned with redistribution of incomes. Every time you decide to preserve the wilderness as against allowing industrial exploitation you are affecting incomes. The poor may not want the parks, but they may want the jobs—**Peter H.Pearse** (author of Paper 12).



**SESSION D**

**RESOURCE UTILIZATION  
AND CONSERVATION**

**Part 1**

**SESSION D: PART 1**

*Chairman:* Dr M.Batisse (UNESCO): Director, Natural Resources Research Branch, Department of Environmental Sciences, UNESCO, Paris.

*Authors:*

**Paper (13): Partager des ressources qui s'épuisent.**

\*Professor P.Aguesse (France): Directeur, Laboratoire d'Ecologie, Université d'Orléans.

Presented by: Professor Jean Dorst (France): Vice Chairman, IUCN's Survival Service Commission; Deputy Director, Muséum National d'Histoire Naturelle, Paris.

**Paper (14): Industry's Contribution to Conservation**

Prof.Dr Gerhard Olschowy (Federal Republic of Germany): Member, IUCN's Commission on Environmental Planning; Director, Federal Institute for Vegetation Research, Nature Conservation and Landscape Management, Bonn-Bad Godesberg.

*Panel Members:*

- 1 Mr Lars-Erik Esping (Sweden): Member, IUCN's Commission on Education; Head, Nature Conservation Division, The National Swedish Environment Protection Board, Solna.
- 2 Dr Alexander Inozemtsev (USSR): Vice President, Presidium of the Central Board of the All-Russia Society for Nature Conservation, Moscow.
- 3 General Avraham Yoffe (Israel): Director, Nature Reserves Authority, Tel-Aviv.
- 4 Mr E.M.Nicholson (UK): Member, IUCN's International Commission on National Parks; Convener of Section CT of the International Biological Programme, London.

*Rapporteur:* Mr. Robert I. Standish (IUCN).

*Secretariat Member:* Miss Mona Bjorklund (IUCN)

## SESSION D: RESOURCE UTILIZATION AND CONSERVATION

### Part 1: Paper (13)

# Partager des ressources qui s'épuisent

P. AGUESSE

*Directeur, Laboratoire d'Ecologie, Université d'Orléans*

### RESUME

L'utilisation des ressources augmente en conséquence de l'accroissement de la population et de la consommation. Les ressources étant limitées, il est évident qu'une attitude nouvelle à leur égard devra être adoptée si nous voulons éviter la catastrophe. Nous pouvons distinguer trois catégories de ressources limitantes: ressources alimentaires, ressources nécessaires à l'industrie, espace vital.

Les diverses possibilités d'accroître la production alimentaire sont examinées: mise en culture de nouvelles terres, utilisation des ressources alimentaires, production d'aliments synthétiques (à partir du pétrole par ex.), industrialisation des techniques agricoles. Les possibilités d'accroissement à notre portée sont limitées.

Les ressources minérales diminuent rapidement et les réserves de certaines matières de base seront extrêmement réduites dans les prochaines décennies. Les ressources énergétiques sont elles aussi limitées. A côté de ces problèmes, la progression de l'industrialisation accroît la pollution. Dans toute évaluation globale, il convient de tenir compte de la dégradation de l'environnement.

Le développement rapide des sites urbains se produit aux dépens de l'espace rural et nous devons envisager la perspective sinistre d'une immense agglomération urbaine mondiale.

L'analyse de Meadows et de ses collègues du MIT met en évidence la nécessité de parvenir à un équilibre basé essentiellement sur un capital stable, une population stable, des pertes minimums de matière utilisée et produite, et sur des niveaux de capital et de population, et leurs rapports réciproques, qui soient adaptés au système de valeurs de la société. Semblable équilibre ne signifie pas nécessairement stagnation. L'UICN doit s'efforcer de définir des solutions qui favorisent la gestion rationnelle des ressources.

### SUMMARY

Resource utilization is rising because of population increases and higher rates of consumption. It is now clear that with finite resources new approaches are needed if disaster is to be averted. Three limiting groups of resources are distinguished: food resources, resources for industry, and living space.

The potential for increasing food production is examined in relation to opening more land for cultivation, fuller use of food resources, producing synthetic food (e.g. from oil), and industrializing agricultural techniques. Only limited possibilities for increase are available.

Mineral resources are being depleted rapidly and some key elements will be in very short supply in the next few decades. Energy resources are also limited. Apart from these problems intensification of industry is increasing pollution. In any global accounting, environmental degradation must be considered.

The rapid increase of urban settlements is occurring at the expense of rural lands. The grim prospect of one planetary conurbation must be faced.

The analysis of Meadows and his colleagues at MIT indicates the need for reaching equilibrium involving essentially stable capital and stable population, minimum input and output losses, and with capital and population levels and the relationship between them adjusted to the system of values of society. Such an equilibrium need not signify stagnation and IUCN must concern itself with defining solutions that favour the rational management of resources.

### **PARTAGER DES RESSOURCES QUI S'EPUISENT**

Il suffit de lire la presse quotidienne, hebdomadaire ou mensuelle, spécialisée ou non, pour se rendre compte de l'actualité d'un problème qui touche un très vaste public. Les données sont relativement simples, aussi seront-elles rappelées fort brièvement: d'un côté une croissance démographique vertigineuse (la population humaine double en 30 ans au rythme actuel), de l'autre une augmentation des besoins corrélative à l'élévation du niveau de vie, des ressources enfin que l'on avait crues inépuisables et dont beaucoup se révèlent être limitées.

Il serait tentant—mais fastidieux—d'essayer de faire le point pour chacune des ressources exploitées par l'homme et de définir, en prenant pour base les taux de croissance et d'utilisation les plus généralement admis, à quelle date les besoins ne seront plus satisfaits. Il semble cependant préférable d'envisager le problème plus globalement et de la considérer simultanément sous l'angle de la conservation du milieu naturel, de l'écologie et de l'économie.

On peut, en première analyse—mais arbitrairement—diviser les ressources susceptibles de s'épuiser en trois catégories: dans la première figurent celles qui sont nécessaires à l'alimentation de l'humanité, dans la deuxième celles qui sont utilisées pour son activité industrielle, dans la troisième enfin, la plus fondamentale de toutes, l'espace disponible.

L'homme a mis en culture, pour augmenter la production végétale 'naturelle', environ 10% des terres émergées (1428 millions d'hectares sur 13.422 millions d'hectares de terres émergées) et l'on a estimé, jusqu'à une date très récente, qu'il n'était guère possible d'accroître la superficie exploitée. Toutefois, les observations faites lors des survols récents par satellites permettent de penser que 30% des terres pourraient être cultivés, ce qui modifierait considérablement la physionomie de notre planète.

En prenant en compte les seuls 10% actuellement mis en culture (l'Ager), on aboutit à la production par an et par habitant de la planète (1971) de 0, 8 tonne de carbone. Or, les besoins à satisfaire sont de l'ordre de 0, 5 tonne par habitant et par an. Ce qui revient à dire qu'une équitable répartition des ressources alimentaires actuellement produites permettrait de nourrir toute l'humanité. Et pourtant, les trois quarts de la population humaine sont sous-alimentés, ce qui signifie que la répartition de la nourriture est mal faite. Nous sommes ici en présence d'un problème politique de répartition et non d'un problème de production.

Cela ne veut cependant pas dire que l'alimentation de l'humanité ne mérite pas une étude plus approfondie. Il existe en effet de nombreux exemples de

sols rendus stériles par des pratiques culturales inadaptées: aux Indes notamment, l'utilisation d'engrais, en l'absence des micro-organismes susceptibles de les transformer, a dégradé des sols auparavant fertiles. Au Mexique, les cultivateurs dénudent les sols en pente pour produire du maïs, oubliant comment l'érosion avait, antérieurement, anéanti les plus anciennes civilisations mexicaines. En Afrique, l'érosion enlève chaque année (Maroc et Algérie) plus de 50.000 hectares et la mise en culture de savanes arborées tropicales (République du Mali) est à l'origine de l'assèchement de sources jusque-là pérennes.

Or la marge entre la quantité produite et la quantité consommée est faible: au rythme actuel de progression de l'humanité, l'excédent est appelé à disparaître rapidement. Il faut donc prévoir la mise en culture de nouvelles superficies, au risque de détériorer des sols qui produisent des matériaux indispensables à l'activité humaine (bois par exemple) ou de perturber le cycle de l'eau en modifiant l'évapotranspiration au niveau des continents. Or, pour la mise en culture des zones arides ou semi-arides, l'eau sera indispensable: c'est pourquoi les Soviétiques ont projeté de remodeler leur réseau hydrographique afin d'augmenter les quantités d'eau disponibles.

On peut aussi envisager, pour nourrir l'homme de demain, d'exploiter les océans. En 1900, on pêchait environ cinq millions de tonnes de poissons par an; on en pêche 64 millions de tonnes en 1970. On estime que les océans sont susceptibles de fournir un maximum de 150 millions de tonnes par an ce qui ne représente pas une quantité bien importante par habitant de la planète. De plus, des aménagements réalisés sur le continent (assèchement du delta du Mississippi en Amérique, barrage d'Assouan en Egypte) sont à l'origine de diminutions importantes de production de poissons sur le plateau continental.

Il reste alors possible de nourrir l'humanité en fabriquant des aliments synthétiques, notamment à partir du pétrole: malheureusement, les procédés ne sont pas encore pleinement satisfaisants en l'on verra plus loin que les ressources en pétrole ne sont pas illimitées.

Si donc les ressources alimentaires de la planète sont aptes à nourrir plusieurs milliards d'êtres humains, on s'aperçoit en revanche que les dégradations de la biosphère sont susceptibles de modifier cette potentialité et qu'en particulier la pollution des eaux, des sols et de l'air peuvent être à l'origine de la diminution des rendements. Pour les maintenir ou les augmenter, il est indispensable d'industrialiser les cultures ou les élevages, ce que certains ont appelé 'la révolution verte': mais ces pratiques n'auront-elles pas comme conséquence d'épuiser les sols? Et l'homme sera-t-il en mesure d'apporter les engrais nécessaires à ce nouveau type d'industrie?

L'humanité, pour ses besoins industriels, exploite de nombreux minerais et diverses sources d'énergie. On a calculé depuis longtemps déjà d'une part l'augmentation des besoins, d'autre part les quantités disponibles, c'est-à-dire les réserves connues aujourd'hui. On sait, par exemple, que les réserves mondiales en cuivre sont de 192 millions de tonnes et qu'au rythme actuel d'utilisation elles seront épuisées dans 38 ans. On sait aussi que l'humanité aura besoin de 170 millions de tonnes de zinc d'ici à l'an 2000 et que les réserves ne dépassent pas 85 millions de tonnes. On sait encore qu'il en est de même pour le plomb: les besoins sont estimés de 1965 à l'an 2000 à 130 millions de tonnes et les réserves connues sont de 50 millions de tonnes seulement. Certes, la situation n'est pas aussi alarmante dans tous les domaines, mais il faut considérer que l'on a toujours mis en exploitation, pour tous les produits industriels extraits du sol, les gisements les plus accessibles.

Ce qui n'empêche, qu'en 1971, pour obtenir les métaux nécessaires à la fabrication d'une seule automobile, il faut déplacer de 3000 à 4000 tonnes de roches dont une grande partie ne contient aucun minerai. Lorsque l'on exploitera des gisements plus difficiles d'accès, le volume de roches inutiles sera environ doublé. La physionomie de la planète est appelée à se modifier profondément.

On peut assurément penser que la technique de la construction automobile est appelée à évoluer et qu'en particulier la quantité de matières plastiques utilisée aujourd'hui progressera sensiblement: on estime que la quantité de plastique par automobile (actuellement de 7 kg en moyenne) aura décuplé en 1980. Ce n'est, en fait, que déplacer le problème car les matières plastiques proviennent pour une large part du pétrole: les réserves sûres sont estimées à environ 55.000 millions de mètres cube et la consommation mondiale sera, en 1975, d'environ 2000 millions de tonnes. De nouveaux gisements restent à découvrir, notamment en mer: leur exploitation comportera, à coup sûr, un certain nombre de risques et il faudra faire un choix en connaissance de cause.

On peut, en particulier, substituer au pétrole une autre source d'énergie, l'énergie nucléaire, en prévision de la date à laquelle les ressources en pétrole ne pourront plus satisfaire les besoins de l'humanité. Mais c'est alors un autre problème qui se pose, celui de l'évacuation des déchets qui est loin d'être résolu de façon satisfaisante. A l'heure actuelle, les déchets sont en majeure partie stockés en caissons étanches soit dans des mines de sel désaffectées, soit dans des fosses marines. Il est évident qu'avec l'augmentation des besoins énergétiques, la quantité de déchets ira en croissant et l'on se heurtera rapidement au problème de leur élimination. Cette question est d'autant plus préoccupante que la durée de vie des éléments radioactifs rejetés est fort longue, de plusieurs milliers d'années. Il est vraisemblable que la durée de vie des caissons étanches sera très inférieure et que l'on fait peser sur les générations futures une menace importante: nous avons toutes chances de détériorer les ressources naturelles des hommes qui vivront sur la terre dans plusieurs siècles.

Toute l'activité industrielle présente d'ailleurs les mêmes caractéristiques: à une exploitation de plus difficile pour obtenir les matières premières s'ajoute une pollution croissant avec l'augmentation de la production. Autrement dit, une atteinte au milieu et aux ressources naturelles à différents niveaux, atteinte qui n'est pas prise en compte dans la comptabilité nationale ou mondiale: les industriels calculent leurs prix sans faire entrer en ligne de compte l'épuisement des ressources naturelles. Il serait temps d'utiliser une comptabilité globale, ou écologique, intégrant dans le prix de revient tous les facteurs en cause. La progression du Produit National Brut devrait être calculée en tenant compte de la dégradation de toutes les ressources naturelles.

Reste enfin à envisager la diminution de l'espace disponible. Elle est liée à différents facteurs qui sont tous plus ou moins directement associés à l'accroissement de la population humaine et à l'élévation du niveau de vie. La consommation d'espace par l'urbanisation est évidente: il faut loger plus d'habitants dans les villes parce que la population augmente et parce que le pourcentage de citadins va en croissant régulièrement. Aux Etats-Unis, en 1900, les citadins représentaient 40% de la population, ils en représentent 75% en 1970. On estime qu'en France, en l'an 2000, plus de 80% des habitants vivront dans les villes. Les campagnes devraient donc se dépeupler et 'l'espace rural' rester naturel: toutefois, l'élévation du niveau de vie permet à des classes privilégiées d'acquérir des résidences secondaires et de coloniser, au moins temporairement, l'espace rural. Le nombre des 'privilégiés'

va sans cesse croissant et l'on a calculé que le jour où chaque famille aurait construit une résidence secondaire, la France ne serait plus qu'un immense lotissement.

Ce vaste lotissement comporte obligatoirement une voirie importante pour assurer sa desserte: la superficie d'espace rural ainsi absorbée prend des proportions gigantesques dans de nombreux pays à niveau de vie élevé. On a pu estimer qu'aux Etats-Unis, ce sont plusieurs dizaines d'hectares qui sont transformées, chaque jour, en autoroutes, aéroports ou parkings. La quantité, en Europe, semble moindre mais n'a pas fait, à notre connaissance, l'objet d'estimations précises.

Quoiqu'il en soit, certains urbanistes prédisent pour l'avenir l'existence d'une 'ville planétaire unique' appelée Oecumenopolis, au sein de laquelle subsisteraient quelques lambeaux de nature: quelles seront alors les ressources 'naturelles' qui ne seront pas épuisées? Ou plutôt quelles seront celles qui resteront accessibles pour satisfaire aux besoins de l'humanité?

Le problème de la place occupée par l'homme au sein de la biosphère est évidemment préoccupant. On peut difficilement concevoir que l'homme puisse exploiter des ressources naturelles qui, dans l'état actuel des choses, sont indispensables à l'amélioration de ses conditions d'existence et, dans le même temps, dévorer l'espace en y implantant ses habitations, ses industries, ses moyens de transport, etc. Il est évident qu'à la cadence actuelle la collision ne tardera pas à survenir et qu'elle existe déjà dans les zones sub-urbaines: nombreuses sont les terres de première qualité, utilisées antérieurement pour les cultures maraichères, qui ont disparu sous les cubes de béton des Z.U.P., z.a.D. ou autres zones industrielles.

C'est pourquoi d'éminents savants sont désormais à la recherche d'un état d'équilibre et que le Professeur Meadows et son équipe affirment que la croissance doit cesser. Mais ces chercheurs sont persuadés que l'état d'équilibre ne peut être atteint dans de profonds bouleversements de nos systèmes économiques et sociaux actuels.

Il ne faudrait cependant pas s'y tromper: Meadows et ses collaborateurs du Massachusetts Institute of Technology ne préconisent pas un arrêt pur et simple de l'expansion économique. Ils pensent que l'état d'équilibre global est caractérisé par une population et un capital essentiellement stables et que le niveau de la stabilité doit être défini car il peut être bas ou élevé. Il s'agit d'un choix qui doit être effectué en fonction du temps: on se rend compte en effet qu'en raisonnant à court terme, on peut aisément maintenir la population et le capital à n'importe quel niveau. Par contre, en considérant une période plus longue, par exemple l'espérance de vie d'un homme—tout homme ne souhaite-t-il pas laisser à sa descendance des conditions d'existence au minimum égales à celles qu'il a connues?—le choix est beaucoup plus réduit: taux et niveaux doivent être ajustés de sorte qu'au cours de la période considérée, les investissements ne soient pas freinés par une pénurie des ressources naturelles et que la population ne soit pas brutalement diminuée par la faiblesse de la ration alimentaire ou par la pollution.

Pour aboutir à l'état d'équilibre à long terme, Meadows propose trois conditions minimales: la première est que le capital et la population restent à un niveau constant: la deuxième est que les taux d'entrée (natalité—investissement) et de sortie (mortalité—dépréciation) soient maintenus à leur minimum. La dernière enfin est énoncée de la manière suivante: les niveaux de la population et du capital et la relation entre ces deux niveaux doivent être compatibles avec le système de valeurs de la société. Les niveaux peuvent être

révisés et ajustés chaque fois qu'un progrès de la technologie ouvre de nouveaux horizons.

Un tel équilibre, contrairement à ce qui a été affirmé en Europe, ne signifie en aucun cas une stagnation économique. Certes, nous ne sommes encore en présence que d'un modèle expérimental dont nous mesurons assez mal les conséquences sur notre vie quotidienne. Il paraît néanmoins incontestable que l'Union Internationale pour la Conservation de la Nature doit participer activement à la définition d'une politique susceptible de favoriser une gestion rationnelle des ressources naturelles qui tendent à s'épuiser dans le système actuel.

## SESSION D: RESOURCE UTILIZATION AND CONSERVATION

### Part 1: Paper (14)

# Industry's Contribution to Conservation<sup>1</sup>

GERHARD OLSCHOWY

*Member, IUCN Commission on Environmental Planning: Director, Federal Institute for Vegetation Research, Nature Conservation and Landscape Management, Bonn-Bad Godesberg*

### SUMMARY

Mistakes made during the creation of industrial areas in the middle of the last century should not be repeated in the present neo-technical age. In the past, availability of resources, energy, transportation possibilities and manpower determined site selection, while today environmental protection is an important additional factor.

The degree of pressure upon the natural environment by industry and technology makes conversion to new products necessary. A technology has to be developed which is not antagonistic to the environment. Also, the necessary biological-ecological measures must be undertaken, and site selection and planning carried out with greater care.

The quantitative expansion of the economy must be changed to qualitative growth. Changes must also be made in consumer-oriented production and recycling of materials (achieved, for example, by the development of re-usable synthetics and of biocides which do not harm the environment and rapidly degrade, or by the manufacture of engines which use lead-free petrol and ensure its complete combustion). Many industrial plants already use devices which effectively filter out dust, but, in the future, such devices must also be made obligatory for removing exhaust gases. Coal and oil, rich in sulphur, are being increasingly replaced by fuels which are harmless to the environment. In future, also, sewage must be biologically purified, atomic power plants must convert their water cooling systems to air cooling, and industrial plants must use water recycling in order to make smaller demands on water supplies and reduce wasteful outflow.

Biological-ecological measures can include the planting of barriers and shelter belts to check fumes and noise; reclamation of opencast mining areas; integration of factories and their waste dumps into the landscape; and the biological stabilization of riverbanks.

Correct site selection for industrial areas and also for industrial plants is the best prescription for environmental protection. Residential and recreation areas should never be exposed to pollution. Waterfronts must be kept free from building. Valuable soil must not be destroyed. Ideas, aims and

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<sup>1</sup> Translation by Mr Hanno Henke of the Federal Institute for Vegetation Research, Nature Conservation and Landscape Management, Bonn, Federal Republic of Germany.

measures pertaining to landscape management of industrial areas must all be consolidated into the landscape plan.

## **RESUME**

Les erreurs commises lors de la création de zones industrielles vers le milieu du siècle dernier ne doivent pas être renouvelées à l'âge néotechnique dans lequel nous vivons. Dans le passé, la disponibilité des ressources, de l'énergie, de possibilités de transport et de main d'oeuvre déterminaient seuls le choix d'un site, alors qu'aujourd'hui intervient un facteur supplémentaire de poids, celui de la protection de l'environnement.

Le degré de pression exercé sur le milieu naturel par l'industrie et la technique exige de se tourner vers de nouveaux produits. Il faut développer une technologie qui ne soit pas antagonique à l'environnement. Les mesures biologiques et écologiques nécessaires doivent en outre être prises, tandis que la sélection et l'aménagement des sites seront entrepris avec plus de soin.

L'expansion quantitative de l'économie doit être transformée en une croissance qualitative. Des changements doivent aussi être apportés à une production axée sur la consommation et le recyclage des matières sera assuré, par exemple, par l'élaboration de produits synthétiques réutilisables et de biocides à dégradation rapide et sans danger pour l'environnement, ou par la fabrication de moteurs fonctionnant avec de l'essence sans plomb. Nombre d'usines emploient déjà des installations qui filtrent les poussières, mais à l'avenir ce type d'équipement doit devenir obligatoire pour le filtrage des gaz d'échappement. Le charbon et le pétrole, tous deux riches en soufre, sont progressivement remplacés par des combustibles moins nocifs pour l'environnement. Les eaux usées devront aussi à l'avenir être purifiées par des procédés biologiques. Les centrales atomiques convertiront leur système de refroidissement par eau en un refroidissement par air et les usines devront assurer le recyclage des eaux qu'elles utilisent afin de réduire leur consommation d'eau et la gaspillage des eaux d'écoulement.

Les mesures biogéocologiques peuvent notamment inclure la plantation de rideaux d'arbres et de brise-vents pour retenir les fumées et arrêter le bruit, la restauration des exploitations minières à ciel ouvert, l'intégration des usines et de ses crassiers dans le paysage et la stabilisation biologique des rives de cours d'eau.

Le meilleur moyen d'assurer la protection de l'environnement est de sélectionner correctement les sites où seront implantées les zones industrielles et les usines. Les zones résidentielles et récréatives ne devraient jamais être exposées aux pollutions. Les constructions doivent être interdites sur les bords de rivières, de lacs et de mer; les couches de sol fertile ne doivent pas être gaspillées. Enfin les idées, objectifs et mesures intéressant l'aménagement du paysage de zone industrielles doivent être intégrés dans le plan d'aménagement du paysage.

## **INDUSTRY'S CONTRIBUTION TO CONSERVATION**

In an industrial age, industrial complexes are a reality with which ever planner must cope. We should learn from past mistakes. Developments, during the first large industrialization in the second half of the last century in many industrial areas of the world, took place without regard for human beings and the landscape and without detailed and regional planning, and they should never be allowed to recur. Their adverse results should serve as a warning, and

are illustrated by the many unhappy examples in Europe wherever coal is mined and ore is processed.

The second industrial revolution, characterized by two important technological and scientific innovations—automation and atomic energy—had its beginning during the second world war but has gone much further since that time. During the first industrial revolution, industrial areas developed, whereas today whole countries may become industrialized. In the past, industrial production, the construction of industrial plants and site selection were determined by the location of resources, transportation possibilities, energy resources and available manpower. In future, however, environmental protection will become an additional factor of equal if not greater importance. The protection of human beings against harmful and harassing emissions of smoke, gas and dust and the protection of residential and recreation areas should henceforth be placed in the foreground of interest.

Harmful effects on the water balance as well as on flora and fauna are other factors which can be eliminated by products and technology which, by means or with the aid of biological-ecological measures and preventative measures based on correct site selection, avoid damage to the environment.

### **Conversion of production processes**

An essential contribution to the protection of the natural environment could be achieved by conversion to products and production processes, which are not antagonistic to the environment. This conversion requires a revision of attitudes on the part of the population and those who formulate the economy. The attitude of maximizing profit has to be replaced by a responsible attitude toward human beings and the environment. Also, a qualitative rather than a quantitative approach must be pursued. In addition, consumer-oriented production must be modified in the light of the ever increasing problem of waste disposal. Recyclable materials must be produced so that the need for waste dumps can diminish.

It can be demonstrated by a few examples that conversion to products that do no harm to the environment is both necessary and possible. The percentage of synthetics used in packaging material has increased tremendously. In the Federal Republic of Germany, the value of the packaging material manufactured was already 13 milliard or 210 Deutschmarks per person in 1970. This relates especially to materials made from polyvinylchloride, PVC, which reached 21 percent of the world synthetic production in 1970. PVC manufacture has chlorine as a byproduct, which can be used again. When PVC-synthetics are incinerated, 55 percent of hydrogen chloride is released. This gas is harmful to human beings and vegetation and it corrodes buildings and vehicles. However, today, industry is already capable of producing synthetics which are less harmful when incinerated and which are biodegradable when dumped. In Canada, Great Britain and Sweden experiments are being carried out on synthetics which degrade under the influences of ultra violet sunlight within a certain period of time. Chemical additives in synthetics could indicate by coloration the beginning of degradation. In this way damage to synthetic packaging material during storage could be detected and eliminated at an early stage.

A major portion of air pollution is due to automobile emissions: for example, 80 percent in Los Angeles and 40 percent in the Federal Republic of Germany. The cause lies in high emission of carbon monoxide (CO), hydrocarbons (C<sub>n</sub>H<sub>n</sub>) and lead. In the Federal Republic of Germany the lead content in petrol was limited to 0.4 g/l with effect from 1 January 1972, and will be limited to 0.15

g/l in 1976. In the United States, the latter figure is already required today and industry is already producing lead-free petrol. In order to eliminate air pollution caused by automobile emissions, industry must develop engines which ensure complete combustion of petrol.

In Germany, recent legislation, sponsored by the Federal Government, compels the detergent industry to replace so-called 'hard detergents', which remain in suspension and tend to dissolve substances in water, with 'soft detergents'. These soft detergents are more than 82 percent degradable by micro-organisms. Industry should strive to develop detergents which are phosphate-free, because water bodies become excessively enriched through the introduction of phosphates.

The pressures placed upon soil and water resources by pesticides or persistent biocides (insecticides, fungicides, herbicides) and the harm they do to animals and human beings, became known worldwide through studies of the effects of DDT. Adverse effects relate, in particular, to insecticides which have a chlorinated hydrocarbon base and maintain high persistency. But, in addition, the latest studies have shown that herbicides used as weed-killers, although hardly harmful to soil and water, can cause gonad damage in humans capable of being transmitted to future generations. The task of the chemical industry, therefore, is to develop and produce pesticides which are rapidly degradable in water and soil and which can be proved to be harmless to plants, animals and human beings. Perhaps, also, agriculture and forestry should revise their principle of complete elimination of harmful animals and plants. This could do much to prevent unforeseeable disturbances to the natural balance of the landscape.

### **Technological measures**

The manifold stresses in the environment can be corrected in as equally many ways. They can be of a preventative type, such as regional planning measures and scientific contributions, or of a technological type, such as sewage, filter or incinerator installations, or of a biological-ecological type, such as measures for nature conservation, landscape management, and green open space planning. Protection, management and development of the natural environment can only be fully effective when, in addition to necessary technological measures for air and water purification, noise elimination and waste disposal, the development of the entire ecosystem with its biological-ecological relationship can equally be considered.

Environmental protection nowadays has the right to demand development of a new technology which is not antagonistic to the environment. This would include, for example, the conversion of mechanical dust filters to electronic filter devices. The use of such devices in the Rhineland Brown Coal Area, in new electrical plants, could eliminate 99.7 percent of the dust emission. Other examples are the replacement of mechanically operated sewage plants by fully biological sewage plants, the conversion from coal and oil fuels rich in sulphur to fuel and energy sources low in sulphur, and replacement of water-cooled thermal and atomic power plants by those which are air-cooled.

During recent years, many companies, particularly those of the chemical, electrical power and metal industries, have sought to eliminate the adverse effects of fumes and dust upon human beings and the environment, by installing chimneys, in some instances over 200 m in height. For the immediate vicinity this is indeed a recognizable advantage. However, for the atmosphere as a whole, it makes no difference because emissions are not reduced but merely

dispersed more widely. However, in inversion weather conditions, when interchange between atmospheric layers in a low pressure area does not take place, high chimneys can be advantageous in preventing smog, if they project above the lower layers.

The desire of power companies to put some limits on the use of river water for cooling purposes is ecologically sound. However, restrictions that are only partial will still result in a raising of water temperature and, therefore, changes in a river's biological regime. At the present time, insufficient studies are available to demonstrate the precise effects on aquatic life. It can be anticipated, however, that breeding patterns of fish will change and that valuable species will decrease or even become extinct. Trout, for example, cannot withstand temperatures higher than 27°C. In addition, due to the warmer temperature, bacteria and algae will increase, whereby oxygen content will be lowered and the biological self-purification process in rivers made less effective. It is for this reason that water-cooled power plants need additional cooling towers which can be operated when the water level of a river is low or its water temperature reaches a prescribed maximum. Increased construction of atomic power plants will necessitate conversion to air cooling.

The growing demand for water, which in the Federal Republic of Germany is likely to double for industrial and triple for domestic use by the year 2000, requires new methods of water distribution. Ground and spring water must be reserved for drinking purposes. But, since most surface waters, especially in densely populated industrial countries, are heavily polluted by sewage, industry will have to convert to the use, in general, of recycled water. This is already being done by many companies in the metal industry. Re-cycling means that water used for production or cooling is purified or cooled and re-used in plant operated by the user company itself. It has the effect of conserving ground and surface water and reducing wasteful outflow.

Experience has shown that the conversion of industry to production processes and technology, which are not antagonistic to the environment and which are very often subject to legal enforcement, has eventually resulted in economic advantages despite high installation costs. Thus, by installing modern filter devices in cement plants, 99 percent of the cement dust can be extracted and sold, covering the cost of installation within a few years. Again, in smelting plants, large quantities of metal dust can be utilized in the same manner. For example, one large chemical plant which collected and re-used all the solubles which had normally been thrown away, made a resulting profit of 3.5 million Deutschmarks. Refineries and petro-chemical plants can re-use combustible exhaust gases instead of burning them.

### **Biological-ecological measures**

Biological-ecological measures are a necessary supplement to technological measures for the protection, management and development of the natural environment. They can include the satisfactory integration of an industrial plant into the landscape, meaning not only visual integration but also comprehensive integration into the natural environment. Comprehensive integration, in turn, includes correct local site selection, determined by topography and the pattern of the landscape, and general ecological treatment of the landscape. In the latter category comes water and air cleanliness; orderly waste disposal; protection of valuable landscape elements; and preservation of flora and fauna. Good building design of industrial plants is essential for visual and acoustic screening.

The best prescription for integrating industrial plants into the landscape lies in subordination, seclusion, and ensuring that they are so located as not to dominate the landscape. For example, a correct location would be the mountain foot or the side of a valley, rather than the mountain top or the centre of the valley. Again, the borders or margins of forests and waters, which are of special value as ecological seams and as recreation zones, should not as a rule be built upon nor their continuity allowed to be interrupted. Enough examples are available to show that there is no need to site industries and ports directly on riverfronts, and that it can be avoided by building ports, off-loading and distribution centres, and industrial plants behind broad belts of meadow or woodland vegetation. Construction of dead-end branch canals is another way of keeping riverbanks from being built on. Shelter-belts should also be used generally to integrate, screen and divide industrial plants from surrounding areas, especially those set aside for residential purposes and recreation, from fruit-growing and horticultural areas, and from forest plantations at their early sensitive stages. The width of each shelter-belt will vary with local conditions.

Technical means of purifying water and air must be supplemented by biological measures. With the help of biological features incorporated in the construction of riverbanks, natural self-purification will be promoted. Exhaust gases from industrial plants can be better dispersed and coarse dust filtered by tall shelter-belts, thereby creating zones of lower pollution. The leaf canopy of trees serves directly to filter dust-laden air, the coarser dust in particular being deposited. Rain, in turn, washes this dust onto the ground. Another aim may be to free from dust areas in the lee of a screen. The shelter-belt principle applies, namely that while part of the wind penetrates the screen, the part containing fine dust particles passes over it. The wind which penetrates the obstacle is filtered, so that a relatively dust free area occurs on the lee side. Similar screens or shelter-belts can be planted to protect residential and recreation areas from annoying industrial and traffic noises.

Industrial waste must be deposited in orderly dumps. The dumps should conform to the landscape and their margins should be planted and gently sloped. As far as possible, waste should be composted and the compost used for soil improvement in agricultural, green space and recreation areas, in the way that has been practised in such an exemplary manner in the Netherlands.

A model of just how responsible industry can be in regard to the natural environment, and which serves as an example for the future, is the Rhineland Brown Coal Area. This involves the biggest European opencast brown coal mining operations. The coal is mined over an area of 1500 km<sup>2</sup>, with large scale modern technical equipment. The pits are 1000-2000 ha in extent and up to 250 m in depth. The spoil heaps are over 100 m in height and up to 270 million m<sup>3</sup> in volume. The mining company has had the necessary scientific studies done for the purposes of reclamation and landscape planning. In addition, it has had landscape plans for the opencast pits drawn up which will ensure a reclaimed cultural landscape. Many exemplary measures have been undertaken, not only on a legal but also on a voluntary basis, to re-establish a natural environment containing ecological diversity. By the end of 1970, about 3400 ha of agricultural and about 4500 ha of forest land had been rehabilitated; many spoil heaps had been integrated with the landscape; some 39 lakes and ponds constructed and made available for fishing, ornithology and swimming; ecologically valuable areas created, which have been placed under nature protection; and large scale popular recreation areas provided. In short, in the Rhineland Brown Coal Area, a new cultural landscape is being built, in which the re-

quirements of agriculture, the economy, recreation and nature are given equal consideration, despite their seemingly contradictory character. This is a good example of how technology, economics and nature conservation do not need to be in opposition but, rather, can reach a sensible balance.

### **Site selection and planning**

The right selection of sites for industrial development constitutes the most effective measure, in the preventative category, for protection of the environment. Sites for industrial areas and even for large individual plants must be selected at a higher than regional level. It is the task of national planning to determine suitable areas for new industries while harmonizing all interests. At the present time, there are three trends in the establishment of industry: first, further concentration along the coast in seaport areas; second, concentration along inland navigable waterways; third, occupation by industrial and commercial firms of areas which have been, until now, free of industry. The first two trends stem from favourable transportation possibilities, while the last one is due to the release of available manpower from agriculture. All three contain several dangers from the point of view of the cultural landscape. Thus inland waterways, with their valley landscapes, are very valuable areas. They play an important role in the ecology of the landscape and have a special use for recreation. The steady advance of buildings along rivers therefore involves a danger that the ecologically valuable waterfronts of our rivers and lakes, with their natural vegetation, will be irreplaceably lost. Keeping waterways of all kinds free from building is a proven, fundamental principle, which should be borne in mind in all future planning. It is inherent to recreation areas and nature parks that they should be undisturbed by detrimental industrial influences. In the age of technology, automation and leisure, it is more than ever necessary to protect certain landscapes, and green open spaces from further pressures and maintain their recreational purpose.

Whenever new industries are established in the countryside, damage to agriculture and forestry by industrial emissions must be prevented. The industries concerned must, therefore, either be required to use production processes which cause no disturbances or they must be equipped with technical devices which prevent damage to useful plants and animals. The best solution in this case lies in the creation of new towns. On the one hand, the new concentration of residential areas in these towns enables industry and commercial firms to be set up. On the other hand, through this concentration, the open landscape can be preserved from further building pressures. Another aspect of the problem is controlling the alienation of land for industrial purposes. It should be a fundamental principle of national planning to protect the best soils from unnecessary building and set them aside as agricultural priority areas. This rule should only be departed from in exceptional cases.

The choice of suitable industrial sites should indeed be based on clear principles, which would include, for example, the fact that industrial plants, with their fumes or other emissions, must always be kept separated from other areas. Here landscape planning has an important task. In general, in the Federal Republic of Germany, winds are from the west to southwest. Therefore, industries and their emissions are best located on the east and northeast fringe of an area under consideration, while sensitive or protective installations, such as hospitals, nurseries, nursing homes, recreation areas, orchards, horticultural enterprises, both open air and greenhouse, etc., are best located on the western fringes of a town.

Effective separation of industrial areas from residential, agricultural and recreation areas, can best be achieved by forest, forest strips and broad green zones. These not only give protection against pollution, but also have a psychological value as a visual barrier, blocking out the view of the source of the disturbing emissions.

The various ideas, aims and suggestions for implementing the principles of landscape management and green open space planning for industrial areas, are consolidated in a *landscape plan*. The plan must indicate how industry is to be placed in relation to residential, recreation and other protective areas. The details of the plan should cover the results of studies of the natural environment and any necessary protective, preventative and creative measures. The plan should, for example, show all existing forests, plantations, shelter-belts, groups of trees and even solitary trees of importance; recreation facilities; damage to the landscape that has already taken place, etc.; and it should indicate clearly which resources must be preserved in the interests of landscape management and green open space planning in the general area of the industrial development.

The value of the landscape plan depends particularly on precise planning and development proposals. The measures needed to protect and improve areas damaged by industry, have to be specified, such as the planting of forest strips and shelter-belts. In addition, all the necessary green spaces both inside and outside the boundaries of industrial installations have to be incorporated in the plan, which will also cover the design of plantings of the most natural possible vegetation along roads and paths, around the squares, on the banks of still or flowing waters, and on slopes or the sites of derelict pits, dumps and spoil heaps. The reclamation and planting of such derelict sites in industrial areas is an essential concern of landscape and green open space planning.

## **Conclusion**

The necessary measures for protection, management and development of the natural environment require considerable financial resources. It is therefore essential that the economy in general, governments and individuals, should contribute towards the expenses involved. In many countries the possibility of introducing a special environmental tax is under discussion. Increasing support is also being given to the view that the 'causer principle' should be applied. This means that it is primarily whoever causes the environmental damage should pay for it. The application of this principle would surely make the less responsible industrial enterprises introduce such products and technology as would not tend to harm the environment. However, for the reason that in large industrial complexes the actual causer of damage often cannot be accurately determined, the principle of joint liability would need to be invoked.

Finally, the responsibility of both government and industry for promoting environmental research needs emphasis, because, in some fields, research is badly lacking. This is especially true for the ecological studies of landscapes on which planning must be based. Many more research institutes have to be equipped for their new tasks in this field, if they are to be enabled to make a contribution to the creation and maintenance of the healthy natural environment so fundamental to the life of human beings now and in the future.

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## SESSION D: RESOURCE UTILIZATION AND CONSERVATION

## Part 1: Discussion

Having introduced the authors and panelists, in particular Professor Dorst who was kindly representing Professor Aguesse in the latter's absence, the Chairman, **Mr M. Batisse**, remarked by way of introduction to the new Session, on the varying interpretation of notions of 'resources': a flexible and dynamic concept is essential, both because a global approach is very difficult and because forecasts often turn out to be wrong (having ignored technological advances and socio-economic feedbacks). The currently popular principle of 'only one earth' must not be allowed to obscure the wide diversity of resource problems.

Présentant le rapport de M Aguesse, M. le professeur **Jean Dorst** signale les 3 points suivants: (a) l'exploitation des mers: l'impact de l'homme se traduit déjà par une surexploitation des ressources renouvelables et des pollutions ayant atteint un stade global. Demain l'homme pourra aussi manipuler les écosystèmes marins et tenter de les modifier à son profit exclusif. Les essais d'aquaculture sont encore très modestes mais iront en s'amplifiant. Notre technologie permettra une véritable 'révolution marine', qui se traduira nécessairement par une simplification des écosystèmes océaniques, *ipso facto* rendus plus fragiles et soumis à des perturbations à l'échelle de la biosphère. (b) Ressources minières disponibles: il convient d'insister sur le caractère relatif des renseignements statistiques. Les données actuelles sont sujets de controverse et sont sans cesse modifiées par les résultats des prospections en cours, aussi bien quant aux volumes des minéraux que quant à la répartition des gisements. La prospective est donc très aléatoire. (c) Le rapport de Meadows et de ses collègues du MIT: il convient d'attirer l'attention sur les dangers de toute prospective du type de celle de cet essai, qui présente certes un grand intérêt, en représentant la première tentative globale de futurologie dans le domaine des rapports de l'homme et de son environnement. Mais il ne tient pas compte de certains éléments fondamentaux et repose sur plusieurs hypothèses actuellement invérifiables. Il faut donc le considérer comme un outil de travail et non pas comme une série de pronostics dont la fiabilité serait suffisante pour orienter nos politiques. Il n'en reste pas moins vrai que l'opposition qui existe entre un développement exponentiel et le fait que nous vivons dans un monde fini, aux ressources limitées, doit guider nos activités actuelles et leur projection dans le futur. Revenant sur le mot 'partager' qui figure dans le titre du rapport de M. Aguesse, en définitive ce n'est que par un partage équitable des ressources que l'on assurera un développement véritable de l'humanité et que l'on évitera une dilapidation stérile de ses richesses.

Introducing his paper, Professor **Olschowy** said that its main points were set out in the Summary, but he would pick out the following for special emphasis. Basically, environmental protection is concerned with conversion to technologies and products which are not detrimental or antagonistic to the environment. This requires a change of attitude both in people and in the economy. Responsibility towards human beings and their living space must replace the maximization of profits and economic expansion must be changed to economic growth. An important point is that this process of conversion, which may often in the first instance have to be legally enforced, has been shown by experience to result eventually in economic advantages despite the high cost of installa-

tion. The key to success in the integration of industry into the landscape is to be found in meeting ecological requirements, including water and air cleanliness, orderly waste disposal, and the protection of valuable landscape elements, flora and fauna. In an age of technology, automation and greater leisure, such protection is more necessary than ever, if landscape and open spaces are to retain their recreational values. It can best be assured by a comprehensive landscape plan, and this in turn will depend in future on a progressive legal basis, sufficient financial backing, the application of the 'causer principle' to the remedy of damage, and better provision for research.

Taking up the last point, panel member Mr **Esping** attached special importance to the principle that although industries and exploiting interests can and must solve the environmental problems they are creating, society must retain control, especially in such matters as the location of industry, preferably through a body vested with full responsibility for National Physical Planning. Thus, there is a tendency in Sweden and elsewhere too (Dr Olschowy explains some of the reasons), for the more undisturbed and undeveloped sites to be preferred by those wishing to establish new industries; they often include the most valuable remaining areas of coastlines, lake-shores and riverbanks. Unless these are to be progressively destroyed, National Physical Planning at a central government level is the only effective safeguard: its task will be to investigate the claims of various activities on land and water resources, and the assets available to satisfy demands, and to draw up guidelines for the management of these resources. For this purpose, it is fundamental that there should be a complete inventory of physical and natural conditions, covering scientifically important biotopes, their fauna and flora, recreational needs, etc., the broad objective being to guarantee for everyone the kind of environment that can alone ensure a high standard of living and, at the same time, to maintain the freedom of action of future generations in the use of resources.

Panel member Dr **Inozemtsev** said that he took an optimistic rather than pessimistic view of the conservation of natural resources and did not believe that agricultural or industrial development and even urbanization are necessarily inseparable from catastrophic deterioration of the natural environment. The essential thing is to identify the basic problem involved in any exploitation of natural resources in order to decide how to solve it. For this purpose the integrity of nature must be fully recognized, so that knowledge of natural laws and interrelationships can provide the most appropriate and promising way to achieving scientifically-based conservation. In this context, he attached great importance to the activities of voluntary conservation organizations and to greater support and encouragement of them by IUCN: the interest of the general public in the environment and in careful and rational use of resources is important for obtaining solutions. He would have liked to have given details of the All Russian Society for Conservation of Nature, which now has some 20 million members, ranging from schoolchildren to ministers, and has gained considerable experience in this field, but in view of the shortage of time, must content himself with making available to anyone interested a booklet in Russian and English, describing the Society's activities and role.

Panel member General **Yoffe** said that he would make a few general comments, without particular reference to the two papers. He had felt that there had been too much emphasis up to this point on the activities of economists and politicians rather than on the topic of nature conservation, which was after all the reason for the presence of the majority of those attending the meeting. There was also too much fatalism or tendency to say that nothing could be done before development takes place and that IUCN's only task was to try to

rectify the results. This was wrong both from the point of view of conservation and also economically, since the intervention of conservation organizations, when people are planning to undertake development projects without consulting environment experts, has often succeeded in preventing the waste of money. We should not be too impressed by the attempts of pressure groups, including governments, to spread the idea that all development is for the good of the people: where it has been stopped by conservationists because of potential harm to landscape, beauty, wildlife and other values, nobody has suffered except perhaps a few prospective shareholders. To quote an example from Israel, a certain Mediterranean beach had a high quality sand, suitable for building, but its exploitation was objectionable both because of the threat to the beach as a recreation area and also as a breeding place for the green turtle. The developers said that if excavation was stopped, building could not continue, but it *was* stopped and it can be definitely stated, five years later, that not one building project had to be abandoned for that reason. So, we should fight the tendency to compromise with so-called decision-makers and, as we are a small group and no one else will do the job, unless we do, concentrate our forces and direct them towards one objective, the conservation of nature.

Winding up the preliminary comments of the panel, Mr **Max Nicholson** said that the two thoughtful and well-informed papers were an indication of the notable recent advance in the synthesis of global problems of resource conservation and utilization. We were perhaps reaching the stage where the rate of expansion of these problems is no longer outrunning the growth of our understanding of them. With regard to Professor Aguesse's paper he would particularly support two of Professor Dorst's introductory comments. A cautious attitude towards estimates of mineral resources was supported by the conclusions of a Commission on Mining and Environment of which he had been a member and of which the investigations, due to be published that day (13 September), had shown the hazards of simplistic, purely arithmetical treatment of such forecasts. Similarly, he agreed with the view that the Club of Rome forecasts by Meadows and his colleagues should be treated as stimulating but not inspired prophecies. He also strongly supported Professor Olschowy in believing that adjustment of industrial processes in the interests of the environment does not necessarily add to costs and may even reduce them. 300 years ago early conservation laws in England prohibited ironmasters from exploiting for fuel the more accessible forests of the Midlands and South-east. One ironmaster, Abraham Derby, was so irritated by these restrictions that he overcame the technical difficulties of replacing wood by coal, which led in turn to the invention of steel and the Industrial Revolution—a good example of conservation laws getting industry to think again about the best way of doing its job!

With regard to the location of industry, there has been a recent case at Fawley on Southampton Water, where one of the largest oil refineries in Europe and also a first class electrical power generating station have been sited behind some interesting salt marshes adjoining the New Forest, among the finest large semi-natural areas in England. Detailed biological monitoring has shown that the fauna and flora are still very nearly identical with what could be expected if the installations had been built elsewhere. It would be desirable if the Rhineland Brown Coal Area experience, referred to by Prof. Olschowy, and similarly successful examples elsewhere, could be described and publicized in one of the further books which Dr Dasmann hopes will be issued by IUCN, as showing how harmonization between industry and the environment can be achieved.

The **Chairman** remarked that there were unfortunately only a few minutes left for comments from the floor. The following were the main points made.

The problem is seldom an all or nothing conflict between economic production and environmental quality, but nearly always of finding and establishing the optimum trade-off. Prescribing general levels of abatement or standard techniques is dangerous and should be avoided, since it seldom leads to a satisfactory equilibrium and lacks proper incentives. The root cause of most industrial pollution is that industry regards water and air as free, and only worth something if their level or quality deteriorates. The best hope of improvement lies in the incorporation of the cost into the price, thus giving the producer an incentive to operate within the scope of an environmental optimum—**P.H.Pearse** (Canada).

M. Aguesse's paper does not cover the problem of distribution, the facts that two-thirds of the resources are in the 'Third World' and two-thirds of the consumption of resources is in the developed world. Solutions to this must naturally be socio-economic and political—**Baba Dioum** (Sénégal).

When Prof. Olschowy advocates that the selection of sites for industrial areas or individual plants should be made at a higher than regional level, it is not clear whether there would be a choice of sites offered. New industries seek sites as close as possible to a labour source, the market and convenient communications. Incentives such as tax concessions, transport subsidies, land at cut prices, may well be required to persuade industry to accept a location governed by environmental and social considerations, though the latter might seem obviously desirable to non-industrial interests. This raises the general question whether that kind of approach does not ignore the politics of the situation and the fact that large industries are often powerful and governments so anxious to see them expand as to be willing to bend the rules, thus negating the whole purpose of 'national physical planning' or site-selection procedures—**R.J. Machlachlan** (New Zealand).

The fact is that if such decisions are made at too low or local a level, subjective factors are even more likely to intervene—**G.Olschowy** (author of Paper 14).

Perhaps the general conclusion could be drawn that there is little to be gained by the exercise of 'futorology', but two possible conservationist approaches to problems as they actually arise had been high-lighted by the remarks of General Yoffe and Professor Pearse, respectively. There were also two viewpoints to be taken on the controversial issue of resource distribution, the close-up one summarized by Mr Baba Dioum or the more distant one of the planet as seen from a satellite—**M. Batisse** (Chairman).

**SESSION D**

**RESOURCE UTILIZATION  
AND CONSERVATION**

**Part 2**

**SESSION D: PART 2**

*Chairman:* Dr L.K.Shaposhnikov (USSR): Chairman, IUCN's Commission on Education; Head of the Central Laboratory on Nature Conservation, Ministry of Agriculture, Moscow.

*Authors:*

**Paper (15): Le rôle du gestionnaire de l'emploi polyvalent du sol (y compris la formation des gestionnaires).**

Mr J. B. Bergevin (Canada): Senior Assistant Deputy Minister, Program Operations (Welfare), Department of National Health and Welfare, Ottawa, Ontario.

**Paper (16): Managing Natural Resources for Scientific, Education and Health Purposes.**

Dr Harald Sioli (Federal Republic of Germany): Member, IUCN's Commission on Ecology; Director, Mac-Planck-Institute for Limnology, Plön.

*Panel Members:*

- 1 Professor Jean Dorst (France): Vice Chairman, IUCN's Survival Service Commission; Deputy Director, Muséum National d'Histoire Naturelle, Paris.
- 2 Professor J. S. Turner (Australia): Department of Botany, University of Melbourne.

*Rapporteur:* Miss Mona Björklund (IUCN).

*Secretariat Member:* Dr Jan Čeřovský (IUCN).

**SESSION D: RESOURCE UTILIZATION AND CONSERVATION****Part 2: Paper (15)****Le rôle du gestionnaire de l'emploi polyvalent du sol (y compris la formation des gestionnaires)**

J.-B. BERGEVIN

*Senior Assistant Deputy Minister, Programme Operations (Welfare), Department of National Health and Welfare, Ottawa, Ontario.***RESUME**

Dès l'introduction, l'auteur met en relief les ajustements qu'il faut toujours faire entre les objectifs de long terme qui requièrent stabilité et permanence, et les objectifs de court terme qui exigent diversité et capacité d'adaptation aux circonstances.

Dans une première partie, le rôle de gardien d'une parcelle de sol est comparé avec celui de maître-d'oeuvre du développement sur cette même parcelle. Ces rôles exigent une connaissance approfondie du dossier en relation avec les dossiers des planificateurs et des gestionnaires d'autres milieux. Le gestionnaire doit aussi répondre à une deuxième exigence qui est celle d'une bonne faculté d'adaptation. Et enfin ces rôles soulignent les besoins de contrôle, besoins qui doivent être satisfaits par l'application de normes de performance plutôt que par des réglementations aveugles et rigides.

La seconde partie traite des qualités de l'homme. D'abord celle de généraliste qui doit être autre chose que l'art de tout diluer dans de vagues énoncés. L'auteur souligne que le généraliste doit d'abord avoir été un bon spécialiste et il nomme trois sujets essentiels de spécialization; la biologie, l'économie et l'administration publique.

Ensuite, l'aptitude aux relations humaines est indiquée comme une qualité importante de ce gestionnaire: relations basées sur la bonne foi et axées sur l'invitation fréquente aux autres intéressés, à venir consulter son dossier.

Enfin l'aptitude aux compromis judicieux est discutée en distinguant les sens à donner au compromis et en reliant cette aptitude à la possibilité de juger la performance, en vertu des normes précédemment jugées essentielles.

Dans la troisième partie, on traite de la formation du gestionnaire et on établit au préalable qu'on ne pourra le créer de toute pièce mais qu'il doit s'être créé lui-même en cours de carrière.

Mais, si on désire se voir en mesure de le trouver plutôt que le créer, encore faut-il favoriser son éclosion. Les conditions requises à cette fin sont: des structures souples dans les milieux académiques et d'affaires, un climat intellectuel favorable et, enfin, des procédés appropriés de sélection du personnel, dans tous les champs d'action.

**SUMMARY**

The author begins by emphasizing the constant adjustments in land use manage-

ment required between long-term objectives which call for stability and permanence, and the short-term objectives in which diversity and adaptability are essential.

In the first section of the paper, the role of the custodian of a plot of land is compared with that of the manager in charge of its development. In both cases, their functions require a sound knowledge of all the information available for the particular piece of land and its relationship with the documentation collected by planners and managers responsible for other localities. The land manager must also satisfy another requirement, namely that of adaptability. And lastly, the roles of custodian and manager constantly underline the need for control, a need best satisfied by establishing high standards of performance rather than by adherence to blind and rigid rules.

The next section deals with the land manager's skills. First he should be a generalist, which means considerably more than just possessing the art of watering everything down into vague statements. The author stresses the fact that the generalist should always have begun by being a good specialist and he names the three particularly suitable areas of specialization: biology, economics and public administration. Secondly, the ability to maintain good human relations is indicated as being an important quality for the land manager—relations based on good faith and relying especially on being ready at any time to make the information available to all interested parties. The third desirable characteristic discussed is an ability to seek out sensible compromises: certain limits to permissible types of compromise are indicated and it is suggested that the ability is linked with a capacity for assessing the course of action on the basis of standards or principles decided upon in advance as being quite essential.

The final section of the paper deals with the training of the land manager and lays down the principle that he cannot be made in one piece but must evolve as his own creation by his own effort in the course of his career. But, since this implies that we will usually have to find the right kind of man rather than expect to produce him, it does mean that we need to maintain the right sort of environment for his evolution. Basically the conditions are flexible structures within academic and politico-commercial circles, a favourable intellectual climate and, lastly, throughout the whole field of activity, really suitable procedures for selecting the staff required.

## **LE ROLE DU GESTIONNAIRE DE L'EMPLOI POLYVALENT DU SOL**

### **Introduction**

Le sujet tel que proposé nous invite à considérer d'abord le travail que doit accomplir le gestionnaire pour ensuite traiter de l'homme et de sa formation. Notre texte sera donc divisé en trois parties sous les rubriques suivantes: A—La Fonction; B—L'Homme; C—Sa Formation.

Nous tâcherons d'interpréter les directives générales du premier texte et de voir comment le gestionnaire peut favoriser la diversité dans l'emploi du sol et protéger la liberté des choix tout en participant à la dynamique du développement.

Il faut comprendre dès le début que l'emploi rationnel du sol oblige les utilisateurs à procéder à des arrangements de long terme et que, par conséquent, le gestionnaire sera toujours partagé entre les objectifs de souplesse que

nous venons de mentionner et ceux de quasi-permanence des affectations du sol.

Nous tenterons donc de déceler les obstacles qui se présenteront sur le chemin de notre gestionnaire et d'esquisser quelques modalités d'action qui l'aideraient à les surmonter.

### **A—La Fonction**

On a vu par le troisième texte (Session A. 2) que l'homme joue un rôle de gardien des ressources et de l'équilibre de la biosphère. Le gestionnaire de l'emploi du sol va donc personnifier ce rôle et va devenir en quelque sorte le mandataire de toute l'humanité en rapport avec la parcelle du globe qui lui sera confiée.

Mais il est convenu aussi qu'il doit sortir des perspectives étroites du conservateur traditionnel et cesser d'être un gardien intransigeant de la flore et de la faune à l'état pur, c'est-à-dire laissées à elles-mêmes en développement libre. Il agira en fonction des tendances de l'action de l'homme; et il reconnaîtra ainsi cette nouvelle dimension que représente l'homme qui, d'une part, fait partie de la nature au même titre que flore et faune et, d'autre part, agit comme maître-d'oeuvre de l'ensemble du développement.

Notre gestionnaire va donc contribuer au développement tel que défini au neuvième texte (Session C. 1) et de ce fait, il va jouer un rôle d'agent régulateur de l'emploi du sol. Ainsi, à sa personnification de l'humanité comme gardien, il ajoutera donc la personnification du maître-d'oeuvre de la biosphère, rôle que l'homme aurait peut-être dû comprendre beaucoup plus tôt mais qu'il se voit maintenant forcé d'assumer.

La fonction du gestionnaire de l'emploi du sol ne consistera donc pas à conserver à tout prix ni à développer sans discernement mais à agir en pleine connaissance de cause, selon chaque situation donnée et avec des moyens suffisants de contrôle. Pour aller un peu plus loin, reprenons ensemble ces trois points: Agir en pleine connaissance de cause; Agir selon chaque situation donnée; Agir avec des moyens suffisants de contrôle.

### **Agir en pleine connaissance de cause**

Afin d'en arriver à un emploi polyvalent du sol, le gestionnaire d'une partie de territoire devra évidemment bien connaître toute la gamme des utilisations possibles ainsi que les caractéristiques des sols et de l'environnement qui favorisent le mieux les emplois possibles. Mais dans le cas qui nous occupe, la pleine connaissance de cause doit aller bien au-delà d'un bagage déjà acquis.

A la base de son action, le gestionnaire doit poser la connaissance détaillée du territoire qui lui est confié ainsi que la capacité de faire la relation entre celui-ci et les emplois proposés pour chaque parcelle. Il ne lui suffirait donc pas de savoir que certaines tendances générales existent dans la concentration urbaine ou, par la résidence secondaire et les sports de plein air, vers la décontraction en direction de la nature. Il devrait plutôt disposer d'un dossier chiffré (ou le constituer) démontrant les degrés de concentration et d'éparpillement des populations. Il en va de même pour le développement de l'industrie ou de l'agriculture dans son territoire.

Une autre connaissance, souvent plus nouvelle pour le biologiste, doit faire partie de l'arsenal du gestionnaire: c'est celle du développement économique. Le responsable de gestion doit non seulement le tolérer mais acquiescer un sens ou un flair du développement.

Il y a peut-être lieu d'insister ici sur la notion de développement pour bien établir qu'il ne s'agira pas de l'économie de la production du sol au seul sens biologique. Le problème se pose de façon aigüe de savoir ou et quand permettre l'implantation d'activités nouvelles qui font du sol un élément passif, non-productif biologiquement. Dans de tels cas où le sol n'est plus que l'assiette d'une activité qui lui est étrangère, le gestionnaire peut et doit faire plus que s'en scandaliser. Il doit contribuer au choix, toutes choses étant égales d'ailleurs, des parties les moins rentables biologiquement pour en faire le support passif d'activités économiques vitales.

Dans ce choix, il devra compter avec les conflits inévitables qui opposeront certains groupes à d'autres. Il devra peser soigneusement les décisions qui élimineront ou maintiendront les options pour le futur. Enfin il sera obligé de tenir compte de tous les facteurs qui interviennent dans ce que l'on appelle maintenant 'la qualité de vie' quelle qu'en soit sa signification réelle et potentielle, dans le présent comme dans le futur.

Un mot enfin pour préciser que la compilation du dossier concernant son territoire de même que l'ensemble des décisions concernant l'utilisation de ses parties ne peuvent être faites en vase clos par le seul gestionnaire de l'emploi polyvalent du sol. L'approche pluridisciplinaire est essentielle en cette matière et l'on doit même dire que le gestionnaire a un rôle important à jouer en planification.

Il n'est ni le maître-d'oeuvre de la planification ni l'arbitre final dont les décisions pourraient faire avorter le meilleur des plans. Il doit plutôt participer à l'élaboration du plan original et de ses amendements, à titre de gestionnaire du territoire, c'est-à-dire à titre de l'homme présumément le plus au courant de ce qui s'y passe et de ce qu'on y projette en divers milieux.

D'autre part, le gestionnaire doit ouvrir sa porte aux planificateurs tout autant qu'il attend d'eux qu'ils l'invitent à participer à leur travail. Ainsi le plan devrait-il mieux refléter la réalité et le gestionnaire mieux appliquer le plan.

### **Agir selon chaque situation donnée**

L'emploi polyvalent du sol ne peut être rationnel que si chaque cas est soigneusement analysé en tenant compte de la relation coût-bénéfice (voir neuvième texte, Session C. 1) et en appliquant des méthodes scientifiques d'évaluation (voir dix-septième texte, Session E. 1). Il importe peu que le gestionnaire de l'emploi du sol produise lui-même ces analyses ou qu'il utilise les résultats d'individus ou d'organismes-collaborateurs.

L'important, en ce qui concerne le gestionnaire, est qu'il connaisse ses sources et qu'il sache utiliser les données qu'il se procure. Il lui revient en propre, cependant, de faire les mises au point essentielles quant à l'échelle des travaux requis.

Les principes en cause sont, en effet, les mêmes, que le territoire soit immense ou restreint ou que les actions proposées affectent l'économie générale ou non. Dans tous les cas, le gestionnaire doit être prompt à définir des ordres de grandeur et à produire ou faire produire les décisions en fonction de l'impact à prévoir sur le territoire et sur l'économie. Et il y a par ailleurs lieu d'essayer de chiffrer l'impact d'un refus autant que celui d'une approbation.

Il n'est plus possible aujourd'hui d'adopter un point de vue restreint et de négliger les effets, dans l'espace et dans le temps, des actions qui modifient

le milieu. Des milliers d'exemples en font foi, qu'il s'agisse de la construction de barrages, de routes, de rectification de cours d'eau, de mise à disposition de terres à de grandes exploitations agricoles, forestières ou d'élevage.

### **Agir avec les moyens suffisants de contrôle**

Après avoir constaté le quasi-échec de certains zonages urbains, il arrive que des chercheurs se demandent si l'unique moyen de contrôle de l'emploi du sol ne serait pas celui de l'expropriation et de la propriété d'Etat.

Il n'est nullement de notre intention d'amorcer des discussions idéologiques en cherchant à départager les avantages et inconvénients des deux moyens de contrôle les plus évidents soit: la réglementation de la propriété privée et la propriété d'Etat. Il ne sera pas nécessaire de nous attarder sur les abus engendrés par l'un et les lourdeurs administratives de l'autre ou vice-versa.

En l'occurrence, il semble que dans les deux cas, il faille déterminer le rôle du gestionnaire à peu près de la même manière: il faut que celui-ci contrôle, ou règle, ou normalise en vertu d'un système permissif et progressif plutôt qu'en vertu d'un système défensif et empêqueur-de-tourner-en-rond.

On peut décrire le système empêqueur en établissant des comparaisons avec les procédés de zonage généralement en vigueur dans nos villes. Selon ces règlements de zonage, les divers types d'occupation du sol sont ou permis ou défendus sans égard à l'évolution du contexte urbain. Evidemment on obtient par là une certaine permanence qui vise surtout à une soi-disant protection des valeurs de la propriété environnante pourvu que les administrateurs suivent aveuglément le schéma original au risque de provoquer des scléroses graves.

On peut également appliquer ces principes au milieu rural, dans lequel les modes d'exploitation, agricoles ou forestières, par leur étendue et les techniques utilisées peuvent affecter des régions souvent éloignées. Les exemples abondent, particulièrement en ce qui concerne les pratiques qui modifient le régime des eaux ou l'usage des pesticides. Plus subtiles, mais non moins importantes sont les décisions qui affectent les choix futurs telles que la pratique de monocultures, l'introduction d'espèces exotiques, ou d'autres interventions sur la flore et la faune sauvages, par exemple la suppression de prédateurs.

D'autre part, si les responsables entendent évoluer avec le marche de la société, ils en viennent à être obligés de faire des myriades d'amendements aux règlements de base jusqu'à leur enlever tout son sens. Il va sans dire qu'on est alors exposé à tous les abus et qu'on invite à la corruption des mœurs politiques dans ces localités.

A l'opposé de cette situation, un système permissif ou progressif consisterait à définir au moyen du règlement de base, les seules grandes lignes de développement d'un territoire donné et, par la suite, à gérer le patrimoine en appliquant systématiquement certaines normes de performances publiquement reconnues et officiellement sanctionnées.

Il n'est pas possible d'entrer dans les détails de cette proposition à l'intérieur du présent exposé. Aussi pour bien comprendre son sens serait-il bon de faire une comparaison avec le Code National du Bâtiment du Canada. Ce code, au lieu de permettre ou défendre chaque matériau ou produit industriel nommément, définit plutôt le rendement qu'on attend d'un mur, d'un toit ou d'une

fondation. Et chaque matériau ou assemblage est ensuite sanctionné s'il rencontre les exigences préalablement définies. Ceci évite les amendements trop fréquents au code lui-même, invite les industriels à l'innovation et permet à tous de porter jugement sur la qualité des contrôles en référant constamment aux mêmes normes officiellement reconnues.

Pourquoi n'en serait-il pas ainsi en ce qui concerne la gestion de l'emploi du sol? Non seulement les normes pourraient-elles aller jusqu'à la définition des conditions idéales de comportement du milieu mais encore pourraient-elles définir jusqu'aux exigences requises pour qu'il soit utilisé sur une base polyvalente. Pour plus de précision disons qu'il serait ainsi possible de remplacer les défenses drastiques d'exploiter ou d'utiliser des zones entières à des fins industrielles en faveur de fins agricoles ou d'habitations (et vice-versa), par des permissions et même des invitations à considérer dans le plus grand détail les potentialités de la moindre parcelle de terrain. La seule limitation et la plus logique serait celle de la performance, c'est-à-dire l'emploi idéal du sol, d'une part, et, d'autre part, le respect de conditions satisfaisantes d'existence pour tous les modes de développement et d'occupation qui deviendraient associés dans une même zone.

Le gestionnaire de l'emploi polyvalent du sol aurait ainsi entre les mains l'outil scientifiquement établi lui permettant de s'acquitter de sa tâche, et, du même coup, les autorités et la population seraient en mesure de juger de la performance du gestionnaire lui-même.

## **B—L'Homme**

Au sujet du responsable de la gestion, on pourrait peut-être commencer par se demander s'il sera vraiment un individu ou si, à cause des exigences de la pluridisciplinarité, on ne doit pas considérer la fonction gestion comme étant la responsabilité d'un comité, d'une commission gouvernementale ou même d'une société privée contractante qui se dirait polyvalente.

Mais ce pourrait être une fausse question parce que, peu importe le genre d'association d'hommes, il demeure essentiel de définir le type d'homme le plus apte à remplir la fonction. Les circonstances de temps, de lieu et de gouvernement pourront ensuite dicter le degré de concentration ou de dilution d'autorité qui devrait lui être concédé.

L'homme visé ici sera donc l'individu qui anime l'une ou l'autre formation administrative et qui décide ou, au moins, qui participe à la décision au sujet de l'emploi polyvalent du sol. Pour l'instant, nous allons nous limiter aux trois types suivants d'aptitudes: Aptitude aux divers rôles du généraliste; Aptitude aux relations humaines; Aptitude aux compromis judicieux.

### **Aptitude aux divers rôles du généraliste**

Surtout dans le cas qui nous occupe, il ne peut être question d'une quelconque 'formation générale' pour être qualifié de généraliste. Il faut au contraire avoir bénéficié d'une solide formation en quelques matières essentielles à notre sujet.

Il est donc important d'avoir d'abord été spécialiste et d'avoir su s'extraire de son cadre premier pour s'intéresser à des situations de polyvalence. Les matières sont nombreuses qui peuvent donner lieu à une première formation de spécialiste et que le généraliste devra les maîtriser avec un certain art.

Nous en distinguerons trois en particulier qui semblent les plus essentielles: la biologie, l'économie et l'administration publique.

On peut dire en premier lieu que le gestionnaire de l'emploi du sol doit nécessairement avoir suivi les cheminements du scientifique en matière d'organisation de la vie s'il veut établir les relations nécessaires et les analogies commodes pour bien interpréter les problèmes de l'habitat tels qu'ils se posent aujourd'hui.

D'autre part, ce n'est pas par hasard que les sciences économiques ont cette appellation qui s'apparente de si près à celle de l'écologie. Il faut que le biologiste s'astreigne aux disciplines de mesure de l'intensité des relations dites économiques; de même, l'économiste intéressé au sol doit-il connaître ce qui se passe dans l'environnement naturel qu'il va contribuer à préserver ou à altérer.

Enfin, les divers spécialistes, de quelque origine qu'ils soient, doivent avoir une connaissance et une expérience suffisante de l'administration publique ou privée et, de préférence, des deux.

Il vient un moment où, pour la fonction que nous étudions en ce moment, les qualités de l'homme doivent primer et ce sont elles qui feront de lui le généraliste désiré. Mais lorsqu'il s'agira d'évaluer les qualités d'un homme, il sera utile de mesurer son comportement passé à l'égard de ces trois sujets majeurs que nous venons de discuter, c'est-à-dire la biologie, l'économie et l'administration.

### **Aptitude aux relations humaines:**

Les idées de polyvalence et de multidisciplinarité imposent évidemment la notion de relations humaines. Mais dans le cas de notre gestionnaire, il faut cerner les situations où cette aptitude sera essentielle et il faut aussi faire voir quelles seront les relations humaines qu'on pourra qualifier de 'bonnes'.

D'abord dans la création d'équipes de travail ou lors de la participation aux équipes qui lui sont extérieures, le gestionnaire ne doit pas faire preuve seulement d'une connaissance des mécanismes et d'une aptitude à les actionner automatiquement; il doit, en plus, faire preuve d'une sorte de doigté qui est plus facilement senti que décrit. Un tel doigté est d'une très grande importance et il remonte probablement aux qualités de 'fiabilité' (reliability) des individus.

D'autre part, les relations humaines tiendront d'un désir sincère d'inviter d'autres groupes à venir se mêler aux affaires de gestion de l'emploi polyvalent des terres. Trop souvent voit-on les administrateurs les mieux intentionnés réclamer pour eux la participation aux affaires des autres et oublier naïvement d'inviter leurs correspondants à siéger avec eux, en se cantonnant dans des exclusives d'administrateurs tout-puissants.

Enfin l'administration de l'emploi du sol intéresse de trop près le public pour qu'on n'incite pas ici le gestionnaire à mettre le public dans le coup. Ses relations humaines consisteront dans ce cas à éveiller la population au civisme et à lui insuffler le sens du développement même si, en pratique, ceci doit donner un rythme un peu plus essoufflant à l'ensemble de ses programmes. Il s'en félicitera lorsque les conflits d'intérêts surviendront et qu'il faudra faire appel à l'opinion publique pour les régler.

**Aptitude aux compromis judicieux**

Parler de compromis, même avec les meilleures intentions du monde, risque toujours d'être fort...compromettant. Mais, dans le cas présent, éviter d'en parler serait tronquer notre sujet de façon inconvenante.

Il serait trop facile, en effet, d'énoncer un assemblage de règles d'or et de se mettre à gérer l'emploi des terres en référant rigidement au Grand Livre du Comportement du parfait gestionnaire. D'autre part, nous voulons être bien compris quand nous affirmerons que le compromis judicieux auquel nous faisons allusion n'est en aucune façon une invite à la malversation.

Il s'agirait justement, au contraire, de trouver, les moyens de gérer un territoire avec un sain réalisme qui ne tombe pas dans le compromis mesquin. Essayons de voir dans quelles conditions d'esprit et d'action devrait se placer le gestionnaire pour arriver à d'honnêtes résultats en cette matière.

Nous dirons d'abord que le gestionnaire doit savoir voir grand et qu'il doit savoir apprécier la perfection sans se laisser limiter par son lot quotidien. Puis, du même coup, nous devons dire qu'il doit savoir limiter ses horizons suffisamment pour s'accrocher à l'action pratique. Les larges horizons lui permettront d'identifier les lignes de force du développement et son sens du pratique lui fera voir comment s'y accroche le petit programme d'aujourd'hui.

De même pour la perfection: savoir l'apprécier mais aussi apprendre à l'oublier pour accepter certaines approches grossières qui permettent de démarrer un projet. Il pourra ensuite par l'action, tendre quand-même vers une perfection mais réaliser bribe par bribe en protégeant l'essentiel.

Comment qualifier cette aptitude au compromis judicieux qui permettrait de voir grand et en même temps de faire petit et d'affectionner la perfection tout en s'accommodant de l'imparfait? Disons tout simplement que notre gestionnaire devra être un optimiste patient. Assez optimiste pour accepter de démêler les écheveaux les plus compliqués et assez patient pour ne pas lâcher prise si le fil est long à dérouler. Il devra être patient devant la petitesse de certains horizons et devant l'imperfection de certaines approches mais aussi être assez optimiste pour continuer à voir les grands horizons et à croire en la possibilité d'une certaine perfection.

Cette attitude ambivalente constitue la ligne de force des compromis judicieux. Voyons maintenant si certaines situations concrètes peuvent être envisagées correctement en fonction de l'attitude décrite. Le cas le plus utile à analyser dans ce sens serait peut-être celui des relations homme-public/grand-commis.

Le stéréotype du politicien fait souvent croire aux technocrates qu'il faut réussir l'action polyvalente malgré celui-ci ou, du moins, en le tenant à l'écart le plus longtemps possible, sous prétexte évidemment qu'il faut pousser les études et les projets de programmation assez loin pour pouvoir l'informer pleinement lors de la prise de décision. Mais en fait, nous avons tous connu des cas où le désir de soumettre un programme complet était beaucoup moins grand qu'une peur viscérale de se faire souffler de belles idées ou de subir prématurément des jugements de valeur. Dans ces cas, il est arrivé très souvent, à notre connaissance, que l'avantage de la non-communication s'est avéré bien temporaire et illusoire et qu'il fut suivi de blocages graves de projets entiers parce que l'esprit de l'homme-public n'avait pas été correctement averti.

En pareille matière, le compromis judicieux devrait consister à jouer franc-jeu avec tous et, tout spécialement, à impliquer le politicien le mieux possible dans les projets d'envergure. Les risques dans ces cas sont largement couverts par la possibilité de faire entreprendre des réaménagements de structures ou de budgets pendant l'élaboration des projets tout en maximisant les chances d'une approbation définitive à la fin du processus. Il faut bien constater cependant que le gestionnaire de l'emploi polyvalent du sol n'aboutira à rien, quel qu'effort qu'il fasse, si les structures gouvernementales ne sont pas tournées, elles aussi, vers la polyvalence. S'il faut innover en gestion des terres par l'approche polyvalente, il faut en même temps que les plus hautes instances gouvernementales ainsi que de l'entreprise privée acceptent les règles du jeu multidisciplinaire.

Enfin disons un mot de l'art de travailler proprement sans entrer dans les compromis douteux. A cette fin, rappelons le point que nous avons établi précédemment en parlant de la réglementation et de la normalisation comme moyens de contrôle de l'utilisation du sol.

La définition, à la face du public, d'un certain nombre de normes de performance qui seraient d'application simple et généralisée devrait être la clef d'un bon système de gestion des terres. Il s'agit d'innover en ce domaine et de remplacer les règlements tâillons et souvent inexplicables, par des règles qui tendraient à transformer tous les cas, toutes les situations, en situations et en cas mesurables.

Signalons que les changements qui seront introduits par le gestionnaire qui aura bénéficié du concours d'une vaste collaboration interdisciplinaire seront initialement opposés par une grande partie de la population qui vit sur ces terres. Traditionnelle et conservatrice, elle aura une certaine réticence à accepter les changements dans son mode de vie. Dans ces cas là le succès ne dépendra pas seulement d'un gestionnaire qualifié mais d'un public qui grâce à une compagnie bien menée aura compris l'esprit des réformes proposées et est disposé à prêter sa collaboration.

La capacité de mesurer la performance et de la mesurer en public, lorsqu'il le faut, éliminerait les situations douteuses et mènerait à la possibilité d'évaluer en cours de route les comportements et la performance de tous les intéressés qu'ils soient les utilisateurs du sol, les politiciens impliqués ou les gestionnaires eux-mêmes de l'emploi polyvalent du sol.

### **C—Sa Formation**

Notre sujet comprend aussi une parenthèse intéressante qui dit: 'et comment créer les gestionnaires'. La première affirmation à faire, à ce sujet, serait qu'on ne crée pas un gestionnaire de cette sorte, on le trouve.

Nous croyons en effet que le gestionnaire apte aux actions multidisciplinaires va se créer lui-même s'il a l'envergure nécessaire pour s'extraire progressivement de sa spécialité. En conséquence, nous soumettrons à votre réflexion deux sujets complémentaires: d'abord, si on doit le trouver, comment le trouver? Et ensuite, une fois trouvé, comment l'entraîner plus spécifiquement à remplir son nouveau rôle?

### **Comment le trouver**

On trouvera de bons gestionnaires après qu'on aura favorisé leur développement et qu'on aura amélioré les procédés de sélection.

Pour favoriser le développement des bons sujets il faut d'abord que leur entourage soit ouvert aux procédés multidisciplinaires. Que l'on soit dans le milieu universitaire ou dans celui des affaires ou encore dans la fonction publique, si l'on est bloqué dans une structure rigide dont l'employeur ne veut dévier ou encore si on est entouré de collègues qui ne font que défendre leurs chasses gardées, on n'aura pas là de quoi devenir facilement un généraliste qualifié. Et, en plus du milieu de travail, on a aussi besoin d'un climat intellectuel vivifiant sinon excitant.

A ce propos, on peut juger assez bien des chances d'évoluer qu'auront nos hommes, en voyant comment on qualifie le changement dans leur milieu. Il arrive souvent en effet qu'on entende des personnes en place pontifier au sujet de l'inévitabilité du changement, pour voir ensuite les mêmes personnes qualifier de façon péjorative tout changement qui se produit chez leurs subalternes ou chez leurs collègues. Ils qualifieront tout d'instabilité, par exemple.

Quant aux procédés mêmes de sélection du personnel, il va falloir faciliter l'évolution des meilleurs en brisant le monolithisme dans la description des tâches. En fin de compte, ce sera auprès des préposés au recrutement qu'il faudra prêcher la polyvalence afin que ceux-ci aident l'employeur à créer un climat d'avancement en faveur de ceux qui veulent se départir de leurs oeilères et évoluer avec leur temps.

### **Comment l'entraîner**

L'entraînement spécifique du gestionnaire de l'emploi polyvalent du sol, bien qu'il soit postérieur à la spécialisation, peut très bien être conçu à l'intérieur d'options académiques, soit en cours de formation régulière, soit lors de sessions spéciales de recyclage. Le danger à éviter, toutefois, serait l'insistance excessive sur le travail pluridisciplinaire avant même que les bases du savoir ne soient bien établies.

Un autre champ d'entraînement qui est en passe de devenir la règle, est l'acquisition successive de plus d'une spécialité, le tout accompagné d'actions pluridisciplinaires.

Enfin la marque qui permettra de juger si notre gestionnaire a bien su se créer lui-même, se trouvera dans l'évolution de sa carrière. S'il a eu la force de caractère et l'habileté voulues pour accomplir divers stages formateurs, on pourra déjà être rassuré sur ses motivations et sur son habileté à retourner des situations.

Quant à la nature et à la qualité des stages, il est évident que polyvalence veut dire variété infinie de regroupements. Mais si on me demandait de nommer le plus important, je mentionnerais le stage dans la fonction publique. Il me semble, en effet, que malgré les plus grands talents, un gestionnaire de l'emploi polyvalent du sol ne saurait saisir toute la portée de ses futures décisions s'il n'a pas une connaissance sérieuse des rouages de l'administration publique.

### **D—Remarques en Guise de Conclusion**

A tout événement, l'aménagement du territoire sans une vraie consultation préalable avec la population concernée est une chose du passé. Comment se fait-il que l'on trouve toujours le temps pour refaire une chose alors que le temps n'est jamais disponible lorsqu'il s'agit au tout début de bien la faire?

Rares sont les fois où l'homme politique n'est pas appelé à jouer dans l'aménagement du territoire un rôle-clef. C'est donc lui, dirai-je, qu'il faut mettre d'abord dans le coup. L'ignorer est une erreur qui s'avère presque toujours irréparable. Dans toutes les variations, il faut l'avoir en avant de nous!

## ANNEXE

*The Problem of the Interdisciplinary Land-use Manager in Tropical Countries* (additional note prepared by the IUCN Secretariat).

Perhaps between 50-70% of the surface of most tropical countries are covered by what may be subjectively called 'marginal lands'. They are not fit for permanent agriculture or animal husbandry since previous efforts to use them for these purposes have led to their degradation. Nor do they easily lend themselves to sustained yield forestry, although 'high-grading', a type of exploitation that takes the best logs but leaves the forest in an inferior condition, is currently practised.

But these lands, mostly in their natural condition, presently play a very important and often vital role in regulating water courses, protecting soils, offering a refuge to wild animals and contributing otherwise in maintaining a healthy and well-balanced environment. Moreover, they lend themselves to various forms of management for scientific, educational and touristic purposes, cropping of wildlife and other uses without imperilling their ecological functioning or regenerative capacity.

Who is in charge of managing these natural areas? Who are the specialists to whom the important task of making the most of these areas is being entrusted? The diversity of these areas, and hence the many forms of management required, demand skilled personnel. Unfortunately, these do not exist in most countries.

Perhaps the forestry profession comes closest to providing the necessary specialist but a particular kind of forester is needed: one who has a good knowledge—and deep appreciation—of the intricate and indirect values of forests and forest lands. (It should be said here that forest lands may not necessarily be covered by forests but may, nevertheless, be managed by foresters.) This type of forester is uncommon, partly because the necessary ecological and environmentally applied outlook has not been sufficiently stressed in forestry schools.

However, other professions—including, for instance, wildlife (both fish and game) specialists, watershed managers, soil conservation specialists, park managers, and biologists familiar with natural areas—also have an important part to play. But, once again, these professions are virtually absent except in a few countries.

Sadly, the great proportion of managers dealing with the so-called marginal lands do not have qualifications fitting them for managing these areas. The deficiency is particularly distressing in many tropical regions where, under the impact of population growth and the urgent need to produce more food, the greatest pressure is often exerted on natural areas, leading to their destruction.

Among the worst cases are those in which a narrow-viewed agronomist or a timber extraction-oriented forester is in charge, since the fate of the areas may then be worse than if they were managed by someone without an *a priori*

bias towards a certain land-use. Many agronomists, for instance, strenuously try to prove, through costly experiments, that fertilization of the very poor and highly leached soils at present covered by tropical rain forests will yield good agricultural crops. Those trained in animal husbandry also tend to try to 'sell' their trade by proving that the transformation of natural areas into grass will contribute to the economy of their country. Foresters, too, will often promote timber exploitation even though they may know in advance that they will not be able to maintain a sustained yield.

Industrialized countries also have their problems, particularly through heavy demands for recreation, increased urbanization and, above all, different forms of pollution that all diminish the value of natural areas. In particular, ill-conceived urbanization schemes take an ever-increasing toll of natural areas year by year.

On the other hand, who is able to show that promoting a land-use which implies the maintenance of the natural systems and their rational utilization will ultimately achieve a much higher direct and indirect income for the country ?

The sad answer is: very few, if anyone. Furthermore, the results obtained, very often based on too few experiments and case studies, frequently reach deaf ears when it comes to decision-making, because land has traditionally been opened for agriculture and animal husbandry, and very few have ever heard or would even believe that there is an alternative based on the maintenance of the diversity found in natural areas and leaving options open for future generations. And yet this alternative, in a shrinking world where pressure on natural resources is ever-increasing, appears to be very promising. As in every science and its application, it demands an approach based on the accumulation of data and experiences. More than anything, it requires an ecological approach, but this is obviously lacking, and scarcely being taught.

The coming years will certainly witness increasing conflicts with regard to decisions on land-use; whether to increase food production at the cost of destroying marginal areas, or to maintain productivity by managing natural areas. At present, conservationists are definitely on the losing side.

In this dangerous situation the greatest danger is obviously the lack of sufficient numbers of the right type of wild-land manager. Obviously, they should not be preservationists—although they, too, are needed for some specific areas—but they should have the approach necessary to make each area 'produce' without destroying it. Sometimes, the best use will be to leave a natural area as a strict reserve because this will give the greatest short- and long-term yield. But other areas can be periodically cropped for their surplus wildlife, or managed as national parks; and many should simply be left alone until a use can be found which will not destroy the system and leave a degraded and unproductive landscape. Hopefully, we may come to realize that the maintenance of diversity and options for future generations is one of the greatest values that can be attached to any area.

Food production will certainly have to be increased. But when it comes to decision-making on land-use, the alternative of increasing the production rate on good soils that will respond to better agronomical techniques should always be weighed against the possibility of encroaching on what are clearly marginal lands as far as agriculture and animal husbandry are concerned.

Thus there is a dire need for well-qualified managers of these 'marginal' lands which, as has been shown, are not really marginal but would more properly be called 'natural areas'. Such managers must compete successfully

with other professionals to show that their brand of land-use, based on the maintenance of natural systems, can be as or more productive as any alternative. They should join with others, particularly with the growing world of conservation-minded people who are beginning to influence decision-makers, and help to shape policies which will bring about the much-needed dynamic balance between man and his environment for which we are striving.

## SESSION D: RESOURCE UTILIZATION AND CONSERVATION

### Part 2: Paper (16)

# Managing Natural Resources for Scientific, Education and Health Purposes

HARALD SIOLI

*Member, IUCN's Commission on Ecology; Director Max-Planck-Institute for Limnology, Plön*

### SUMMARY

This paper presents an analysis of the problem of managing the world's natural resources for scientific, educational and health purposes, having regard to certain limitations of science which must be recognized before applying it and its product, technology, to the management of the environment and its resources.

Starting with the observation that there is no parallelism between the level of development of our scientific-technological world and the 'happiness' of its citizens, including a satisfactory environment, it is argued that science, *in practice* does not yet understand the complex mutual interactions of ecosystems and *in theory* looks at and acts upon the world from the viewpoint of only one of many different aspects which are theoretically possible, namely causality. For these two reasons science is unable to predict the short and long-term consequences of human interactions with nature involved in the management of natural resources.

Hence, education must include measures for developing man's awareness of the complexity of his living environment, and for strengthening his respect for those qualities in it, as well as in his own life, which are not capable of being managed on a basis of causality alone. As for health, it is not only man's physical fitness and freedom from disease that must be included in his future management schemes, but also his psychical well-being.

**RESUME**

La communication analyse le problème de la gestion des ressources naturelles du monde à des fins scientifiques, éducatives et sanitaires, en égard à certaines limites de la science qu'il faut reconnaître avant de l'appliquer elle et son produit, la technique, à la gestion de l'environnement et de ses ressources.

Partant de la constatation qu'il n'y a aucun parallélisme entre le niveau de développement de notre monde scientifico-technique et le 'bonheur' de ses citoyens placés dans un environnement satisfaisant, l'auteur soutient la thèse que la science, *sur le plan pratique*, ne comprend pas encore les interactions réciproques complexes des écosystèmes, et que *sur le plan théorique* elle regarde le monde et agit sur lui à travers un seul des nombreux aspects théoriquement possibles, à savoir la causalité. Pour ces deux raisons, la science, lorsqu'elle s'occupe de gérer les ressources naturelles, ne peut prévoir les conséquences proches et lointaines des interactions humaines dans la nature.

L'éducation doit, en conséquence, comporter des mesures qui rendent l'homme conscient de la complexité de son environnement vivant et qui augmentent le respect que celui-ci porte aux qualités qui, dans cet environnement et dans sa propre vie, ne peuvent être gérées par la seule causalité.

En ce qui concerne la santé, l'état physique de l'homme et l'absence de maladie ne doivent pas être seuls pris en considération dans ses futurs plans d'aménagement mais aussi son bien être psychique.

**MANAGING NATURAL RESOURCES FOR SCIENCE, EDUCATION AND HEALTH**

When I received the invitation to prepare a contribution for this meeting, I thought that it would be very easy to present the basic unquestioned facts about science, education and human health which need consideration whenever some region of the planet is to undergo changes in natural resource management for some real or imagined benefit to mankind. It would seem that most people, including this distinguished gathering, who adhere to the ideas of the IUCN, believe that science is the *sine qua non* for all progress, that education is the solution for most problems of individuals and societies, and that health is the highest and the only true value in human life. If this is so, it is only a question of selecting specific management programmes, by weighing foreseeable consequences against chosen goals. Such goals include economic ones set by a state, city or specific industrial complex; strategic ones for defence against an aggressive neighbour; or recreational ones for the citizens of modern industrial societies. With the principles of science, health and education and the necessary facts about the region to be managed in mind, it would then be necessary only to feed them into a computer programmed for different management goals to obtain an optimized management scheme for the future.

Under such premises the problem is really very simple. It would have been sufficient in this paper to present only a few examples to convince the sceptics that we can progress towards the 'better world' if we follow established principles, and that no disagreeable future surprises can occur. I would then only have needed to stress that for proper natural-resource management it is sufficient to set aside enough reserves for future scientific studies on the structure and dynamics of ecosystems, for citizen education as to proper resource utilization and for pollution-free recreational use.

Our so-called scientific-technical world is in fact based on such ideas. So

firmly are they believed by 'civilized' man that a new discipline called Futurology has been developed in which future changes are predicted by extrapolation of present trends. It would be expected, therefore, that our world would show undeniable signs of constant improvement in the well-being of its inhabitants.

However, a look at the world around us may create doubts about the validity of the simple deductions we have drawn. The citizens of the most advanced centres of the scientific-technical world, where the necessities of life are available to everyone, appear to be unhappy, unstable, depressed and, at times, even brutalized human beings. The liberating laugh has been replaced by what is best characterized by an untranslatable word from German theatre slang, 'Klamouk'. A sense of humour has given way to unceasing competition. The feeling of security generated in former religion-based societies has gone. Such societies created a sense of existence and personal destiny in their inhabitants. Now all this has been replaced by a surrogate system of insurance. No doubt people now live longer on the average than in former times, but they are indeed less healthy, dependent as they are on the enormous production of the pharmaceutical industry. And the environment of mankind has deteriorated to an alarming degree.

Further examples of such symptoms could be given. However, even if they are considered to have been selected subjectively and were to be countered with opposing examples, there can still be little argument, I think, that the apparent contentment of the citizens of modern scientific-technological civilizations has declined along with environmental quality, as technological development has proceeded. As happiness has declined, so too, it would appear, has the capacity for sorrow and suffering concerning personal Fate, personal weaknesses, loss of loved ones, and so on. It seems that the extremes of human emotion, the heights and depths of feeling, have been suppressed. The intensity with which life is experienced, not via television but directly, has shrunk as progress based on the causality principle of science has proceeded. Anyone who has the opportunity to observe and compare life in the highly civilized and developed regions with that in 'backward' areas will find the differences very striking. This loss of intensity in experiencing life seems to be the strangest but clearest of phenomena. I shall return to it shortly.

For the moment the following question arises. What might be the reasons for these negative effects of technological society on its citizens and their environment? Three possible answers can be given.

1. Science and its techniques of application are not sufficiently advanced. Or as a colleague, whose life and interests are bound to the industrial zone of the Ruhr, once put it: 'not all of this is the fault of techniques, because we still have very few techniques'.
2. The results of science have been applied falsely, both to nature and to man.
3. The basic principle of science and technology, namely causality, is possibly only one of a number of basic principles, all operationally equal and all valid, but not 'provable' by man's system of logic and therefore of no use for the purposes of management toward specific objectives.

I shall discuss each possible answer beginning with the first.

If the problems of mankind and the environment are consequences only of too few techniques, then their solutions will come from continued support for scientific research and for the application of scientific results in perfecting new techniques. Since the conditions of our environment and of humanity are deteriorating at what seems to be an exponential rate, we must stimulate research output at an even faster rate. But it is not clear at present whether

this deterioration can be arrested quickly enough in the short time remaining.

This first answer is based on the belief that a knowledge of the principles of science is all that is necessary for man to understand the world in all its complex dynamics. The belief is implicit that future man *will* be capable of understanding earth's ecosystems with their interconnected, intrinsic relationships that include man himself and extend even to cosmic influences. It is obvious that under such beliefs all efforts must be made to develop science as rapidly as possible and to apply its results with haste. This sounds both wise and logical, and it has in fact been the basis for a recent newspaper campaign to alleviate the crippling effects of past natural resource mismanagement.

Reality, however, is not so simple. We forget that we find ourselves on the steep sections of a number of exponential curves, including the curves of resource use, food production, population increase and pollution. One of our most common errors to date has been to think in straight lines. True scientific thinking must instead follow this family of exponential curves, and since in the real world all these factors are interlocked, it must strive to bring them into mutual concurrence. Such procedures have been followed by many scientific thinkers and a voluminous literature of their work is available. Now the human brain is being aided by computers. The giant computer at MIT has been employed for these purposes by the 'Club of Rome', a group of 70 respected experts from a number of disciplines. After being presented with a huge quantity of data in many permutations and combinations the computer has calculated with incontestable objectivity what will happen in the future when these curves intersect. The results are to be published in a book 'The Limits of Growth' (a review only of which was available to me from TIME 24 January 1972, at the time this paper had to be ready). The study makes it clear that a continuation of the present policies of natural resource management will inevitably lead to disaster within the next two generations. Let me explain briefly the main points of this computer study.

The starting point is the reality of human population growth. A growing population needs increasing amounts of food. Increased food production no longer depends upon increased cultivation of agricultural lands (the best land is under cultivation already) but on the increased use of fertilizers, pesticides and modern farm machinery. All of these agricultural aids are products of industry, as are the pharmaceutical products upon which we depend for increased animal production and, incidentally, human growth and longevity. Greater technical output demands greater rates of use of resources (which are scarce and getting more so daily) and increases pollution. Pollution, in turn, interferes with food production and human population growth.

The economic principle of continuous industrial growth has also been included in the MIT calculation. As industrial resources become scarcer and pollution increases, more money (or labour) must be spent in the acquisition of new resources and in combating pollution. Less money is thus left for intensifying and extending scientific research and for perfecting more efficient techniques and industrial facilities. At a certain point—around the year 2020 according to the computer—the curves for the different factors begin to converge and cross. Population outstrips food and industrial supplies. Investment in new equipment falls behind the rate of obsolescence, and the industrial base (= our scientific-technical world) 'begins to collapse, carrying along with it the service and agricultural activities that have become dependent on industrial products (like medical equipment and fertilizers). Because of lack of health services and food, the world's population dwindles rapidly.'

I cannot go into more details here, but thousands of alternative programmes

were computed. Every time the result was 'All growth projections end in collapse'. That is to say, the ending of environmental deterioration by scientific progress, as discussed earlier, will not be possible.

This, then, is science's final conclusion, and when we ask the computer how to manage natural resources scientifically, the answer cannot but be: 'Stop all exponential growth by 1975, that is, balance human births and deaths. Halt industrial growth and hence also the consumption of raw materials and energy. Recycle all possible resources such as inorganic scrap and organic wastes'.

Such results from computer studies are not surprising to anyone who has observed recent trends in a scientific manner. The human brain can make mistakes in logic and is restricted in the number of factors it can store and manipulate. A computer however cannot fail and is irrefutable if the principles with which it is programmed, in our case causality, are correct and sufficient. The demand of the computer is a tremendous challenge to our generation. It will probably involve the greatest challenge ever posed to humanity.

In making the changes in our resource management systems demanded by the computer results, the easiest to fulfil will probably be that to the recycling of material. From an ecological viewpoint, recycling is only the transformation of an open-ended system into a closed circulation system. However, man must also be considered as a natural resource and in this regard one fundamental question therefore remains to be answered. What is to be done with the people now employed in a system of growth when a steady-state society becomes operational and much of the present-day work is done by automated machines ?

It would seem necessary that much of the future work of recycling in a steady-state society will need to be done by human labour, rather than by new machines. Even then it is probable that there will remain much more leisure time for people than at present. These hours will not be able to be filled by activities related to consumption, or by recreation; for 'recreation' describes an activity whereby the individual is again made fit, or 'recreated', for work.

The computer gives no answer to this question. The MIT team says only that the patterns of human behaviour must undergo fundamental changes. Instead of the aim and source of pleasure in life being the accumulation of material goods, people must learn to dedicate themselves to services such as education or recreation. It is safe to assume that research, the arts and athletics would flourish in such a 'no-growth world'.

But with such a statement we leave the field of pure science, and a new and larger question arises. Does the world consist only of direct causal linkages, as science has presumed in building its mathematical-mechanical image of the world? Will man be happy and satisfied in the steady-state of an endlessly recycling world or will he become bored? This perspective brings us to the problems of education and health in managing natural resources, and leads us to the last of the three answers outlined earlier. But consideration must first be given to the second answer: that of the false application of scientific results as an explanation for the negative effects of science on human society.

In fact, we have pointed to the essence of this question in the statement that thinking in straight lines has been one of our common errors. In this manner we can try to prove the innocuousness of releasing 500, 000 tons of lead into the biosphere by arguing that no one has been found dead on the roadside from poisoning by lead from automobile exhaust fumes.

An equally incorrect application of science is met with in the argument that by applying some simple mechanical laws we can understand the enormous complexity of ecosystems, and thus alter them as we wish for our benefit. Another is when we take into account in our management schemes only the present composition of some region, as if that composition were an absolute condition rather than a transient one influenced by history, other local factors and inherent evolutionary potential. Our present management schemes are full of such erroneous applications of science. These mistakes have arisen either from shortsightedness of the persons responsible for their application or, in some cases, sheer criminal egotism. But they are all more or less trivial errors and can, at least in theory, be remedied by greater insight and goodwill. Thus there is no need to dwell on this point further.

Instead, we must come to the basic problem of whether science constitutes an absolute basis upon which management systems can be designed. This is dealt with in the last of our three possible answers.

As already mentioned, science is based on the principle of causality, which was discovered well over 2000 years ago by the ancient Greeks and gradually replaced the gods. It is a product of the human brain and more than compensates *Homo sapiens* for his lack of predatory teeth and claws, mechanical and thermal protection, and speed. When we apply the causality principle to science and technology, we must be conscious that this principle lies in *man* and not necessarily in the world around us. There is no need for causality to be the *only* principle governing the operation of the world. Thus, the causality principle, and with it science and technology, although tools which widen man's special (and limited) ecological niche on earth, are not the means to deeper insight nor subjugation of the world to man's will.

However, the application of this principle to help us understand the niche of scientific man has so increased our power over nature that we are dazzled by success. It is horrifying to observe how human masses can be made euphoric, even intoxicated (and thus steerable), by showing them the power of human technical 'progress' over the natural environment. In his blindness, man no longer realizes that his niche comprises a system of extreme complexity and fragility; that an almost infinite number of biotic and abiotic factors interact; that every factor influences and alters the others at different intensities, in different directions and with differing degrees of effectiveness; and that all are subject to feed-back controls, such that the response of the whole ecosystem to deliberate intervention becomes unpredictable. This means that in the near and (according to the computer study) distant future we cannot possibly foresee all the consequences of the damage inflicted by man upon his niche. And again this means that the relatively simple causal linkages which rule the inorganic sciences are not sufficient to enable man to manage and transform natural ecosystems as needed.

Hence, we come to the first limitation in the use of science and technology in resource management. Man's great power over the natural environment, together with his inability to foresee the consequences of his interactions with it, now permit him to destroy his environment and, with his environment, himself. For it is clear that no organism can survive without its niche. Man can no longer obey the Old Testament commandment to 'go and subdue the world to yourself. This may well have been suitable advice in biblical times for a small, technologically underdeveloped population living in a harsh desert environment. However, in the present situation the rule must be to interfere in the ecosystem only to the extent that can be proved to have no harmful effects whatsoever. The burden of proof, furthermore, must be with those who want to interfere.

This is the reason for one limit to the use of science in managing natural resources. Another derives from the fact that the principle of causality is, as we have said, a concept formulated by the human brain and is not necessarily the only force which governs the whole visible and invisible world.

To understand this we must go back to the definition of life. Life is not only the operation of certain physico-chemical processes which make living matter 'alive'. Life is the constant interaction of the living organism, which has *its* internal laws of action and reaction (e.g., physiology, psychology, ethology), with the environment which has *its* own internal laws different from those of the organism. Between these two 'law-systems' or 'law-structures' there is a tension field. This field must be overcome by the organism both actively and passively, and if successful it wins its life. This definition may be said to represent the ecological aspect of the dynamics of life; it can also be regarded as a much abbreviated and simplified ecological formula for the world. At the same time it is no formula at all because it cannot predict the place and time of the events related to life.

The same concept can be applied to man. By overcoming the tension field between himself and his environment he wins not only his material existence but his sense of spiritual experience as well. The fact that the law-system of the environment is different from that of man and is not, at least not yet, completely understood by man means that new unforeseen situations occur again and again. This creates a sense of surprise which is essential to life. The organism and the environment are two poles between which extends a stage upon which the play of life occurs. This drama is not a one-sided 'struggle for survival' but is a conversation, a dialogue between equal partners, the organism and the natural environment. The result of this dialogue is the emergence of a functional life-unity. Simple examples of man on his 'stage' are sailors on the ocean and peasants in the field. In this latter case, the result of the dialogue between man and his environment is revealed by the cultural landscape created by it.

However, if the 'continuous conversation' degenerates into a ruthless fight, the tension field may be destroyed by the total victory of one of the partners and the death of the other. If this process, which might be thought of as 'ecological entropy', occurs then the play of life will have come to an end.

The death of man's partner in this life-play may also occur when its law-system is replaced by man's. The law-structure of the environment is indeed undergoing such a replacement process, based exclusively on the human principles of causality. Man no longer accepts the reactions of his partner to the alterations he imposes. The active and passive interaction with his partner has given way to ruthless annihilation. In place of a 'vis-à-vis' with an inherent law-structure of its own, man has substituted a replica of himself. Dealing with this replica is like looking into a mirror. In fact, the reflected self-image is incomplete, restricted as it is to the human law-structure of causality. Looking into a mirror eventually becomes boring, finally deadly boring. The symptoms are already more than evident in the life style of the scientific-technical world.

The final goal of science is the establishment of a world formula by which all that exists in time and space can be codified and expressed in the objective language of mathematics. A mathematical formula can only deal with quantities and quantitative relationships. Qualities, on the other hand, cannot be defined by numbers or equations. The scientific-technological world has no room for the qualitative aspects of human life, for beauty and ugliness, love and loneliness, happiness and grief. Consequently, the heights and depths

of sentiment are continually suppressed, and our emotions are levelled to the sterile state of a contentment devoid of qualitative sentiment. The value of love, the sublime qualitative eros, is being replaced by a quantifiable sexus. In the visual style of modern life, as characterized by the city, there is no urge to create beauty but only to demonstrate the power of man over his environment. The final purpose seems to be the construction of a new super-mechanism of functional perfection which cannot be judged in such terms as beautiful or ugly. Thus science, as we understand it, is not false, but is only one aspect of the whole world. Other aspects which we can neither calculate nor prove are equally real and true, but we cannot manipulate them by means of our scientific-technological principles because the latter are all derived from the concept of causality.

With these limitations of science in mind, we can now try to define how we should proceed to manage natural resources for scientific, educational and health purposes.

We can see that science is limited in a double sense. First, science, *in practice*, is limited to a knowledge of relatively simple physico-chemical relationships of matter and energy. It does not yet understand the complex mutual interactions of ecosystems, even though these may, at root, be governed only by the simple physico-chemical laws. Second, science, *in theory*, (here we take science to mean 'natural sciences') comprehends the world from only one of many different, theoretically possible viewpoints, namely the causality principle. Therefore, when managing natural resources for scientific purposes we must take care that the effects of our alterations to the environment can be foreseen as far as possible into the future. As already stated, and I wish to repeat it, the burden of proof is therefore on those who wish to make the alterations. Where doubt exists the changes must remain unmade. Such a rule is the first step toward the healthy 'no-growth' world which must be established without delay.

The second step comes from the observation that causality, although correct, is not the only principle governing the world, and that science and technology are not the only guidelines for man's interplay with his partner of equal rights. Other principles, qualitative in nature, such as beauty, love, happiness and their opposites, must be respected in the same way as is the maintenance of material productivity. Only when the qualitative as well as the quantitative principles are observed can an environment be created that is worthy of life. Only then will full human development be possible, rich in diversity and colour and in the fates of individuals and masses. It must be ensured in every management scheme that the richness of man's 'vis-à-vis' and life content is not diminished or replaced by surrogates. We already have in our midst an appalling number of such surrogates, including the widespread use of psychedelic drugs.

From this truly scientific viewpoint, education and health must also be considered.

Up to now the goal of education has been seen as the preparation of people to fit into a civilized environment in order to obtain more material goods and agreeable comforts. The concept of continuous growth is a basic tenet of the present educational system and hence deeply rooted in man's behaviour. It is here that a new educational role must be developed—to create in man an awareness of the complexity of his living environment. In this way his sense of respect for the qualities of his environment and his own life experiences will be strengthened and he will be better prepared for existence in a future 'no-growth' world.

This last aim, the creation of new behaviour patterns, will probably be the most difficult task. These patterns will need to be very different from those that prevail in our present, expansionist civilization. The new behaviour, however, must consist not of inactivity, but rather must combine activity with an acceptance of one's fate. It must fill leisure time with new, more satisfying activity. Perhaps, in this regard, the expansionist technological societies could learn much from the great cultural heritage of Asia, which stresses the importance of meditation and an awareness of the super-human world and of man's position and destiny in it. To move in this direction will require more than the use of man's computer-assisted cerebrum. His whole personality, including his capacity for conceiving and creating in a qualitative fashion, will be needed to deal both actively and *passively* with his entire 'vis-à-vis'. Such an integration of leisure time into the whole life experience will require stimulation through simple sports activities, scientific research, the arts, and philosophical and religious thinking. If '*Homo ludens*' is to be the climax species of humanity, he will most likely evolve as a result of leisure time activities in a future 'no-growth' world.

Will man undertake such radical changes in the educational process? The question cannot yet be answered. It is a task, however, which *must* be started immediately, since it appears to be the second, essential step on the harsh road to man's eventual survival.

We must still consider health in the management of natural resources. We need mention only a few points here, as the need to maintain physical health has been discussed repeatedly in recent times. It is unnecessary to repeat the warnings concerning the grave hazard to modern society posed by such factors as infection in overcrowded cities, contamination from environmental pollution, dissemination of disease via modern transport systems, and chronic poisoning by industrial wastes. It is more than obvious that such problems must be eliminated in the management of modern society. To the above list belong, as well, such psychological hazards as noise pollution and the ever-accelerating 'speed' of society.

Perhaps less well considered, however, is the fact that modern medicine with the assistance of the pharmaceutical industry has increased human longevity, but frequently not health, and has prevented people from dying of various inheritable diseases. However, as they have not cured the diseases these are now being transmitted to an ever increasing proportion of succeeding generations. Such 'progress' and the 'pathological' increase in population that has resulted, will be quickly lost when pharmaceutical output decreases, as predicted by the MIT computer study. The need to foresee such pathological phenomena and to avoid them in future planning is obvious from what I have said about science and the 'no-growth' world.

However, man's psychological well-being is also part of health and it seems to me that in this area much must be done. Haste and noise have been mentioned previously. I wish to stress in addition that the modern routine of stressful work to increase consumption, followed by recreation to rehabilitate the worker for renewed stress, is a vicious circle that empties life of meaningful content. The final consequence of this emptiness of life, this psychological insecurity, is the pathological fear in man of the natural physiological event of death. This problem, too, must not be forgotten in future management schemes.

The crucial problem to be attacked if the mental health of mankind is to be improved is just this emptiness of life. It is the consequence of the absence of a true physical and spiritual partner for man. To achieve a satisfying

content in life, especially in the spiritual realm, is the largest task we face in connection with human health. When man's vis-a-vis' is regained, boredom will no longer exist, all substitutes will be insignificant, the disquieted youth will have a fascinating life before them, and idle time will become creative leisure. In consequence, the fear of death will be overcome.

But these prospects are only music of the future. At this point the role of scientific thinking in the management of natural resources of the future, ends. Thus I must conclude with the admission that I have not dared to suggest how to proceed with the managing of natural resources for scientific, education and health purposes. Rather I have tried to show that the extent to which natural resources can be managed is limited. Until these limits are reached, the causal logic of science must be followed and never circumvented even for momentary advantage. When causality ends, however, no existing form of management can be possible.

## SESSION D: RESOURCE UTILIZATION AND CONSERVATION

### Part 2: Discussion

The Chairman, Dr **Shaposhnikov**, said that as the time available for this second part of Session D was rather limited, he proposed simply to introduce the speakers and panel members and call upon the former to present their Papers.

En principe, dit M. Bergevin, et à la lumière des textes présentés aux sessions, les caractéristiques et le rôle du gestionnaire qu'il a tenté de décrire dans son rapport sont encore valables. Il insistera, par exemple, pour qu'on lui donne un code d'éthique dont il s'inspirera, que ce soit l'éthique du respect de la vie de Schweizer ou de M. Monod ou toute autre éthique; il fera largement usage du genre de dossier que constitue le rapport que présentera le Professeur Sternberg demain (Session E); il aurait probablement été chargé du projet de rénovation de la 'Rhineland Brown Coal Area' dont a fait mention Mr. Olschowy, sauf qu'il se serait assuré que la fumée des cheminées ne tombe non seulement pas sur la tête des Allemands mais non plus sur la tête des autres; il se refusera bien sûr de travailler pour des fumisteries du type 'mid-Canada Development corridor'. C'est chez le gestionnaire que se rencontrent les intéressés dans l'aménagement d'un territoire, divisibles arbitrairement en deux groupes: d'abord le groupe représenté par le genre de personnes ici présentes, c'est à dire ayant une formation professionnelle, raisonnables, paisibles et dont la vision est plus souvent tournée vers le long terme; l'autre groupe sera représenté par l'entrepreneur au sens économique du mot, habitué à se frotter à la concurrence, bruyant, son regard dépassant rarement le court. Certes les forces en cause ne sont pas égales et ce travail de pondération au moment de la décision finale constitue le plus difficile pour le gestionnaire. Il faut que ceux qui partagent la cause de l'UICN changent de style de représentations auprès des 'preneurs de décisions' et à l'heure de l'établissement des priorités dans les budgets gouvernementaux. En général, le gestionnaire ne sera pas comme tel un produit de l'université car celle-ci n'a pas encore appris à décroisser la multitude de ses facultés et partant n'a pas encore développé cette discipline de 'gestionnaire de l'emploi polyvalent du sol'. Enfin l'ère des super-ministères qui s'amorce dans divers gouvernements facilitera énormément la tâche du gestionnaire.

Dr. Sioli said that the kinds of question he was trying to answer in his paper were—Do we have management problems, in meeting not only material needs but those of the human personality, because we still have too few techniques? In other words, if we could apply our knowledge, and avoid certain obvious errors, have we already the means of solving our problems and creating a better and ultimately optimal world?—a new world which will fit our needs and aspirations better than the one which has evolved in the last 3000 million years, and this despite the notorious failures and shortcomings in the realization of the scientific and technical ideal, especially in so-called developed countries. If the answer was affirmative, all that would be necessary would be to work in a laboratory, ask for more instruments, feed more facts into a computer, and the results which would emerge would never fail to work in practice. This might be a technician's belief, but science must go deeper and ask if there is a realistic reason for assuming that, before it is too late, we may understand so much of the structure and dynamics of ecosystems as to be able to substitute other and better ones, which are more stable and productive for mankind. In trying to understand ecosystems ecologists are now con-

structuring models, linked by lines representing energy-flow, but we must not forget that they are only models and do not contain the whole reality. At most they may help our understanding of the simplest man-made ecosystems.

This raises the further question of what is 'life' in an ecological sense: it is not just the complex of physio-chemical processes which make matter 'live', but the interaction of the organism with its environment, a 'tension field', in which the play of life is acted out between the organism and its 'vis-à-vis'. In modern civilization we have eliminated our natural vis-à-vis and substituted a man-made one, the technical industrial world, or, in the spiritual field, what is variously referred to as a 'paideuma' or 'culture pattern' or 'God'. Thus the tension between two different structures has ceased to exist and in effect we look into a mirror and see ourselves, or a partial image of ourselves—which has much to do with the boredom and other ills of the modern 'developed' world. But even more at the root of the trouble is the 'causality principle' on which science is based: it is not very old in human history, but it has become an extremely effective tool in man's play of life, with which he has now programmed his whole brain like a computer, suppressing all other capabilities by hypertrophication. A computer can accept and digest only quantities—but life also comprises qualities, not merely the so-called qualities that are mostly quantifiable substitutes, such as better automobiles, air-conditioning or even leisure for recreation, but the real qualitative values, beauty, love, loneliness and so on. These are the values we have suppressed in the vis-à-vis of our life, with inevitable reactions on our internal emotional world. They cannot be reconstructed by mathematically linked causal structures and the lack of them leads mankind to the final feeling of frustration with life and revolt or suicide by flight into the surrogate material world. Thus the application of our knowledge of only that aspect of the world which comprises its causal framework is not sufficient for the management of resources for the true benefit of the whole human personality.

Au début des commentaires 'panélistes', le professeur **Jean Dorst** dit que le rapport de M. Bergevin démontre clairement que nous avons maintenant besoin d'une nouvelle catégorie d'hommes ayant des vues globales sur les problèmes du développement. On doit rappeler à ce sujet ce que c'est vraiment l'écologie: sans doute il s'agit en premier lieu d'une branche de la biologie, puis d'un ensemble de techniques dérivées des recherches fondamentales; mais il s'agit avant tout d'une manière de penser et d'envisager les questions avec un esprit synthétique. L'acquisition d'une manière de penser nouvelle peut seule permettre la communication entre les divers spécialistes et la définition d'un langage commun. Ce n'est qu'alors que nous pourrons arriver à la solution d'un certain nombre de problèmes cruciaux que tentent en vain de résoudre des gestionnaires ayant de bonnes intentions mais des vues trop partielles. Je pense notamment aux applications des méthodes employées pour l'analyse des systèmes naturels à l'analyse des 'écosystèmes' humains et industriels. L'approche devrait être la même sur le plan de méthodologie. M. Bergevin a insisté à juste titre sur la souplesse avec laquelle nous devons envisager les divers problèmes en fonction d'un grand nombre de facteurs. Dans ce domaine aussi l'écologie peut servir utilement de modèle. Il n'y a pas si long-temps, les spécialistes de cette discipline croyaient pouvoir s'en tenir à quelques lois générales qu'ils étaient fiers d'avoir découvertes, Ils savent maintenant que nous nous trouvons en face d'une infinité de cas particuliers. En vue d'assurer les conditions optimales de l'environnement humain, il est vain d'appliquer partout la même 'recette'.

Cette nouvelle manière de penser est particulièrement utile en ce qui concerne l'action dans les pays tropicaux, de là l'intérêt extrême de la note annexée

au rapport de M. Bergevin. Seuls un esprit nouveau et une approche globale peuvent permettre à ceux qui ont la responsabilité de ces secteurs vitaux de la biosphère d'agir d'une manière rationnelle, à propos avant tout des zones marginales encore pleines de promesses mais déjà menacées par l'application de méthodes rétrogrades. Par ailleurs, il conviendrait que les dirigeants politiques aient une conscience écologique pour leur faire 'sauter' l'étage représenté par Manchester et la Ruhr en industrialisation, par Paris, Chicago et Tokyo en urbanisation, et par les monocultures dévastatrices en agriculture.

Enfin, il se trouvait en désaccord sur un point du rapport de M. Bergevin. Celui-ci évoque les 'conservationnistes traditionnels' attachés à la protection de parties de la nature à l'état pur. Nous sommes tous convaincus que l'homme ne peut assurer sa subsistance et son bien-être qu'en transformant une partie considérable de la surface de la terre. Mais il n'en doit pas moins conserver à l'état originel, ou dans un état voisin, un échantillonnage suffisant et représentatif de tous les habitats naturels. Cela nous permettra d'étudier la structure et le fonctionnement d'écosystèmes, de garantir aussi la conservation des espèces. Ces mesures sont de la responsabilité de tous les hommes. Elles font particulièrement partie des objectifs essentiels de l'UICN. Renoncer à cette politique serait faillir à un des devoirs fondamentaux de l'Union. Professor **Turner**, panel member, said that the emphasis in Mr. Bergevin's paper was not on how to manage land for wise use but how to train the land manager and the type of man needed; the latter point was also taken up in the IUCN annexe, with reference especially to marginal tropical lands. The problem, however, really applies to all training for conservation work. Teaching of conservation is now encouraged at all levels, but it is worrying that courses at technical college and first degree University levels are sometimes being developed by generalists as *professional courses* for land managers and conservationists. M. Bergevin is right in insisting that the latter should be recruited from specialists fully trained in a discipline such as biology (especially ecology), forestry, agriculture, engineering, economics or public administration. It is the same with geographers, most of whom begin their professional life in another discipline. It would be useless to have a flood of enthusiastic amateurs speaking the jargon of conservation, but unable to tackle the scientific and technological problems involved in land management and conservation.

In his complex philosophical paper, Dr Sioli refers to the management of natural reserves and argues rightly that a purely scientific approach is inadequate. Although he does not offer any detailed alternative, the value of his paper lies in its stress on the psychological problems of modern man, accentuated by increasing leisure. He is rightly concerned by the loss of intensity of experience of life and consequent loss of real happiness in 'developed' communities and believes management of natural areas should aim to increase that intensity and happiness. But how? Perhaps two ways could be suggested: either encouraging a small number to participate fully, while providing the great bulk of people with ordinary 'tourist' facilities: they will bring in the money and help to justify the reservation of land, even though they themselves may not attain 'happiness' in the philosophical sense. The other alternative would be to try to educate *all* people, young and old, so that all desiring it could benefit from real creative participation in national parks and similar reserved areas. But this alternative carries a heavy price: it makes the management of parks and the conservation of wildlife infinitely more difficult.

The **Chairman** next called for contributions from the floor and the following were the main points made in the ensuing discussion.

Until recently scientific-technological management was still being considered as the first priority for meeting the material needs of society, but experience has shown that to achieve a healthy standard of living, society has to develop a perfect harmony with nature and environment. One point that could be added to what was said by Professor Turner about natural reserves: international conservation work has tended to concentrate on endangered species and the protection of large areas not yet substantially influenced by man's impact. But it should not be forgotten that, especially in intensively developed regions, there are still many *small* areas of great value scientifically, educationally and culturally. They often represent the remnants of natural features, not yet destroyed or only slightly altered by man, and their importance deserves more international attention—**Zdenek Vulterin** (Czechoslovakia).

M. Sioli nous montre les limites de la science et de la technologie qui sont à considérer dans le développement et la gestion de l'environnement. La prédominance des considérations quantitatives a conduit à une réduction du degré de satisfaction de l'individu, allant de pair avec un déclin dans la qualité de l'environnement. L'auteur rapporte notamment le nivellement des extrêmes que l'on peut observer dans la manifestation des émotions humaines. Les solutions ne se trouvent donc pas uniquement dans le progrès de la science. L'éducation, comme il en a déjà été fait mention, doit permettre à l'homme de comprendre le dynamisme complexe de ses interactions avec son environnement global. Il convient dans cette approche (1) de supprimer les barrières artificielles entre milieux naturels et modifiés et (2) de tenir compte de l'homme lui-même et de ses influences. Une grande part des conséquences négatives des interventions humaines procèdent de la simplification des problèmes. L'éducation mésologique se doit dès lors de promouvoir une approche interdisciplinaire au sens le plus large, tenant compte de tous les facteurs, qu'ils soient de nature écologique, économique, sociale et culturelle. L'éducation mésologique doit aussi faire une place importante aux aspects qualitatifs des relations des hommes entre eux et avec leur environnement. Ainsi, à la Conférence (1972) de London (Ont.) il a été recommandé de créer auprès des universités, des centres d'excellence afin de développer l'enseignement et la recherche des voies interdisciplinaires. De même, à Ruschlikon, à la Conférence européenne sur l'éducation mésologique (1971), il a été recommandé de créer au niveau national un centre d'information et de recherches sur l'environnement ainsi qu'une structure ayant une fonction de régulation entre le centre et les sphères de prise de décision. Dans la gestion de l'environnement, il est également très important, comme l'a indiqué M. Doets, de favoriser la participation de la population visée par les mesures d'aménagement: ceci implique des interventions d'ordre éducatif et un certain contrôle de la qualité de l'information que l'on destine au public, afin de ne pas induire des réactions pouvant conduire à son désintéressement pour l'environnement, par suite d'un processus de fatigue au sens physiologique du terme. Les responsables de l'éducation ont une tâche écrasante, car l'éducation constitue une des principales voies susceptibles de déterminer le progrès de l'homme. Ce progrès ne doit-il pas se situer dans la trajectoire même de l'évolution de l'homme, caractérisée par le processus de cérébralisation? Dès lors ne faudrait-il pas en arriver à pouvoir juger toute intervention dans l'environnement par les répercussions que celle-ci peut avoir sur l'équilibre et le progrès mental de l'homme?—**Michel Maldague** (Canada).

In environmental education the most important problem is how to integrate the curricular material now available into the actual practice of schools and universities. In the USSR, where from Grade 5 to the final Grade 10 scholars are given considerable opportunities for environmental, ecological

and conservation studies, it was considered necessary to prepare qualified teachers for this purpose by compulsory courses on nature conservation, in the biology, geography, chemistry and other faculties, in all Teacher Training Institutes (over 200 of them). The syllabus was prepared by Prof. A. V. Mikheev and Dr V. M. Galushin. Somewhat similar but optional as well as compulsory courses have been established in universities and agricultural, forest and other institutes. In 1969, the first Department of Environmental Conservation and Biocenology was established at Kazan University under Prof. A.V.Popov, which now has about 100 students destined for the many vacancies in this field which are now waiting to be filled at State and other educational institutions. Thus we have succeeded in moving environmental education from the 'talking' to the 'action' stage; soon hundreds of thousands of students will be ready to play a part in improving and maintaining the highest possible quality of environment and human life—**V.A.Popov** and **V.M. Galushin** (USSR).

The time seems overdue for the real ecologists of the world to insist on proper standards of training, experience and integrity, both among themselves and for others aspiring to join their ranks. So many people call themselves ecologists nowadays that the real ones often hesitate to do so. This situation in ecology is a highly anomalous one and dangerous: for it is the vocal proponents who are apt to be listened to by politicians and industry, while the real ecologist, recognizing the extreme complexity of his subject, hesitates to pronounce upon it—**N. Polunin** (Editor, *Biological Conservation*).

The discussion has assumed that land managers can manage any type of land, but it seems obvious that quite a different type of man is required to manage agricultural land than, say, a national park, in exactly the same way as medical specialists differ. A further point is that a highly respected scientist or a competent engineer may make a poor manager and what is needed is someone specially trained to deal with the prime use of the land being managed. The good manager will know how to harness the specialists and make proper use of their advice, although I agree that his own training should have regard to the environmental impact of various courses of action—**R. J. Machlachlan** (New Zealand).

With reference to Professor Maldague's remarks, I agree entirely on the value of university level, academically-oriented environmental education and research, and did not wish to imply otherwise—**J. B. Bergevin** (author of paper 15).

Coming back, in conclusion, to my main point, it is simply that there is a borderline to our scientific thinking, on this side of which we must of course continue to extend and perfect our research and the application of our knowledge in order to satisfy material needs; but beyond which, in the realm of spiritual needs, nothing can be proved since it does not obey the causality principle and we cannot establish incontestable guidelines for managing the equally natural resources involved. Nevertheless, I believe the conservation of the qualitative values of life, which constitute these resources, should be the concern of IUCN and, although the present generation, too much bound to causal thinking, may not be able to cross the borderline and envisage and explore the qualitative reaches and aims of life, I have hopes of the next generation—**H. Sioli** (author of paper 16).



**SESSION E**

**MANAGEMENT OF NON-AGRICULTURAL  
RURAL LANDS**

**Part 1**

**SESSION E: PART 1**

*Chairman:* Dr. L.Hoffmann (Switzerland): Executive Vice President, World Wildlife Fund International, Morges.

*Authors:*

**Paper (17): The need for New Concepts in Land Evaluation**

Professor Hilgard O'Reilly Sternberg (USA): Professor of Geography, University of California, Berkeley, California.

**Paper (18): Conservation and Development of Tropical Rain Forest Areas.**

Mr Kenton R.Miller (F.A.O.): Member, IUCN's International Commission on National Parks; Team Leader, Wildland Management and Environmental Conservation Programme for Latin America, Santiago, Chile.

*Panel Members:*

- 1 Mr M.B.Cortez (Philippines): Senior Executive Assistant, Ministry of Agriculture, Diliman, Quezon City.
- 2 Ing. Mario A.Boza (Costa Rica): Chief, Department of National Parks, Ministry of Agriculture, San Jose.
- 3 Professor J.B.Cragg (Canada): Member, IUCN's Commission on Ecology; Director, Environmental Sciences Centre (Kananaskis), University of Calgary, Alberta.
- 4 Mr T.Gahuranyi (Zaire): Directeur General adjoint, Institut de la Conservation de la Nature, Kinshasa.

*Rapporteur:* Madame Paule Gryn-Ambroes (IUCN).

*Secretariat Member:* Mr Alfred Hoffmann (IUCN).

## SESSION E: MANAGEMENT OF NON-AGRICULTURAL RURAL LANDS

### Part 1: Paper (17)

# The Need for New Concepts in Land Evaluation

HILGARD O'REILLY STERNBERG

*Professor of Geography, University of California, Berkeley, California*

#### SUMMARY

Three broad interconnecting themes are treated with illustrations drawn mostly from developing tropical areas of the New World, especially Brazil.

The first section, addressing itself to the unpremeditated interplay of forces that results in portions of a given territory remaining rural and non-agricultural, deals primarily with the overexpansion of inefficient agriculture at the expense of wilderness areas. By maximizing output of existing farm and pasture land, in ways that do not imperil the environment, the thrust into so-called 'new' areas might be restrained. Tropical ecosystems, long under pressure from small land-hungry pioneers, are undergoing an assault unparalleled in history, for which technological hardware and vast financial resources have been mobilized—but practically no environmental knowledge. If wild lands are treated as a scarce rather than a cheap resource, because of the ecological price that future generations will have to pay, a shift in factor proportions should result in more intensive use of existing farmland. Since most of the ongoing clearing is spurred by official incentives, or effected through outright government colonization schemes, enlightened leadership might strive to avoid, rather than stimulate the opening up of much land of relatively low potential.

The second section deals with some inducements for the deliberate setting aside of open lands. The finite earth-space requires a design for coexistence, having among its objectives that of protecting natural processes from disruption by man and man from the insults of nature. If environmental diversity is to be preserved, with all its potential resources, areas set aside as reserves must be large enough to contain all members, plant and animal, of the ecosystem. On the other hand, areas that are particularly hazardous to man should be avoided by large concentrations of people: this criterion should increasingly affect urban planning and development decision making; its beneficial effects can be greatly enhanced if combined with an ecological viewpoint in integrative spatial organization.

The third section concerns value systems, particularly in less developed countries, that bear upon the preservation of non-agricultural rural lands. Assuming that alternates will be sought to U.S.-style consumerism, countries that have not destroyed genetic pools, ecological diversity and cultural pluralism, will have the edge on those that have carried to its ultimate consequences the pursuit of the currently fashionable homogenized, industrial model. Leaders of emerging nations should set their sights on quality, rather than quantity growth. Those of wealthier countries must create global conditions where such a plank becomes desirable and feasible.

In conclusion: if it is too much to expect a strict 'hands-off' policy in relation

to the remaining non-agricultural rural lands, at least some extensive tracts must be saved from piecemeal degradation, so that natural processes may run their course.

## RESUME

Trois grands thèmes apparentés sont traités et illustrés par des exemples pris pour la plupart dans les régions tropicales en voie de développement du Nouveau Monde, notamment au Brésil.

La première section étudie le jeu des forces qui font que certaines parties d'un territoire donné conservent leur caractère rural et non agricole. Elle traite essentiellement de la surexpansion d'une agriculture inefficace aux dépens des régions sauvages. En maximalisant le rendement de terres de cultures et des pâturages par des méthodes qui ne menacent pas l'environnement, les empiétements sur les régions dites nouvelles pourraient être freinés. Les écosystèmes tropicaux longtemps soumis aux entreprises mineures de petits pionniers à la recherche de terres subissent actuellement un assaut sans précédent, mené à l'aide d'équipements techniques et de moyens financiers énormes mais pratiquement sans aucune connaissance des données écologiques. Si les terres des régions encore sauvages étaient considérées comme des ressources rares plutôt que des ressources bon marché, en raison du prix écologique que les générations futures auront à payer, la modification de l'échelle des valeurs conduirait à une utilisation plus intensive des terres déjà exploitées. Etant donné que la majorité des opérations de déboisement s'effectue à l'instigation du gouvernement ou d'après des plans officiels de colonisation, des dirigeants éclairés pourraient chercher à éviter plutôt qu'à encourager la conquête de vastes espaces ayant des potentialités assez faibles.

La deuxième section traite des motivations qui pourraient inciter à mettre de côté des terres encore libres. La surface de la planète étant limitée, il est essentiel de trouver des schémas de coexistence, un des objectifs étant de protéger les processus naturels contre les dégradations d'origine humaine et de protéger l'homme contre les atteintes de la nature. Si l'on veut préserver la diversité de l'environnement, avec toutes ses ressources potentielles, les zones mises en réserve doivent être suffisamment étendues pour englober toutes les composantes, animales et végétales, de l'écosystème. D'autre part, les zones particulièrement dangereuses pour l'homme ne devraient pas accueillir de vastes concentrations humaines. Ce critère est à prendre en considération dans les plans d'urbanisation et au niveau des prises de décision. Ses effets bénéfiques peuvent être considérablement accrus s'ils sont combinés, à un point de vue écologique, dans la planification intégrée de l'espace.

La troisième section concerne les systèmes de valeurs—en particulier dans les pays moins développés—qui ont trait à la préservation des terres rurales non agricoles. En supposant que l'on recherche des solutions autres que le style de consommation 'à l'américaine', les pays qui n'auront pas détruit leurs réserves génétiques, leur diversité écologique et leur diversité culturelle seront fortement avantagés par rapport à ceux qui auront poussé à l'extrême la poursuite du modèle industriel homogénéisé en vogue à l'époque actuelle.

Les dirigeants des pays en voie de développement devraient s'attacher à rechercher une croissance qualitative plutôt qu'une croissance quantitative. Ceux des pays plus riches doivent créer des conditions globales telles qu'une pareille politique devienne souhaitable et possible.

Disons en conclusion que si c'est trop que d'attendre une politique rigoureuse de non-mainmise sur les terres rurales non-agricoles restantes, il faut au moins sauvegarder quelques zones d'une certaine étendue contre une dégradation progressive et continue, afin que les processus naturels puissent suivre leur cours.

### THE NEED FOR NEW CONCEPTS IN LAND EVALUATION

'For love of an insignificant profit the population destroys one of the greatest resources that could assure its subsistence and the well-being of its children, as well as the good fortune of coming generations. Unfortunately, it is not only the ignorant class that acts in this manner. The highest ranking persons do the same, as well as almost all the foreigners established in the country.'

João Martins da Silva Coutinho, military engineer and explorer, writing of the Amazon turtle—and of human improvidence, 1868.

'... everything indicates that future generations will have the right to criticize us severely if we sacrifice the per capita income growth for other priorities.'

Mario Henrique Simonsen, economist, writing on development, 1972.

There are two principal levels of land evaluation and management. The more general one concerns the processes that result in portions of a given territory remaining rural and non-agricultural. The other level, not touched upon here, concerns the specific ways in which these portions are utilized: e.g. wilderness tracts, game sanctuaries, parks.

On both levels, decisions should be based on adequate information and oriented toward goals that reflect the values of the communities concerned. In short, a chain: information-evaluation-decision-planning-implementation. It has more than one weak link. Thus, information is usually inadequate or nonexistent—especially in the case of developing tropical areas, upon whose New World expression this paper lays emphasis. And people are unclear, frequently ambivalent, about the value they attach to their resources—known, suspected or imagined. Indeed, even basic decisions are often lacking and the community drifts into haphazard dilapidation of assets, prompted by different interest groups.

Information about 'land' bears upon all the elements that make the 'personality' of a place: rocks, relief features, soils, macro- and micro-climates, plant and animal communities, water (increasingly, a limiting factor in the use of the *oikumene*)—and, of course, man himself and his works.

The gathering of some of this intelligence can be greatly expedited by new techniques of remote sensing, which make use of high-flying aircraft and, where views of large areas and time-series are required, satellites. The new sensors are particularly useful in overcoming some of the specific problems posed by tropical environments. Probably the most ambitious project thus far attempted to obtain *à pas de géant* an overview of the natural resources of a vast inter-tropical region, is Project RADAM (RADar in AMazonia). Airborne in 1971 and destined to cover some four million square kilometers of Amazonia and contiguous areas in Brazil, it uses side-looking airborne radar (SLAR) to punch through the equatorial cloud cover that reduces the efficiency of conventional air photography. The equivalence of signals and 'ground truth' having been established in all haste, the radar images are now being analyzed in terms of geology, geomorphology, hydrology, pedology and phytogeography (Moura, 1971).

Even before the latest advances in scanning devices and the advent of spacecraft, a huge backlog of aerial photographs had been accumulated in many parts of the developing tropical world, e.g. Latin America and Africa, and never seriously analysed (Schweitzer, 1972). Among the reasons for this waste of informational resources is lack of properly trained manpower, compounded by the short-sighted tendency of some governments to slap the 'classified' stamp on all air photographs indiscriminately, making it extremely difficult for scientists, foreign and national, to study them.

Despite the assistance of these new land inventory techniques, full understanding of ecosystems requires the detailed *in situ* study of interrelationships, at successive notches of integration—for instance, the plant/animal coevolutionary syntheses carried out by Herbert G. Baker (Berkeley) or David H. Janzen (Chicago). For this kind of investigation, close-up, not remote sensing is required; there is no substitute for slogging over the ground.

Information-gathering is influenced by and, in turn, influences the evaluation process. An important by-product of holistic thinking in relation to the environment is the better appreciation of the fact that the *mise en valeur* of any one of its elements will affect the others. One resource may be destroyed if another is exploited. Now, some value systems may be quite permissive when the inevitable 'trade-off' involves surrendering a non-tangible benefit. But value systems change, especially after basic needs have been provided for. Greater store may be set on the environment's capacity to provide for amenities—if that capacity is still there. Value may be discovered in what appeared valueless. The ongoing reappraisal of goals by the developed countries (DCs) suggests that the less developed ones (LDC's) should not make decisions that irreversibly impoverish or destroy the ecologic base, thus rendering futile a later reassessment of priorities. This is especially true where information is so incomplete that many undertakings can properly be considered a sort of 'ecological roulette.'

Within the assigned frame of reference of this paper, I have picked three broad, interconnecting themes, to be treated in as many sections and only as examples. The first section deals with the complex, often unpremeditated interplay of forces that controls the existence, as well as the expansion and contraction, of non-agricultural rural lands. The second explores some of the many possible inducements for a deliberate setting aside of open lands. The third touches upon value systems, particularly those prevailing in the LDC's, that condition receptivity to the ideals of quality growth and thus bear upon the chances for preservation of significant expanses of non-agricultural rural lands.

#### **A. STRESS ON NON-AGRICULTURAL RURAL LANDS**

In addition to the rural-non-farm domain, this discussion will refer to two other major functional land categories: urban and rural agricultural. Within a particular territory, the lands thus classified, whose boundaries may be transitional or diffuse and are commonly unstable, are part of a physico-biotic as well as socio-economic-political fabric. These lands, by which I mean all the complex processes associated with them, interact with each other and with other non-coextensive subsystems—some chorological, some systematic or sectoral—woven into the fabric. They are also linked to systems of a higher order of magnitude; market prices and political or other world events may ultimately influence the destiny of the most remote parts of the earth. For

instance, in the Peruvian rain forest, where during the rubber boom Indians were enslaved to work as tappers, profound cultural and biological repercussions resulted: eighty percent of the indigenous population of the Putumayo River were annihilated during the first decade of the century (Varese, 1971).

Of the land in the three major categories mentioned, two kinds, urban and agricultural, are, in terms of prevailing values, obviously 'productive.' Excluding some deliberately protected areas, those in the third category, rural non-agricultural lands, constitute no more than a residue after urban and farm areas have been subtracted from the total space considered. If endowed with any potential at all, so goes the reasoning, the leftovers will eventually be used. Since the space preempted by urban and agricultural milieux defines by exclusion the extent of rural non-farm lands, much of this review, including the present section, deals with the subtrahends.

I shall address myself primarily to the category of agricultural lands. This choice is not meant to play down the phenomenon remarked by Jean Brunhes sixty years ago, which is even more striking today: 'no human fact ... has more quickly and powerfully changed "the face of the earth" than the recent and prodigious growth of the cities' (Brunhes, 1910). But these nerve centers, which radiate into all parts of the geographic body, are, in terms of direct competition for space, less significant than the agricultural lands. In the US, for instance, urban space, including airports, railroads, highways and places with more than 1,000 population, occupies only 2½ per cent of the territory (Krause, 1971). Of course, through the urban field of which it is the core, the city projects its influence far into the surrounding countryside.

Given the extraordinary urban growth in the LDC's, the question as to whether the future increases in urban population will be entirely absorbed by existing communities or partly accommodated in new towns is of considerable interest to the fate of the rural non-farm lands. In the case of Latin America, for instance, guesstimating ninety million additional urbanites by 1990, some experts are talking of the need for ninety new one-million cities—or forty-five two-million agglomerates. Far-fetched, perhaps, but with a solid tradition of building cities from scratch, it will not be a surprise to see quite a few new ones added to the ranks of Belo Horizonte, Brasilia, Ciudad Guayana and others. The implantation of a series of new towns is likely to produce a considerable impact on the environment, not only directly but also through the establishment of new urban fields and the building of a network of highways that will make isolated areas accessible. Opening up of 'new' lands is precisely one of the main purposes of pre-planned towns in emerging nations. Accessibility, *per se*, is bound to affect the environment, whatever the stage of a country's development. But the closer a community is to the profit end (or the further from the aesthetic end) of the spectrum of environmental values at the time the lands are opened up, the greater the impact is likely to be.

### **Expansion and retreat of agricultural land**

The time dimension also is basic in the case of agriculture's impact on the rural non-farm lands. Much forest and woodland, wide stretches of grass in what is now the United States, were broken to the plow or modified by introduced livestock. For centuries, farms encroached on wilderness. Lately, however, gains have been more than offset by losses to agricultural land: the net retreat of cropland has proceeded at a rate of some ¾ million hectares per annum (Abel and McArdle, 1971). Many areas on which cropping is being discontinued are ill-suited for modern machinery and agricultural technology.

Cleared land, over which farmers at one time walked their horse-drawn implements, have been abandoned or deliberately planted to trees. Similarly, extensive grasslands, once cultivated, have reverted to a herbaceous cover. The overextension and subsequent retreat of farming is not limited to lands of modern colonization. Witness, for example, the recent desertion of rural settlement in Norrland, where, for economic, political and military reasons, the Swedish government encouraged farming in the late nineteenth and early twentieth centuries (Stone, 1971).

Social and economic costs of agricultural retrenchment are high, and original ecosystems have been grievously damaged, in some cases beyond recovery. One wonders if an assessment of agricultural potentials, incorporated into an overall plan for settling might have spared some of the lands that time was to prove marginal and dispensable.

Is it an equally vain exercise to speculate that the attack now being carried out against the remaining wilderness areas of the world, especially those in the tropical LDC's, might be tempered by greater foresight? The times are certainly different. There are now more environmental awareness and an increased potential for overall assessment of resources. And although the individual pioneer still threads his way into the forest to hack out an ephemeral *roca*, large-scale enterprises, spurred by official incentives, and outright government colonization schemes are responsible for most of the ongoing clearing. Enlightened leadership might therefore use more integrated planning and appropriate manipulation of incentives to avoid rather than stimulate the opening up of much land of relatively low potential. In this connection, the fact that the decrease of agricultural land in the US has been possible despite a growing population should be duly evaluated by the peoples of the LDC's. That a reduction of more than ten percent in area of cropland occurred in the last two decades (Krause, 1971), while the population increased by a third to pass the 200 million mark is due to a hefty increase in farm productivity—so great an increase, in fact, that it has created problems of overabundance, and extensive tracts of farmland have been taken out of production temporarily. In 1970, the total cropland diverted under specific government programs amounted to an estimated twenty-four million hectares (USDA, 1970).

Greatly increased efficiency that boosted the production per hectare by half since mid-century is due in part to the shift from marginal to better soil, in part to a more intensive use of the land, achieved by several means: increased use of power, better farm management and increased credit, as well as considerable inputs from scientific research, e.g. new fertilizers, pesticides, improved plant and livestock varieties (Krause, 1971).

Concerning these inputs, the rather sudden realization that misuse of fertilizers and indiscriminate 'overkill' with persistent synthetic pesticides has created serious environmental problems will slow down the rate at which farm productivity has been increasing in the US. The current ecological crisis should be a warning against uncritical transfer of 'advanced' agricultural technology to the LDC's. However, these countries still have immense scope for improving the productivity of farming and stock raising, in ways that do not threaten the environment.

### **In-depth growth of tropical agriculture**

In the emerging countries of the tropics, rapidly growing populations traditionally have been fed by advancing an inefficient agriculture into 'new' lands.

With a few notable exceptions, efforts to intensify and rationalize food production have been minor; more has been done for commercial export crops. However, if the encroachment upon wilderness areas is to be curtailed, and at the same time food demands met, there must be an increase in productivity. A policy destined to promote such growth in depth sets itself somewhat antithetical goals: on the one hand, to maximize the output per hectare; on the other, to ensure the integrity of as much of the environment as possible. And all this, without increasing the vulnerability of tropical agriculture to pests and diseases. Alternatives to horizontal expansion must do more than adapt imported technology; they should explore a wide and varied range of measures that include, for instance, utilization of native resources as well as institutional reforms.

Efforts to produce high-yield cereal varieties suitable for the tropics, notably wheat and rice, culminated in the late sixties in what has been heralded as the 'green revolution.' It is no aspersion on the undeniable merits of the agricultural scientists involved to see in their achievements something less than the ultimate solution to the food problems of the tropics. The very success of the 'miracle' grains, leading to their widespread adoption and the displacement of low-yielding indigenous varieties, carries the danger of providing a more favorable environment for pests and diseases. There also may be less tolerance to peaks of climatic or hydrological stress. That there is a very real basis for fearing that the food production of a region could be wiped out in one fell swoop was confirmed in 1971, when considerable areas in the Philippines, planted to high-yielding varieties of rice, including IR22, IR8 and IR5, were stricken by a severe outbreak of disease (*tungro*) or subjected to critical flooding.

It seems that, if agricultural productivity is to be effectively increased in the low latitudes so as to restrain undesirable expansion into wilderness areas, long-range solutions should be sought that are capable of exploring the rich diversity of tropical crops as well as peasant systems of agriculture of which they are a part. Witness, for instance, how inter-cropping or the value of native root crops has been generally ignored in the thrust for large-scale operations, partly as the result of the not always appropriate transfer to agriculture of 'economy of scale' thinking.

Where, as in many tropical developing countries, the land tenure situation is characterized, on one hand, by the generally inefficient *latifundium* and, on the other, by the non-viable *minifundium*, increased productivity in the agricultural sector cannot be achieved without institutional changes. The objective of such changes: a social and economic environment conducive to the elaboration of a tropical-specific type of agriculture that seeks maximum sustained yield and fully utilizes resources native to the environment.

Unless one is dealing with a problem of the kind derived from indiscriminate use of pesticides or pollution by fertilizer run-off, it is the *latifundium*, with its extensive use of land, that is most detrimental to the overall environment: a use that is sufficient to destroy the ecosystem, yet not intensive enough to produce abundantly, to provide land for those that would till it, and to render unnecessary the advance of the frontier of settlement.

Need one say that powerful interests align themselves against a deep-cutting solution of the land tenure problem? Such interests are likely to feel more comfortable with an application of the venerable 'safety valve' theory: surplus populations are drawn off and left to gnaw away at the rapidly retreating edge of the remaining wilderness.

### **The age of large-scale clearance**

Tropical ecosystems have long been under pressure from these small land-hungry pioneers, pushed by the socio-economic malaise of distant source areas. Now they are threatened by a massive assault mounted by groups—armed with technological hardware, commanding great financial resources—and guided by a frighteningly inadequate understanding of the tropics. Certainly no period in history has witnessed a more extensive and rapid transformation in the planet's vegetation cover than that under way in the tropical lowlands of Latin America. It surpasses by far even such major episodes of land clearance as occurred during what the historian Marc Bloch described as 'l'âge des grands defrichements.' The medieval clearings, which produced what appears to have been the greatest increment to the farmland of France since prehistoric times, ran their course over a period of two to three centuries (Bloch, 1952). The ones now in progress are compressed into a few decades: to strip vast areas, tractors are deployed alongside the ax-wielding woodsman, and, it is said, even defoliants have been used (Frisch, 1970).

Consider, for instance, the case of Brazil, where recently there has been a great increase in the total amount of land in farms, mostly in the Central-West and Amazonia. Although statistical data are not at hand at the time of this writing, it is safe to say, on the basis of field observations, that cattle ranches occupy an overwhelming proportion of the land opened up since 1960. The pursestrings of the funds used in the vast campaign of clearing and grassification are held by the Superintendence for the Development of Amazonia (SUDAM). Resources derive from a highly ingenious scheme that allows substantial tax deductions, provided funds are put up for investment in approved development projects. The bulk of the tax moneys allocated as of 1971 went to agro-pastoral (i.e. livestock) projects (43.5 percent), followed by industry and services (39.9 and 16.6 percent, respectively). Major beneficiaries have been wealthy entrepreneurs working out of São Paulo and engaged in carving immense cattle spreads out of the forests and savannas of Mato Grosso, northern Goiás and southern Para.

Several factors contribute to the expansion of pasturelands in Brazil, part of the ongoing grassification of the New World tropics (Wilhelmy, 1954; Sternberg, 1968; Parsons, 1970). But other stimuli would not be effective if operators did not foresee expanding markets and favorable beef prices. Even if the figures for world-wide growth in population that serve as a basis for projecting future protein requirements should fall short of expectations, medium term prospects for beef are, indeed, very good (FAO, 1971). The producers' position seems assured by growing internal consumption in Latin American countries and a substantial demand on the part of some developed importing countries.

Nevertheless, to the conservation-conscious observer, the ongoing 'grass rush,' carried out at the expense of existing ecosystems, appears a shortsighted dilapidation of irreplaceable resources, an elimination of future options.

### **Better use of existing pastures**

First and foremost, this expansion of grassland seems unwise because foreseeable demand for beef probably can be satisfied with existing pastures. Livestock production in the developing countries is among the world's most inefficient industries (FAO, 1969); in addition to poor grazing conditions, the prevalence of epizootics and the generally inadequate levels of husbandry as well as adverse institutional factors contribute to low productivity. To bring to fruition the potentialities of existing pastures there is often no need for very

sophisticated or costly technology. The harvest and storage of forage, for instance, can cushion the adverse effects of seasonal fluctuations on the condition of pastures (Behar and Bressani, 1971). A second example is the identification of trace-element deficiencies: small investments in corrective measures can contribute greatly to the productivity of the herds. A final example is the suggested 'integration of animal and plant agriculture' in order to improve soil fertility (FAO, 1969). The extent to which some experts believe the Latin American livestock industry can be upgraded is reflected in a recent report dealing with the Beef Program of CIAT (Centro Internacional de Agricultura Tropical):

The present beef cattle population of tropical grassland areas of Latin America could probably be increased four to five times, and total marketable beef production increased up to ten-fold through application of available knowledge to existing pasture and animal resources, proper seeding of improved pasture, population with beef cattle of now idle grassland and development of improved breeding systems, particularly through selection and crossbreeding' (CIAT, 1969).

In brief, the 'deplorable level' (Behar and Bressani, 1971) of the cattle industry in Latin America and other tropical areas, with beef production at a fraction of capacity, constitutes in itself the best assurance that an ample margin exists for greatly expanding the output of beef without expanding the area of grasslands. The keynote: intensified use of existing pastures.

The scarcity and plenty of resources implied here does not conform to traditional cost-benefit analyses. Where land is treated as a 'cheap' factor, extensive grazing with perhaps some supplemental feeding might produce the most profitable economic combination. But if one were to inject econometrics into econometrics, wild lands would be treated as a scarce resource, not because of their cash value but because the ecological price of their conversion to pasture is judged too high for future generations to pay. Production processes would have to adjust to this shift in the weighting of factors; the trend would be toward more intensive cattle-feeding systems, with reduced amounts of land and greater inputs of capital and management. Even if one does not envisage the ultimate in confined livestock systems—which have their own problems (Mueller, 1971)—much land now in pasture might be put to alternate uses, including food and feed crops, thus permitting a remeshing of crops and stock production, where appropriate, and halting the escalation of wilderness-taming.

### **Possible changes in food intake patterns**

A kindred argument for curbing imprudent expansion of grazing areas is the possibility of a change in patterns of meat intake. In the LDC's, bovine and sheep meats—mostly beef in Latin America—account for nearly seventy per cent of the meat consumption, against fifty per cent in the DC's (FAO, 1971). With adequate precautions, a great amount of domestic fowl and pork meat can be produced in the LDC's, with relatively minor demands on space, as has been established in some areas of the Far East, where land is in short supply. Yet poultry in many countries remains a luxury. Thus, in Cuba, according to an account recently quoted by Dumont (1970), 'chicken is reserved for the sick and women with child.' In Brazil, despite a rapid increase in poultry production around major urban centers, a considerable segment of the population understands only too well the grim humor of the old saying: 'when a poor person eats chicken, one of the two must be sick.'

The expansion of grazing areas for domesticated livestock goes hand in hand

with a widespread disregard for native animals as a source of protein. These were utilized by aborigines such as the natives of Brazil, who at the time of discovery had 'bodies so clean, so well-fed and handsome, that they could not be more so' (Caminha, 1500). Some of the wild species that provided the Amerinds with a bountiful and palatable source of protein now hover on the brink of extinction through overkill and destruction of their habitats. Yet they are probably more efficient converters of native vegetation than the introduced livestock. Some form of rational cropping of wildlife, perhaps as a supplement to more conventional ranching (including the raising of water buffalo), seems particularly promising in riverine environments, the habitat of such significant meat-producers as the capybara (*Hydrochoerus hydrochoeris*), the largest rodent living, or the tapir (*Tapirus terrestris*). The streams themselves provided, along with the coastal waters, a substantial portion of the protein used by the aborigines, and might again play an important role if their biological integrity can be saved. The South American river turtles (*Podocnemis expansa*), once described as the cattle of the Amazon, were kept in corrals by the Indians; recent experiments have demonstrated the possibility of raising *tartaruga* (Smith, N. J. H., 1972), as had been suggested over a century ago by Coutinho (1868).

Among the many alternatives the future may hold, whose effect would be to dampen the drive for more man-made grasslands, is a partial turning away from animal protein itself. The efficiency of cattle as converters of nutrients into high quality food for human consumption is relatively low, and there are situations where the more intensive use of land to produce crops directly ingested by man may be more expedient. Prospects for increasing the amount or improving the quality of vegetal protein are significant. There is even the possibility that plant-derived substitutes will make appreciable inroads on the meat market, as in the past they have partly displaced other farm products, such as butter. According to projections made by the Economic Research Service, USDA, if conditions most favorable to market penetration obtain, replacement of beef by soy substitutes in 1980 might represent as much as 8½ percent of the U.S. beef output; this switch would liberate 1.4 million hectares otherwise used for livestock production (USDA, 1972).

The statement that direct chemical synthesis may in the future replace the biochemical processes of nature in the elaboration of some basic foods currently shipped in from the farm, smacks of science fiction. Yet know-how is available for production in factories of food commodities or their components, in which vitamins and synthetic amino acids have been forerunners (Pyke, 1970). Whether or not one shares futurologists' enthusiasm for this kind of prospect, it does represent a maximum concentration of food production per unit area (with all attendant problems), and should be taken into account when reflecting on how tomorrow's spatial organization may affect the present urge to encroach upon rural non-agricultural areas.

### The 'Frontier Vision'

This section has dealt with the expansion of urban and farm lands, discussing it in terms of the need to accommodate a growing population or to increase agricultural output. A brief mention should be made of an entirely different type of motivation for advance upon the wild lands, one that is not always explicit and has somewhat elusive psychological dimensions. I refer to the 'frontier vision,' a vision that takes hold of some people and inspires them to open up wild lands simply because it is the 'right thing' to do. One could easily point to many adverse effects the application of this concept is having in the

less developed tropics. But perhaps it is better to demonstrate the latitudinal range of the vision by drawing attention to such plans as the 'Mid-Canada Development Corridor' that aims at the enhancement of an area lying roughly between the 50th parallel and the northern tree line from Newfoundland to the Yukon (Rohmer, 1970). Sovereignty over resources is among its objectives; also national pride: 'Canadians will cease to live as colonials, imitating the cities and economic life of Great Britain or the United States and ... live as a northern people like Siberians or Scandinavians' (Conway, 1969).

## B. THE TIME OF THE FINITE WORLD

Paul Valéry said it almost three decades ago: 'the time of the finite world commences' (Valéry, 1945). At the root of the frontier vision and of the related theme of pioneer conquest has been the idea of colonization of 'new' or, what has been regarded as the same thing, 'empty' lands. With the unprecedented territorial windfall of the Age of Discovery, Europeans and their descendants got into the habit of regarding space for settling almost as if it were an infinite or renewable resource. Now, however, it is finitude, emphasized dramatically by the image of our planet as seen from outer space, that lends urgency to the need for a rational organization of earth-space, for a *géographie-volontaire* (Labasse, 1966), to save at least some significant ecosystems from urban and rural sprawl.

This earth-space of ours is not merely a geometric, nor even an economic space, but a highly diversified, multidimensional pulsating tissue. Its place-to-place variations must be auscultated, if a delicate attunement is to be achieved between, on the one hand, the heartbeat of the land, with its message of opportunities and constraints, and, on the other, human design.

A design for coexistence should have among its objectives that of protecting natural processes from disruption by man and man from the insults of nature—out of enlightened self-interest if not on aesthetic or moral grounds.

It is essentially on a moral plane, however, that one particular issue needs to be situated, when discussing the kind of spatial organization that is germane to the objectives of this session. The issue I refer to arises from the fact that the notion of the emptiness of 'new' lands—with its corollary urge to hasten clearing, taming, peopling—is often unfounded. Pioneer colonization can be less a conquest of emptiness than the triumph of a modern civilization, commercial and technological, *the* civilization, over backward groups condemned to submit or perish (Raison, 1968). It is a tragic fact that in the white man's dealings with the aborigines, 'physical, spiritual or cultural imperialism of one kind or another' (Biskup, 1968), has its analogues in almost every newly colonized country.

Areas reluctantly and ungenerously set aside for aboriginal reservations, have subsequently been reduced, intruded upon or exchanged for less valuable land. Recently, the approach seems to be to 'integrate' the aboriginal populations in the national society. Ignoring completely their mobile way of life, some proposals in New World areas would 'grant' plots of farm land to the Amerinds, on a parity with civilized settlers. In relation to the Australian aborigines, once 'the idea was to kill them off,' it has been admitted, 'then the more humane programme was to let them die peacefully and meanwhile to smooth the dying pillow, now the policy is to assimilate them' (Coleman, 1959).

Point-blank: lands that are occupied by indigenes, no matter how sparsely,

cannot ethically be dealt with as a *res nullius*, to be developed or assigned to any other use.

Proceeding now to a brief commentary on the matter of a design for coexistence from the viewpoint of the place for non-agricultural rural lands, with uses that range all the way from recreational purposes to complete interdiction, this section will take up first some aspects of the endangered environment; then, a few thoughts on natural hazards to man, concluding with a meshing of the two concerns.

### Roots of change

In reviewing some ecological aspects that might lend support to a policy of deliberately setting aside sizable rural non-farm areas, I shall limit myself to a few that seem appropriately 'developmentist.' Exemplification comes from a part of the world where technological man is thrusting violently into areas that are unique, virtually unresearched and presumed to be highly vulnerable: the sparsely settled parts of the lowland tropics, especially in the Americas. They have already made major contributions to the world economy.

An outstanding example of the lowland tropical elements borrowed from the Amerind's cultural heritage is manioc (*Manihot esculenta*), which has become a major food staple. The Indians handed on not only the ancient cultigen itself, but also the rather complex techniques for preparing flour and for eliminating the poison from the roots of those cultivars that have a high concentration of a cyanogenetic glycoside. Some techniques, incidentally, appear to boost the concentration of protein in the finished product (Rogers, 1972).

Manioc outranks all other food crops in the production of energy per unit area. As raw material for compound animal feeds and industrial starch, it is an increasingly important international trade item (International Trade Center, 1968; Ayres, 1972). In line with the preceding section of this paper, it might be pointed out that a wider use of manioc as cattle feed in some of the countries producing this crop could supply a valuable supplement to grazing, thus reducing the area required for pasture. Furthermore, several researchers have pointed out that, even when people enjoy an adequate intake of protein, symptoms of its deficiency may still occur if the proper calorie levels are not met, since protein will be utilized for energy purposes (Gopalan, 1968; Miller and Payne, 1969; Sukhatme 1969, 1970a and 1970b). Indeed, it has been stated that in areas such as India, 'widespread incidence of protein deficiency ... is mostly the result of an inadequate quantity of food' (Sukhatme, 1970b) and, in fact that 'the main bottleneck in the current dietary situation is caloric inadequacy' (Gopalan, 1968). If such is the case, extraordinary energy-producers like manioc should have an important role in the composition of a balanced diet in the tropics.

The vegetation of the New World may still have a valuable contribution to give in respect to manioc. Experts believe there is considerable margin for improvement of this already precious root crop, in interspecific hybridization between *Manihot esculenta* and several other species (Rogers and Appan, 1970). It is significant for what will come later in this section that 'species of manihot are seldom widely distributed and occur mostly as very local populations' (Rogers and Appan, 1970; my italics).

The case of manioc illustrates only one of many practical reasons for guaranteeing the diversity of the biosphere. In addition to the possible use of gene pools for the improvement of known crops, the tropics abound with wild, unrealized provender that needs to be explored before the wreckers with their

bulldozers bring the storehouse tumbling down. Many such provisions were known to the aborigines who, over the millenia, by trial and sometimes costly error, learned to use available food resources, preparing them in a palatable manner, and freeing them of toxins when necessary. Some foodstuffs, in fact, did come down to us, only to be disdained as poor man's fare, low in status, even when high in nutritive value. It will be necessary to discover or rediscover the potential use for many food resources of forest and savanna: most of the Indians are no longer with us, and their lore is beyond recall.

One is reminded of episodes such as that narrated by Dr. Emilia Snethlage, at the time Head of the Zoology section of the Museu Goeldi in Belém. In 1909, this extraordinary woman set out to cross the divide between the Xingu and Tapajos rivers. At the end of a four-week march in the company of a band of Kuruaya Indians, provisions were exhausted and nourishment consisted largely of roots or tubers gathered by the Tupi. One, of the arrowroot family (Marantaceae), named 'hothin-a' by the Kuruáya was a whitish, grape-sized tuber, pulled in bunches from shallow soil between the rocks at water's edge. It had a potato-like taste and could be eaten raw or roasted, but generally was prepared as a mush by the Indian women who accompanied the expedition. Another tuber, 'hamai-pin,' also provided a pap, especially savory when mixed with honey; Miss Snethlage described it as irregularly bulbiform, black-skinned, with white, extremely juicy flesh (Snethlage, 1913).

How many other edible roots and tubers like the Kuruaya's 'hothin-a' and 'hamai-pin' may remain unknown, while constituting perhaps important potentials for food production in the tropics? Some will never be identified. It is not possible, for instance, to ask the descendants of her Indian companions to retrace Dr. Snethlage's steps and identify the plants mentioned by her. These are still there, and geologists, helicoptered in to reconnoiter the area's mineral resources (Anon., 1970), may be inadvertently stubbing some of the tubers, as they scuff around the stream banks. But the Kuruaya, who had intermittent contact with the national society at the turn of the century, are now extinct (Ribeiro, 1967).

A recent guest editorial in *Science* starts out with the whimsy that roots and their activities have been kept very much in the dark. The author, a plant physiologist, concludes with a plea for the closure of the information gap concerning the processes that are 'literally at the root of life on Earth' (Epstein, 1972). The gap is far wider in respect to the related nutritional aspects of tropical roots and tubers, often disposed of in a cavalier fashion because they are primarily carbohydrate. It is perhaps not without significance that a book extolling the 'green revolution' should be entitled *Seeds of Change* (Brown, 1970). One hopes that new attention to the potentials of tropical roots and tubers may soon bring forth a *Roots of Change*.

### **Survival of unperceived resources**

Theoretical efforts to estimate the agricultural potential of the tropics often are so loaded with temperate zone biases that their purpose is defeated, as, for instance, when the light-response curves of middle latitude crops are used to establish indices of productivity for the low latitudes. Even from a practical point of view, rather than trying to transplant temperate crops to the tropics, more effort should be made to develop plants indigenous to the low latitudes. The reopening of the entire field of photosynthetic metabolism since the mid-sixties, with the discovery of an alternate pathway of CO<sub>2</sub> fixation, has demonstrated the existence of a group of higher plants that have important adaptive advantages in high-temperature environments (Hatch and

Slack, 1970; Hatch, Osmond and Slatyer, 1971). It has also shown how little is known, as man discriminates between high-efficiency plants, to be improved and propagated, and weeds or useless plants, to be eliminated. Today's weed just might be tomorrow's staple—if it survives. Although emphasis in this paper has been on the food-producing potential of the tropical plants, there are many other possibilities; e.g., natural replacements for synthetic pesticides—again, *if* the potentially useful plants survive to be discovered. In many tropical areas, the 'rate of forest destruction exceeds the rate of screening for untapped but useful phytochemical compounds' (Lowry, 1971). The question arises as to the minimum size which continuous areas of natural reserves must have if they are indeed to include all potential resources. Consider, for instance, the Amazonian Hyloea. The fact that this rain forest stretches for thousands of kilometers, relatively unbroken and with no marked discontinuities, and the recurrence of certain plants almost throughout the length and breadth of the Amazon valley might suggest that it is enough to set aside certain discrete forest reserves in order to ensure a complete spectrum of genetic resources. Not so. Richard Spruce, who spent years in the Amazon valley during the mid-19th century, describes the Hyloea as 'wonderfully rich,' despite an appearance of uniformity: 'by moving a degree of either latitude or longitude I found half of the species different' (Spruce, 1908). An example is the woody climber guaraná (*Paulinia cupana*) of the Maue, Mundurucu and Apiaca Indians, which grows in the Tapajos-Madeira region and is cultivated mostly around Maues, being used as the basis for a popular soft drink sold all over Brazil—and now exalted by an imitation bottled in Montreal. The astonishment caused a few years ago, during an FAO forestry survey, by the discovery of a conifer of the genus *Podocarpus* in the region between the rivers Caité and Maracassumé, in Para (Heinsdijk and Bastos, 1965), is an indication of the degree to which the Amazon rain forest is unknown—it also confirms the rather localized occurrence of some species.

The smallest effective dimensions of wild areas, as related to the preservation of plant diversity, cannot be appreciated without the growing recognition that plants and animals have evolved as members of ecosystems (Baker, 1970); resulting mutualistic bonds are essential to the equilibrium among plants species of the tropical forest. The identification of minimum ecological modules thus requires a thorough understanding of the biosystematics of the tropical forest, if truly functional assemblages are to be preserved. Among many plant-animal relationships that need to be investigated are those concerning plant reproduction (pollination, dispersal of seeds and improved germination by their passage through the gut). Consideration must be given to the possibility that some animals affecting the equilibrium of the forest may be transients, who carry out their assigned roles and move on, perhaps out of the module—if Noah's Park is not big enough for the system.

### **Natural hazards and open space programs**

That the whole earth soon will not be big enough for mankind is a hotly debated proposition. That parts of it are inhospitable to humans is beyond dispute. Avoidance of 'high-risk' areas by permanent, especially urban, settlements would reduce the stress of environmental insults upon a segment of the population and, therefore, must be considered by a 'volitional geography.'

Different natural hazards tend to fall into regional patterns; detailed maps showing their distribution and severity should constitute a fundamental requirement for land-use planning at all levels. There is, however, a considerable range in the extent to which the spatial arrangement of risk can be brought to

bear upon open-space programs. Applicability varies, not only with the type of hazard, but also with the human factors involved.

The possibility of setting aside hazardous areas for non-agricultural rural use will depend on the options offered to the population involved. Contrast, for instance, the impact of hurricanes along the shores of the northern Bay of Bengal (where in November 1970 a killer storm lashed the coast and offshore islands of what is now Bangladesh and caused some 300,000 fatalities) and on the Gulf and Atlantic coastlands of the US (where the most deadly hurricane on record produced the 1900 Galveston surge, responsible for 6,000 deaths). Not only are the physical conditions very dissimilar, but the demographic, social and economic components in these two coastscapes are worlds apart. Whereas one would be at a loss to suggest alternatives for the poor farm- and fisherfolk who occupy the littoral of the Bay of Bengal, the same does not apply, for instance, to the well-to-do population that is now creating 'another of America's megalopolises' along the Florida coast, north and south of Miami: 'men and machines ... gobbling up sandy pineland and hardwood hammocks, filling the bay bottoms.' The aggression against nature continues through the Florida Keys (Wilson and Eisner, 1968), and an ecosystem rich in plant and animal life is being destroyed. The crowding of residential resorts into this hurricane-prone coast seems to be inviting retribution. A Hurricane Preparedness Conference for the Southeast recently brought out the fact that it will be virtually impossible to evacuate Greater Miami, where a hurricane of major proportions is overdue. The director of the National Hurricane Center at Coral Gables, referring to the possible impact of a major hurricane on prestigious Key Biscayne, is quoted as saying that 'it could turn into a nightmare': the low-lying island commands only one exit route to the mainland and does not have enough high-rises to hold all residents who might seek shelter there (Brandt, 1972).

In some of the world's disaster-prone areas, major agglomerations already have mushroomed and, even with a well-devised policy of disincentives, it would be utopian to expect more than to bring growth to a stop and, ever so slowly perhaps, reverse the trend. However, there are many open areas, high-risk areas, that at this very moment are being viewed with a speculative eye by real estate 'developers.' It is here that a master design for coexistence can have the greatest impact. There is much scope for ecological studies to play a supporting role in this approach to spatial organization, which derives quite properly from an overriding concern with hazards to man, but can advantageously be linked to effective programs for open space preservation, so as to reduce the hazards to nature. Such an approach requires that the prevailing growth model be replaced by one that gives due consideration to non-profit values. The people involved must be willing to forego certain 'development' values—and to pay the price. Persons ready to adopt such a position have increased in numbers and militancy in developed areas. They are still an almost invisible and not very vocal minority in the emerging countries.

### C. 'UNDERPOLLUTED' COUNTRIES?

Considerable expectation exists among peoples in the LDC's that science and technology will provide a cornucopia of goods and services. Often there is an underlying confidence in great, untapped resources and in the discovery of a simple way to unlock treasures hoarded by nature, coveted by foreigners.

Many recent converts to ecology find it difficult to comprehend that people in the LDC's should be eager to have belching smokestacks and other visible symbols of development—and of pollution. A look at some infant mortality figures might help. In some state capitals of Brazil, for instance, this rate lies between 150 and 200 per thousand live births (Brasil, 1970). In limited extreme-poverty districts, it may well be twice as high. That this, probably the best single index for gauging the general health and welfare of a population (Smith, T. L., 1972), should be so staggering is tragic evidence of the extent to which human resources are being wasted. For people whose main concern is survival, it is hard to understand, much less care about the deleterious effects of pollutants on morbidity and mortality: however undesirable, these are certainly minor in the short run, when compared with those of utter, catastrophic poverty. As a spokesman from India put it: 'The wealthy countries worry about car fumes. We worry about starvation' (*New York Times*, 1970).

Governments at all levels tend to assume—often with faultless motivations and usually with widespread support—that leadership carries a mandate for promoting economic growth, regardless of long-term effects on the environment. The problems of 'pollution havens' (Russell and Landsberg, 1971) is a case in point. Consider the statement for which the Planning Minister of Brazil was recently taken to task by editorials in the world press. Discussing ongoing negotiations for the establishment of a highly polluting wood pulp plant for Japanese paper manufacturers (who are facing pressure from domestic anti-pollution legislation), the Minister was quoted: 'Why not, we have a lot left to pollute. They don't.' (*New York Times*, 1972). A subsequent clarification, while recognizing the need to reduce the effects of certain industries on the deterioration of the environment, reasserts the basic premise that 'countries like Brazil, having ample reserves of unutilized land, can be much more flexible than, for instance, Japan, in the choice of sectors with major pollution potential.' (*Estado de Sao Paulo*, 1972). An administration that has led the economy 'from mess to miracle,' as headlined in the *Wall Street Journal* (1972), breaking every record of economic development in 1971 with an 11.3 per cent increase in GNP, is not likely to admit that its 'flexibility' in dealing with environmental degradation could be disastrous.

As to pollution exporters: to obtain and sustain a high standard of living at the cost of one's neighbor's environment is colonialism of a particularly insidious kind. Presented to the LDC's under the magic cloak of one more opportunity to industrialize, it seems to raise few nationalistic hackles. Yet that is what it is: ecolonialism.

As a matter of fact, quite a lot is being published nowadays in the LDC's about ecology. But generally the rules of the game are that environmental concern should never impede development. Those who know better often maintain a low profile. An example comes from a country that hardly can be included among the least developed. One of the editors of the first report by the Israel National Committee on the Biosphere and Environment is quoted: 'We must not sound as if we're against progress, or that would be the end of us.' (Miller, 1972).

Entrepreneurs—a flourishing class in many LDC's—are actually getting in each other's way as, devoted to the progress ethic, they discover new possibilities in the environment. With little or no value attached to natural processes, with interrelationships de-emphasized, it is not surprising that certain money-making activities should impinge upon others. Consider, for instance, the tourism business, which is expanding rapidly in the tropics and, in some places, is or may become the major source of revenue. If scenic beauty,

variety of game animals, cultural diversity, and similar assets are adversely affected by other uses of the environment, the flow of visitors may easily be turned. Where massive funds are invested in tourist services, it is 'only good business' to protect such resources, not merely for their intrinsic value—reason enough—but because they represent the prime input of an industry capable of contributing substantially and on a sustained yield basis to the national income. Conversely, in the words of a recent plan for Hawaii, 'the needs of the tourism industry must be adapted to—and not detract from—the indigenous amenities.' (Overview, 1972).

While belief in indefinite economic progress is quite generalized, for the LDC's it holds out the much decried, but no less desired, material well-being of their rich, spendthrift cousins. Yet it is obvious that a US-style throw-away economy will never be ecumenical. If the contrast in living standards of 'have' and 'have-not' countries is to be abated, some of the 'necessities' of the consumer society may have to be renounced by all, and, in fact, alternate styles of development sought. In the search, countries that have not destroyed genetic pools, ecological diversity, and cultural pluralism will have the edge on those that have carried to its ultimate consequences the pursuit of a homogenized, industrial model. Such a course may lead a society to dangerous overspecialization, leaving it with less adaptive resources than one which endeavors to mesh the new with the old, without destroying its heritage—and options.

The transference of technology to LDC's, as it has been made, has run counter to diversity. And yet, that which has been judged good for, say, the United States may not be good for a tropical developing country; in fact, as is now becoming evident, it sometimes is not good even for the prototype. One course of action that might favor a better adjustment of technology to the conditions prevailing in the LDC's is to encourage the transfer of technical knowledge among developing countries, so that native ingenuity may be better combined with imported expertise (Tarapore, 1972).

A drive for 'status' technology may bring few advantages and many disadvantages to the countries importing know-how. A Brazilian newsweekly not long ago displayed on its cover a full-color photograph of a beer can; the corresponding story announced the entry of the country's brewery industry into the canned beer market (*Visão*, 1970). The impact of strip-mining iron, tin and bauxite, the expenditure of electricity—about 17,000 kilowatt hours to convert five tons of bauxite to one ton of aluminum (Yochelson, 1972), and other ecological costs might seem more acceptable if the end product were to contribute, effectively, to the quality of life. But the last link in the chain of insults to the environment: a throwaway container! This, at a time when conservationists in the United States are demanding that strong measures be taken against the manufacture of beer cans and that all facilities under control of federal and state governments discontinue the purchase and sale of non-returnable beverage containers.

There is no need for the LDC's to adopt a twentieth-century version of Rousseau's theory of the 'happy savage,' nor to turn their backs on science and technology and revert to romantic primitivism. But whenever some form of 'hard' technology is adopted it should be capable of contributing to the general welfare without the ill effects that are so obvious in the production of, say, steel beverage cans with aluminum fliptops. Escape from hunger and poverty should not be made even more difficult by environmental degradation. Today's problems must be solved without creating super-problems for tomorrow.

Realistically, however, no LDC is willing to fall behind in the race to adopt sophisticated rather than 'soft,' ecologically-adjusted technology. In the perspective of a one world system, the DCs contribute in several ways to foment this race. One inducement is the 'under-remuneration by the industrialized countries for agricultural and animal produce,' as pointed out by the Group of African Experts (1972), which met last April at the Institute of Economic Development and Planning (Dakar), and demanded upgrading and stabilization of the prices of their products. If, on the one hand, it behooves the leaders of emerging nations, in the best interest of their own people, to set their sights on qualitative, rather than on quantitative growth, the wealthier countries, on the other hand, must do their bit to create global conditions where such a plank becomes clearly desirable and politically feasible.

## CONCLUSION

It is too much to expect that mankind would or even, at this point, could adopt a strict 'hands-off policy in relation to the remaining non-agricultural rural lands. But if the earth space is holistically viewed, researched, organized-managed if you accept the paradox—at least some extensive tracts may be saved from piecemeal degradation. From management itself. From development. From man's busyness, his urge to assert himself, to cut and fill and straighten. Some tracts where it may be possible, actually, to 'laissez faire la Nature.'

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## SESSION E: MANAGEMENT OF NON-AGRICULTURAL RURAL LANDS

### Part 1: Paper (18)

# Conservation and Development of Tropical Rain Forest Areas

KENTON R. MILLER

*Member, IUCN's International Commission on National Parks; Team Leader, Wildland Management and Environmental Conservation Programme for Latin America, F.A.O., Santiago, Chile*

### SUMMARY

The tropical rain forest areas of the world long remained of little interest for development and the application of modern technology. Activities were confined to the extraction of minerals, timber and wildlife products.

Recent pressures to extend agricultural lands, to increase opportunities for employment and to seek new natural resources, and national challenges have begun to affect these relatively old and stable ecosystems. Simultaneous to the execution of development programmes there is a growing awareness of the unique characteristics of tropical rain forests. Some of these values can be irreversibly lost as vast areas of forests are destroyed. Many facets such as the role of tropical rain forests in the regulation of the environment warrant study and analysis.

Through equilibrated land-use planning methodology it appears feasible to produce the types and qualities of goods and services required from these areas. Fundamental to resource-management decisions on tropical rain forests is the careful treatment of riverine, estuarine and ecologically critical zones. Unique resources require special management categories such as national parks, monuments and sanctuaries. Vast areas must remain in permanent vegetative cover in categories such as national forests and produce forest, wildlife and water-based benefits.

Several problems require serious attention: the development of methodology for integrated land-use planning for tropical rain forest ecosystems; the formulation of methods for the distribution of costs and benefits related to vast inter-regional and international areas; the application of such techniques as international subsidies, user fees and taxation to support the management of unique resources; and, the granting of external assistance to support the management of unique resources in ways which carefully respect national sovereignty.

### RESUME

Les régions de forêt tropicale humide du monde sont longtemps demeurées à l'écart du développement et des applications de la technologie moderne. Les activités s'y limitaient à l'extraction des minéraux, l'exploitation du bois et des animaux sauvages. Les pressions récentes créés pas le désir d'étendre

les terres agricoles, d'accroître les possibilités d'emploi et de trouver de nouvelles ressources et les ambitions nationales ont commencé d'affecter ces écosystèmes relativement anciens et stables. Parallèlement à la mise en oeuvre des programmes de développement, il se produit une prise de conscience grandissante des caractéristiques tout à fait uniques de la forêt tropicale humide. Certaines de ces valeurs risquent d'être irrémédiablement perdues avec la destruction de vastes zones forestières. De nombreuses questions telles que le rôle des forêts tropicales humides dans la régulation des processus de l'environnement exigent d'être étudiés et analysés.

Grâce à des méthodes de planification équilibrée de l'aménagement du territoire, il paraît possible de faire produire à ces régions les genres et qualités de biens et de services qu'on attend d'elles. Un des points essentiels à observer dans les décisions prises pour aménager les ressources des forêts tropicales humides est la nécessité de manipuler avec soin les zones estuariennes, riveraines et les milieux écologiquement critiques. Les ressources présentant un caractère unique doivent être incluses dans des catégories spéciales telles que parcs nationaux, monuments et sanctuaires de la nature. Des régions étendues sont à conserver sous couvert végétal permanent dans des catégories telles que les forêts nationales pour produire de la forêt, des animaux sauvages et tous les types de bénéfices que peut apporter l'eau.

Diverses questions exigent un examen approfondi: élaboration d'une méthode de planification intégrée de l'utilisation des terres pour les écosystèmes des forêts tropicales humides; formulation de méthodes de répartition des frais et bénéfices liés à de vastes zones inter-régionales et internationales; application de méthodes telles que subventions internationales, taxes d'utilisation et taxes pour financer la gestion de ressources exceptionnelles; et enfin octroi d'une assistance extérieure pour l'aménagement de ressources uniques en respectant scrupuleusement les souverainetés nationales.

## CONSERVATION AND DEVELOPMENT OF TROPICAL RAIN FOREST AREAS:

### Introduction

There are vast areas of the biosphere covered by tropical rain forests. The major rivers of the world such as the Amazon, Orinoco, Magdalena, Congo and Mekong, are associated with tropical lowland basins. These areas are relatively unknown and subject to great romantic expectations and exaggerations in terms of their nature and potential wealth.

Tropical rain forest areas have received little attention in the past except for the extraction of marketable commodities such as wildlife, timber and forest products, decorative fish, and minerals.

Recent changes have occurred, however, as governments come under pressure to amplify the production of food, to expand agricultural lands, to seek new natural resources, to formulate opportunities for employment and to create new and challenging frontiers. The rain forest areas are often looked upon as great unlimited areas of land and resources which warrant immediate and 'instant' development.

Unfortunately, the rapid development of extensive areas in the face of pressing requirements often leads to the superficial planning of projects and partial evaluation of resources which are based only upon incomplete information. The unique characteristics and values of tropical rain forests are seldom con-

sidered. Such aspects as the role of tropical rain forests in ecological stability and environmental regulation, and the associated values of wild fauna, genetic materials, scientific research and education, recreation, tourism, and the conservation of options for future utilization by man, are normally passed over.

Experience has shown that the application of production methods which are not adjusted to the nature and characteristics of tropical rain forests, can easily lead to resource destruction. Many resources, as well as the future products and services which can be derived from them, are irreversibly lost. Many forms of resource alteration and manipulation initiate irreversible trends which can be detected visually only after many years, and the subsequent destruction (or social costs) is passed on to future fiscal periods or even future generations. In some cases, the destructive influence is passed on to other geographic regions quite unrelated to the site or process of production.

Controversy has developed over the conservation and development of tropical rain forests. It can be argued, however, that it is quite possible to give serious consideration to the unique characteristics and values of tropical rain forests within the general framework of land-use management and planning methodology. Ecological aspects can serve to define limits upon development alternatives, special values can be reviewed, and all the many requirements and pressures can be considered systematically and objectively.

Several elements of direct economic concern are involved in the management and development of tropical rain forest lands: for example there are short-term costs associated with foregoing the more intensive development opportunities in favor of more conservative alternatives, and there are adjustments to be made for those costs which are passed on to others not receiving equitable shares of the benefits. These in turn lead to questions of international subsidies, taxation of users, special trust funds and national sovereignty.

While an analysis of the tropical rain forest cannot be considered as conceptually complete without careful treatment of the indigenous peoples which inhabit such areas, the author chooses to leave that aspect aside. In principle, however, the planning effort for the conservation and development of tropical rain forests requires guidelines and policies which will adequately accommodate the requirements of indigenous peoples in ways consistent with the management of lands and resources throughout the region.

Several conclusions can be drawn from the presentation which support the inclusion of the key characteristics and values of tropical rain forests into land planning methodology and the study of several important aspects, answers to which are required for the successful management of tropical rain forests in the future.

### **Characteristics and values of tropical rain forests**

The increasing interest being given to tropical rain forests is due in great part to the growing appreciation for the more obvious characteristics of the formation:

- continuous, more-or-less unbroken growing season;
- high amounts of rainfall (2, 000 to 8, 000 mm) distributed throughout the year;
- large tracts of unallocated, or at least, untitled lands;
- easy access through fluvial navigation; and
- rapid growth of vegetation.

Experience has already raised serious doubts about presumptions such as high potential yields of agricultural crops, endless abundance of resources, and the ease at which domesticated plant and animal species can be introduced; and such problems as soil exhaustion, laterization, accelerated erosion, rapid brush and weed encroachment, and insect/pathogen infestations are receiving greater attention.

Several additional characteristics can be added to the list which give particular attention to some of the other less obvious values of the tropical rain forest which are unique and deserve special consideration:

- high rate of speciation of flora and fauna;
- large number of endemic species;
- evolution relatively unbroken by environmental shifts during millions of years;
- great interaction of plant and animal species with other life zones and ecosystems; and
- large tracts of land still covered by rather continuous vegetation and in a state relatively undisturbed by modern man.

It has long been debated whether large areas of the land mass can actually affect climate and weather. Microclimatic effects have been produced along the Andes of South America and the edges of the Sahara. Mass manipulation of vegetation has brought disequilibria through responses in insect and avifauna populations in tropical North Australia and in East Africa. Ruptures in the interrelationships of resources have been produced, for example, where upstream alterations have challenged the survival of estuarine fisheries, where irrigation projects run short of water supplies, and where chemically laden effluents damage downstream water-based activities. The *environmental regulatory role* of a major tropical river basin covered with complex evergreen vegetation can only safely be assumed until further studied.

The tropical rain forest is noted for its complex interrelationship among elements which together actuate in some sort of *dynamic ecological stability*. Studies on slash-and-burn agriculture in the tropics (Phillips, 1959; Mohr and Von Baun, 1954) have demonstrated clearly how the stability of mineral recycling can be broken and lost.

The *flora* of the tropical rain forest has received attention through the utilization of timber, gums, saps and chemical derivatives of forest tree species, as well as medicines and decorative plants. The *fauna* has been mostly considered in terms of hunting trophies, zoological specimens and more recently for viewing. A comprehensive survey and study of 19 countries in Africa demonstrated the potential wealth to be derived from wildlife in that continent (Riney, 1967). Subsequent work by FAO has been demonstrating the management principles involved in meat production based upon wild fauna utilization. Arguments have been presented which recommend the management of wildlife as an alternative to current land use practices on marginal lands, thereby enabling these areas to contribute protein on a stable basis to the regional food supplies (Riney, 1969). Combinations of cattle schemes, wildlife cropping and tourism around and within national parks in Uganda promise to add further income to the country. Tourism already supports \$15 per ha on national parks, and new projections set \$3.50 per ha from livestock and \$0.75 per ha from wildlife (Myer, 1971). Hunting ranches have been successfully created in Mexico (Hernandez-Corzo, 1970). This kind of activity could perhaps eventually be extended to portions of the rain forests of the Yucatan Peninsula. In

Colombia, the Institute for the Development of Natural Resources reported that in 1970 \$4, 879, 048 were received in revenues associated with the hunting, export and collection of wild fauna primarily from tropical forest areas (INDERENA, 1971). Most current examples on the values of wild fauna come from savanna formations, but the relationship between tropical rain forest and savanna warrants emphasis. Studies on the utilization of wild fauna as a meat source for rural dwellers in the rain forest of the Upper Amazon in Peru, have shown high levels of protein intake *per capita* (Pierret and Dourojeanni, 1966).

Tropical rain forests contain some of the world's richest reservoir of *genetic materials* which have been used for centuries as sources for agricultural crops, medicines, timber species and ornamental plants. Marston Bates (1960) describes many aspects of this wealth upon comparing the 'Forest and the Sea'. Cacao, for example, is a tropical tree crop which is being crossed with strains from native populations in order to seek higher yields. More important, however, than the many examples which could be cited, is the importance of maintaining a pool of genetic resources for future requirements. By keeping options open, the rich speciation of the tropical rain forest can continue to render benefits to mankind as new requirements are found.

The tropical rain forest is already playing a fundamental role in *science* and *education*. Major universities from all continents now have experiment stations and active research programmes in tropical rain forest areas. Graduate students and scientists such as those working on the International Biological Programme (IBP), are prying into basic questions of productivity, mineral recycling, energy conversion, and land use. The tropical rain forest offers opportunities for the *investigation* of such important questions in ways not available in other life zone environments. The direct economic benefits from these activities are demonstrated in Costa Rica where the expenditure of visiting researchers alone total some \$500,000 annually.

The use of tropical rain forests for purposes of *recreation* has not generally been appreciated. The recreational use of national park lands in tropical areas such as Henri Pitier and Guatopo in Venezuela and Tikal in Guatemala, and others, already shows signs of becoming a major activity of the future much like that already demonstrated in national parks throughout the world. Although many consider such aspects as heat, insects, dangerous animals and rainfall to be against recreation development, experience does not bear this out and travel to areas where unique natural phenomena are to be found is little impaired. Only the methods change by which recreation activities take place much like they vary among arctic, alpine, forest, savanna and ocean settings. Moreover, residents of tropical areas also warrant the opportunity to have solace, aesthetic pleasure and open space in their future.

*Tourism* has already become big business in many countries which possess tropical rain forests, and in many cases the visitor takes in tropical rain forest sites in his tour. This is clearly demonstrated in Puerto Rico in connection with Luquillo National Forest (Miller, 1967), in Trinidad and Tobago with the Caroni Swamp Reserve, in Argentina with Iguazu Falls National Park, and in Rhodesia with Victoria Falls National Park. The uniqueness of tropical forests is attracting national and international tourism, and in this way is supporting the development of tourist industries and the creation of employment and other related benefits.

Finally, among the values of tropical rain forest are to be added the more subtle considerations of *ecological diversity*. Strong arguments have been presented for the maintenance of diversity by such methods as the conservation of representative samples of different ecological environments (Dasmann,

1970). Such foresight can insure the availability of development alternatives in the future.

### **Development versus conservation**

Discussions on the conservation and development of tropical rain forests often tend to polarize the relationship in favor of either conservation or development. Several factors deserve mention which help shed light upon the issues and focus attention upon areas for problem-oriented action programmes.

While close examination of the pressures upon tropical rain forests will not be presented here, there is little doubt that problems of food, land tenure, redistribution of wealth and the creation of employment are issues of transcendent importance throughout the developing world. It must also be appreciated that there are pressures to inhabit and take possession of national territories through colonization for political reasons, as well as to capture the imagination of the population through new frontier-like programmes which tend to concentrate national attention upon key political objectives. To deny the existence of these realistic pressures could only lead to partial and incomplete analysis of the conservation/development problem.

It is likewise necessary to recognize the characteristics and values of the tropical rain forest itself. To neglect political and policy-type factors would potentially risk social strife and political chaos; to neglect the forest itself could reduce man's options and flexibility for survival and reduce his capacity to study his own habitat. The latter could also lead to a reduction in the quality of life which has yet to be achieved in developing areas and which shows signs of deterioration in some intensively developed parts of the world.

Also, some processes for the extraction and elaboration of resources cause alterations in such natural systems as air and water continental and energy transformation. There are, however, *thresholds* beyond which alteration becomes irreversible, where former forested areas become desert-like, where rivers dry or flood, where soils become sterile; beyond some point, even without additional exploitation of the resource, additional destruction continues. The economic aspects of this relationship have been studied and similarly beyond some given level no reasonable amounts of additional investment can rebuild that which has been lost (Ciracy-Wantrup, 1952). It is common to encounter schemes for the conversion of large tracts of forest into pasture for beef and dairy production. It is equally as common to find counter-proposals to leave entire areas in native forest. Given the characteristics of and requirements upon the tropical rain forest, such all-or-nothing arguments are unrealistic. Production techniques must be carefully chosen to avoid thresholds particularly in relation to rainfall and soil fertility, and yet yield the commodities and services required. The challenge is to seek, through intellectual means, a compromise based upon a planning methodology which respects social, political, economic, ecological and technical considerations.

It is important that we be honest in our appraisal of the future of tropical rain forests. It can be argued that 'development will definitely occur with or without conservation'; conversely, however, it cannot be defended that 'conservation will occur with or without development'. The only rational approach open is for ecologists, foresters, biologists, water specialists, and park managers to work intimately on development planning and resource management exercises and help make the process more objective. Recent efforts have been highlighted by work on guidelines for development planners and the review of conflicts between technology and the environment.

An example of building resource conservation into development was outlined at the FAO Seminar on Forestry Development, Agrarian Reform and colonization for Latin American Countries (FAO, 1968). Among the recommendations of the Seminar it was stressed that agricultural expansion into forest should be permitted only on lands with agricultural potential, and based upon ecological and economic considerations of land use capacity. Considering the grave nature of the problem of forest destruction from spontaneous colonization, it was recommended that zoning of land use also include critical areas where permanent protection and special conservation practices are required. The participating heads of forest services, and the agencies of agrarian reform, colonization and agricultural and development credit agreed upon the need to work together to plan land use, giving careful attention to both the needs of rural residents and for the long run protection of natural resources and the environment.

### **Development with conservation**

The tropical rain forest has characteristics which make it flexible to short-term alterations, *i.e.* open or abandoned sites which have been mildly altered will be quickly taken over by vegetation. In the Amazon of Peru and the Atlantic slopes of Central America, it is a common sight to see farmers working each day to cut back bush encroachment in their pastures. Due in great part to year-around rainfall and to the particular types of soil, flexibility declines, however, as thresholds are approached and accelerated erosion prohibits the invasion of primary succession. To avoid irreversibility it is necessary to establish criteria for guiding the development and management of tropical rain forest areas. The inclusion of such criteria in the decision-making process for planning these important areas would transform conservation philosophy into useful guidelines for managerial action.

With methodology which includes conservation guidelines, potential land uses for the tropical rain forest areas can be evaluated and the alternatives examined in detail. Similar to the team proposed by the cited FAO Seminar, as well as the 1970 FAO Mission to Colombia on Watershed Management, a team would consist of professionals from forestry, agriculture, agrarian reform and colonization agencies, making sure to include expertise in ecology, hydrology, watershed management, wildlife biology and management of national parks.

During the early stages of the integrated land planning exercise in the tropical rain forest, special attention should be given to areas which are on or approaching ecological thresholds of irreversibility, *i.e.*, accelerated erosion, extending areas of landslides and mass earth movements, uncontrolled stream-flow, rapid laterization, etc. Such areas can be indicated on the planning maps as *critical zones* thereby making explicit that such zones are to be left aside, and on a preliminary basis kept free of development activities. These areas may still be barely stable but will not withstand any form of intensified use. They may require reforestation or stabilization activities. Critical zones should be allocated as protection zones, or placed into categories of land use such as national forests, parks, monuments or reserves, according to the ultimate objectives of the resource.

Areas of unique or outstanding natural value, such as remaining stands of large old-growth tropical rain forest in riverine and estuarine biota, can be placed in land use categories such as national parks or monuments, also according to the appropriate objectives of the resource.

Given the rainfall, the soils, the great fluctuations in the levels of stream-flow

and, especially, the size of the watersheds found in most tropical rain forest areas, it is imperative that *vegetative cover be maintained* over slopes, upper catchments, swamps and inundated lowlands, along stream banks, and on highly erosive soils. It is also imperative that a relatively large portion of the area be allocated for *multipurpose uses, i.e.* in a land use category which will permit a wide variety of uses and combinations of uses, yet respect the need for permanent vegetative cover. It is desirable that this category of land use be given considerable *managerial flexibility* in order that production emphasis can be shifted among wood, wildlife, water, recreation, tourism, mining, forest industry and other compatible uses, as technological innovations are found, as management techniques are prepared and as requirements change. Owing to the effect of this category over the remaining region, and the importance of its management on long-run stability and development, it is advisable that it be placed under government management and administration in the form of national, state or provincial forests.

A final category of land use to be discussed here in relation to tropical rain forest is that area of land which is distant from all markets, not particularly unique or of outstanding natural value, yet is probably *worth holding for future allocation and utilization*. Normally such sectors are relatively unknown, are similar at first analysis to adjacent areas, and do not warrant expensive inventory projects at this stage of development. The planning team may decide that the area possesses indicators of resource wealth which will be of value in the future. They believe that the promise of this future value will more than cover the cost of holding and protecting the area (including the *opportunity cost* for not having used the area). This type of area can be placed into the category called *reserve* - a sector of land which is held but unallocated for a specific purpose or to a particular agency until future requirements and opportunities justify further inventory and study. The area may become a national park, a forest, or go to agriculture, all depending upon future decisions which cannot rationally be taken today.

The results of such an exercise would include a set of land use categories which are related to both human requirements and the potentiality of the natural resource. Long-run considerations are included in the analysis. Categories are related to objectives, and to the products or services required. Some portion of the area is allocated to agriculture and livestock production. The majority of the area is kept in some form of permanent vegetative cover. A vast portion of the land is held in flexible forestry management so that shifts can be made to meet future needs and technology. Unique and ecologically representative areas are permanently dedicated as parks, monuments and sanctuaries. Areas of apparent value but too unknown to support a plan for specific land use allocations, are held for future replanning periods. The parks, forests, monuments, sanctuaries and reserves are held in government hands to insure their adequate management and protection, as well as the provision of the products and services desired by today's and tomorrow's society.

Thus, it would appear feasible to develop the tropical rain forest with and through conservation practices. The inclusion of conservation criteria into the planning will provoke more discussion as well as more difficulty in the evaluation of alternatives. But the end result will more closely approximate an economic system with the capacity to rationalize pressures for land use, yet without the elimination of species and the loss of diversity.

### **Remaining problems**

While planning methodology is the key tool required for approaching development *with* conservation, it is difficult to analyze rigorously those commodities

and services derived from wildlands which are not exchanged on the market. The establishment of critical zones through ecological criteria alone is a stop-gap measure and helps to treat specific vital areas by eliminating them momentarily from the need for further evaluation. The costs and benefits associated with scientific, educational, recreative and other activities requires intensified examination. Great strides are being made with recreation and tourism in European and North American countries, East Africa and the Caribbean, and preliminary reviews of expenditures related to research in rural areas holds promise for more solid justification for some of the non-marketed services of wildlands.

Those areas considered to be related to community welfare and which require communal action and coordination can be treated as *'common property resources'* (Kneese, 1970), where management and administration is delegated by society to a public agency such as a national forest or park service or nature conservation agency. Such handling of parks and other wildlands does not bury the economic issues, but does offer a temporary hedge where the economy does not respond to demands for wildland services nor to long-run considerations for land use. Public institutions can use these areas and produce wildland services on an extra-market basis. It is important to emphasize however, that the costs and benefits are accruing in any case, awaiting methodology for their measurement, evaluation and analysis. If the society chooses to declare certain areas 'common property resources' they can allocate them to public management while other conventional economic and managerial apparatuses are studied and perfected which will reflect more adequately the will of the people *and* the requirements for careful longrun resource management.

Most tropical rain forests are vast and include several human communities, several regions, and often touch upon several nations. While one community may operate a mining or manufacturing complex and receive the benefits, another town down-stream receives polluted or sediment-laden waters and in effect must thereby absorb costs associated with an activity in which they did not participate or enjoy benefit. Shifting agriculture and non-technically supervised logging and grazing activities are all examples of this problem in tropical areas. The distribution of costs and benefits from development activities requires further study.

Following the example of the La Plata River Basin Project (OAS, 1969) in South America, it is reasonable to assume that governments are prepared to accept the need for planning at regional and river basin levels and for some form of regional and international coordination on resource management. Remaining problems include the design and formulation of realistic methods for public management of vast tracts of land in remote areas. Such methods will require preliminary testing at pilot levels to convince governments of their feasibility.

There is generally less information available on human and natural resource aspects of tropical rain forest areas. Few studies have been made on the values associated with the different resources and latent opportunities. Before governments can be convinced to employ other than traditional production methods, alternative land use possibilities which are founded upon modern technical research and conservation criteria must be studied and receive on-site testing.

Examples from benefits of wildland services such as tourism and research are becoming available, but governments will remain skeptical or at least

will tend to assign low priorities to these activities in view of other pressing problems. It is imperative that land use allocation at least provide for the holding and protection of areas for these future needs, lest the demand arise with no supply to be found.

Interest is growing among the international conservation-oriented community over the utilization of tropical rain forest and the dedication of large areas to permanent parks, monuments and sanctuaries. Frequent advocacy is made for the need to maintain vast areas in permanent vegetative cover. Who receives the benefits? Who pays for the investments in facilities, the relocation of colonists, the foregone returns from resource extraction and agriculture (even if they only yield positive returns in the short run)? The income from tourism, research expenditures and hunting is, at best, only partially received by those agencies or even regions which cover the costs. Clean regular flowing water may not be priced at all, yet restrictions on land use practices elsewhere imply that costs are being borne upstream. The values related to re-creation are exported to cities from whence come most visitors. Cultural and moral values in saving nature are received as benefits in the form of national pride and prestige. These economic and accounting problems require clarification to help governments decide how and where to charge costs, and how and where the benefits should accrue. Several examples of this can be cited.

*International subsidies* are required in those cases where the world community advocates that a particular site be allocated and managed as a national park. This normally implies that the nation possessing the area avoid alternative forms of production on the site and, in addition, invest in management, protection and the construction of facilities. Since the world community at large reaps the benefits from the park, it can only be logical that the costs be distributed accordingly. The trend in international subsidy has begun for example with the regular donations from international sources to the Charles Darwin Foundation and the Galapagos National Park in Ecuador.

*User fees and taxation* are required where wildland services are utilized by recreationists, tourists, research programmes and other periodic visitors. Fees can be charged for entrance into the area, or some percent of tax can be levied upon tour prices.

*Trust funds* are required where investments in facilities, equipment, research and protection cannot be expected from regular budgetary sources, due to other national priorities, and where any delay in programming the development and management of the wildland area could imply loss of or damage to the resource. Trust funds can be set up between donors and those agencies responsible for managing the different types of wildland areas.

International interest in specific sites in tropical rain forests and international support for their management and protection, raise problems of *national sovereignty*. While the efforts of conservationists cannot be construed to imply the challenging of national jurisdiction, there is great need to clarify the terms of reference upon which the world community would be willing to support the conservation of specific sites.

A great amount of research is being concentrated on the tropical rain forest, especially with the efforts of the IBP. The role of the tropical rain forest in environmental regulation requires clarification in ways which can be easily captured by government officials and the general public.

## Conclusions

Tropical rain forests warrant special consideration and treatment when being considered for management and development because of their unique characteristics and values. There are great pressures for direct utilization of the resources and for the conservation of large areas. Both types of pressures are valid and require careful analysis and evaluation.

Through multidisciplinary planning it would appear possible to produce the commodities and services required from the tropical rain forest. It is necessary to: specify ecological planning guidelines; define and delineate critical zones which require special handling; delineate agricultural and grazing zones where permanent forest vegetation is not required and where soils and socio-economic factors are suitable; dedicate large areas to multipurpose forestry management to conserve permanent vegetative cover, and yet allow for the flexible and dynamic production of many commodities and services; establish national parks, monuments and sanctuaries where unique resources warrant permanent protection in their natural state; and establish reserves on a temporary basis where the resources are not sufficiently known but warrant holding until demands and management skills permit definite allocation.

Several major aspects warrant immediate study: alternative uses of the resources of tropical rain forests; economic analysis and evaluation of alternative uses including the associated short and long-run implications; problems related to production and conservation of non-marketed commodities and services on publicly managed lands; methods for governmental management of large tracts of land; methods for more equitable sharing of the costs and benefits; mechanisms for international assistance on financial and technical aspects, and methods for international cooperation on resource development and management (special emphasis should be given to supporting local leaders, directors and scientists to carry out the appropriate research and to publish the results within their own countries); and lastly, the role of the tropical rain forest in environmental regulation.

It is urgent that the unique characteristics and values of the tropical rain forest be respected: this can be obtained through the study of relevant issues, and the development and testing of methodology for realistic planning which can lead to the production of required goods and services, in some suitable combination with the attainment of political goals and the protection of wildlands.

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## SESSION E: MANAGEMENT OF NON-AGRICULTURAL RURAL LANDS

### Part 1: Discussion

Having introduced the authors and panelists, the Chairman, Dr **Hoffmann** briefly prefaced the Session by remarking on the recent change in attitude towards 'non-rural lands': they were no longer widely regarded as 'wastelands', and it was realized that it was in or concerning these lands that the greater part of future options would have to be exercised, hence the paramount need for integrated planning.

Presenting his paper, Professor **Sternberg** said he did not propose to add much to the Summary, which explained that the subject was treated in three sections, dealing, respectively, with the well-known phenomenon of overexpansion of inefficient agriculture at the expense of wilderness areas, the inducements that can be offered for the reservation of some of these areas (together with the criteria on which they should be based) and, finally, the value systems, especially in less developed countries, which bear on the problem of reservation. He would like, however, to emphasize that the '*mise en valeur*' of any part of an ecosystem must always have an effect on other parts. Another important point, to which reference had been made during the earlier sessions, was that the improvement of existing 'developed' land was often a sounder policy than opening up new land: thus in South America it had been estimated that the meat output could be multiplied ten-fold simply by applying better techniques to existing ranches. Lastly, although the gathering of the facts so essential for choice and planning can certainly be expedited by the use of modern technological gadgets, such as the satellite, there was no real substitute for hard work and foot-slogging on the ground, when it comes to achieving a real assessment and understanding of ecosystems.

Mr. **Kenton Miller**, in presenting his paper, said that the lesson of the last few days' discussions was surely the need for simultaneous review of the scientific, economic and social guidelines. His paper was largely concerned with tropical American ecology and economics, in which the study of wildlife had recently been added as an objective to the long-established ones of exploiting plants for food and drugs, and introducing new animals for protein production. The dependence of the great rivers on tropical rain forests was beginning to be realised and, despite the myths still widely current about this forest, its diversity and fragility were better appreciated as research and tourism expanded. Yet the demand for more agricultural land is such that the 'development' or replacement of forest land is bound to continue. The essential conservation measures which should be adopted would include—(a) identification of fragile areas (steep slopes, liability to flooding etc.); (b) demarcation of areas containing unique resources or resources which will certainly need to be exploited and sustained in their present form; (c) holding of adequate reserves to maintain future options; (d) application of proper planning methodology and cost/benefit analysis to the lands selected for opening up for agriculture or pasture. One implication of this was that the world as a whole may have to pay for preserving some of the original forest land on the principle that who reaps the benefit must pay the bill.

**Mr. Magdaleno Cortez** led the panelists' commentaries which followed. The principles of land evaluation set out in Professor Sternberg's paper were of

great significance to countries such as the Philippines, where there was a widespread clamour for land of one's own, few people could afford to buy existing estates, and therefore, virgin forests were being chopped down, with the usual resulting flouting of land use principles, failures and disillusionment. Because of this the Philippines Government now insist on evaluation of land which it is proposed to open up, and its allocation in 3 hectare rather than the old 24 hectare lots. He questioned one point made in the paper about the wiping-out in 1971 of high-yield rice by disease: actually the latter affected two provinces only, the main culprit in the losses sustained being an unprecedented series of storms. Finally, he agreed with Mr Kenton Miller that a point can be reached in the deterioration of land, where even reforestation is impossible. In trying to control the situation and enforce the necessary measures, the dilemma is always the human one of whether and how much allowance must be made for poverty.

In his country, said panel member Ingeniero **Mario Boza**, people had certainly not reached the stage of ceasing to regard wildlands as wastelands. They had no idea of the multiple values of forests and very few would therefore ever think of opposing projects for chopping them down. A common phrase in the agricultural supplements of newspapers, referring to the activities of a certain farmer, is 'formerly useless forest, now a prosperous farm'. Moreover, when floods occur because of clearing and bad land use on watersheds, people regard this as just a natural and inevitable phenomenon. Only a systematic campaign can ever change these attitudes. Over the past two years in Costa Rica a beginning had been made with this, and it was believed that if it could be supported by the creation of one or two more national parks or models of good use of natural resources, real progress would now be made. The signs were: increasing use of and interest in existing parks, especially on the part of schools and universities, where the role of parks is now a regular topic in the courses; and more frequent calls for assistance in establishing new parks. Finally, it might be relevant to mention one particular example of the values of non-rural or forest land: in 1971, steps were taken by the Costa Rica Forest Service, and also the relevant department of the OAS, to select certain fine tree-species for research and reproduction, including cedars and mahoganies which are fast disappearing. This research has now become a very important activity in wildland areas, for which considerable funds are being made available, ranging from the half-million dollars contributed by an international agency, as mentioned by Mr. Miller, to the 900 Costa Rican dollars recently spent on a field ecology course for 40 students undertaken in one of the parks. These types of development deserve maximum publicity, if popular attitudes are to be changed.

Having been responsible for training ecologists, although he himself had never been trained as one (and, therefore, according to Professor Polunin's remarks in the previous session, presumably had no right to express his views!) Professor **Cragg**, panel member, said that in fact the only formal training he had ever received concerning man's relationship with his global environment, was in geography; he was in fact much in favour of geography as a University subject. The papers presented for discussion both emphasized the need for new concepts in land evaluation and the search for such concepts deserved full support. Ecologists were concerned with recycling, but were too often guilty of re-cycling, or re-circulating, the same old and untested ideas.

With reference to the tropical forest problems, which had been highlighted by the speakers and in the papers, the studies of Dr Hugh Raup in the Harvard Forest (British Ecolog. Soc. Symposium, 1964) are worth recalling. In the

1930s reports on that forest contained statements about its ravaged condition, its enfeebled reproductive capacity, its impoverished soils, and about bringing it back to the 'highest point of sustained yield'. Raup pointed out that all this was based on the three unproven assumptions: that prior to European settlement, there had been a more productive forest; that the settlers had destroyed this former level of productivity; and that rehabilitation and sustained yield management were indeed possible. Raup examined the historical and ecological evidence and concluded, first, that the form and age structure of the older stands were very much as when the first settlers arrived, that the precolonial woodland was incapable of being managed in a realistic way, and, thirdly, that there was no ground for a theory of a self-perpetuating climax in this forest. It seemed to him, therefore, that uncertainty rather than certainty characterized the system and, to quote his words, which are relevant to many ecological situations and to the remarks in the two papers on management of tropical forests—'I propose that we should plan ahead only so far as we can see with some degree of certainty and then readjust our plans at frequent intervals'.

**M. Tanganyika Gahuranyi** (panéliste), après avoir constaté que du point de la conservation des terres, il existe trois types de zones fragiles dans les forêts tropicales, à savoir, les zones à tendances érosives, les zones estuariennes et les zones surexploitées, a attiré l'attention sur la possibilité de trouver un nouvel usage pour ces zones, en sensibilisant le public à leur aspect esthétique, par exemple par le développement du tourisme. Dans certains pays les populations occupent les terres fragiles d'une manière trop extensive: les gouvernements devraient pouvoir disposer de ces terres et rassembler les populations en zones exploitées rationnellement, tandis que l'on garderait les autres terres restantes protégées. Malheureusement le déplacement des populations est très difficile sans avoir recours à des mesures draconiennes. On doit néanmoins l'essayer et chercher les ressources fiscales afin de l'accomplir.

The main points made in the discussion which followed the panel members' comments, are summarized below.

Where, as in India, there are large unemployed rural populations, the only way to prevent the wholesale incursions into forest and other non-rural land referred to in Professor Sternberg's paper, would seem to be by some kind of manipulation of incentives—**Zafer Futehally** (India).

This raises the whole issue of the financing of development, much of which is at present speculative and misapplied. Although it would not help to solve the problem mentioned by the previous speaker, the main orientation of governmental spending should be towards increasing the productivity of existing agricultural land. Two other points worth noting are that the original indigenous population of the Americas may have been as high as 100 million, introduced disease being probably the main agent in the catastrophic decline: secondly, the possibility of very high protein production from specialized non-extensive uses of non-rural land, such as the construction of fishponds (which have achieved productivity levels of up to 3 tons per hectare/year), should always be considered as an alternative to clearing of land—**H. O'R. Sternberg** (author of Paper 17).

It is just as important to avoid hasty and indiscriminate application of advanced technology in 'developed' as in 'less developed' countries. One case in point is the excessive and unnecessary application of fertilizers. What it amounts to is that a great effort is needed to develop the methodology for establishing new agro-ecosystems in a way which will make them compatible

and supplementary to natural ecosystems. The problem of marginal lands should be looked at in this way: in some cases, for example, they can be transformed by irrigation, but for these to be successful all the implications—ecological, agronomic, engineering, social—must be taken into full account—**G.T. Scarascia-Mugnozza** (Italy).

The problem of tropical forest utilization is of great concern to IUCN, as is the present tendency, in many countries, to lay the stress on enhancing the value of marginal areas. IUCN's role is two-fold: to bring the alternatives to the attention of the decision-makers and to convince them by fully documented examples of ecologically successful development initiatives. It is hoped that the forthcoming book on 'Ecological Principles' will be a useful working tool in the dialogue with the planners—**G. Budowski** (Director General, IUCN).

In this connection it is worth recalling some of the remarks of Mr Maurice Strong in his keynote address: he emphasized the need for organizations like IUCN to define their objectives in clear terms. IUCN has pioneered many aspects of conservation despite very slender financial resources: the time has probably now come to limit attention to selected and well defined problems, of which that of the humid tropics may well be one, since it is doubtful whether the field is, or will be, fully covered by organizations such as SCOPE and MAB. Through its own task force, meeting for weeks rather than days, a program would be drawn up and the arrangements for over-all guidance and control, together with the allocation of specific aspects of the subject, would be agreed and established—**J. B. Cragg** (panel member).

Additional points (recorded but not presented due to lack of time):-

Parmi les caractéristiques des forêts tropicales humides est le caractère extrinsèque de la fertilité des sols. Par exemple, la fertilité des latosols de la Cuvette Centrale du Zaïre résulte non de la qualité (argiles ou Kaolinites à faible capacité d'échange) mais de la vitesse du 'turn-over' des éléments biogènes. La fertilité donc est la résultante du cycle organique—inorganique: c'est là une des raisons de la fragilité des écosystèmes équatoriaux. Il faut dès lors être très prudent avant d'intervenir dans ces zones et, en conséquence, intensifier l'utilisation des sols dans les zones les plus propices et y remplacer les processus naturels responsables de la fertilité par une activité humaine impliquant un investissement d'énergie et de connaissances. Les écosystèmes tropicaux ne peuvent être traités suivant une méthodologie qui s'applique aux autres régions du monde, pour la raison fondamentale que les mécanismes à l'origine de leur fertilité interviennent différemment—**M. Maldaque** (Canada).

The kind of basic data and mapping supplied in recent years in the United States by the Ecological Survey seems essential to proper resource and land development and management, but is still lacking in many countries—**Dale W. Jenkins** (USA).

**SESSION E**

**MANAGEMENT OF NON-AGRICULTURAL  
RURAL LANDS**

**Part 2**

**SESSION E: PART 2**

*Chairman.* Professor W. A. Fuller (Canada): Member, IUCN's Commission on Ecology; Department of Zoology, University of Alberta, Edmonton.

*Authors:*

**Paper (19): Management of Wetlands**

\*Professor M. F. Morzer Bruyns (Netherlands): Vice President, IUCN Executive Board; Professor of Nature Conservation and Nature Management, Agricultural University, Wageningen.

Presented by Mr Daniel A. Poole (U.S.A.): President, Wildlife Management Institute, Washington, D.C.

**Paper (20): Management of Polar Lands**

Mr John K. Naysmith (Canada): Chief of the Water, Forests and Land Division, Northern Natural Resources Branch, Department of Indian Affairs and Northern Development, Ottawa, Ontario.

*Panel Members:*

- 1 Dr A.A. Kistchinski (USSR): Member, IUCN's Polar Bear Research Group, Survival Service Commission; Scientific Officer, Central Laboratory on Nature Conservation, Moscow.
- 2 Mr Thor Larsen (Norway): Member, IUCN's Polar Bear Research Group, Survival Service Commission; Biologist, Institute of Marine Biology, Norway.
- 3 Dr E.B. Worthington (U.K.): Scientific Director, International Biological Programme, London.

*Rapporteur:* Dr Patrick de Rham (IUCN).

*Secretariat Member:* Mrs Paule Gryn-Ambroes (IUCN).

## SESSION E: MANAGEMENT OF NON-AGRICULTURAL RURAL LANDS

### Part 2: Paper (19)

# Management of Wetlands

M. F. MÖRZER BRUYNS

*Vice President, IUCN Executive Board; Professor of Nature Conservation and Nature Management, Agricultural University, Wageningen.*

### SUMMARY

Wetlands are of special interest to man. They have received particular attention from nature conservationists, because many have been irretrievably lost and many more are endangered. All types of wetland fall within the scope of this paper and their management is defined as including not only deliberate regulation, but also all the side-effects of human activities.

Wetlands have vital functions for wild plants and animals. They have many functions for man. For nearly all these functions natural, unpolluted waters are essential. Wetlands, therefore, need to be managed, but knowledge of the functioning of wetland ecosystems is indispensable for good management, because changes are nearly always involved. Interference with natural wetland ecosystems without taking account of the ecological consequences is far too frequent.

Most wetlands have several different functions. This is a normal situation and, in principle, multipurpose use should always be possible. But the authorities responsible for wetlands have a duty to ensure that one kind of use does not ruin their other functions. In too many cases supervision is completely lacking. As a result, many threats to wetlands arise, including water shortage, irregular floods, erosion, pollution, eutrophication and general disruption of ecological balances. Optimal use has to be specially organized and demands the full cooperation of governments, landowners, managers and users. Decisions must be based on the results of scientific investigations. Such research must provide information on the patterns and processes of each individual wetland and also its relationship to the region and country as a whole, and its international importance.

Management therefore has to be based on surveys, in the first place, of all human impacts on the area. Influences from outside (calling for external management) have to be given special attention, in addition to the 'normal' internal management concerned with water levels, water quality, plant and animal life and human activities. Changes designed to improve the situation should always be introduced gradually.

Wetland ecosystems can be developed to a certain extent, for special uses and altered circumstances, without disrupting vital balances, provided that basic conservation principles are observed. Thus the management of a wetland for a combination of uses, such as production (fish, game, reeds), recreation, education, scientific research and even for the discharge of waste water, is quite possible. It can only be achieved, however, through careful planning, good administration, separation in place or time of the various functions the wet-

land is to fulfil, and efficient management. All these must be based on applied ecological research at both national and international levels.

## RESUME

Les zones humides présentent un intérêt particulier pour l'homme. Les spécialistes de la conservation de la nature leur ont accordé une grande attention, beaucoup d'entre elles étant irrémédiablement perdues et d'autres menacées. Le présent article examine tous les types de zones humides et définit leur aménagement qui ne doit pas seulement envisager la gestion intentionnelle mais aussi tous les effets secondaires des activités humaines.

Les zones humides sont vitales pour les plantes et les animaux sauvages. Elles ont aussi des fonctions multiples pour l'homme. Presque toutes ces fonctions exigent une eau naturelle, non polluée. Il est donc nécessaire d'aménager les zones humides mais, pour le faire d'une façon avisée, il faut connaître le fonctionnement des écosystèmes de zones humides, car leur aménagement implique presque inévitablement des transformations. On intervient bien trop souvent dans les écosystèmes naturels des zones humides sans tenir compte des conséquences écologiques.

La plupart des zones humides ont plusieurs fonctions différentes. Cette polyvalence est normale et devrait en principe toujours être possible. Mais les instances chargées d'aménager les zones humides doivent assurer qu'un type d'utilisation ne détruise pas toutes les autres fonctions. Et trop souvent, cette supervision fait totalement défaut, ce qui crée des menaces pour les zones humides—manque d'eau, inondations irrégulières, érosion, pollution, eutrophisation et rupture générale des équilibres biologiques. Une planification spéciale est nécessaire pour assurer l'utilisation optimale de ces zones; elle exige la collaboration totale des gouvernements, des propriétaires terriens, des planificateurs et des utilisateurs. Les décisions seront prises en fonction des résultats des études scientifiques. Ces recherches apporteront des renseignements sur les structures et les processus de chaque zone humide ainsi que sur ses rapports avec la région et l'ensemble du pays et sur son importance au plan international.

L'aménagement doit donc être basé tout d'abord sur une étude de tous les impacts humains dans la région. A côté de l'aménagement intérieur 'normal', portant sur les niveaux d'eau, la qualité de l'eau, la flore, la faune et les activités humaines, les influences extérieures (exigeant un aménagement des zones extérieures) recevront une attention particulière. Les modifications destinées à améliorer la situation devraient toujours être introduites de façon progressive.

Les écosystèmes de zones humides peuvent être développés jusqu'à un certain point, à des fins particulières, sans que les écosystèmes essentiels soient altérés, à condition d'observer les principes fondamentaux de la conservation. Ainsi, l'aménagement des zones humides à diverses fins telles que la production (poisson, gibier, roseaux), les loisirs, l'éducation, la recherche scientifique et même la décharge des eaux usées, est parfaitement possible. Ceci ne peut toutefois être réalisé qu'au prix d'une planification soignée, d'une bonne administration et d'une division dans le temps ou l'espace des différentes fonctions que la zone humide est appelée à remplir, ainsi que d'un aménagement efficace. Tous ces processus seront basés sur la recherche écologique appliquée, aussi bien au plan national qu'international.

## MANAGEMENT OF WETLANDS

Wetlands are a category of lands of special interest to man. No other category—maybe with the exception of forests—has had as much attention for so many years from nature conservation organizations. Wetlands are not only valuable and indispensable in very different ways, but are always relatively scarce and restricted in area and, wherever they occur, vulnerable.

In fact wetlands of almost all countries of the world have been decreasing drastically during the last decades. In many places smaller wetlands have disappeared completely, large ones have become smaller, and what is left has been changed: deteriorated, impoverished and spoiled by human influences.

These processes have now been going on for many years and nature conservationists were already in action against them in the 1920s. But since that time the same processes have nevertheless continued and nowadays changes are proceeding so rapidly and, due to modern technical possibilities, in such a way that in many places it will be catastrophic for the last remaining wetlands—and even whole classes of wetland—and their ecosystems, if nothing can be effectively done to prevent them.

For this reason special attention is given in this paper to proving that by means of conservation it is possible, with proper development, to have wise use without deterioration.

### Which wetlands are important?

For the purpose of this paper wetlands are areas of marsh, fen, peatland or water, natural, semi-natural or even artificial, permanent or temporary, shallow or deep, with water that is either static or flowing, fresh, brackish or salt. The wetlands discussed do include coastal but no marine waters.

Each kind of wetland has its own characteristic ecosystems, showing essential and often remarkable differences from the others. The size of wetlands is important: large areas can be managed much more efficiently than smaller ones, but small wetlands can be—and often are—as valuable as the larger ones. Small wetlands are generally more vulnerable than larger ones and in need of special attention. The wetlands under consideration here therefore include not only the larger marshes of delta areas, like those for instance of the Danube in Romania and the Guadalquivir in Spain, the large peatbog areas still to be found in Ireland and the large and deep lakes of Scandinavia, the Alps and Eastern Europe, but also all the smaller wetlands—local lowland marshes and fens, peatbogs and a variety of small waters, such as shallow broads, dune lakes, coastal lagoons and creeks, clay- and gravel-pits, potholes, oxbows, weels and pools. The same applies to running waters, with their equally great variety of springs, torrents, streams, rivers big and small, and estuaries. The diversity of wetlands is extraordinary; and every one of them, without exception, is of outstanding value in its own environment. Each can only function optimally and in complement with others, if use and management take account of these values, aim at maintaining this diversity and are deliberately focussed accordingly.

### Management of wetlands

Management broadly speaking means the deliberate influencing and regulating of elements of our environment. It is necessary to realize, however, that it

amounts to more than this and, in fact, covers everything we do. Thus management of wetlands includes not only deliberate human action aiming at one or another use of a particular water or wetland, for instance drainage, irrigation, reservoir construction, fisheries, recreation and the discharge of wastes, but it also includes other influences exercised by man on wetlands even if they are not aimed at specific results. All such actions and influences ought to be considered and treated as management.

Man needs to be especially on the alert concerning consequences of those manipulations which he does not expect to be of great influence, in other words the side-effects of his actions. It is now well known how important such side-effects can be, especially in wetlands: they have had far more impact in many cases on wetland ecosystems than was expected when the particular action was taken. The side-effects of the application of pesticides and of the discharge of waste water are probably the best known examples. The consequences of the introduction of exotic species is another and there are many more; in fact one can definitely say that every action produces its own side-effects.

Less than 20 years ago all these side-effects were given hardly any attention, except by those interested in nature conservation. Today they are considered to be one of the most serious environmental problems. It is for this reason essential that both the deliberate and the side-effect aspects of management are always taken into account especially as waters and wetlands are used and managed in so many different ways.

### **Functions of wetlands**

Wetlands have many functions. Although they are all interrelated and ought to be considered as elements of one system, for practical reasons a division should be made into—(a) functions in the natural environment; and (b) functions in respect of human needs.

Wetlands without exception play an important role as elements in natural landscapes. They serve and influence wildlife often over a very large surrounding area. For this reason man should always aim at the preservation of these functions, preventing irreparable losses and deterioration. In his development planning, if he so chooses, he is in fact well able to conserve wildlife and other natural resources.

Conservation of wetland resources is also of great value when it comes to the use of wetlands for human needs. These needs can be summed up under the following ten heads, all of them indispensable to human life or well-being:

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1 Water for domestic use</li> <li>2 Water for agriculture</li> <li>3 Water for industry</li> <li>4 Water for energy</li> <li>5 Water for transport</li> <li>6 Production, e.g. of plant material, fish and game;</li> <li>7 Recreation, tourism;</li> <li>8 Scientific research;</li> <li>9 Education;</li> <li>10 Esthetic values.</li> </ul> | } including the provision, in each case,<br>of facilities for the discharge of waste<br>or surplus water; |
|---|---|

All these are in their different way indispensable for different categories of

people. For each of them (except perhaps transport) clean, unpolluted, biologically well-balanced water is necessary, in the case of nos. 1-4 to make it usable at all, and in the case of nos. 6-10 because, without clean water, they cannot function properly, that is to say they become impossible in ecosystems degenerated by pollution or otherwise.

### **Functioning of wetlands**

Intact non-degenerated ecosystems, essential to the conservation of wildlife and of other natural resources and including the permanent availability of usable water, can only be maintained by proper management. This must be based on scientific knowledge of the functioning of the ecosystems concerned.

Ecology and, for wetlands, especially hydrobiology provide the information needed for the purpose of understanding how and why human influences can destroy ecosystems. Bad or insufficient management will usually be found to be the cause, and the rehabilitation or recovery of an ecosystem often takes years. In fact, it is only possible to check the process of degradation and to improve the situation, if the amended management programme, subsequently applied, is based on knowledge of the interrelations of all the elements in the ecosystem. This is generally recognized to be a highly complex affair: account must be taken of the interrelations of water level—including the biologically highly important changes in water level—strength of current, water quality and all the other biotic factors; plantlife (Phytoplankton or other submerged vegetation as well as emergent and shore vegetation) and animal life (from zooplankton to macrofauna, including fish, birds and mammals) are all of equal importance.

The interrelations of these elements, food chains and food webs, and biochemical cycles differ in different types of waters and wetlands. They determine the way in which the ecosystems function internally, whether well or badly, and ultimately also how they will serve human needs. This is a most critical point, because the management of wetlands in most cases involves altering them. This can often be done without interfering with the functioning of the ecosystems in a way that would result in degeneration. It is however essential that the authorities responsible for wetland management take full account of the ecology of the systems they are dealing with. Unfortunately, although this would plainly seem to be logical, it turns out to be the exception. It is especially deplorable that this should be so, even, for example, in countries that are technically highly developed.

### **Use of wetlands**

Wetlands are used all over the world for one or other of the purposes listed above, usually for several of them simultaneously. This is so commonly the case that it is usually accepted without further thought and in the majority of wetlands is unobjectionable. It may even be said that, in principle, wetlands—provided they are well managed and large enough—are capable of fulfilling all ten functions at once without any difficulty.

*Multipurpose use*—Multipurpose use may be normal and even commendable; one should be aware, however, that not all combinations of functions are necessarily feasible. Thus, while domestic use of water from wetlands can easily be combined with its use for agriculture (irrigation), industry and transport (shipping), provided the quantity is large enough, it is possible only when the

discharge of waste water from whatever source is not too large: in other words, when the amount of waste water does not upset the hydrobiological balance of the wetland ecosystem. The combination of domestic use with discharge of untreated waste water should, however, generally be avoided.

When more of the complex of functions of wetland ecosystems are involved, than merely the supply of water, the possibility of combining these functions becomes even less self-evident. This applies especially to fisheries, discharge of waste water, hunting and other disturbing activities, for instance recreation. Thus, scientific research needs undisturbed wetland ecosystems, although fishing, hunting and marsh-plant exploitation may be acceptable in certain localities. Decisions on whether certain combinations of uses are acceptable or not, depend on the way in which wetlands are managed (and users controlled). When wetlands are managed mainly for one single purpose, for instance to provide irrigation water or for recreation-purposes or to get rid of waste water, it means that other functions do not stand a chance. This is often the actual situation. Wetlands of that kind may to a large extent be written-off as a natural resource. Absence of any management at all—everybody to do as he chooses—is even worse. Such situations also exist. Multipurpose use of wetlands still remains the obvious way to use them to best advantage. It *can* be achieved by severe management but it means that all interested parties must accept restrictions.

*Threats to wetlands*—Wetlands are often not estimated at their true worth. Especially by economists they are looked upon as non-productive waste lands, with hardly any economic value, a source, moreover, of fever and discomfort. Development-planners have therefore tended to concentrate on reclamation, drainage and regulation. Many wetlands have disappeared or have been altered as a consequence and the process is still going on. Where circumstances have been favorable for multipurpose land use planning, parts of wetland areas have been preserved, in some cases with original ecosystems intact. In other cases the remnants of the ecosystems have been disturbed, impoverished and degraded.

Drainage and reclamation have brought mankind many advantages, but also disadvantages. Not all projects have turned out favorably. Mistakes have been made, resulting in losses from some reclamation being greater than the profits. This is why it is important for nature conservationists to assist in the preparation of reclamation, drainage and regulation plans, and make sure that none of the valuable functions of wetlands are overlooked, or mistakes made which could have been prevented.

Two other important threats to wetlands all over the world are pollution and eutrophication; pollution by human settlements, industry, agriculture and recreation; and eutrophication through mineralization by wastes, inflow of effluents from sewage plants, and agricultural fertilizers. They have caused extensive changes in wetland ecosystems. Oligotrophic and mesotrophic wetlands are more susceptible to such changes than ones that are already eutrophic. When the level of pollution is referred to as 'slight' in environmental reports, the wetland ecosystem must be considered as already distinctly degenerated. Pollution and eutrophication should therefore be considered as misuse and as such unacceptable in wetland management. Everything possible should be done to prevent them or to improve the situation if they are apparent.

The same applies to the last serious threat to wetlands needing to be mentioned: disturbance by human activities. Wetlands have developed over the centuries in relation to man, their plant and animal life, for example, being

adapted to reed cutting, fishing, hunting, etc. However, modern society has introduced an intensification of human activities not only in the professional but also in the recreational field, for instance watersports. These activities, although in principle acceptable, have much more impact on the natural wetland ecosystems than generally realized if they are not properly controlled. This must be taken into account in wetland management, to prevent unnecessary deterioration.

Although threats to still existing wetland ecosystems are considerable and it will not be possible to avert all of them, much can be done. Nature conservationists should cooperate professionally in plans for development and assist more actively in wetland management. In this way they do much to help in checking the adverse consequences of bad use, misuse and undesirable side-effects and in developing ways of achieving optimal use.

*Optimal use of wetlands*—We can define optimal use as multipurpose use, for all requisite functions, on a 'sustained yield' basis and without deterioration. Because many individual interests which sometimes clash are involved, optimal use of wetlands, for instance a lake or river, can only be realized through cooperation of *all* the interested parties involved. Landowners, managers, users and others will have to be brought within a master organization in order to coordinate their interests, management and use. This organization must focus on the common interest of all. Organizations of this kind hardly exist at present.

Cooperation and coordination of activities should be and can often be developed privately by the interested parties themselves. In many cases governmental institutions and services have important functions. They should often initiate and take the lead in the joint activities. A governmental policy is essential at all levels, whether national, state, provincial or local authority. The guidance and directions of governmental authorities are especially needed in country planning and for the establishment of laws and regulations.

Optimal multipurpose use can only be achieved when the countryside plan allows various parts of the wetland areas to be allotted to different uses. This is necessary in order to prevent the undesirable allocation for a single use—for instance in the financial interests of the landowner concerned—of particular parts of a wetland that, taking all other interests into account, could be better used for other purposes. It is for instance vital to the conservation of natural resources that the occupation of the shores of a wetland by human settlement, industry, roadworks and any other purpose such as recreation, education, or nature conservation, is regulated by the government or an independent organization, in order to make certain that every interest gets its fair share of attention.

Laws and regulations are also indispensable, not only at a national level, but more especially at the local level. This is the only way, in many cases, to prevent misuse and mismanagement. Regulations are necessary for nearly all wetlands to cover the quantitative and the qualitative aspects of water management (water balance and the discharge of all kinds of waste) and also, separately, the management of plant and animal life (e.g. controlling the picking of flowers or other exploitation of vegetation, fishing, hunting and trapping).

*Scientific research for optimal use*—Optimal use of wetlands on the basis of a specific management plan is only possible when sufficient information is available about every aspect of the wetlands concerned. This in turn can only be provided by research. At least three categories of scientific research are necessary, of which the first two are concerned with patterns and the third with processes:

1. Collection of information on individual wetland areas. This research should provide by means of surveys and inventories a comprehensive picture of the geology, geomorphology and topography, hydrology, soil, water, plant life and fauna of the wetland concerned. Its results should be presented in maps and texts, which show the patterns of the wetland ecosystems against the background of the different abiotic and biotic factors. On the basis of the inventories, the various types of wetlands can be classified and the natural resources evaluated. Ecological studies of the interrelations of the ecosystems can also be based on the results of the research.
2. Regional and geographical comparison of wetlands. Regional research produces information about the geographical distribution, numbers and acreages of all types of wetlands. It makes clear which types of wetland are common and where rare ecosystems are to be found, thus indicating the relatively most valuable sites. This information should be used in regional planning and supply the basis for development plans.
3. Investigation of wetland processes. Wetland ecosystems are hardly ever static; they nearly always show changes from year to year. These changes are caused partly by natural succession, partly they are the result of human influences. It is essential for good management of wetlands to study both categories of changes intensively, but specially the consequences of human influence. In the first place the effects and side-effects of all the different management measures on the natural pattern and succession should be studied in the field. Field experiments on permanent sample plots and other field studies and ecological monitoring, especially of suitable indicator species for certain processes such as pollution, should be given full attention.

The necessity for the three categories of research mentioned is generally accepted. In many countries survey-work is already in hand and, to some extent, internationally coordinated, for instance in the IUCN/IWRB Project MAR, and the IBP/IUCN projects AQUA and TELMA. Research programmes are, however, far from complete. Fundamental research into the syntaxonomy and succession of vegetation has already been done on a rather large scale. In most countries, however, research into the consequences of human impacts on wetland ecosystems has hardly started.

Without the research discussed, management not based on years of experience will be haphazard, especially when new techniques have to be applied.

### **Management in general**

In the context of this paper, management may be defined as the deliberate regulation of the various elements of the ecosystems involved, taking account of the effects and side-effects of all activities and other influences existing in the wetland to be managed.

*Surveys and rules*—The first step in good management is to make a complete inventory of all man-made impacts operating in the area, including those which originate from outside sources.

Only on the basis of such a survey can the manager know if the general condition of the wetland is totally satisfactory, or at least acceptable, and where changes in management will have to be introduced to keep out undesirable influences or to improve a local situation.

Knowledge and insight into the functioning of ecosystems, the mechanisms of interrelations in plant and animal life and the potency of ecological balances,

together with practical experience of management of natural areas or nature reserves, checked by field experiments, are indispensable. They should enable two important rules for the management of wetlands to be deduced, both aiming at the preservation of diversity and biological richness of the ecosystems. The rules, which are especially helpful when changes in management occur (for instance when a younger manager takes over or when the area acquires a new function), are: (1) Continue the previous management policy for the time being and do not change the situation too abruptly, even though it seems quite certain that some change is advisable or indeed necessary; and (2) Introduce any changes in management gradually and never effect two (or more) changes at the same time. If more than one change has to be made, do not introduce the second until the ecosystem is adapted to the consequence of the first.

Natural ecosystems are nearly always able to adjust themselves harmoniously to changes effected gradually. But if, for example, changes in the water table, in the strength of water flow or in the recreational activities allowed are introduced abruptly, biological balances will certainly be disturbed. In many cases this is bound to be followed by qualitative impoverishment of the ecosystem.

Management of wetlands and other natural, or semi-natural areas has two aspects: external and internal. These aspects have to be dealt with separately because the policy and actions required are quite different.

*External management*—External management deals with influences on wetlands from outside the area and has the aims of (1) keeping out undesirable influences, and (2) retaining favorable influences.

A great deal of time usually has to be spent on external management. The majority of problems that arise are to do with the defence of wetlands against threats from their surroundings but nearly as much attention should be given to the preservation of valuable interrelations existing between the wetlands and their surroundings. One or more of these may often prove to be of vital importance. Neglect of external management can have very bad consequences.

External management requires willingness and ability on the part of the manager to negotiate regularly and frequently with all his neighbours, near or far, about common or conflicting interests. Four categories of problems are especially important: concerning water level, water quality, plant and animal life, and human activities.

As far as water level (or quantity) is concerned, the flow from outside *into* the wetland and loss by seepage or otherwise *from* the wetland are of vital importance. Uncontrolled changes beyond its borders, brought about by drainage, irrigation, etc., can easily be catastrophic for the ecosystems. This can only be prevented by special measures, which have to be taken in time and be free from any risk of failure.

Water quality is crucial to the type and scope of optimal development of wetland ecosystems. An influx of water affected by eutrophication or pollution, on the one hand, or the loss of a supply of fresh water, on the other, can be equally unacceptable. In most cases methods of preventing or curing the undesirable consequences of such situations are available but tend to be very costly. Water quality therefore always needs very special attention.

What is happening with the management of flora and fauna in the area surrounding a wetland is of more importance to its well-being than in many cases realized. On the one hand, it may for instance be tied up with cultiva-

tion of crops, increase of weeds, subsequent use of herbicides and possibly erosion, or, in much the same way, with the spread of undesirable (sometimes exotic) animal pests. On the other hand, the situation in the surrounding area can also be dangerous for valuable animal species of the wetland area, especially if the latter are to a certain extent dependent on the outside area for food or if they are persecuted (birds of prey) or shot (game) as soon as they venture outside.

Human activities in lands adjoining wetlands nearly always have undesirable consequences. First of all, there is the threat of pollution, which can be air-borne, carried by water and also the result of dumping. It is often practically inevitable. Secondly disturbance by human activities, especially of the fauna, can be serious. Various methods exist of mitigating these undesirable effects, of which perhaps the most important is to establish buffer zones.

*Internal management*—Internal management is concerned with the regulation of all elements in the wetlands themselves, aiming at the conservation and wise use of all their natural resources, although often tending to be focussed on one or two. The various means employed can be summarized as follows:

*Water level*—Measures to keep enough water in the area, to regulate inflow, outflow, current and daily or seasonal fluctuations; also to make water deeper or shallower (dredging, scooping, tipping) and to make, where necessary, 'new' marshes or open water.

*Water quality*—Measures to secure optimal quality are largely concerned with the prevention or careful regulation of the discharge of wastes and of eutrophication processes.

*Plant life*—Vegetation may have to be protected in one part of a wetland, introduced into another and kept in check elsewhere. This is done indirectly by habitat management (of soil and other abiotic factors of the environment) and directly by, for instance, grazing, mowing, cutting, turfing, burning, dredging or (exceptionally) the application of herbicides; also by seeding, planting and (subject to careful regulation) the introduction of plant species from other regions. Shore vegetation needs special attention, because of its protective function and vulnerability: the management of the slope is of vital importance.

*Animal life*—Regulation of animal numbers largely depends on habitat management and especially the management of vegetation. All animals need food, rest and opportunities to breed and rear their young. Populations can therefore be regulated by controlling food (plants and prey-animals) and disturbance by man and natural enemies. However, in practice, reduction of numbers is usually achieved by trapping, shooting, hunting, poisoning, the use of pesticides and the encouragement or introduction of natural enemies, whereas efforts to build up numbers rely on providing food, shelter, cover and control of natural enemies. One-sided control, as often practised in regulating animal numbers, is to be avoided.

*Maw*—Management of human activities must take into account the full range of man's influence. This includes not only the effects and side-effects of his deliberate management-measures and exploitation, but also the more indirect impact of visitors—whether tourists, scientists, students or poachers.

Internal management can only be completely adequate when—

- (i) external management is well in hand;
- (ii) the wetland managed is a natural unit;
- (iii) the managing authority has complete control over the area; and

- (iv) the managing authority comprises a competent multi-disciplinary organization.

*Management for development-Wetlands* are usually rich in ecosystems. The natural diversity is reflected in mosaics of zonations and successions. Thus wetlands often contain deep water, shallow water and marsh of different shapes and sizes, which may in one place be oligotrophic and in other places eutrophic. This diversity is the basis for a plant and animal life rich in species and led to the multiple use, which until this century was typically made of wetlands all over the world.

Management of wetlands has shown that it is possible to make modifications (for instance by controlling succession) for special purposes, without disturbing ecosystems in such a way that ecological balances are disrupted irreversibly. In short, the conservation of the ecosystems can be achieved: it is a matter of scale, tempo and application methods. Not only can individual ecosystems be adjusted to a certain extent to managers' wishes without spoiling the original richness of the wetland, but even mosaics of wetland ecosystems can be adapted to special aims.

This natural adaptability of wetland ecosystems gives valuable opportunities for development, so long as developers and managers bear in mind that it is essential to take into account the ecological processes characteristic of the area involved. Development and use have to be based on natural principles of land use. This also applies to development of newly-made artificial wetlands, because it leads to a better functioning of all aspects of such areas.

### **Management for direct use**

The scope of this final section is limited to the management of plants and animals, not only because management of these renewable resources is of primary importance, but also taking account of the fact that, although people ought to know better, fatal mistakes are too often made, bad use or misuse being the result.

*Natural products*—The range of natural products, used in many different ways in many different countries, is very considerable.

*Plants*—Water plants and the vegetation and woodland of marshes and shores are extensively harvested and used, and in some places more or less cultivated. They provide food for waterfowl and other animals, sometimes including domestic livestock. They are also used as raw material for the fabrication of compost. Marsh-plants such as reeds and rushes, which serve the useful function of protecting the shores of many wetlands, are used for building and thatching, for the production of cellulose, and for other industrial and agricultural purposes. Similarly, the woodlands which grow in marshy areas have many industrial uses, including the rather specialized one of supplying material for dyke building in Holland.

The main tasks for management are to locate, record (with the aid of vegetation maps) and to maintain those areas where valuable species are able to grow; and to control succession processes, which is a most important aspect of management and involves finding out, in good time, the best method of ensuring regeneration in order to keep production going.

*Animals*—Fish, amphibians (frogs and toads), reptiles (snakes, turtles and crocodiles), birds (especially waterfowl such as swans, geese, ducks, divers,

rails and herons) and mammals (such as beavers, muskrats, otters, manatees and hippopotamus) are harvested for many purposes: meat hides and pelts, and numerous other natural products. In all cases the management objective is to ensure that good habitats are permanently available for the species concerned all the year round and at all stages of their life (juvenile to adult). Safe refuges for migratory species, with adequate foraging and wintering areas, are among the many requirements and care must be taken that habitats are not degraded by pollution or excessive disturbance, especially by man.

The specific control of populations calls for the observance of many rules, of which the most important are to (1) keep populations balanced, avoid building them up too much artificially by stocking and never by introducing exotic species; (2) harvest wisely and avoid overcropping but, equally, taking too few, never using harvesting methods that are harmful to the habitat or other animals in the ecosystem, such as dynamiting fish, netting birds or poisoning mammals; (3) keep all niches in the ecosystems functioning properly, for example by not killing too many predators (they keep the population in a good state of health).

These rules are no less applicable to the harvesting of invertebrates like molluscs and crayfish. In fact, wise use leading to optimal production on the basis of sustained yield, should invariably be perfectly possible. Overcropping has to be avoided by all means. The essential condition is to supervise cropped populations by research and monitoring.

A combination of all the types of production mentioned in this section is feasible and often advisable. The different products occupy different niches and have complementary functions. Generally speaking management for yield is hardly ever—and at the most only locally—in conflict with other fields of management.

*Recreational use*—Wetlands have become of more and more importance for recreation and tourism in many countries. Shores, beaches and open waters fulfil complementary functions. Large waters such as lakes attract many people for boating and sailing, but smaller waters, such as broads and gravel pits, are often even more densely occupied.

People enjoy themselves on and in the water and along the shores, but they usually fail to realize the vulnerability of the ecosystem, and only rarely take care not to do any harm. Recreational activities for that reason result in various kinds of damage. The shore ecosystems, in particular, often have to endure more than they can stand; open water ecosystems are often polluted badly; and animal life is disturbed everywhere. The result is that impoverishment cannot be avoided and the wetland ecosystems can no longer fulfil their recreational function properly.

Wetlands, however, can be kept 'productive' for recreation if managed specifically for that purpose and a deliberate effort is made to stop deterioration. This means that nearly all recreation activities must be subject to certain restrictions. Most of these turn out to be not too severe, although usually in the beginning protests are heard. Management for recreation largely revolves around guiding, instructing and controlling the public. In the first place, it is necessary not to allow people to go everywhere, and, more important, not to land everywhere; which implies 'zoning'. In the second place, the use in certain areas of, for instance, large boats or speedboats has to be prohibited, as being incompatible with the maintenance of the ecosystems. Often the establishment of open and closed areas or 'routes' and the development of special sites, where people can concentrate for swimming, fishing, picnicking

or camping, may be advisable, and the rules, supported and explained in maps and guides, need to be well-publicized. Using such methods the management of wetlands for recreation can be successful not only to the great advantage of the recreational uses themselves, but also of other uses such as fishing, shooting and reed-cutting.

*Education and other cultural uses*—Wetlands should play a role in the education of young people of all ages, and also in adult education. This is necessary if each individual is to have the opportunity of appreciating the true nature of wetlands and understanding why special management is so often essential. The educational function of wetlands is too often not developed at all or badly neglected.

For educational purposes wetlands must be managed in a special way. It is important that all characteristics of wetland ecosystems with their plants and animals and their main functions should be demonstrated, as well as the need and methods of proper management. Usually this can only be achieved in specially chosen, managed and wardened areas, where 'nature trails' can be established for students of all categories (primary, secondary, technical and university, as well as the individual). It is advisable to keep these limited educational areas free from other uses (for instance, recreation).

Wetlands are also in demand for nature photographers and artists and for scientific research. For these functions specially reserved and undisturbed areas, where for instance boating and recreation are not allowed and the discharge of wastes is strictly controlled, are again essential, and the areas need to be managed in such a way, for instance, by providing access only along special channels and routes, that people with permits to enter them can do so without causing disturbance. For scientific work special reservations are needed to safeguard areas large enough for different kinds of research (botanical, zoological, hydrobiological) into all aspects of the ecology (zonations) and processes (succession). This should include facilities for setting up and studying permanent sample plots and experimenting with management techniques.

In wetlands of importance, therefore, certain areas should be reserved for educational and scientific research purposes, although they can often be combined with areas reserved for conservation, discussed in the next sub-section.

*Use for conservation*—The objective of management for conservation is preservation of natural and semi-natural ecosystems including all species of plants and animals occurring in them. This should, in principle, cover all successional phases from pioneer to climax, as well as characteristic combinations of ecosystems in zonations or other gradient situations.

Management of natural ecosystems has to focus to a great extent on the problems of excluding undesirable influences, particularly pollution and disturbance. The maintenance of systems which are in danger of disappearing (perhaps due to succession) is another preoccupation, which may for example involve removing submerged vegetation or dredging in the interests of maintaining areas of open water.

Management of semi-natural ecosystems aims at careful continuation of the old management practices. Usually the older techniques are to be preferred to the use of powerful modern machinery. In either case, rather large reserved areas are necessary for proper management and conservation. In special cases the task of management is to preserve, sometimes in a single site only, a small population of a rare plant or animal species. This always requires

specially adapted techniques, sometimes involving careful regulation of water level or selective mowing or grazing and, for animal species, the provision of extra food and cover. Special wardening is always necessary to prevent disturbance.

In an area managed for conservation purposes, conservation has to come first. Often, however, combinations with other functions, even some categories of recreation, are possible. In other cases a combination is not possible: it depends on the vulnerability of the ecosystems involved.

In each wetland of any importance a considerable part should be claimed for conservation purposes: one should reckon on at least one third of the total area (shore line and open water).

### **Multipurpose management of wetlands**

Wetlands have many functions and without exception each individual wetland has at least two or more. In practice, wetlands tend to be used by different groups in several different ways, more or less independently. In most cases management focusses on the needs of one use at a time. Some combinations of different uses have existed for centuries, others (including all connected with recreation) have developed in recent years. Several combined uses—whether old or new—do not present any problem, but others do. The use of wetlands for instance to get rid of untreated waste water, which caused little problem until a few decades ago, has now become increasingly unacceptable and needs to be rigorously controlled. The development of recreation in wetlands often makes it impossible nowadays to combine recreational with other uses such as fisheries or conservation.

It is possible to extend combined uses of wetlands and improve existing but malfunctioning ones, provided that wise management is imposed, which restricts or guides activities as and when necessary. Activities reckoned to be irreconcilable can often be undertaken in a particular wetland, even if it is only a small one, provided that they can be systematically separated either in space, in different parts of the wetland, or in time, in different seasons, or both. In this way real multipurpose use is practicable. The careful planning, wise allocation and efficient management necessary must be supported by—(1) full information about ecological potentials; (2) multipurpose-oriented national planning policies; (3) strong government and administration; (4) competent managerial experts; and (5) financial resources sufficient to enable the wetland to be managed to best advantage.

Optimal multipurpose use and adequate management of wetlands can be achieved when all countries meet the following requirements, both at a national level and through governmental and non-governmental international organizations:

*Research*—Much further fundamental as well as applied research needs to be carried out on all the different aspects of wetlands and their management. Ecological research is at least as important as hydrological, which in many cases has been given greater attention. Each country should have its own research program, based on universities and independent research institutes. International cooperation between these institutes on a regular basis is essential, and each government should give its research workers ample opportunities and funds for this purpose. International organizations, governmental and

non-governmental, should promote such cooperation, as well as the coordination of international research. The MAR, AQUA and TELMA projects, sponsored by IUCN, IBP, SIL, ICBP and IWRB, to which previous reference has been made, are good examples of this and show that the role of the non-governmental organizations is of such vital importance that governments and inter-governmental organizations could well provide supporting funds.

*Planning and governments*—Wetlands ought to be considered in each country as a category which is always of special importance. National planners and administrations should give due weight to the conservation of wetlands not only on a national basis, but also internationally. At the national level, the viewpoint of regional and local authorities, especially, should be oriented to recognize the international value and significance of wetlands, the boundaries of which should always be related to natural and not merely political circumstances. The draft Wetland Convention discussed and accepted at Ramsar (Iran) in 1971 might well serve as a model.

*Management*—For each wetland, as defined by its natural boundaries, there should be a development plan and a management plan. These plans should be based on scientific and other research and drafted to cover different periods (for example, the next 20-30 years, 6-10 years, and immediate future). The plans can be generally rather simple, although all aspects of management, including external and internal factors, should be covered.

Management itself should be in the hands of wetland experts (including trained ecologists). Each manager or managing authority should be vested with complete control of the area concerned and have the power to regulate the various factors involved according to the potentials of the area.

Multipurpose use of wetlands on these lines accords with wetland management as it has always been advocated by IUCN and other bodies. It also accords with the principles of the Water Charter published by the Council of Europe in 1968, with the recommendations of the UNESCO inter-governmental conference (also in 1968) on the Scientific Basis for Rational Use and the Conservation of the Biosphere, and with the manifesto and 'plan of action' of the United Nations Conference on the Human Environment held at Stockholm in 1972.

## CONCLUSIONS

1. Wetlands are always valuable and are always vulnerable and as such need careful management. This is not always realized by all groups of people who participate in taking important decisions concerning wetlands management.
2. All types of wetlands are important, and each category has its specific functions in relation to the natural environment and to human needs.
3. Management must take all influences of man into account, including the side-effects of various actions.
4. Knowledge of the functioning of the different kinds of wetland ecosystems is indispensable for good management. Management practices are frequently adopted without sufficient knowledge of their effect on such functioning.
5. Wetlands can nearly always be used successfully for several purposes at the same time. Management should always be planned on this basis.
6. In almost every country, wetlands, including those of international importance, are threatened because of misuse and inadequate management.

7. It is nearly always possible to make improvements, but this can only be accomplished with the help of appropriately-planned applied scientific research.
8. Abrupt changes in management practices must always be avoided, and any modifications introduced gradually. External influences and internal relationships need to be dealt with separately.
9. Development of wetland ecosystems is feasible but it will only be successful when based on sound ecological principles.
10. It is possible to exploit wetlands for special functions without rendering them useless for other functions but this will depend on careful application of special management practices.
11. Optimal multipurpose use depends essentially on careful planning, sufficient separation of functions, and adequate management.
12. Management can only be efficient when wetlands have natural boundaries, when management plans are made and controlled by wetlands management experts, and when management practices are based on the results of research.

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**SESSION E: MANAGEMENT OF NON-AGRICULTURAL  
RURAL LANDS****Part 2: Paper (20)****Management of Polar Lands**

JOHN K. NAYSMITH

*Chief of the Water, Forests and Land Division, Northern National Resources Branch, Department of Indian Affairs and Northern Development, Ottawa, Ontario, Canada.***SUMMARY**

A program for managing polar lands is discussed within the Canadian context. It is suggested that if northern peoples are to benefit fully from the development of the north's natural resources it is necessary that it take place within the framework of a comprehensive land-management program. Central to conserving Canada's northern lands is the concept of 'managed-use'. Here the basic premise is utilization but under conditions which minimize alteration of the resource-base while accepting the fact that if the land is to be used some degree of disturbance is unavoidable.

The regulatory and research roles within the 'managed-use' concept and the importance of research in ensuring the discriminate use of regulations are discussed. The composition of the Land-Use Information Maps Series and the Terrain Type and Sensitivity Index Maps is explained and their value in terms of administering land-use regulations and in providing long term guide lines for planning purposes is described.

Implicit in 'managed-use' of land is a degree of control upon the user determined by the benefits which will accrue to society as a result of the controls. It is important that such a land-management program also recognizes the requirements of those native people who rely in part on the land for their livelihood and the author suggests that those responsible for planning northern development must take into account the whole range of values and characteristics inherent in the polar lands.

**RESUME**

L'auteur examine dans le contexte canadien un programme de gestion et d'aménagement des territoires polaires. Pour que les populations du nord bénéficient pleinement de la mise en valeur des ressources naturelles du nord, il serait nécessaire que ce développement s'inscrive dans un programme global d'aménagement du territoire. La conservation des terres du Nord canadien est basée sur le concept de 'l'utilisation aménagée'. La prémisses essentiel est ici l'utilisation, mais conçue de façon à réduire au minimum l'altération des ressources, tout en admettant que l'utilisation des terres appelle inévitablement un certain degré de perturbation.

Les fonctions de régulation et de recherche dans le concept de 'l'utilisation aménagée' et l'importance de la recherche dans l'application discriminée des réglementations sont ensuite discutées. L'auteur explique la composition

de la Série de cartes d'information pour l'utilisation des terres et des Cartes des indices de types et de fragilité des terrains et décrit leur valeur du point de vue de l'application des réglementations sur l'utilisation du territoire et de l'élaboration de directives de planification à long terme.

'L'utilisation aménagée' des terres implique un certain contrôle sur l'utilisateur qui sera déterminé par les avantages dont bénéficiera la société en conséquence de ce contrôle. Il est important qu'un tel programme de gestion des terres tienne aussi compte des besoins des populations indigènes qui dépendent en partie de la terre pour leur subsistance. L'auteur suggère que les pouvoirs chargés de préparer les plans de développement pour le nord prennent en considération toutes les valeurs et caractéristiques propres aux territoires polaires.

## MANAGEMENT OF POLAR LANDS

*Land management might be considered as the reconciliation of a continuum of land-use conflicts.*

### A challenge

The concept embodied in the theme of this conference 'Conservation for Development', is at one with the basic premise upon which the land management program for Canada's North has been established. With respect to polar regions one might define development as the industrial utilization of non-renewable resources. On this basis it could be said that development in northern Canada began some 80 years ago with the Yukon gold rush. Following that relatively short but dramatic period at the turn of the century, and recognizing the important but localized gold mining operation at Yellowknife in the Northwest Territories, it was not until the 1960's that widespread industrial activity began in the north. The momentum, largely generated by petroleum and mining exploration in the last decade, has been manifested in the '70s in several ways. These include several producing mines, oil and gas discoveries, development of a gas field and a marked expansion in all forms of transportation. Although a major pipeline out of the Canadian arctic is not yet a reality a massive government-industry research program is underway in anticipation of the construction of a large-diameter pipeline up the full length of the Mackenzie River Valley.

Almost all of this activity has been precipitated by externally generated demands for non-renewable resources. This characteristic is not peculiar to the Yukon and Northwest Territories. For example, with a population of only 22 million, Canada ranks third in world mineral production, providing more than 50% of the world's asbestos, 48% of its nickel and 23% of its zinc. It is important that such development, in addition to being advantageous to the ultimate consumer, should provide social and economic benefits to the residents in the 'producing region'. It follows then that non-renewable resource development should contribute to local and regional as well as national economies. However, in concert with economic development, it is important that all of the values of the land be recognized.

In addition to providing a source of raw materials for a technological society, the polar lands are a direct source of livelihood in terms of hunting, trapping and fishing for a not insignificant number of people. Turning from the material values of the polar lands there is, too, a growing awareness of the recreational and aesthetic value inherent in the Arctic and sub-Arctic. Finally the

region provides relatively large areas, yet unmodified by man, which are of considerable value in terms of scientific investigation and interpretation.

Man in his effort to meet the material needs of society must not ignore the other elements of the natural resource-base. In this respect Pruitt<sup>(1)</sup> warns that if government is not prepared to exercise the necessary constraint and use existing basic knowledge, the tundra region, rather than continuing to produce wildlife and other renewable resources, could very quickly turn into a biological desert. Pruitt refers to Holloway<sup>(2)</sup> and states that eleven species of tundra animals (8 mammals and 3 birds) are listed by the International Union for Conservation of Nature (IUCN) as 'threatened' throughout their world range, and there is concern by IUCN for the survival of 21 additional species (8 mammals and 13 birds). Pruitt then adds that this is a higher percentage than in any other major biome in the world.

The destruction of vegetation and the subsequent heat-induced subsidence that can occur in tundra regions as a result of indiscriminate land-use operations have been thoroughly documented and need no further elaboration here. However, Bliss<sup>(3)</sup> does note another source of surface disturbance which could result in widespread loss of vegetation and hence carrying capacity for mammals. He refers to the burning off of certain amounts of gas or oil once arctic petroleum production is underway, and the resultant air pollution. He points out that lichens are very sensitive to air contaminants and indeed will die so rapidly that they have been used as a biological indicator of pollution. Also in discussing the question of air pollution Hare<sup>(4)</sup> cites the inversions which obtain in Canada's western Arctic and Alaska and the resultant serious air pollution which exists in Fairbanks due to the relatively low capacity of those arctic airs to remove contaminants.

On a global scale Hare points out that northern climates are in delicate equilibrium and indeed this equilibrium could be disturbed by man. Referring to the steady build-up of atmospheric carbon dioxide, primarily as the result of fossil fuel consumption, he states: 'It is reasonable (though by no means unanswerable) to speculate that the concentration (of carbon dioxide) may raise the mixing ratio far above its present value. Doubling the ratio might raise world temperatures by 2.4 deg.C (Manabe and Wetherald, 1967). If this were to happen, the stability of the Arctic Ocean's pack-ice would be imperilled, and it is quite likely that the pack would disappear....the entire thermal economy of the Northern Hemisphere's climate, and hence zonation, depends on the presence of the pack-ice.... If the pack is taken out, everything must be drastically changed, though we cannot yet predict the details'.

It is evident that the effect of man's activity in the polar region can be considerable and detrimental. Industrial expansion, growing communities with permanent populations, increasing numbers of tourists and researchers could have a profound effect upon the arctic ecosystem. These phenomena are not restricted to any particular area but indeed affect most northern circum-polar lands. For example Uspenski<sup>(5)</sup> states that the influence of man on the nature of the Russian Arctic and sub-Arctic is increasing extremely rapidly, mainly due to the development of industry and transportation. He cites Tyurdenev and Andreev<sup>(6)</sup>, who stated that in 1926 there were 732.7 thousand people in Siberia while in 1968, there were approximately 5 million people; the relative size of the urban population for the period increased from 8% to 66%. By comparison the population in Canada north of the 60th degree north latitude is 50, 000. Activity of another kind is noted by Norderhaug<sup>(7)</sup>. He stated that in 1968, twenty-eight different research expeditions comprising 209 participants from 11 nations visited the archipelago of Svalbard. In the summer of 1969 more than 5,000 tourists visited the same area by coastal

ship and hunting and photo safaris are now conducted on a regular basis. Norderhaug concludes by stating that, 'in view of the increasing number of people looking to the Arctic for research, recreation and industrial expansion, Conservation and Wildlife Management in Svalbard will have two main objectives: (1) to restore and maintain Svalbard's wildlife and high arctic ecosystems for their uniqueness and biological productivity; and (2) to make these natural resources available for future research, recreation and harvest in a controlled manner'.

## Conservation

Conservation might be defined as the reduction of waste. However, in order to develop a comprehensive land management program, some expansion of that definition is probably necessary. In this context it may be useful to consider mankind's needs with respect to the natural environment as falling into three categories: material, recreational and perceptive; and rising from this a conservation program comprising four elements: managed-use, restoration, protection and preservation.<sup>1</sup>

With the elements of *managed-use* and *restoration* the emphasis is on utilization but under conditions which minimize the disturbance of other resources during the harvesting and processing phases. For example, where land or water is needed in order to carry out an industrial operation, regulatory controls can be imposed upon the user as conditions for acquiring the rights to the use of the land or the water. The object is to minimize disturbance to the resource-base while accepting the fact that if the natural resources are used, some degree of alteration, however small, is unavoidable.

With the *protection* element of conservation, unlike the *managed-use* aspect where a degree of disturbance is acceptable, the object is the elimination of the possibility of irremediable degradation of the environment because of the serious consequences which would arise from a failure to achieve that goal. Included in this category would be pollution of water by toxic materials which could effectively eliminate marine plant and animal life. In this instance legislation and pursuant regulatory controls may be quite different from those required for *managed-use* programs.

The fourth element of conservation is the *preservation* of particular segments of the resource-base. Here the question is one of preserving areas of unique aesthetic and recreational value. Although the other elements tend to mitigate the adverse effects of resource use, the *preservation* element must be a positive force in maintaining, through parks and wilderness areas, the intrinsic values of the land for the well-being of the individual.

As an adjunct to the *preservation* element there is a need to identify particular sites as being of historic and archaeological importance and other areas that are important for purposes of scientific research. Such areas, although relatively small, should be maintained in a relatively unmodified state.

It is evident that no single piece of legislation can encompass all of the elements. Conversely no particular segment of the land can be subjected to all elements at the same time. For example, if the decision is taken to conserve

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<sup>1</sup>A further discussion of this point can be found in 'Canada North—Man and the Land' by J.K. Naysmith, Department of Indian Affairs and Northern Development, (Canada). Cat.No.R72-6970. OTTAWA.

a particular area through *managed-use* then the *preservation* element is at once precluded since utilization of the land is implicit in the former. Land management in the Canadian North encompasses all four elements of conservation, with the concept of *managed-use* being the most prevalent over the majority of the area.

## LAND, LAW AND SOCIETY

### Legislation

The Territorial Lands Act (Cap. 263 Revised Statutes of Canada 1952, as amended) refers to all lands in the Yukon and Northwest Territories that are vested in the Crown, and are therefore public domain, under the control, management and administration of the Minister of Indian Affairs and Northern Development.

The original Territorial Lands Act and its regulations provided for the sale and lease of lands, for the lease of mining and mineral rights in the Northwest Territories (the Yukon Quartz Mining Act is the pertinent Act in this regard in the Yukon Territory), for quarries, for oil and gas permits and coal leases, and for the management and leasing of timber rights.

Thus although the Act did provide authority for the disposition of public domain in the Territories, it contained no provision for the *managed-use* element referred to earlier. Consequently an important amendment to the Territorial Lands Act was passed by the House of Commons in 1970 and proclaimed in November 1971, at which time Land Use Regulations came into effect.

The purpose of the amendment and the regulations is to provide a measure of control over the types and methods of northern resource exploration, development and restoration procedure in order to minimize degradation of the land surface (see Map 1). The most significant amending sections are as follows:

- 3A. Where he deems it necessary for the protection of the ecological balance or physical characteristics of any area in the Yukon Territory or the Northwest Territories, the Governor in Council may, after consultation with the Council of the Yukon Territory or the Council of the Northwest Territories, as the case may be, where he deems such consultation to be practicable or, otherwise, after consultation with each of the members of the Council with whom consultation can then be effected, set apart and appropriate any territorial lands in that area as *a land management zone*.
- 3B. The Governor in Council may, after consultation with the Council of the Yukon Territory or the Council of the Northwest Territories... make regulations respecting:
  - (a) the protection, control and use of the surface of land in a land management zone; and
  - (b) the issue of permits for the use of the surface land in a land management zone, and terms and conditions of such permits and the fees therefor.
- 3C. (1) Every person who
  - (a) violates any regulations made pursuant to Section 3B; or



- (b) fails to comply with any terms or conditions of a permit issued pursuant to such regulations is guilty of an offence and liable on summary conviction to a fine not exceeding five thousand dollars.
- (2) Where an offence under subsection (1) is committed on more than one day or is continued for more than one day it shall be deemed to be a separate offence for each day on which the offence is committed.

## Regulations

At the time that consideration was being given to drafting regulations pursuant to the 1970 amendment, it was recognized that no formal mechanism existed by means of which various sectors of the community could participate in developing policy with respect to northern land management. The way for *public participation* now seemed open and a *task force* was formed to aid the government in writing the Land Use Regulations. The *task force* comprised representatives of the petroleum industry, the mining industry, conservationists, the university community and government. This opportunity for exchange between industrialists and conservationists proved extremely useful. As various points of view became more clearly understood, certain fears were allayed and original positions became less rigid. With the objective being to produce a workable yet effective set of regulations this body of experts proved invaluable to the government. Several drafts were written and a number of consultations were held with the governments of the Yukon Territory and the Northwest Territories, other federal departments, petroleum and mining associations, and conservation groups. In June 1971, draft regulations were published in Part I of the Canada Gazette providing all interested parties with a final opportunity to present their views and recommend changes to the proposed regulations. Several representations were made which resulted in further changes and *in November 1971 the Land Use Regulations became law.*

*A land-use operation is defined in the Regulations to mean, among other things, any work or activity on territorial lands that involves the use, except on a public road or trail, of any vehicle that exceeds 20,000 pounds net vehicle weight or the use of any vehicle that exerts pressure on the ground in excess of 5 pounds per square inch; the use of any self-propelled, power-driven machine for moving earth or clearing land; the levelling, grading, clearing or cutting of any line, trail, or right-of-way exceeding five feet in width; the establishment of any campsite that is to be used in excess of 300 man-days.*

The Regulations do not apply to: anything done by a resident of the Yukon Territory or the Northwest Territories in the course of hunting, fishing or trapping; or lands the surface rights to which have been disposed of by the Minister. If necessary, restrictive covenants can be written into any surface lease which will ensure the same results as the Land Use Regulations.

*The Regulations are divided into three parts, plus an attached Schedule A which defines the boundaries of the Land Management Zones (see Map No. 2).*

Part I of the Regulations provides general rules for: the protection of land where excavations are being carried out; the proper construction of water crossings; the clearing of trails, rights-of-way and highways; the protection of survey monuments and archaeological sites; the good housekeeping of campsites and the construction of fuel storage facilities; and for the removal of buildings and equipment from campsites when a land-use operation has been completed.



Part II of the Regulations outlines the procedures required of an applicant who proposes to carry out a land-use operation in a *Land Management Zone*. First the applicant must apply for a permit and his application must describe in detail the plan of operation. The application is received by the Regional Manager of Water, Forests & Land (referred to as the Engineer in the Regulations). The Engineer may order an inspection of the lands to be used and he may ask for more information in order to evaluate the environmental impact of the proposed land-use operation. Within 30 days of receipt of an application the engineer must either notify the applicant that he will issue a permit and that this may be subject to certain conditions which he deems necessary to protect the physical characteristics of the land management zone or he must notify the applicant that he has ordered a full inspection of the site. In this case he must, within six months, either grant the application subject to certain conditions or refuse it and state his reasons. Part II of the Regulations also defines inspection and reporting procedures throughout the term of a land-use operation and its completion. The permittee must pay a fee to the Crown for a land-use operation and the Engineer may also require the permittee to place a *security deposit not exceeding \$100, 000* with the Minister prior to commencing an operation.

Section 21 of the regulations, which deals with terms and conditions of permits, provides for the setting of specific stipulations for any land-use operation within a Land Management Zone. Included in any land-use permit may be conditions respecting the following:

- (a) the location and the area of lands that the operator may use;
- (b) the times at which any work or activity forming part of the land-use operation may be carried out;
- (c) the type and size of equipment that may be used in the land-use operation;
- (d) methods and techniques to be employed by the operator in carrying out the land-use operation;
- (e) the type, location, capacity and operation of all facilities to be used by the operator in the land-use operation;
- (f) the methods of controlling or preventing ponding of water, flooding, erosion, slides and subsidences of land;
- (g) the use, handling and ultimate disposal of any chemical or toxic materials to be used in the land-use operation;
- (h) the protection of wildlife habitat;
- (i) the protection of objects and places of recreational, scenic and ecological value;
- (j) the deposit of a security deposit in accordance with section 26; and
- (k) such other matters not inconsistent with these Regulations as the Engineer thinks necessary for the protection of the ecological balance or physical characteristics of the land management zone.

Part III of the Regulations outlines the duties and powers of inspectors, procedures in default of any operator or suspension of an operation and the process of appeals. An appeal may go to the Minister who will make a decision within 30 days.

The problem of managing an area as vast as Canada's polar lands requires an *interdisciplinary approach*. The ecologist, engineer, planner and administrator

must be given equal time in arriving at those decisions which will effect the land. An interdisciplinary team has been set up in each Territory which is known as the Land-Use Advisory Committee. This team, under the chairmanship of the Regional Manager, Water, Forests and Land, reviews the land-use applications and sets the stipulations attached to the permit. The Land-Use Advisory Committee includes a fisheries officer, a wildlife biologist, a game management officer, a member of the regional planning office and an engineer. Once an application has been processed and a land-use permit issued it is the responsibility of the Regional Superintendent of the Lands and Forests Service to ensure, through the Resource Management Officers posted throughout the Territories, that land-use inspections are carried out and that the conditions of the permit are adhered to.

### **Special land-use operations, e.g. pipelines**

Major undertakings, such as pipeline construction, where some form of land tenure is required, are handled somewhat differently, although in essence the same principles are followed. Under Section 19 paragraph F of the Territorial Lands Act the Governor General in Council may authorize acquisition of a right-of-way for a pipeline subject to such terms and conditions as may be deemed proper. Provisions for hearing procedures are allowed for under section 19H which states that the Governor in Council may inquire into a question affecting territorial lands and may, for the purpose of such inquiry, summon and bring before them any person whose attendance they consider necessary to the inquiry, examine such person under oath, compel the production of documents and do all things necessary to provide a full and proper inquiry. For example, in 1971, a company acquired a right-of-way some thirty-two miles long containing 256 acres for purposes of constructing a pipeline. The conditions appurtenant to the land permit included the following:

- (a) term of the permit 25 years renewable for a further term of 25 years;
- (b) an annual fee of \$3.10 per acre subject to review every five years;
- (c) several clauses dealing with erosion controls; surface subsidence and melting of permafrost; precautions against landslides; revegetation of right-of-way; stream crossings and river bank restoration; disposal of garbage, waste and debris; archaeological sites; limnology and biology surveys during and after the period of construction;
- (d) reference to manpower requirements for construction and maintenance programs and employment opportunities for Indians and Metis living in adjacent settlements;
- (e) a clause requiring a guarantee deposit of \$500,000 to guarantee the observance of the terms and conditions during the period of construction and \$50,000 for the remainder of the term of the permit. The costs of any action necessary to remedy a failure to comply with terms and conditions may be charged against the security deposit.

### **The Arctic Land-Use Research (ALUR) Program**

In the course of developing land-use regulations and through discussions with the oil and gas industry, the mining industry, conservation groups and various government agencies, it was evident that few data relating to the effects of

man-made disturbance to northern lands were available. It was evident that in many cases the degree of restriction of land-use operations was being set arbitrarily with little or no scientific basis. Thus the Department of Indian Affairs and Northern Development established the ALUR Program.

The objectives of ALUR are to provide an information base for regional planning and for the management of northern resource development. More specifically, the ALUR Program will: compile baseline information on undisturbed northern ecosystems; identify and define environmental problems associated with the use of renewable and non-renewable northern resources; investigate operation practices in resource exploration and development with a view to devising methods that will minimize environmental damage.

The information base will be of particular value to the Department of Indian Affairs and Northern Development in the implementation and application of regulations governing the use of land and water in northern Canada and issued under the authority of the Territorial Lands Act and the Northern Inland Waters Act. Also, the information will be disseminated as widely as possible to other government departments, resource development industries and the scientific community.

The Program falls into three broad categories:

- (a) research directed to specific, identifiable problems (for example, damage to tundra by tracked vehicles, containment of mine tailings);
- (b) inventory of the resources of a given region and assessment of the environment consequences of different patterns of development (for example, hydroelectric power and/or commercial forest products and/or recreational);
- (c) terrain classification and development of a terrain sensitivity index.

*The Advisory Committee* consists of four members from the university community and four from industry with the ALUR Manager, an officer of the Department of Indian Affairs and Northern Development, as chairman. The Committee as a whole is representative of a broad spectrum of scientific and industrial expertise and knowledge of northern conditions and development. Thus, the Committee is equipped to provide the Department with valuable advice on: extant and anticipated problems which require research; an assessment of ongoing research; the availability of research personnel, services and support facilities; evaluation of research proposals. Also, the Committee is particularly effective as a vehicle for interchange of ideas and information among the scientific community, the resource development industries and the Department.

*Projects in 1971* included the following:

- (1) Studies in the Boreal Forest Region of the Yukon Territory.  
Establishment of base line data on soils, vegetation cover, water table levels, ground frost, snow accumulation, hydrology, fluvial geomorphology, erosion and observation of the effect of experimental manipulation (principally the removal of stands of commercial forests for conversion to lumber).
- (2) Studies in the Mackenzie River Delta and the Arctic Islands.  
This work is concerned with the environmental consequences of oil exploration activities, in particular, the movement of equipment on seismic lines, drill sites and winter roads. Thermokarst, thermal

erosion, subsidence and damage to vegetation have been observed as an aid to devising operating procedures which will minimize long-term ecological damage. The efficacy of revegetation as a means of stabilizing and restoring areas of surface disturbance is being investigated.

- (3) Mine Waste Containment and Water Quality.  
An investigation of the engineering problems associated with the operation of tailings ponds in a northern climate and of the associated problems of achieving acceptable water quality. The work is being carried out at mine sites near Yellowknife, Northwest Territories.
- (4) Ecological Classification of Keewatin District, NWT.  
The development of a classification of the region based on geology, geomorphology, soils and vegetation and taking into account the natural evolution of the main ecosystems and their modification due to use by man.
- (5) Waste Disposal.  
An investigation of the problem of waste disposal from mobile exploration camps and transient construction camps.
- (6) Land Based Oil Spills.  
An investigation of the probability of oil spills, of the problems associated with containment and cleanup in a terrestrial environment and of the effects of oil on the biosphere.
- (7) The development of an information storage and retrieval system for Arctic land-use data.

### **COMPREHENSIVE PLANNING A REQUISITE**

Irrespective of the degree of success attained in dealing with current issues through legislation, regulations, administration and research, comprehensive planning provides the necessary cohesion for a long-range land-management program. In turn the degree of success attained in planning is proportional to the effort expended in the areas of inventory and evaluation. The following is a brief discussion of two programs in Canada's North which deal with these two elements.

The first is a *Land-Use Information Map Series*, a compilation in map form of data on items of environmental and social importance. The second is a *Terrain Type and Sensitivity Index Map*, which in effect represents an inventory of the ecological characteristics of an area in terms of soils and vegetation. From these data, and based on various types of impact (e.g. removal or compacting of the organic layer), several degrees of terrain sensitivity are defined. Areas are then differentiated and plotted according to this sensitivity index.

#### **Land-use information map series**

The first phase of this program includes 44 map sheets at the scale of 1 : 250,000 covering 535,000 square kilometres in the Mackenzie River Valley of the Northwest Territories and the northern portion of the Yukon Territory. The Series, which is being compiled at the request of the Department of Indian Affairs and Northern Development by the Lands Directorate of Environment Canada, will ultimately cover the entire 3.8 million square kilometres

of Canada north of the 60th degree north latitude. The Series depicts in map form a wide range of present and potential uses of the land. Information and data for the Atlas were derived from local hunters, trappers, residents and area game officers of the Yukon Territory and Northwest Territories, the governments of the Yukon Territory and Northwest Territories and federal agencies such as the Canadian Wildlife Service, Fisheries Service, Water Management Service, National and Historic Parks Branch, National Museum of Man, Northern Natural Resources Branch, Canada Land Inventory and Surveys and Mapping Branch. Non-governmental agencies also participated, such as the International Biological Programme—Conservation of Terrestrial Communities (Canadian Panels 9 & 10).

Each map sheet is a self-contained unit and includes the following kinds of information:

### **Wildlife**

- (1) location and characteristics of important and critical wildlife areas according to species, habitat function (e.g. migratory route, breeding area), seasonal utilization;
- (2) comments on wildlife behaviour (e.g. spring caribou movement to calving grounds);
- (3) boundaries of game preserves, sanctuaries and proposed wildlife ranges;
- (4) notes on hazards to wildlife (e.g. use of aircraft near nesting areas, protection of molting and staging areas).

### **Hunting and trapping areas:**

- (1) location of areas;
- (2) boundaries of game management zones;
- (3) boundaries of big game hunting, outfitter areas;
- (4) locations of outfitters' camps; and
- (5) notes on trapping seasons, period of greatest activity during trapping season, traditional hunting and trapping practices, methods of travel, etc.

### **Fisheries:**

- (1) fish migration routes;
- (2) fish spawning areas or potential areas;
- (3) commercial fishing areas;
- (4) notable domestic fishing areas;
- (5) locations of sport fishing camps; and
- (6) notes on hazards to fish and marine mammals (e.g. underwater seismic blasts, removal of gravel from stream beds, increased sediment loads).

### **Recreation:**

- (1) National Park reserve areas;
- (2) area, route or point of recreation-tourism interest, with descriptive notes (e.g. on historic canoe routes);

- (3) camp ground, roadside park or picnic areas; and
- (4) boundaries of recreation-terrain regions with accompanying recreation-terrain rating table.

**Other information:**

- (1) demographic data for each settlement, summary of local economy and value and quantity of fur exported by communities;
- (2) climatic data;
- (3) location of historic and archaeological sites;
- (4) location of hydrometric and water quality stations;
- (5) location of capped oil and gas wells;
- (6) location of Territorial Government Development Control Zones; and
- (7) location of proposed IBP Reserves and brief description of each site.

**Terrain type and sensitivity index map**

The acceleration of northern development has greatly increased the need for information about terrain conditions in the Northwest Territories and the Yukon and beneath the adjacent seas. This requirement for terrain information stems not only from the general lack of knowledge about northern lands, but also from the peculiarities of terrain behaviour in the north, relating mainly to permafrost, ground ice and muskeg, which impose complications, not encountered in southern Canada, on foundations of structures, excavation, slope stability, erosion and sedimentation, water supply and drainage, disposal of wastes, overland traffic and supply of gravel or other construction materials.

In order to meet this requirement for terrain information geological and related investigations are being undertaken by the Geological Survey of Canada which will provide:

- (1) an inventory survey of the land or terrain;
- (2) knowledge of properties of material, terrain performance and hazards in the permafrost region; and
- (3) a terrain sensitivity rating system and terrain sensitivity maps.

**Terrain inventory surveys**

Systematic geological surveys of terrain conditions of selected areas are being undertaken to provide information on surface and near surface earth and rock material, landform features, muskeg, ground ice and permafrost including river bank, coastal and near shore conditions. In some areas, these surveys by geologists and geomorphologists have been broadened into integrated terrain surveys involving, in addition, soils (pedology), vegetation, and geotechnical (engineering) factors. The primary outputs of these surveys are 'terrain inventory' or 'surficial geology' maps at a scale of 1 : 125, 000, which illustrate the nature of surface and near-surface materials, landforms, permafrost and ground ice, areas of eroded ground, etc., and divide each area into 'terrain units' with distinctive constitution and performance. Separate

maps and charts, keyed to the 'terrain inventory' maps are being prepared to depict, for example, soils, vegetation and engineering conditions.

### **Terrain sensitivity index maps**

Although the 'terrain inventory' maps contain much *factual* information concerning materials and terrain conditions, they do not provide a direct assessment of the effects of disturbance or of the susceptibility of the various terrain units to disturbance. In order to meet the need for such *interpretative* information a terrain sensitivity rating system and terrain sensitivity maps are being prepared separately. The first product is a series of preliminary, simplified terrain sensitivity maps at 1 : 250, 000 scale, generalized from the 'terrain inventory' maps. They subdivide each area into:

- (1) a simplified series of standard terrain units;
- (2) provide a description of each unit in such terms as landform, material, ground ice and muskeg cover; and
- (3) rate each unit in terms of its sensitivity or performance when subjected to various kinds of disturbance.

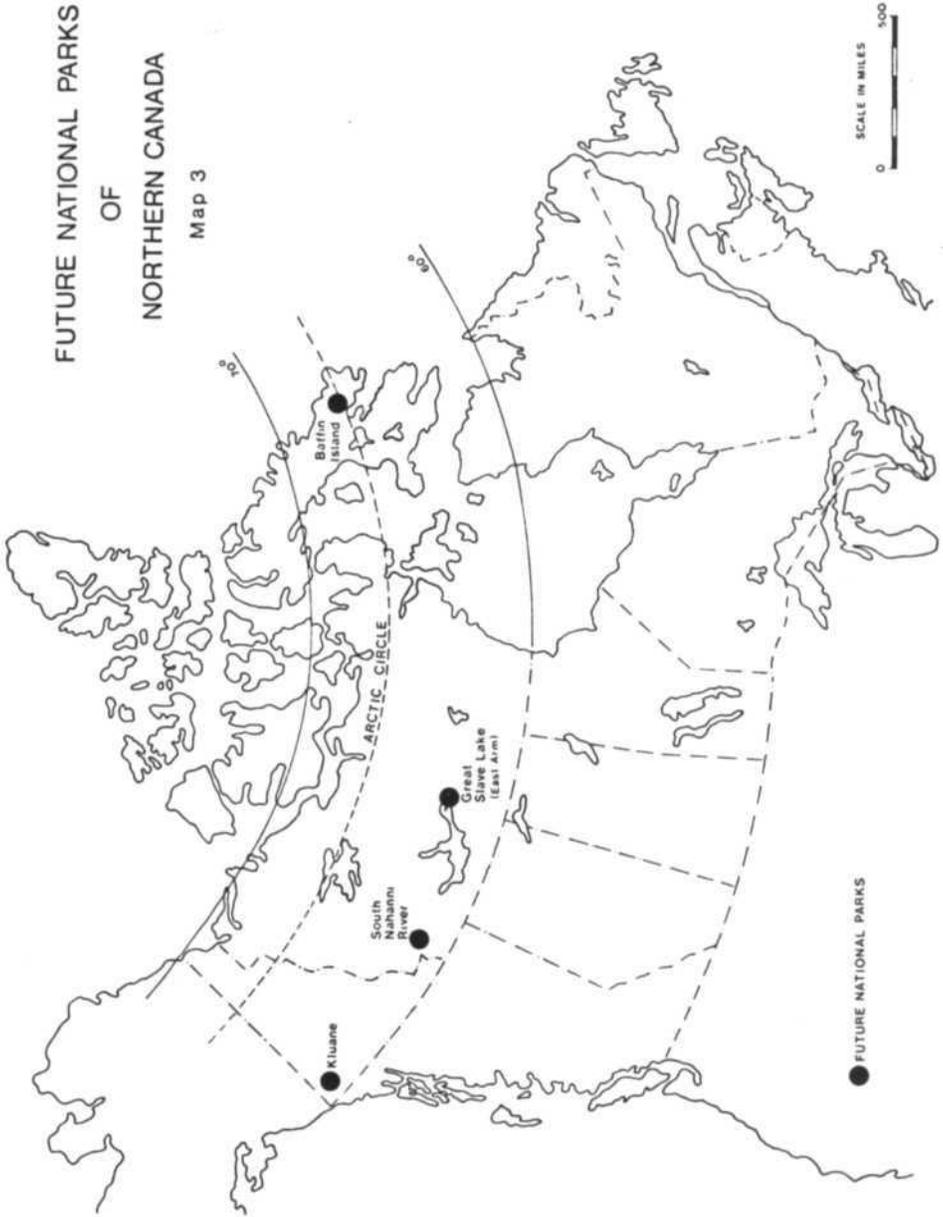
Subsequent investigations are designed to develop an up-graded terrain sensitivity rating system, to revise the maps, and to prepare a manual of terrain performance in which case histories of disturbance at typical sites are keyed to the mapped terrain units.

In essence, the Land-Use Information Series and the Terrain Type and Sensitivity Maps are a systematic presentation of wide-ranging data providing a basis for managing northern lands. Land management might be considered as the reconciliation of a continuum of land-use conflicts. The only constant is the fact of management; the nature of the problem and the manner of reconciliation change with the course of time.

Even if one is prepared to accept the thesis that *managed-use* represents a sound approach to conservation, the degree of regulatory control must be carefully analysed. The increased costs to the private sector as a result of imposing restrictions on its operation must be related to the benefits which will accrue to the public sector as a result of decreasing environmental alterations. Land management or conservation is a concept with a price tag and society must be made aware of the magnitude of both the costs and benefits: determining the former is relatively easy, quantifying the latter calls for a far greater effort.

Forces, exogenous to the region, will continue to exert pressures directed at the development of the natural resources of the polar lands. In that event, northern residents must be the recipients of direct benefits, such as a higher standard of living, and an opportunity to be active participants in a changing economy if that is their wish. To date, industrial activity has provided some employment for the native people of the north. It is quite clear, however, that high unemployment does exist and that a systematic effort is required if private sector employment is to alter this situation significantly.

It must be recognized that there is still a segment of the north's indigenous people who continue to earn at least some part of their livelihood from the land. In the Canadian north the Eskimo settlements of Coral Harbour on Southampton Island in Hudson Bay and Sachs Harbour on Banks Island in the Arctic Islands and the Indian village of Old Crow north of the Arctic Circle in



the Yukon Territory are examples of communities in which hunting, trapping and fishing constitute a significant segment of the local economy. It should not be construed that traditional ways of life will be always preferred but land management principles must recognize the need to minimize the possibility of seriously altering the wildlife habitat in those areas where traditional pursuits are still followed.

Earlier in this paper reference was made to that element of conservation which deals with the preservation of certain lands for purposes of park and wilderness areas. Four areas in the Canadian north have been, by Order-in-Council, and pursuant to Section 19 of the Territorial Lands Act, withdrawn and appropriated for future National Parks. They are the *Kluane* National Park in the Yukon Territory and the *Nahanni*, *Great Slave Lake* and *Baffin Island* National Parks in the Northwest Territories (see Map No. 3).

The 22,000 square km *Kluane* National Park contains Canada's highest mountains including Mount Logan at 6,050 m and extensive ice fields of the St. Elias Range, which form one of the world's largest non-polar glacier systems. The *Nahanni* covers 4,800 km<sup>2</sup> of wilderness area through which a major portion of the South Nahanni River flows, including Virginia Falls which plunges more than 90 m. *Baffin Island* National Park is situated on the east coast of Canada's arctic and covers 21,000 km<sup>2</sup> on the Arctic Circle. The park area comprises a coastline containing deep fjords and vertical cliffs rising more than 900 m above the sea.

In total the four areas which have been withdrawn cover an area of 56,000 km<sup>2</sup>. Other areas are under study including sites on the Tuktoyaktuk Peninsula north and west of the Mackenzie Delta, the Firth River area along the Yukon's arctic coastline and various sites in the Arctic Islands. Planning is also under way to designate, under the Territorial Lands Act, a zone in the northern Yukon Territory as the *Arctic Wildlife Range*. Unlike the park areas in which no development will be permitted the Arctic Wildlife Range will be administered under the Land-Use Regulations which will allow industrial activity, but under very rigid controls.

In managing Canada's polar lands we have endeavoured to bring together the researcher from the ALUR Program and the Resource Management Officer responsible for carrying out the land-use inspections and implementing the regulations. The researcher, who is determining the nature and extent of the impact of various types of land-use operations on terrain of different characteristics, can provide useful information to the Resource Management Officer. Similarly, the man conducting the land-use inspection will be able, in time, to contribute to the design of the researcher's future projects based on his own needs for information. Dialogues of this kind are being encouraged in order to gain maximum benefits from the findings of the research team.

It is essential that those who are responsible for administering a land management program should be in a position to deal quickly and effectively with applications for land-use permits. The efficacy of a land management program is highly dependent upon the dispatch with which the administrative machinery functions. The most operable set of regulations will not remain viable if public support for the program is lost through recurrent administrative delays. In many instances reference to the information contained in the *Atlas and Maps* discussed earlier will be sufficient to process the application and set the stipulations for the land-use operation. At other times data from the *Atlas and Maps* will be valuable to the interdisciplinary Land-Use Group in reaching a final decision.

The usefulness for planning purposes of such instruments of management as the *Land-Use Information Series* and the *Terrain Sensitivity Maps* may ultimately exceed their value as administrative tools. Planners who are responsible for design, layout and location of future communities and installations such as pipelines, roads and airports must be cognizant of the characteristics and values inherent in polar lands.

#### ACKNOWLEDGMENTS

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**SESSION E: MANAGEMENT OF NON-AGRICULTURAL RURAL LANDS****Part 2: Discussion**

In order to leave more time for discussion of the major and quite distinct topics of the two Papers, the **Chairman**, Professor **W. A. Fuller**, said that he proposed to ask the two authors to present their Papers straight away and would then call on the panel member concerned with the Wetlands topic, Dr. Worthington, to make his comments, to be followed by discussion, deferring until later the comments of the two other panelists and the discussion on the Polar Lands paper.

Mr **Poole**, representing Professor Morzer Bruyns, author of Paper (19), who had been unable to attend the meeting, felt that there was nothing he could usefully add at this stage to the author's own printed summary.

Mr. **Naysmith** said that the point he wished to emphasize, in presenting his paper for discussion, was that the broad objective of the Canadian legislation, the details of which were dealt with in the text, was to meet the material, recreational and perceptive needs of the people of the Canadian North. For the first time in the history of that region, industry, conservationists and all other interests, including of course the local communities, had been brought together. He attached particular importance to the Arctic Land Use Research (ALUR) Program. It was time to make a real effort to reduce the redundancies in the environment *versus* development dialogue.

Referring to Professor Morzer Bruyns's paper, panel member Dr. **Worthington** felt that a brief reference to the problem of definitions was desirable. A delegate from Uganda at the Stockholm Conference had asked what 'wetlands' were; in Part 1 of the present Session, Professor Cragg had made a plea for precision; and it was obvious that 'wetlands' discussed in Paper (19) were a much broader concept than those discussed, for example, in the recent IBP Symposium at Mikolajki in Poland. For the IBP purposes wetlands had been defined as 'areas of waterlogged or submerged soil with emergent vegetation', whereas Professor Morzer Bruyns's definition was all embracing. What this showed was that subdivision is essential in considering wetland conservation problems: it was, in fact, already reflected by the three jointly sponsored projects known as AQUA, MAR and TELMA, to which the addition of a fourth, TALASSA (to cover coastal or marine wetlands), has been planned. Two other incidental points were deserving of mention: first, Paper (19) quite rightly stressed the importance of management plans—they are indeed the essential basis of staffing and financing; but, secondly, a remark made by Professor Kassas in Part 1 of Session C was worth recalling: he had referred to the fact that management of the Nile wetlands dated back many centuries to the early Pharaohs and he had underlined the point that making predictions about the effects of management practices is always very difficult. This was worth remembering in connection with the part of planning concerned with assessing ecological consequences of wetland activities although it did not of course mean that efforts at assessment should be abandoned.

The Chairman then called for further contributions to the discussion of the wetland topic and the following were the main points made.

Dr. Worthington referred in his comments to the IBP Mikolajki meeting and the definition of 'wetlands' adopted there. One of the main objectives of that

meeting was to plan a synthesis volume, reviewing, particularly, IBP/PF (productivity of freshwater ecosystems) work in this field, which is due to be published in 1974. One chapter will be devoted to 'Use, Management and Conservation', of which I am a co-author and all additional information under this head, would be greatly welcomed and should be routed to me through IUCN, Morges. There is still a great deal of research needed, if wetland conservation is to be effective, some of which such as assessing the precise influence of the recreational impact was mentioned in Paper (19); other topics, needing much more attention, include: the quality and size of the buffer zones which would effectively shield wetlands against excessive input of nutrients, deposit of dust from industrial plants, etc.; the interrelations of plants and animals or between plant and plant (e.g. *Typha* and algae); the life history of dominant or particularly important wetland species; the possible role of birds in eutrophication; and methods of determining the ecological limits of wetland ecosystems. For these kinds of study not only are a few large protected areas required but also well-scattered small areas; the latter could also serve as important 'gene-pools', if disease or other impacts were to wipe out a particular species in a major wetland. To establish such a network will, as Professor Morzer Bruyns emphasizes, require cooperation between all interested groups—**F. Klotzli** (Switzerland).

Ecology is placing itself in a straitjacket by trying to define in precise terms words which are in general, common usage, like wetlands, grasslands, forests, tundra. It would be much more useful to replace them by new ecological terms which have more precision—**J.B. Cragg** (Canada).

The scarcity of wetlands stressed in Paper (19) sounds curious to Finnish ears, since 30% of Finland is covered by peatbogs. Possibly much the same applies to the whole boreal forest zone of Canada and the USSR. The IBP researches mentioned by Dr. Klötzli, however, do not cover sphagnum-dominated wetlands, which means in effect, that they are leaving out 80-90% of the wetland areas of the world. Peatlands are in urgent need of planned conservation, as was emphasized at the International Peat Congress, Helsinki (June 1972). Out of Finland's 10 million ha of peatbog, 4 million have already been drained for afforestation projects and a further 3 million scheduled for draining. But recently a nationwide project has been launched to save representative samples for scientific, educational and recreational purposes—**P.U. Mikola** (Finland).

As the previous speaker indicated, drainage of peatland for forestry purposes has been widespread and ever more rapid in southern and central Finland and, in the process, many values (in some cases probably greater than forest-products in money terms) have been lost—cloudberry, cranberry, wetland birds, education, recreation, not to mention the stability of the groundwater regime. The economic soundness of this process is being more and more questioned—**P. Borg** (Finland).

Unlike such magnificent scenery as that of the Rockies here at Banff (where a reserve, the first in Canada, was consequently established as long ago as 1885), wetlands—swamps, marshes and forest-covered tropical flood-plains—tend to have few champions. Only a relatively small but hopefully growing minority is equipped to discover in the raw, at times even unpleasant, sensory impressions of a swamp the more subtle vision of beauty derived from experiencing its inner intelligible harmony. A rigorous educational campaign is therefore essential to support research and conservation in an environment of great value for mankind's future (e.g. as a spawning and feeding ground of fresh, brackish and salt-water fauna)—**H.O'R. Sternberg** (USA/Brazil).

Prairie wetlands in North America have continued to be drained, also, but a point not so far mentioned is that in many fine marshes which survive, the number of wildfowl has greatly declined. On the 50 sq. mile Delta Marsh, Manitoba, for example, the breeding population of mallard fell from c. 1000 pairs in 1950 to 17 pairs in 1966. The fact is that the 55 year old Migratory Bird Treaty between the United States and Canada has grown out of date: when it was signed, a large part of the U.S. harvest had been produced in the U.S.A.; now 85% is of Canadian origin; the U.S. Fish and Wildlife Service still adheres to an outdated policy of high governmental priority for duck shooting—'Our function is to provide recreation to people: our stock in trade is the migratory bird resource'. The situation will go on deteriorating until a more realistic pattern of international waterfowl conservation is established. Meanwhile a once abundant species like the Canvasback has been reduced to a mere 179,000 birds (1971-72 winter inventory), of which only a third are females—**H.A.Hochbaum** (Canada).

This seems to be the only opportunity to add a special plea for international cooperation in the protection of samples of Steppe-land, which is even more under threat than wetland, because it is relatively easier to turn over to grazing or cultivation. Very few areas of relatively virgin steppe remain and many steppe-dependent species are in danger of total disappearance (e.g. the bustards *Otis tarda* and *undulata*, Demoiselle crane *Anthropoides virgo*, Steppe eagle *Aquila nipalensis*, Sociable plover *Chettusia gregaria*, Russian (greater) mole-rat *Spalax microphthalmus*, Bobak marmot *Marmota bobak*, Steppe polecat *Mustela (Putorius) eversmanni*). As with the MAR, AQUA and TELMA projects, to which reference has been made, the first task would be to make a detailed survey of all the remaining undisturbed or only slightly disturbed steppe areas—**Yu. A. Isakov** (USSR).

The **Chairman** regretted that he must now close the discussion of wetlands, which could obviously have occupied the rest of the morning, but it was time to turn to Mr Naysmith's paper on Polar Lands. He would first ask the other two panel members for their comments.

Dr. **Kistchinski** thought it important to realise that the Arctic was very much at a cross-roads between the old traditional land use development and the enormous changes made possible by modern technology and needs, which brought a whole set of new problems and conflicting interests. He agreed with Mr.Naysmith that in polar lands protected areas fell into two categories: those where all economic activity was prohibited and those in which some forms of these activities could be allowed. The former category is always difficult to establish, because of traditional rights of the local people. Integrated land use was, in the long run, the best policy.

Mr. **Thor Larsen**, completing the panel's comments, said that polar lands and wetlands had this in common, that they could often serve several purposes simultaneously. Nevertheless, some combinations are not feasible—an estuary with its thousands of birds is dead when changed into the concrete and steel of a harbour; so is the Arctic when it becomes scarred by roads, tracks and dumps. More attention deserves to be paid to the 'soft values', the beauty of the Arctic. The difficulty is to give them a price tag, as can so easily be done with oil, coal and other minerals. Yet aesthetic and wilderness values of the Arctic are increasing and will increase as a refuge from stress: as the national parks have an important function today, so the Arctic will have the same function tomorrow. One important point to remember is that although many people never have and maybe never will see the Arctic, the fact that they *can* if they want to means something to them. Those who live in cities have access

to theatres, concerts, libraries and art collections, but it may be weeks or months or even years between each time that they actually go to them: but what matters and is valued is that the opportunity of going to them exists. Another point is that the management of non-agricultural lands should always be planned in the long-term: we may have quite different priorities in the future and to try to argue a case for conservation on a basis of present day economics and values may be the wrong approach. Nobody asks for a price tag on an archaeological site or a cathedral or other fine buildings. The aesthetic values of nature cannot be exactly priced—nor questioned.

The main points made in the discussion which ensued, were as follows.

There are several reasons for thinking that the conservation program for the Canadian North is still inadequate, despite the progress reported in Paper (20): there is no provision for long-term information on the conservation status of reserves which are still essentially unmanaged; there is also considerable doubt about the boundaries of these reserves, which seem to bear little relation to the ecosystems involved—**V.Geist** (Canada).

Judging from my experience as Chairman of the Canadian Arctic Resources Committee, there is in fact much uncertainty whether an adequate balance is being maintained, in the Canadian North, between exploitation of non-renewable resources and environmental protection and the recognition of the indigenous population's rights to land and other resources. For example, the plan for the highway down the Mackenzie valley was announced recently by Prime Minister Trudeau and construction has already started, but environmental impact studies have only just been put in hand and the report on them is unlikely to be ready before engineering decisions on the location of the right-of-way are taken. Again, a department called Environment Canada has been established, yet responsibility for environmental protection in the north (comprising 40% of Canada's land area and wholly under Federal jurisdiction) is still, as indicated in Mr Naysmith's paper, vested in what until recently was called the Northern Economic Development Branch—**D.H. Pimlott** (Canada).

In view of the emphasis in the paper and previous discussion on pipelines, hydroelectric installations and mining activities, it should be pointed out that highway construction has more influence on the environment than all other developments put together. Thus the Dempster Highway in northern Yukon, between Dawson City and Inuvik, was built with little attention to the environmental, social or aesthetic interests affected. This is quite inconsistent with the Federal Government's demand that private industry should undertake studies of such impacts in the case of projected pipelines—**George W.Scotter** (Canada).

There is insufficient recognition in Mr Naysmith's paper that Darwin's dictum to the effect that every traveller should be a botanist applies in the polar regions and should be the basis of all land-use and management studies. Not only are green plants the primary producers on which virtually all life in the Arctic, as elsewhere, depends, but they also have a role in stabilizing the surface and in relation to permafrost, solifluction and other soil conditions. There have been very many studies of the productivity of the land ecosystems of the North, notably by Vladimir Nicolaievich Andreev in the USSR, to which full consideration should be given; further *ad hoc* investigations ought to be undertaken (for each area will vary from each other), whenever land-use problems come up in any place where macroscopic plant life exists, as it does on all ice-free northern lands—**N. Polunin** (Editor, *Biological Conservation*).

The national parks projects for the Canadian North are important but a great deal still needs to be done, surveys completed, adequate funds provided, Indian claims and boundary disputes resolved, and a complete system of reservations established. After all, the areas now designated have been reserved for 30 years; what is wanted is to speed up the process and get something worthwhile on the ground—**J.G. Nelson** (Canada).

Many, if not all, of the criticisms that have been made have been taken into account in the recent 'Northern Policy' statement issued by the Canadian Government, which has in particular aimed at keying policy into the wishes of the local inhabitants themselves. The funds available for environmental studies have been greatly increased. In short, the legislative basis and procedures have been largely decided by Parliament and it now up to all of us to get on with the job—**J. K. Naysmith** (author of Paper 20).

In closing the discussion and the Session, perhaps one basic question, on which we have not touched, ought to be raised and should receive further attention by IUCN. The spur to Arctic development has been the search for energy. Are we sure that we need to tap these new but by no means unlimited energy sources and that the sacrifice of environmental values involved is really worth while?—**W. A. Fuller** (Chairman).



**SESSION F**

**DYNAMICS OF VANISHING SPECIES  
AND THEIR HABITATS**

**Part 1**

**Session F : Part 1**

*Chairman:* Professor Jean-Paul Harroy (Belgium): Chairman IUCN's International Commission on National Parks; Professor of the Institut de Sociologie, Université Libre de Bruxelles.

*Authors:*

**Paper (21): Vanishing Species: Habitat Change and Reconciling Conflict.**

Professor I. McTaggart Cowan (Canada): Vice President, IUCN Executive Board; Dean of Faculty of Graduate Studies at the University of British Columbia, Vancouver.

**Paper (22): Environmental Disturbance and Species Survival**

Mr Peter Scott<sup>1</sup> (U.K.): Chairman, IUCN's Survival Service Commission; Chairman of World Wildlife Fund International, Slimbridge, Gloucester.

*Panel Members:*

- 1 Dr Enrique Beltran (Mexico): Member, IUCN's International Commission on National Parks; Director, Instituto Mexicano de Recursos Naturales Renovables, Mexico City.
- 2 Dr Kai Curry-Lindahl (UNESCO): Vice-Chairman, IUCN's International Commission on National Parks; Ecology and Conservation Section of Unesco's Field Science Office for Africa, Nairobi, Kenya.
- 3 Mr P. M. Olindo (Kenya): Member, IUCN's International Commission on National Parks; Director, Kenya National Parks, Nairobi.
- 4 Mr M. K. Ranjitsinh (India): Member, IUCN's Survival Service Commission; Deputy Secretary for Forests and Wildlife, Ministry of Agriculture, New Delhi.

*Rapporteur:* Miss Moira Warland (IUCN).

*Secretariat Member:* Mr Joseph Lucas (IUCN).

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<sup>1</sup> Now Sir Peter Scott

**SESSION F : DYNAMICS OF VANISHING SPECIES AND THEIR HABITATS**

**Part 1: Paper (21)**

**Vanishing Species: Habitat Change and Reconciling Conflict**

I. MCTAGGART COWAN

*Vice President of IUCN. Dean of the Faculty of Graduate Studies, University of British Columbia, Vancouver.*

**SUMMARY**

Our concern with the survival of animal populations falls into three categories: management for a crop, management for enjoyment both as unique species and for the mass spectacle that some species present, and management for survival.

About 700 species and subspecies of vertebrate animals are currently recognized as being present in such small numbers as to be specially vulnerable to extinction. About half the birds and two-thirds of the mammals in this number have been reduced to this state by over-killing. A substantial proportion of them were rendered vulnerable to overkill through destruction of large parts of their natural habitats. Killing for food, leather and for the pet and zoo trade accounts for the incipient extermination of over 60% of the endangered reptiles and amphibians.

The endangered fishes are suffering as a consequence of hydro-electric developments, irrigation and by genetic extinction through interbreeding with more 'aggressive' stocks of introduced races.

Island forms are specially vulnerable accounting for 100 of 180 endangered birds.

Where direct overkill has not been an important factor, habitat changes arising from agriculture, deforestation, wetland drainage, marsh burning and warfare are the responsible forces. All but the last involve the competitive use of land for 'developed' purposes. In many nations, all unfenced land is regarded as available for any purpose and even the central government has no clear authority over land uses; thus few controls in the interest of conservation are possible.

Redress suggests the urgency of each government acknowledging its authority over its unfenced lands and the human activities on these; the designation of the habitat requirements for survival of the threatened species; the establishment of reserves of a size and ecotope appropriate to the protection of such species as are likely to respond to such 'enclave' conservation; and the modification of management plans of National and State Parks for the special purpose of assuring the maintenance of the habitats needed by endangered species.

Furthermore, it is imperative that we explore the creation of an international mechanism that can be used to subsidize the government of a developing nation for withdrawal from commercial or subsistence exploitation of lands required for 'survival conservation'.

**RESUME**

Nos tâches à l'égard de la sauvegarde des populations animales portent sur trois domaines: gestion des populations en vue d'une 'récolte'; gestion en vue de préserver l'intérêt que présente le spectacle d'une espèce de caractère unique ou du rassemblement de milliers d'individus de certaines espèces; gestion en vue de sauvegarder l'espèce.

Il est reconnu qu'environ 700 espèces et sous-espèces ont actuellement des effectifs si faibles qu'elles sont particulièrement vulnérables au danger d'extinction. Près de la moitié des oiseaux et des deux tiers des mammifères ont été réduits à cet état par une chasse excessive. Une importante fraction d'entre eux ont été rendus vulnérables à cette surexploitation par la destruction de grandes parties de leur habitat. La chasse pratiquée à des fins alimentaires ou commerciales—cuirs, commerce des animaux familiers ou des animaux pour les jardins zoologiques—est responsable du commencement d'extermination de plus de 60% des reptiles et amphibiens menacés.

Les poissons menacés souffrent des conséquences du développement de l'industrie hydro-électrique, de l'irrigation, ainsi que d'extinction génétique par suite de croisements avec des souches plus 'agressives' de races introduites.

Les formes insulaires sont particulièrement vulnérables, comptant en effet 100 des 180 espèces d'oiseaux menacés.

Lorsque la chasse excessive n'est pas la cause majeure de la diminution, celle-ci est causée par la transformation des habitats par l'agriculture, la déforestation, le drainage des zones humides, le brûlage des marais et la guerre. Excepté la dernière, toutes ces causes impliquent une utilisation concurrentielle des terres à des fins de 'développement'. Dans de nombreux pays, toute terre qui n'est pas enclose est considérée comme disponible pour n'importe quel usage, et même le gouvernement central n'a pas de pouvoirs définis sur l'utilisation des terres, ce qui rend difficile l'instauration de mesures restrictives en faveur de la conservation de la nature.

Le redressement de ces abus exige des gouvernements qu'ils affirment leur autorité en ce qui concerne les terres non encloses et les activités humaines qui s'y déroulent, qu'ils définissent les conditions d'habitat nécessaires à la survie d'une espèce menacée, qu'ils établissent des réserves dont les dimensions et les biotopes conviennent à la protection des espèces susceptibles de réagir positivement à un système de conservation 'en enclaves' et enfin qu'ils modifient les plans d'aménagement des parcs nationaux et parcs d'état en vue d'assurer spécifiquement le maintien des habitats dont dépendent les espèces menacées.

Il est en outre urgent que nous explorions la possibilité de créer un mécanisme international qui servirait à subventionner le gouvernement d'un pays en voie de développement pour l'aider à retirer de l'exploitation commerciale ou vivrière des terres requises pour une 'protection de sauvegarde'.

**VANISHING SPECIES: HABITAT CHANGE AND RECONCILING CONFLICT**

The rapid evolution of our attitudes toward wild animals has been among the important verities of the last quarter century. The simplistic views of the late 19th century and first third of the present century saw animals as good or beneficial if they could be sold or eaten or if their form, colour or song ap-

pealed to our senses. Conversely they were harmful if they attacked us, our livestock or crops, or if the sight or sound of them brought fear or repugnance. The vast majority of organisms were little known, less understood and of no consequence. They were ignored, while the harmful were marked for destruction and the beneficial were protected if they were unsaleable, or killed while the stocks lasted if there was a market for any part of them. Conservation was based upon rationing an inevitably dwindling resource rather than upon the concept of sustained yield.

Increasingly today we see the world of plants and animals as one world potentially available to all people to enjoy. Our burgeoning knowledge of organisms, stimulated by the vitality of radio and television and the magnificent accomplishment of colour photography and colour printing, has introduced millions of people to the fascination of multitudes of small lives. This has been an important element in the changing ethics of man toward the living world in all its variety.

Specifically we now know that largely through human action several hundred animal species and subspecies verge upon extinction. Ambitious and often expensive programmes to improve the chances of survival for these threatened creatures are regarded as appropriate recipients of our money and talent. These species are seen as the repositories of unique genetic material, evolved through millions of years in response to the changing opportunities of the environment. Thus seen they may well provide the templates for our own genetic manipulation. Many millions of people find pleasure in observing and photographing birds, mammals and a myriad less obvious creatures. The great dramas of congregations and migration, the easy contacts with the commonplace as well as the rare and elusive all excite interest and bring variety and natural stimuli to people increasingly confined to the artificial environments of cities.

Marketable creatures are recognized as existing in populations with predictable capacities for sustaining a human harvest. Killing beyond tolerable limits is widely seen as socially unacceptable. To an increasing extent also there is a concern for the individual creature and for the manner and purpose of its dying. The killing of wild creatures for their pelts or plumage to be used for adornment is coming into question, as also is the maximum sustainable yield that has been our basic objective in the management of the creatures regarded as 'game' animals. While recreational hunting and fishing are highly popular forms of outdoor activity there is ever increasing insistence on the quality aspects of this recreation rather than quantitative harvest.

Even the time-honoured villains are no longer accepted as such. The coyote or leopard that raids a flock is now seen as an individual that has developed unfortunate habits—rather than a representative of an evil clan. The wolf of yesterday with a bounty on his head is now the carefully-managed game animal.

We know that some species transmit parasites and diseases important to us and our animals. But our understanding goes also to the details of life cycles and transmission and we acknowledge many ways of correcting the problem. By direct decision, as also by oblivious pursuit of our single-minded purposes, we will continue to influence the lives and the survival of animal forms that occupy all parts of the world. Our redefined interests however are the basis of a new ethic acknowledging the urgency of fostering human behaviour that encourages the persistence of a rich and varied fauna of wild creatures in wild habitats.

Our concern with the survival of animal populations falls into three major categories:

### 1. Management for a crop

Most species that elicit our concern to the extent that special regulations are designed to assure the continued well-being of a species, have attracted this attention because they have commercial value. For these the objective is to produce a usable surplus.

### 2. Management for enjoyment

(a) At the species level: millions of people of all ages and many races find pleasure in associating themselves with wild living creatures, especially the birds and more spectacular mammals. They enjoy the familiar species that are man-tolerant, but increasingly they seek the rare and unusual. This group of recreational users has the greatest demand for variety and, as nature tourists, they make an important financial contribution to the countries that maintain a rich variety of native creatures in attractive environments. Largely through the interest of this group in society, many countries have blanket regulations establishing automatic protection for all birds and most mammals for which no specific 'open' season is declared.

(b) As the mass spectacle: to an increasing extent people are finding delight in the majestic biological spectacles: the concentration of geese, swans, ducks, cranes and other species that thread the migratory flyways of the northern continents and accumulate in their millions at resting points or on winter refuges; the herds of wildebeest, zebra and gazelles in their hundreds of thousands that travel the traditional game highways of the East African plains; the myriads of alcids, kittiwakes, cormorants, gannets, boobies, albatross, terns and penguins; or the fur seals, sea lions and elephant seals in their thousands upon sea girt breeding colonies. Each of these bring delight to large numbers of people for whom the spectacle—the numbers, movement, clamour and smell have meaning far beyond the intrinsic interest of the species as individuals. Management for the spectacular masses of wildlife is an increasingly important objective that has received too little attention.

### 3. Management for survival

Finally, there is the fight to keep some species alive even as tiny remnants desperately vulnerable to extinction by human action, by the mischance of accident, or by the impartial gamble that determines sex ratios, age ratios, fecundity and survival.

The principles supporting management for each of these objectives is the same, though the focus must be sharper where ultimate survival is the objective. The most important principles are maintenance of a population large enough and broadly enough distributed to guarantee the objectives; provision of habitat containing all needed components in adequate supply; particular concern to detect and understand the emergency situation that may arise only at long intervals and the special requirements needed by the species to survive these; protection from the impact of introduced predators and diseases; enforceable and enforced controls upon human destructiveness that will exceed the capacity of the species to produce a surplus. All these demand research to produce the facts upon which action can be based.

As we seek attitudes and behaviour in man that will serve this objective, we can gain from a review of events in the recent past that have brought extinction to some 130 species and subspecies of birds and mammals in the last four centuries and reduced another 500+ to numbers so low that their survival is threatened. When the 100+ amphibians and reptiles and 60+ fish are included, the total of all vertebrates endangered, largely as a consequence of human presence, is about 700 species and subspecies.

TABLE 1 PRIMARY CAUSES OF NUMERICAL REDUCTION OF ENDANGERED SPECIES

Group	Birds	Mammals	Reptiles & amphibians	Fish
Number of species	180	253	100	61
<i>Causes</i> (in per cent)	*	*	*	*
Overkill	48%	66%	63%	16%
Agricultural activity	18%	18%	12%	—
Deforestation	28%	18%	9%	—
Introduced predators	23%	2%	9%	16%
Introduced diseases	4%	3%	—	—
Genetic 'swamping'	1%	1%	—	—
Biocide chemicals	2%	—	3%	5%
New competitors	3%	2%	16%	19%
Hydro-development & aquatic pollution	1%	—	—	62%
Natural causes	7%	2%	2%	—
Cane commercialization	—	.05%	—	—
Urban development	—	2%	31%	—

\* Totals in each vertical column is greater than 100% because more than one force is acting jointly upon some species and it is not known which is the limiting one.

I have summarized on Table 1 the most important causes giving rise to the marked reduction in numbers in those endangered species for which there is reasonable certainty of the destructive influence. These have been taken from the four volumes of the Red Book devoted to these groups of organisms.

In about half the birds and two-thirds of the mammals overkill is involved in reducing the species to its present plight. Within this category I have included capturing for zoos and museums as well as the killing for food or for saleable products. It is important to recognize that most of these were rendered vulnerable to overkill by prior destruction of large parts of their natural habitats.

Among the birds three other categories of impact account for most of the remaining species that are in trouble. These are agricultural activity (i.e. land clearing for agriculture, pasturing of livestock and pastoral grazing), deforestation, which may indeed be the first stage of converting forest land to

agricultural use; and the impact of introduced predators. In mammals these three categories account for the dangerously reduced populations of most of the species and subspecies.

Overkill for food, leather and for the pet and zoo trade accounts for the incipient extermination of over 60 per cent of the endangered reptiles and amphibians. The other major forms of impact are urban development chiefly in California and the Bahamas, competition from goats or rabbits introduced on to islands, predation by introduced species such as dogs, pigs and mongoose. Here, as in the birds, island forms are highly vulnerable. Thirty-nine per cent of the endangered species are island indigenes, without including the sea turtles in this group.

In general therefore 52% of the rare and vanishing reptiles owe their plight to habitat alterations directly consequent upon human activity. The unique feature is the heavy impact of urban development on the reptiles. This arises from the large number of very localized species of small population size that originally inhabited parts of California and the Bahama Islands now in great demand for housing.

For these forms the only hope is the establishment of inviolate refuges where protection can be assured from both killing (man and his pets) and habitat change. In many cases this may be practicable, as the species are probably adapted to survival under small-population circumstances.

As might be expected the endangered fishes are suffering under a different series of pressures. Prominent among these are water impoundment for hydroelectric development and irrigation, and 'development' of springs in arid areas for human use. A second major source of trouble at widely scattered parts of the world is the introduction of exotic predators and competitors (together 35%). A unique cause of the impending extinction of a number of the indigenous subspecies of trout in the Sierra Nevada and adjacent areas is genetic extinction through interbreeding with more 'aggressive' stocks of trout 'planted' for sport fishing purposes.

In all groups the endangered species of today do not differ significantly, as to systematic groups or the nature of the destructive influence, from the species exterminated during the last two centuries. Despite the awakened concern, the recognition of international purpose in preventing the extinction of species, and despite also the large expenditures to this end, the soaring human numbers and insatiable demand for physical and biological resources have thwarted any dramatic improvement in our impact on the vertebrate animals.

The identification of the three or four major sources of destructive pressure on populations of now scarce kinds of vertebrates should not lead us to ignore the other forms of environmental pressure acting on a smaller number of species.

Some of the species affected may be of special importance and some of the negative pressures may be of rather recent advent and thus have had less time to act. Biocide chemicals could be in this category.

It is possible also, that such factors as diseases and parasitism, that are difficult to detect, have had greater impact than is recognized. I think, in this instance, of the impact of introduced avian malaria upon the Drepanid birds of the Hawaiian Islands (Warner 1968).

Before turning to a more detailed examination of the kinds of conflicts that have occurred between man and these now rare wild vertebrates, it is pertin-

ent to ask whether there are any special biological or geographic circumstances that have predisposed species to destruction by man.

It has been remarked by several authors that island forms of birds are particularly vulnerable to extinction. My inventory reveals that about 100 of the 180 endangered birds on my list are island forms. The comparable figure for mammals is 54 out of 253. However this should not be taken as reflecting differential vulnerability but rather that mammals have not been as adept as birds at reaching islands and thus setting themselves up for elimination by human activity. The insular mammals that have been seriously reduced are largely composed of the forest mammals (lemurs, etc.) of Madagascar, the larger forest species on Formosa and several small kinds inhabiting the Caribbean Islands. Deforestation on Madagascar, overkill on Formosa, and a combination of circumstances including the introduction of the mongoose, Norway rat and dog to the Caribbean Islands are the primary reasons given for near extinction.

Among the mammals nearing extinction are about 100 large herbivores, 50 fur bearers, seven seals and all eight of the great baleen whales. In general then it has been a misfortune to a mammal to have a saleable pelt or carcass, or to compete with the flocks and herds of some pastoral peoples.

The great whales provide a poignant commentary upon the futility of our international efforts. Almost without exception they have been reduced to their present level during the 20th century, in the full knowledge of what was being done to them. Their destruction served no irreplaceable purpose for mankind, but it served commerce to ignore the long term biological consequences in the interest of recovering investment.

The special purpose of this Session is to focus attention on those forces that are destroying species through the route of habitat destruction. In North America and in Europe, we are familiar with the frenzied encroachment upon land through ever more and broader highways, the conversion of airfields to 'jet lengths', the cancerous and unplanned extension of cities onto the agricultural and wild lands adjacent. With different manifestations the problem of the conversion of land to 'developed' purposes is a problem of world-wide consequence. It is fundamental to many of our environmental problems and directly or indirectly gives rise to most of the threatened or actual exterminations of native plant and animal forms.

A recent IUCN editorial (1972) comments on some of the basic problems involved. Even where a nation has an inventory of its land and its capabilities, the capacity to enforce its plans are usually scarcely developed, indeed . . . 'one may question whether it is politically or socially feasible' to enforce planned land use even where the power to do so is clearly vested in the government. Traditional patterns such as nomadic pastoralism and slash-burn agriculture were appropriate to a much earlier age of human society, when populations were small and much less destructive than they now are. At that time land was abundant in proportion to its users and there was time for the scars of man's presence and misuse to heal before he came that way again. This is no longer so, but age-old custom dies hard.

In many parts of the world all unfenced land is regarded as available to anyone for any purpose and there is no clearly recognized authority over it by government. Here subsistence agriculture is in many areas a predominant way of life and the techniques for soil nurture are unknown or too expensive to be practicable. It is for this reasons that it seems unlikely that there will

be an early improvement of this land ethic and its application in large parts of the world where a major part of the threatened species occur.

### **Forest destruction**

Many of the wildlife species threatened through habitat destruction are in tropical or subtropical lands where the eroding forces are forestry and agriculture. This is supplemented in many areas by the increasing demand for 'bush meat' as an important source of scarce protein. In Madagascar, Taiwan, Indonesia and other parts of the East Indies, Thailand, western Africa and the American tropics the destruction of the forests is proceeding in many places at an increasing rate. Often this is stimulated by foreign capital and is thus seen by the local government as a welcome source of trading capacity. This is understandably difficult to resist and the social pressures to encourage the destruction of their native landscapes are powerful.

The resolution of that conflict appears to rest on the identification of those wildlife species that can survive only in 'climax' forest habitats; the designation of areas appropriate in size and composition and the removal of these from exploitation for purposes other than the retention of rare and unique biotas. This is essentially the park, reserve or refuge route to species survival. It carries with it problems of a different order but there seem to be few effective alternatives.

There is an alternative or supplementary possibility. The United States has taken the lead in prohibiting the import of all endangered species of birds, mammals and reptiles or products arising from them. If it is recognizable, in some instances, that these species are as effectively threatened by destruction of their forest habitat to supply exotic timber for the sophisticated markets of the affluent countries, it is possible to impose an embargo of the same kind on this timber, or in other ways use tax and customs regulations to discourage the exploitation.

Some countries, of which Madagascar is a good example, have a disproportionate problem arising from the large number of unique and highly specialized mammals, each with its own forest requirements. Designation of land for 'survival conservation' could be much easier for a nation struggling to build up its capital resources if it could recognize some economic returns arising from this form of land use. There is need for economic studies of the values accruing from such actions. In some instances the dedicated area can be a potent attraction for the increasing numbers of nature tourists. In some other cases more novel approaches should be explored. For instance, I suggest that some international mechanism be explored that could be used to financially subsidize a government for its withdrawal from commercial exploitation of the habitat necessary for the survival of certain designated species or environments. This has many complexities but should be soluble.

Such an approach could be equally applicable where the needed forest areas were in private ownership.

The northern forest species for various reasons are, with few exceptions, under no threat from forest removal. An exception is found in Kirtland's Warbler, probably always rare and with very narrow tolerances. Here habitat protection is already directed toward its survival.

## Agriculture

Pastoralism, slash-burn agriculture, wetland drainage, marsh burning and the clearing of land for the permanent production of crops are land uses that have from place to place given rise to serious conflict problems with the survival of native animals.

Second order effects arise from the use of biocide chemicals and from the introduction of the diseases and parasites of domestic livestock into highly susceptible wild species.

Sometimes where pastoralism is a long standing way of life there has been direct destruction of wild grazing animals as competitors or of wild carnivores as predators. In general, however, these instances have not brought existing species to endangered levels. They may have accounted for the early extirpation of the large carnivores in Asia Minor and adjacent areas.

More frequently the wildlife suffers in direct competition for food. The domestic herds in the growing season use the feed upon which the wildlife is dependent for survival during the dormant period. Then too, in arid lands water holes may be few and, if preempted by domestic stock and by man, wild species may be denied water and thus the use of the range. The successful strategy here is to identify the relatively small area that holds the key to wildlife survival and to exclude these from human use. Such techniques however are usually possible only in reasonably sophisticated societies where regulations are accepted and enforceable.

Some of the conflict between pastoralists and wild predators arises from poor attention to the destruction of dead carcasses. Where these are merely left on the range to be destroyed by the natural mechanisms, they cultivate in the predators a taste for domestic prey, and at the same time breed flies by the myriad to plague man himself. The answer lies in education of the herdsman—but this is not easy and is probably only achievable as part of a total educational programme directed towards other important elements of life style and animal improvement.

In many parts of the world, in one way or another land is denuded of its native cover for the temporary growing of human food. The land is not agricultural, its use gives rise to erosion, soil impoverishment and the elimination of huge areas from its natural role in maintaining the native plants and animals. This is a deeply engrained tradition more or less inappropriate to today's conditions. Governments, where this land destruction persists, should seek what ways they can devise to use tax incentives or penalties, or other forms of regulation, to discourage it. Elimination of the practice, along with the introduction of improved methods of agriculture and if need be moving people to better land, would be beneficial to both the people and the total environment.

Where wildlife is threatened by inappropriate land use, probably the only effective short term approach is to establish reserves from which agriculture and forestry are excluded. Again there is no doubt that enforcement will be difficult but education of a population is a slow process and a vigorous start is an important step forward.

The last agricultural practice I wish to mention is the use of biocide chemicals. So much has been written already about the role these play in food production, public health and conservation that I need say little. So far no mammals and only a few species of birds are known to be endangered as a con-

sequence of poisoning by insecticides. These are all of them terminal predators and thus biological accumulators. There are powerful economic incentives behind the search for safer, more specific insecticides and I am confident that they will be developed and put to use. In the meantime careful restrictions applied to the timing, method of application and quantities used will be beneficial to both conservation and agriculture.

### **Parks and reserves**

Talbot (1962) dealt in detail with the very important part that the creation of parks and reserves has played in the protection of residual stocks of endangered species. They are particularly useful in that they preserve total biotopes including the little known or unknown species along with the major and well known. The passage of ten years has reinforced the growing need for large reserved wild-land areas to serve social needs in all parts of the world. However there is a danger that the legal proclamation of a park or reserve will be looked upon as the end of a process rather than the first step.

Where such an area has as a primary purpose the conservation of a rare species it is of utmost importance that there be an inventory of this and related species, a statement of objectives and priorities along with a plan for the protection and encouragement of the habitat essential to the survival of the species.

A reserve may be accorded almost complete protection from fire and this, in turn, may speed the passage of its vegetation to a relatively stable state that does not meet the needs of the protected form. With nowhere else to go to find the required environment the species can be imperilled.

It is essential to know also what the minimum area and minimum viable population for the species may be, as, with the park in being, a more relaxed attitude may arise towards changes outside the park. There must be careful monitoring of competitor species lest they increase and either outcompete directly, or serve as a resource which encourages increased populations of predators which will make disproportionate demands upon the endangered species.

Then too there may be too much concentration upon building up a large population of the endangered form with the end result that it overstocks the range, the age ratios within the species change and it becomes vulnerable to what I have termed 'statistical extermination'.

Parks frequently draw tourists and to an increasing extent, in North America, these seek the back country on foot. Here they are invading the wilderness refuge of those species that shun man and do not prosper in his presence. This disturbance may promote conflict, as between bears and people, and result in demands for destruction of the wildlife. It is imperative therefore that primacy of use by the wild species of certain areas be recognized and steps taken to reduce disturbance and conflict by man management rather than wildlife management.

In many parts of the world where wildlife has a strong appeal to the tourist (e.g. East Africa) automobile transport is widely used and almost unrestricted. In some areas there are automobile tracks in all directions and during the dry season dust raised by cars is the most obtrusive item in the landscape. Many species of wildlife need protection from disturbance. This is particularly true of the ungulate female with her newborn young. Disturbance that separates

mother and young, or drives them into the herd, before the vital bond between the two is firm, can as effectively kill the young one as if it had been assaulted directly. This is a constraint not well appreciated by those who manage wild land but should be the basis for closing off from tourist access areas where large numbers of births are taking place

### **Island habitats**

It has already been remarked that a large percentage of endangered species are island forms. The reasons for this special vulnerability are no doubt partly to be found in the restricted adaptive capacity of creatures evolved in the simplified ecosystems that characterize islands. Partly the problem lies in the limited size and the vulnerability of the habitat. Man can, and frequently does, completely alter an island. Goats, sheep, donkeys, or pigs are introduced to islands that have evolved without browsing species. Norway rats enter as an accidental companion of man, cats and dogs follow, sometimes with the purposeful transplant of mongoose in the mistaken hope that it will eliminate the rats. The cumulative result has been disastrous to birds, mammals and reptiles of the islands.

Only where jurisdiction is clear and authority acknowledged and respected can much be done to prevent these occurrences. Island refuges or reserves, immune from human colonization, is one answer; the L.B.P. Islands for Science programme is a most useful beginning in this direction.

Where islands still preserve a varied and interesting fauna, including ground nesting birds, there should be special prohibition against the importing of certain domestic or cultured species. For instance, mink or fox farming should be prohibited on islands in the North Pacific and North Atlantic where their escape could endanger ground nesting alcid and other oceanic species. Dogs and cats should be forbidden on others. Sheep and goats should be forbidden on islands of still other types. As yet there are no established principles covering the interaction of rabbits and native birds on small islands of a variety of types. They were a disaster on Laysan Island, but may be to some degree beneficial on some islands of southern New Zealand where the experimental measurement of their impact is now proceeding.

### **Warfare**

Warfare as it occurred up until the 1960's had surprisingly little direct impact upon wildlife species. The use of small islands supporting wildlife populations as bombing targets is an act of vandalism. Such an instance may have finally exterminated the Japanese sea lion and has been of consequence on Fonfani Island near Malta. By far the most damaging impact of warfare has been the distribution of armed men and equipment through the ranges of a number of large and rare species. The Arabian oryx and kouprey will serve as examples.

More recently however, the widespread dissemination of powerful biocide chemicals over huge tracts of land has been very destructive to entire ecosystems. This form of behaviour is available to only a few nations and should be regarded as unacceptable.

If wars must continue as a means of examining human conflict it is urgent

that the military decision-makers be persuaded of an environmental ethic inhibiting the purposeful reduction of entire biotas and prohibiting the use of military weapons upon wild species.

### **The reconciling of conflict**

It is not my purpose to review the contrasting approach to the application of conventional economic value systems to decisions on environmental matters. A number of economists in various parts of the world are struggling to develop new techniques whereby the unsaleable elements in our environment, and our so-called common property resources, can be arrayed in equatable terms alongside the saleable elements (Pearse 1968).

The matter of resolution of conflict has at least three facets. In the first place in a nation that exercises control over land use, purposeful decisions on land use represent a judgement, however ill-informed, that the use proposed is likely to produce gain in value to the community. In many cases the decision rests on a tacit assumption that 'development' is intrinsically more desirable than land left in its natural state and needs no additional support or questioning. In these circumstances the only issues of concern may be what kind of development and by whom.

In some instances, analytical examination of the alternatives and consequences using the input of ecological, geographical or social research, can lead to the exposure of several possibilities, each with its own spectrum of positive and negative components. One possibility to be considered is no development.

To an increasing extent governments are developing the legal and legislative framework within which to reach decisions that consider a much broader base of consequences and values. Examples can be cited in the Territorial Lands Act in Canada (1971), and the Ecological Reserves Act of British Columbia, and the Environment Protection Act of the United States of America.

On the other hand many, if not most, decisions to dedicate land to such conservational uses as wild land for recreation, National Parks, wilderness areas, wild rivers and similar categories, are the result of direct intervention of concerned citizens with a devotion to and vigorous belief in the public benefits to be derived from these uses. The arguments are seldom supported with either economic or human behavioural data, nor the hard data arising from experimental research upon ecological questions. It is sufficient that vigorous and persuasive politically-minded 'conservationists' convince those with decision-making power to resolve the conflict in this direction.

Some decry such expressions of collective wish as emotional but it is a most important source for the resolution of conflict in our society and one which is growing in influence.

There is a second order situation that arises after a preliminary decision is made to proceed with a development that will alter land from its original state. The relevant question now becomes how to proceed so as to minimize destructive alteration of the environment. This question must then be refined into researchable terms and a larger body of data sought from carefully designed research into ecological, physical and social issues likely to arise. The objective is to define ways in which alteration of site or route, changes in timing and method of construction and operation, alteration in design or the use of restorative procedures can ameliorate potential damage.

The final resolution of conflict that arises from development will be at the political level where social, economic and scientifically based arguments are all of them important in the decision-making process. Ecological data adequate to provide a rational basis for conservation action are available for a few species in various parts of the world. But for most species, and I believe for almost every ecosystem, the understanding is yet to come. There are possibilities that one outcome of the L.B.P. programme will be the provision of the complete data needed to understand a few ecosystems and to provide also effective methods of data analysis and retrieval.

When this transpires the objectivity of environmental decisions may be able to progress one step further.

There seems to me to be a fundamental difference in the levels of conflict between development and the natural environment as we compare situations in the so-called developed and developing countries. In the countries where technology is highly sophisticated major environmental alterations can proceed with greater rapidity, the consequences of social and economic decisions have an impact over a much wider area. They may indeed be global, or they can reach into other countries with the subversive power of economic blandishment. In such countries, also, the impact upon local environments is more complicated, more insidious, and more difficult to redress.

The development of the sophisticated technologies upon which the way of life of these countries rests, requires massive input of capital into research and development. In these countries, also, the research needed to gain understanding of the impact of technology upon the biota, and to design means of rendering development compatible with the survival of a rich and healthy natural environment, must be of an intensity and sophistication commensurate with the problems generated. It requires financial support of equivalent order.

Our environmental research is not yet meeting the most urgent demands for the information that will permit us to live in compatible relationship with our environment. Only through greatly intensified research, coupled with expanded educational efforts to spread understanding of problem, solution and consequence among our population can we gain control of the destructive consequences of our way of life.

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## SESSION F: DYNAMICS OF VANISHING SPECIES AND THEIR HABITATS

### Part 1: Paper (22)

## Environmental Disturbance and Species Survival

PETER SCOTT

*Chairman, IUCN's Survival Service Commission; Chairman, World Wildlife Fund International; Hon. Director, Wildfowl Trust, Slimbridge, Gloucester.*

### SUMMARY

The environment influences the evolution of species, and they in turn modify the environment. Many species have become extinct during geological time but always because of environmental change. Man, too, is a product of evolution, yet he has been at war with nature for so long that he regards himself as the antithesis of nature. But he is more antagonistic than antipathetic; he is the arch-predator, the arch-competitor and, above all, the arch-disturber of the environment. In the past 400 years he has been responsible for at least quadrupling the rate of vertebrate extinction. But although this rate is not apparently slowing, there is hope, for man has a conscience.

Some forms of the environmental damage man has wrought are deliberate and wanton, some are accidental and incidental. Yet others are a product of the sheer numbers of the human species. Man's effects may take the shape of the destruction of habitats of plants or animals directly by fire, plough or axe, or indirectly by polluting substances, or of an assault on the animals and plants themselves, either by arrow, spear or shotgun or by the introduction of competitors and predators.

It is probable that man-induced environmental degradation will continue because of the preoccupation of the human race with short-term gain. It is, however, vital to safeguard as far as possible the diversity of the gene-pool existing in all living things, whether these now appear to have any usefulness or not. And there are cultural and economic reasons for preventing species extinction; we have no right to extinguish any form of life, and many bring positive benefits to countries by attracting tourists.

Among the animals with which the Survival Service Commission of IUCN has been preoccupied have been the great whales, wildfowl, sea turtles, freshwater fishes, and the big cats. There are many others. There are also many others to which, for one reason or another, we have not been able to turn our attention. A start has been made among the plants with the compilation of the Red Data Book of endangered angiosperms—though this is still far from complete.

The S.S.C. has a comparatively simple object—to avert the extinction of any living species or subspecies. Its operations fall into three categories: fact-finding, information/communication, and action. The first two categories are intimately bound up with the production of the Red Data Book volumes and we are assisted in this task by a tireless group of devoted and knowledgeable correspondents throughout the world. The third category takes many forms ranging from on-the-spot surveys and enquiries to long range programs for species rehabilitation. Governments can sometimes be persuaded to accept Ultimate Responsibility for the survival of a species occurring within their

territory, or to set aside appropriate reserves or national parks. They can also be persuaded to adhere to Conventions designed to protect threatened areas or species.

But perhaps the most important role for the S.S.C. is to persuade mankind that human development and fulfilment ultimately demands the maintenance of genetic diversity. If this is achieved the habitats and their occupants, including man, will no longer be endangered on our one and only earth.

## RESUME

L'environnement influence l'évolution des espèces qui, à leur tour, modifient l'environnement. De nombreuses espèces se sont éteintes au cours de l'ère géologique mais ceci s'est toujours produit par suite de modifications de l'environnement. L'homme est lui aussi un produit de l'évolution et pourtant il est en guerre avec la nature depuis si longtemps qu'il se considère comme l'antithèse de la nature. Mais sa position relève plus de l'antagonisme que de l'antipathie. Il est l'archiprédateur, l'archiconcurrent et l'archidestructeur de l'environnement. Pendant les 400 dernières années, il a fait quadrupler le rythme d'extinction des vertébrés. Mais, bien que ce rythme ne semble pas se ralentir, il subsiste un espoir car l'homme possède une conscience.

Certaines des dégradations qu'il a causées dans l'environnement sont délibérées et gratuites, certaines sont accidentelles. Par contre, d'autres sont uniquement l'effet de la densité de l'espèce humaine. L'impact de l'homme peut se traduire par la destruction des habitats des plantes ou des animaux, soit directement par le feu, la charrue ou la hache, soit indirectement par des matières polluantes ou par une agression sur les animaux ou les plantes elles-mêmes, par l'arc, la flèche, la lance ou le fusil, ou par l'introduction de concurrents et de prédateurs.

Il est probable que la dégradation de l'environnement, provoquée par l'homme, se poursuivra en raison de l'importance que la race humaine attache aux profits à court terme. Il est toutefois vital de préserver autant que possible la diversité de la richesse génétique présente dans tous les êtres vivants, que leur utilité actuelle soit manifeste ou non. Il y a, en outre, des raisons culturelles et économiques d'empêcher la disparition des espèces. Nous n'avons aucun droit de faire disparaître une forme quelconque de vie qui d'ailleurs peut souvent apporter des profits utiles aux pays en attirant des touristes.

Parmi les animaux dont la Commission du service de sauvegarde (CSS) de l'IUCN s'est préoccupée, on peut citer les grandes baleines, la sauvagine, les tortues marines, les poissons d'eau douce et les grands félins. Il y en a beaucoup d'autres encore. Il y en a aussi beaucoup dont, pour une raison ou pour une autre, elle n'a pas été en mesure de s'occuper. Un travail a été entrepris sur les plantes par la compilation d'un Red Data Book des Angiospermes menacés, mais il reste tout à fait incomplet.

La CSS a une tâche relativement simple—empêcher la disparition d'espèces ou de sous-espèces vivantes. Ses activités se divisent en trois catégories: réunion de données, information/communication et action. Les deux premières catégories sont étroitement liées à la préparation des volumes du Red Data Book et, dans ce travail, la Commission est aidée par un groupe infatigable de correspondants dévoués et compétents dans le monde entier. La troisième catégorie couvre de nombreuses activités, allant d'enquêtes et d'études sur le terrain à des programmes à long terme pour la restauration des espèces. Il

est parfois possible de persuader les gouvernements d'assumer la responsabilité finale de la sauvegarde d'une espèce vivant dans leur territoire ou de créer des réserves ou des parcs nationaux appropriés. On peut aussi les inciter à adhérer à des conventions destinées à protéger des zones ou des espèces menacées.

Mais le rôle le plus important de la CSS est de persuader l'humanité que le développement et l'épanouissement humains exigent le maintien de la diversité génétique. Si ceci peut être réalisé, les habitats et leurs occupants, l'homme y compris, ne seront plus en danger sur cette planète, leur seul et unique habitat.

## ENVIRONMENT DISTURBANCE AND SPECIES SURVIVAL

### Extinction is caused by environmental change

Environment is the mould for species, and is itself perpetually changed by their evolution. Since the dawn of life, species have been born and species have become extinct. The rates at which they have done so have varied widely down the twenty million centuries and among the different systematic groups of plants and animals. Inability to adapt themselves to change has led to the extinction of whole evolutionary lines that appear from the fossil record to have been, in their day, widely diversified and highly successful. But the rate of change in their 'surrounding circumstances' was too rapid. They could not keep up. In some cases the changes were inorganic—climatic or elemental—in others, maybe, they were the random result of mutations which produced consequent interaction on the ecosystem. Species extinction can *only* come about through environmental change of one kind or another.

### Evolution of the conservationist

Man is a product of natural selection—inescapably a part of nature. Yet he has fought against nature for so long that he has come to regard himself as the antithesis of nature. Objects or problems are 'natural' or 'man-made' as if the words constituted a distinction. But from the acceptance that man is a part of nature, it follows that man's influence on the environment is 'natural'. By the same token the capacities evolved in man to reason, to plan ahead, and to communication, give him the chance to assess the consequences of his actions, and in particular those which affect the environment. They also give him the possibility (and the responsibility) to minimize the damage and disturbance he causes.

There is evidence (Fisher, Simon and Vincent, 1969) that since the year 1600, man has increased the rate of extinction in vertebrate animals by at least a factor of four. Some regard that figure as very conservative, and hold that a factor of twelve would be more realistic. Such high rates of extinction may have been caused at certain times in the past by climatic or elemental factors, but it seems unlikely that any animal species before man could have been so destructive. Man emerges as the arch-predator, the arch-competitor, and the arch-disturber of the environment. Yet the self-same process of natural selection which made him all these things also evolved in man a conscience, and with it a school of thought and pattern of social behaviour which leads some members of the species to be labelled 'conservationists', and to adduce all kinds of arguments—ethical, aesthetic, scientific, economic, and 'skin-saving'—for redressing the baleful balance of our current impact on the planet. Were it not so, we should not be here together in Banff, nor would there have been a United

Nations Conference on the Human Environment in Stockholm. There would be no I.U.C.N. and it would have no Survival Service Commission.

### **Different kinds of change**

The list of inorganic environmental changes which may affect the course of organic evolution includes sudden catastrophes such as volcanic eruption, earthquakes, tidal waves, hurricanes, tornados, typhoons, floods and droughts; or in the longer term climatic changes, whether of accountable or unaccountable origin. Very long term changes such as continental drift, chemical balances in air and water, and perhaps even wobbles in the earth's rotation may have influenced evolution by natural selection profoundly. But the accumulated genetic changes in the plants and animals themselves have had a far greater effect on the other plants and animals.

Successful species—notably invertebrates such as locusts, termites and ants—have by their very numbers made large scale environmental changes. Even smaller organisms have made much larger changes, and plants have made the largest of all. Local over-population by elephants and rodents and some birds may change the vegetation and thus greatly alter the biotope. But by comparison with all of these the impact of *Homo sapiens* on the global environment is of an entirely different order.

### **The arch-disturber**

As a ruthless and efficient predator Stone-Age man was responsible for the extinction of a large number of species. The development of weapons capable of killing or wounding from a distance—the spear, the sling, the arrow, and eventually firearms—each in their turn tipped the scales against man's prey and against the predators which hunted him and his domestic animals. Deforestation and capriculture in 'the cradle of civilisation' altered the climate of the Mediterranean region, creating widespread desert. Down the centuries the destruction has escalated exponentially. Over-exploitation and pollution threaten the biosphere today on a scale so vast and so ubiquitous that to most people it is incomprehensible.

Only in a few cases is the damage to the environment calculated and deliberate—and even then the reasons are supposed to be so vital to human progress as to justify the actions. The verdict of history on such destructive practices as the use of biocides as defoliants in the Vietnam war may well fail to provide such justification. Nuclear test explosions in the atmosphere since the fall-out implications became fully known seem likely to be judged equally unjustifiable.

But the vast majority of environmental damage is caused by unintentional and inadequately understood side-effects of human actions which have acceptable and even laudable objectives. Of these the most obvious example is pesticides used in disease control and in agriculture—often very effectively, though in some cases to deplorable excess. The fallout from the burning of certain synthetic substances such as polychlorinated biphenyls (used for their insulating qualities and the gloss they give to paints and varnishes) has also been shown to affect predatory species at the top of the food chain. Then there is lead from high octane fuel, and the wide spectrum of atmospheric and water pollution caused by industrial processes. In the oceans there are the general problems of effluents from land-based human activities, and two special problems—the disposal at sea of chemical and radio-active wastes, and oil spillage—whether by accident or design.

It remains to be seen whether the newly developing countries of the 'third world' will be so mesmerized by the questionable benefits of industrial civilization as to accept pollution as an inescapable concomitant of prosperity. Until the poverty gap can be narrowed it seems likely that the cry will be 'pollution means prosperity', and until human populations become stable on a global scale the poverty gap must continue to widen.

Sheer numbers of human beings can alter wildlife habitat, quite apart from the effects of their activities. Many shy species cannot live their lives and reproduce successfully if the density of human beings in their habitat rises above a threshold which may be quite low. In such cases inviolate refuges or reserves may be the only chance for their survival.

Even more serious has been the introduction of predator or competitor species, often for reasons which future generations will brand as grossly irresponsible. Examples are legion, especially on islands. Crude and simplistic attempts at biological control, with cats, mongooses and owls; ill-conceived introduction of potential sporting quarry such as foxes and many birds; goats, pigs and rabbits as food for shipwrecked mariners; rats, cats and dogs as a result of carelessness and ignorance; and escapes from commercial fur-farming ventures, mink being the most notably disastrous.

Whether man's activities, based on unlimited positive feed-back will inevitably lead—as some hold—to irreversible damage to the biosphere, is still widely debated. Some scientists predict 'the greenhouse effect' produced by an excess of carbon-dioxide in the atmosphere. Others are more concerned about the effects of plutonium-radiation, for plutonium—the basis of 'breeder reactor' nuclear power—is a synthetic element known to be exceptionally hazardous to life, likely to be in great demand and susceptible to human greed and human error.

Others again are concerned with particulate pollution of the stratosphere. It has already been shown that increased 'dust' and water vapour produced by jet planes and other sources of pollution in the northern hemisphere have reduced the amounts of sunshine reaching the earth's surface, by comparison with the amounts getting through in the southern hemisphere. Consider, for example, how this will affect the navigation (and therefore the survival) of northern night-migrant birds which depend on star patterns that may be progressively less frequently and less clearly seen.

### **Scientific reasons for preventing species extinction**

What seems likely is that the processes of environmental attrition will grind on, and that eco-catastrophes of various kinds originating from man's actions will continue to assail the biosphere, some with greater, some with lesser effect. Man will continue to play the role of the environmental arch-disturber because of his preoccupation with short-term advantage and his inability to take the long view. In that case the question may increasingly be asked 'With global pollution and environmental disaster looming over us, why waste time and money trying to save the whooping crane?' A simple answer might be that at every possible point we must concern ourselves with 'holding the line'. A more important one would be to establish the vital value of *genetic diversity*, for it is an essential element in maintaining the stability of healthy ecosystems. The greater the diversity of species in a natural community, the greater its stability. And there is reason to fear an impending massive loss of diversity as a result of man-made disturbance of the biosphere. This is the concept which led the UN Conference in Stockholm in June 1972, to make no less than *nine* recommendations designed to maintain the genetic diversity of the living world.

Of the scientific reasons for preventing the extinction of species and incipient species, this is probably the most powerful. Reproductively isolated populations, clines and sub-species are of no less significance than full species if recruitment of new species is to keep pace with the 'normal' extinction rates of pre-human eras. Species-birth is as important as species-death.

But what should be the attitude of the conservationist to a species which is thought to have become an anachronism, and is judged to be 'due for extinction'? It seems doubtful whether any such subjective judgment could justify a course of action leading either deliberately or by default to the extinction of a species, even if all its known habitat has been or is to be destroyed. No one can tell what the attitude of a future generation may be, nor how much effort, time and money it may be prepared to expend in recreating a suitable habitat at some future date. Thus the responsibility must remain on all conservationists to fight for the survival of each and every living form. Value judgments may have to be made when resources are in short supply, but the scientific principle persists that NO species is expendable.

### **Cultural and economic reasons**

In addition to the scientific reasons there are the ethical and aesthetic arguments—that we have no right to exterminate, and that the diversity of nature gives pleasure, inspiration and a sense of wonder to mankind. No doubt Professor Denis Gabor had these aspects in mind when he wrote (*in litt.* 1971) 'I have never seen either of them, but it makes me happy to think that there are still wild elephants in Africa and whales in the southern seas'.

There are economic arguments, too. Tourism to the Galapagos Islands, to Aldabra, and to the Seychelles is largely based on their natural history, and in particular on their endemic, and in many cases endangered species. Once more diversity is the keynote. No other animal has ever before known or cared about the avoidance of species extinction, but nowadays to many people it is no longer acceptable that man should deny existence to any other members of the crew of our spaceship.

### **The future of the great whales**

Some domestic animals and certain others have so adapted themselves to living with man, whether he likes it or not, that they seem to be assured of a place-in-the-sun. Pest species like rats and mice, starlings and house sparrows seem to have been allowed into that category. Others, such as the predators, have been described as environmental litmus paper—indicators of the health of the biosphere, like the canaries in the coal mines—a mere mechanism to help man save his skin. Yet the world attitude to the plight of the great whales—reflected in the overwhelming vote by the national delegates at the Stockholm Conference in favour of the proposal for a 10 years moratorium on all commercial whaling—seems to have been primarily motivated by ethical considerations, with an ancillary element of resource wastefulness. The International Whaling Commission meeting two weeks later in London did not accept the moratorium recommendation, though it has now implemented the International Observers Scheme, abolished the blue whale unit system, and agreed to reduced quotas which, according to the best available scientific assessment, would mean a gradual rebuilding of commercial stocks of the fin whale to maximum sustainable yield in 60 years time. By the same methods

of calculation, if a moratorium had been introduced it would still take 30 years to rebuild these stocks to the same level. Meanwhile the whaling industry would inevitably have disappeared. On the other hand, scientists at the meeting agreed that stocks of the other commercial species, the sei, the sperm and Bryde's whale, are at the population level allowing maximum sustainable yield. Although the scientific records on whaling are probably more complete over a longer period than for any other living resource, the data base remains regrettably weak, and the margins for potential error are wide.

In addition to the question of exterminating the largest animals that have ever existed in the world, which if wisely managed could continue to provide a food resource, the world's conscience has been aroused by the knowledge that whales have rather recently been discovered to be more intelligent than was previously supposed, and that existing methods of capturing whales are still unacceptably cruel. Although, on current assessment, the scientific case for the moratorium may not be proven, I, for one, should like to have seen the IWC agree to it. The Chairman of the International Whaling Commission, more than once at the last meeting, contrasted his Commission with the UN Conference at Stockholm with the phrase 'We're in the real world here'. In this context the whereabouts of reality may still be a matter of speculation.

It may also be germane to consider how the ocean environment was altered for the whales by the inventions of the harpoon gun and the whaling factory ship, and how they were unable to maintain their numbers against the pressure of predation. In turn we should also consider how this affected the populations of *Euphausia superba* (Krill) and other plankton species. The oceanic ecosystems demand genetic diversity no less than those on land.

### Some other specific cases

Migratory waterfowl have been managed as a resource in North America for forty years, yet the numbers of one of the most interesting and popular species—*Aythya valisineria*, the Canvasback, have been allowed to decline alarmingly. Drastic limitation of hunting pressure combined with fresh impetus for ecological research into its requirements may well be necessary if it is not to become an endangered species. Examples of species threatened by sporting pressure are generally much less common than those endangered by less direct disturbance of the environment, but there is another particular case which requires mention. This is the poisoning of whole river basins, sometimes containing highly localised endemic species in order to re-stock them with trout. The phrase 'Trash Fish' which has often been used, indicates a deplorably ignorant and irresponsible outlook.

Fresh-water fish, due to their isolation, have speciated far more than their salt-water relatives, and are correspondingly much more vulnerable to extinction by local pollution. The paternalistic philosophy of sport fishery authorities all over the world, who feel bound to produce sport fishing at whatever cost in ecological disruption, adds inexcusably to the list of endangered fresh-water species.

In the past, interest in impending extinction has centred round the higher vertebrate animals—largely mammals and birds. Perhaps inevitably this trend continues. Among the mammals the great apes, the great cats (especially the tiger and some of the fashionable spotted species), the wolves, the polar bear and the rhinos have received special attention. Among birds cranes, bustards, swans, geese and ducks have aroused particular interest and important recent

work has centred on the birds of prey. Flamingos are to come under scrutiny and there has been concern about the kagu of New Caledonia and about the vulnerability of rails—especially island forms.

Marine turtles have occupied attention for some time and there has been new initiative to prevent the extinction of the world's crocodilians, and of some iguanas and monitors.

It has proved almost impossible to interest entomologists in preventing species extinction in spite of the number of endangered Lepidoptera. Nor until quite recently have botanists shown much interest in endangered plant species although the first Red Data Book on Angiosperms, still far from complete, has been issued.

### **Objectives and operation of IUCN Survival Service Commission**

The Survival Service Commission of IUCN has a comparatively simple objective—to avert the extinction of living species and subspecies. Whenever possible the species should be helped to survive in its natural habitat, but measures such as translocation and captive breeding may have to be used as an additional safeguard and in desperate cases as the sole prospect for survival. The Commission's operations are broadly divided into fact-finding, communication, and action programs. First we have to discover which species are rare, and for each of them try to maintain some sort of inventory of their world population, keeping it as up-to-date as possible. Further research concerns reproduction rates, minimum viable populations,<sup>1</sup> factors limiting population increase, the carrying capacity of the available habitat, the possibility of rehabilitating degraded habitat, the minimum size of habitat areas, the possibilities of captive breeding, and the prospects of subsequent successful release into the wild.

Specialist groups of people who are enthusiastic and knowledgeable about particular species or groups of species provide basic data from which the summary sheets of the Red Data Books are compiled and used as a method of disseminating information on endangered species. Red Book volumes have so far been issued for Mammals, Birds, Reptiles and Amphibia, Freshwater Fishes, and Angiosperms. Replacement loose-leaf sheets are issued from time to time bringing the information up to date.

The degree of threat to each species is indicated by the colour of the sheet—pink for the most endangered, white for others at risk, amber for those which are suffering galloping depletion and must be watched, grey for those on which there is limited information, and green for those formerly endangered which are held to be now relatively secure. Broadly the objective is to reach a situation in which the Red Books contain nothing but green sheets.

A group of the Commission able to attend meetings three or four times a year have been designated the Alert Group, and their function is to establish

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<sup>1</sup> The world population of more than 500 Père David's Deer all originated from 16 animals brought from the world's zoos by the 11th Duke of Bedford. The world population of Laysan Teal, now probably 250, was once down to 7 individuals, and the 1500 Nene or Hawaiian Geese were once down to under 50. Golden Hamsters now numbered in millions all originated from one female and her litter.

the priorities for immediate action and follow up, and to work out the mechanisms for implementing the Commission's long range programs for species rehabilitation. Steps have to be taken at international, national and local levels.

A government can sometimes be persuaded formally to undertake Ultimate Responsibility for the survival of a species occurring within its territory, or to set aside appropriate reserves or national parks (for which the presence of an endangered species provides an additional motivation). Governments can jointly or severally undertake to limit the export, import and transit of endangered species. They can enter into conventions or treaties with other governments. They can provide subsidies for conservation in areas of marginal agricultural value, or sell conservation concessions (on the same basis for example as timber concessions) in order to maintain wild areas or to rehabilitate those which have been degraded. (These might be held internationally either by IUCN, WWF or the UN Environmental Unit set up at Stockholm.) In all of these things the Survival Service Commission, through the IUCN Board, can act as a stimulus or a catalyst.

It is perhaps important to realize that conservation has had its successes in the past. In terms of species that were certainly at one time threatened with extinction, the following are some of those currently out of danger: White Rhino (southern race), Plains Bison, Wisent, White-tailed Gnu, Bontebok, Saiga Antelope, Pronghorn Antelope, Père David's Deer, Pribilof Fur Seal, Northern Elephant Seal, California Grey Whale, Trumpeter Swan, Nene or Hawaiian Goose, North American Wood Duck, Northern Snowy Egret, Hudsonian Godwit, Japanese Crane.

Although not yet safe, the situation is now greatly improved for the Whooping Crane, the Duncan and San Cristobal Tortoises in Galapagos, the Javan Rhino and the Guadalupe Fur Seal, while recent captive breeding success with the White-winged Wood Duck in England suggests that some at least of the danger of its extinction may have been averted.

But the Red Books still hold a great many species and there is no reason at all for complacency. We know of many island species with very limited range which are desperately vulnerable. But on islands it is often much easier to estimate numbers than it is in say tropical rain forest. Ecological islands on large land masses may well hold remnant populations, especially of birds, amphibians, fish and plants which may be on the verge of extinction without anyone knowing it. Indeed it is possible that some will be exterminated by man-made environmental changes without ever having become known to science.

If the behavioural evolution of man leads to a general acceptance of the principle that human development demands the maintenance of genetic diversity by preventing species extinction, then the work of the Survival Service Commission may have achieved an evolutionary breakthrough of significant proportions for the future of our species and our one and only earth.



## SESSION F: DYNAMICS OF VANISHING SPECIES AND THEIR HABITATS

### Part 1: Discussion

The Chairman, Professor **Harroy**, remarked that the subjects to be discussed in the Session rather appropriately followed on the presentations of medals and honours for work in the conservation field which had preceded it. But, due to that ceremony having rather reduced the time now available, he would not enlarge on the point, but introduce the authors and panel members and call on them to inaugurate the discussion by briefly introducing and commenting on the two papers.

Professor **Cowan** thought that the new view of the role of plant and animal species in relation to their habitats and as reflecting the health of the biota, would hardly be contested by anyone present and was slowly gaining more general acceptance. Apart from the sound scientific reasons for recognizing the importance of species, both as a template of successful combinations and the best available method of monitoring the environment, there had been some change in ethical outlook: it was becoming socially unacceptable to indulge in 'overkill' and the reasons for killing—cropping, enjoyment or survival—were increasingly called into question. But the old attitudes still persisted, still had to be contested by every possible means—attitudes such as those exemplified by the first European settlers of North America: they had met majestic and spectacular concentrations of animal life—passenger pigeons, buffaloes, the Barren Ground caribou—but of these only the last still survived and now even their habitat in the Yukon and Alaska was threatened by pipelines. Similar spectacles elsewhere, except for a few examples such as that of the Serengeti, had succumbed to overkill and habitat destruction; the extinction of a large percentage of island species and the present plight of the whales were a poignant commentary on conservation efforts of the 20th Century. As for plant life, the continuing assault on climax communities was notorious and aggravated by a fundamental difference from the past: the fact that technological impacts of highly developed countries have become ever more insidious and widespread.

Mr **Peter Scott** said that he had only a few points to add or emphasize in introducing his paper. It was important to remember that evolutionary changes were inherent in factors affecting the survival of species, including not only predation but also pollution and man's own conscience: the latter, with its conservation-orientation, evolved from environmental pressures, such as pollution, including its newest manifestation to which little reference had so far been made, plutonium pollution or nuclear radiation. He would like to draw special attention to and invite discussion of the points made in the paper about the whale situation, to which the previous speaker had also referred. The IUCN attitude to the issue might well need to be revised. Another point, mentioned towards the end of the paper, deserved emphasis and perhaps some discussion, namely the similarity of the 'ecological islands' of Continental areas—mountains, forests and the like—to the better known example of oceanic islands, in respect of their fragility and high risk of species extinction.

Panel member Dr. **Beltran** recalled the saying of Lamarque in 1870, that if man continued treating nature in the way he was doing he would have the unique privilege of destroying his environment before becoming extinct himself.

It was not too late, however, to stop this process since all the factors, such as bad management, overpopulation and misuse of technology, were essentially ones that can be corrected with the means and knowledge now at man's disposal. As both the authors had stressed, a complete change of attitude, courage and resolution were what is now needed.

Two points which merited special emphasis, in the view of panel member Dr **Curry-Lindahl**, concerned environmental stability and ethics. There was abundant evidence of the role of species in relation to the former: landscape health was dependent on the interplay between herbivores and carnivores; in marginal lands, especially, such as arid grassland or savanna, tundra, steppe and desert, the stabilizing function of wild herbivores was obvious. But it was perhaps less well recognized that a new ethic was necessary to give conservation a new dimension and a new driving force.

Speaking essentially as a 'field man', Mr **Olindo** commented that much more effort was needed (1) to draw the uncommitted or unconvinced into the discussion and (2) somehow to overcome the mainly financial obstacles which too often resulted in the 'Third World' being poorly represented, although in fact the discussion is always of particular concern and importance to the Third World. He would also like to make the point that it was far from easy for anyone working in the field to be sure whether species are endangered or not: he needs much more expert guidance, scientific assessments or methods of assessment, which are completely documented and easy to apply. As has been frequently said, any attempt to 'freeze' development is no answer: the solution lies in an extension of international agreements and the creation of international and mainly financial mechanisms, which will enable countries in great need of land for development to set aside selected habitats on a sufficient scale. This can only be achieved by awakening the conscience of mankind as a whole.

Panel member Mr **Ranjitsinh** said that IUCN and especially its Survival Service Commission had become an established depository of the facts about endangered species and the problem now was largely concerned with how to ensure that this knowledge is properly used. He was in favour of focussing attention in the first place on the 139 known endangered species of Asia and Australasia and, particularly, the 32 species of which the population was believed to be below a hundred. This was likely to have more public appeal and attract more financial support, which is important where, among the common difficulties which have to be faced, are public apathy and lack of funds, even though some governments have begun to show more interest. It was still, of course, necessary to spare no effort to stimulate and educate that interest.

The **Chairman** said that a large number of participants had signified their desire to join in the discussion and he would call on as many as possible. If anyone had useful points which could not be taken because of lack of time, he hoped that they would be submitted in writing and that it would be possible to add them to the conference record. A summary of the points made follows below.

An aspect of the whaling moratorium recommendation which has been largely overlooked, is that only two nations at present share in the consumption of the major part of the world's whale products. If stocks were built up, a much wider spectrum of countries should be able to benefit, including those of the 'Third World'. Another important point is that the Gulland Plan, to place whaling conservation directly under the United Nations, is an essential corollary of a moratorium, since unless existing whaling fleets can be purchased or leased

by the UN for research purposes, it will become impossible to monitor the situation and the build-up of stocks during the period of cessation of whaling—**R.S.R Fitter** (U.K.).

The other side of the picture is authoritatively presented in two papers due to be published in a forthcoming issue of the journal *Biological Conservation*, which suggest that the Stockholm recommendation for a whaling moratorium was perhaps premature—**N. Polunin** (Editor, *Biological Conservation*).

The case for a total ban on whaling is probably more closely tied up with the problems of verification and enforcement than with the scientific evidence, which remains ambiguous. None the less, there is no reason why the Survival Service Commission should not concern itself with the enforcement issue and IUCN could well take a more positive lead than merely contenting itself, as at Stockholm, with 'not opposing' a moratorium—**Richard N. Gardner** (U.S.A.).

As many problems of vanishing wildlife are essentially caused by interactions with man, Paper (21) could well have laid more stress on the social sciences. The greater involvement of the latter was called for at the last General Assembly at New Delhi and an assessment of what progress has been made would be of interest. On another point, namely the question of what are the minimum numbers and habitat requirements for survival of threatened species, it is pertinent that although the remaining population of grizzly bears in the U.S. States of Montana, Wyoming and Idaho is 'guestimated' at less than 1000, all three states still allow hunting of this species: permits issued by Montana alone total about 1400 per season, though the hunting success ratio is known to be small. This seems to be a good example of tampering with a not exactly known but certainly dangerously small population of a species—**D. Henning** (U.S.A.).

The approach to survival problems still tends to be emotional, although ecology is the key to solving the problems and, as ecology is a science, scientific methods of ensuring survival of species are essential. The IBP/CT assessment of natural areas in its check-sheet project has given a lead in using the right kind of objective and quantitative approach. In the case of endangered species the parameters of a similarly objective assessment might include—(1) commercial value; (2) recreational value, both for viewing and hunting; (3) ecological values, as an indicator and in respect of habitat preferences, range, population density and dynamics, adaptiveness (especially to anthropogenic influences); and (4) conservation values, covering legal protection of the species, regulation of its exploitation, its potential as a pest, the extent to which it is found in existing reserves, etc. It is this kind of methodically arranged information which provides the proper basis for the evaluation and management of endangered species—**W. Erz** (Federal Republic of Germany).

A good opportunity of trying out the suggestion in Professor Cowan's paper about an international mechanism enabling a government to be subsidized for withdrawing from commercial exploitation habitat necessary for the survival of a species, would be in connection with the Thjorsarver issue in Iceland, where the main breeding ground of the Pink-footed Goose is threatened by inundation for a hydroelectric project. Here is a case in which it should be easy to work out how much an alternative project would cost, the excess over the Thjorsarver project then being offered to the Icelandic Government internationally or perhaps in this case by Britain (as the country which would suffer most from the extinction of the goose species concerned). This kind of approach has its parallels with the system for subsidizing farmers for actual stock losses suffered through activities of predatory animals, a system which

could well be tried in Canada in connection with cattle killed by cougar or wolves (in place of the present right to kill predators entering onto ranch-land)—**M.T. Myres** (Canada).

I agree strongly with Dr Erz's contention that measures for conservation of endangered species should have a very firm scientific basis. But while I also agree with other speakers who press for more involvement of the social scientists and economists, the difficulty always has been to get them interested. A point worth stressing, in conclusion, is that there is a progressive likelihood of what may be termed catastrophic extinction of species arising from completely accidental and unintentional disturbance of critical factors such as age and sex ratios—**I. McT. Cowan** (author of Paper 21).

The consensus of opinion at this meeting is clearly in favour of revising IUCN's viewpoint on the proposed 10-year whaling moratorium and coming out categorically in favour of it. With regard to the point made by Dr. Myres, the object of the Thjorsarver project in Iceland was to provide power for a local aluminium plant and attract other heavy industry rather than, as he seemed to think, to export electricity. The dialogue with the Icelandic Government has, in this case, probably been sufficient to bring about the desirable modification or relocation of the project, and in any case extraneous factors would probably make it difficult at present to adopt Dr Myres's suggestion. This does not mean that it would not be a valid one in more suitable circumstances—**Peter Scott** (author of Paper 22).

Additional points (recorded but not orally presented):-

Reference was made to the status of the Canvasback duck: this species cannot be saved, any more than the baleen whales, by imposing catch or bag limits. It is already partly protected in Canada and completely in the eastern and central United States. But the fact has to be faced that various 'authorities' have given very different estimates of the surviving population and that so long as other species can be hunted in the area where it occurs, even complete protection would not be effective against 'accidental' shooting—**H. A. Hochbaum** (Canada).

There still seems to be no effective method of stopping major developments, such as the James Bay hydroelectric project from going ahead regardless of public opinion, the findings of ecologists and biologists, and the recommendations of conferences—**Mrs C. Osborne** (Canada).

In Zambia, where we already have data showing that DDT and dieldrin for tsetse control is having a lethal effect on a wide range of vertebrate species, what disturbs us is that countries such as ours still seem to be regarded as a dumping ground by manufacturers of these chemicals, now that their use is restricted in more developed countries. It is difficult for Zambian conservation agencies to get legislation introduced banning the import of these chemicals, when their use in local health and rural development programmes is still being recommended by departments of some of the major UN Agencies, who certainly ought to know better—**J. E. Clarke** (Zambia).

**SESSION F**

**DYNAMICS OF VANISHING SPECIES  
AND THEIR HABITATS**

**Part 2**

**SESSION F : PART 2**

*Chairman:* Mr John S. Gottschalk (U.S.A.): Member, IUCN's Commission on Ecology; Assistant to the Director of the National Marine Fisheries Science, Department of Commerce, Washington D.C.

*Authors:*

**Paper (23): Optimum Productivity of Populations and Sustained Yield of Wild Animals.**

Professor D.I.Bibikov and Dr V.V.Dezhkin (U.S.S.R.): Zoological Department, Central Laboratory on Nature Conservation. Ministry of Agriculture, Moscow.

*Panel Members:*

- 1 Mrs M. S. Fitter (U.K.): Member, IUCN's Survival Service Commission; Editor of *Oryx, the Journal of the Fauna Preservation Society*, London.
- 2 Mr E.O.A.Asibey (Ghana): Chief Game and Wildlife Officer, Department of Game and Wildlife, Accra.
- 3 Mr P.M.Olindo (Kenya): Member, IUCN's International Commission; Assistant Director, Zoological Park, Washington D.C.
- 4 Dr A.H. Macpherson (Canada): Member, IUCN's Survival Service Commission; Director, Western Region, Canadian Wildlife Service, Edmonton, Alberta.
- 5 Mr John Perry (U.S.A.): Member, IUCN's Survival Service Commission; Assistant Director Zoological Park, Washington D.C.

*Rapporteur:* Miss Gina Douglas (IBP/CT).

*Secretariat Member:* Mr Alfred Hoffman (IUCN).

## SESSION F: DYNAMICS OF VANISHING SPECIES AND THEIR HABITATS

### Part 2: Paper (23)

# Optimum Productivity of Populations and Sustained Yield

D.I. BIBIKOV AND V. V. DEZHKIN

*Zoological Department, Central Laboratory on Nature Conservation, Ministry of Agriculture, Moscow.*

The question of optimum productivity of animal populations as a whole is so vast that we will only mention some of its aspects. On the basis of results from research on the ecology and management of beaver (*Castor fiber* L.) and marmot (*Marmota centralis* and *caudata*) populations, as well as of data available from literature, it is possible to show the need for different approaches to the definition of optimum productivity under different conditions. Let us consider for example the beaver population near Voronezh (Dezhkin, 1965): one can start with the assumption that there are three possible levels of optimum productivity of beavers, based on densities of around 0.7 kg of animal weight to 1 ha, 1.1 kg/ha or 2.2 kg/ha: at such density levels, the reproduction rate and food basis may be said to be satisfying and sufficient. From a practical point of view, however, only the 2.2 kg/ha density is of utility to man. Higher levels than this, for example 3.4 kg/ha, already indicate a beginning of overpopulation and depletion of food. Lower density levels (under 2.2 kg/ha) cannot be considered optimum, as the smaller beaver population does not make full use of the primary productivity of the habitat concerned.

On the above basis, the optimum production of an animal population can be expressed as the maximum increase in its biomass per unit of space and time which will permit full utilisation of the available food, but at the same time ensure the maintenance of the food supply and cover conditions needed for the future existence of the population and also for providing maximum yield for man.

Sometimes it is reasonable to limit the productivity of certain species, predators for example. By reducing the number of wolves *Canis lupus*, it is possible to create conditions for higher productivity of the wild ungulates which form their principal prey. In these circumstances, man has in effect taken over the ecological functions of predators in the control of wild ungulate populations, though such activities as stock harvesting, selection, disease prevention and so on. These methods of control are in any case necessary in wildlife management, but are also being implemented to some degree in USSR national reserves (*zapovedniki*).

The notion of 'population control' requires more precise definition. To support optimum productivity of the ecosystem in the interest of man, the directions of influence upon one or other species under different conditions inevitably tend to conflict. For example, it is desirable to maintain the number of huntable populations of marmots at a moderately high level, but to reduce them in natural foci of plague: if there is a plague risk, the numbers of these rodents, since they carry the infected fleas, have to be reduced to such a level as to exclude the possibility of pest bacteria transmission. In short, the direction

of the influence exerted on wild animals and the strategy for maintaining sustained yields vary according to different conditions.

The problem of increasing productivity to a level answering present day requirements is being successfully investigated in the USSR for freshwater ecosystems. Thus, the studies of F. Krogius and his colleagues have shown the possibility and effectiveness of using computer models for investigating the dynamics of Kamtchatka fish populations. These have shown the effect of a reduction of numbers of Pacific salmon (*Oncorhynchus* spp.) on the life of water bodies. In terrestrial game management, similar research has only just begun, for example on deer by Walters and Bandy (1972).

In managing wildlife resources, it is important to prevent the development of both too low and too high population densities. High densities of ungulates for example (if large predators have been exterminated) exhaust and destroy the pastures and are followed by a worsening of the physiological condition of the animals and by death. In some regions of the USSR, inadequate management of the moose (*Alces alces*) populations, which strongly increased as a result of forest clearing, has made forest regeneration difficult (Dinesman, 1959). In the forests of Eastern Europe, the growth of fir trees has been reduced by nearly half through browsing by moose. Although they consumed only 3.5% of the plant mass, they damaged the young trees, thus checking their growth rate and ultimately killing them. As a consequence, the occurrence in the biological cycle of an unused quantity of elements, estimated at 30 kg/ha of carbon, 3 kg/ha of nitrogen and about 0.5 kg/ha of calcium, has been detected by Dinesman and Shmalgausen (1967).

Where populations of *Marmota* are unexploited, high concentrations develop, which increase the complexity of intraspecific relationships, competition for territory and burrows, and also the number of ectoparasites, which are potential vectors of plague. This creates conditions which favour intensive epizootics (Bibikov, 1965). By contrast, the exploitation of a reasonable proportion of the individuals in the population is beneficial to the species itself as well as to man.

The highest productivity will therefore be found not in a preserved and untouched population, but in rationally exploited mammal, bird or fish populations. This has clearly been shown, in the case of wild ungulates by Talbot (1970), Pimlott (1970) and others, in muskrats by Korsakov (1950), in beavers and in many other species. Through regulation of population numbers, it is possible to reduce the range of fluctuations and obtain a more regular harvest.

The few aspects of the problem which have been discussed show the necessity for taking into account a great number of ecological, geographical and other factors. The complexity of these factors points to the importance of using computerized systematic models as a method of reaching solutions.

## SESSION F: DYNAMICS OF VANISHING SPECIES AND THEIR HABITATS

### Part 2: Discussion

The Chairman, Mr J. Gottschalk, introduced the speaker and members of the panel and reminded the audience that, for this second half of Session F, the emphasis would be on harvesting for sustained yield. This was the ultimate aim of management and related to:- the size of surplus populations; the ability to recognize optimum production levels (which may depend not only on material productivity but also the potential for providing recreational enjoyment, and is affected by the cultural and economic objectives established by Society and therefore by political factors); and, thirdly, the extent to which characteristics of the range and the species will permit harvest without impairment of the ability of the species to continue to exist at optimum population levels. Two points always need to be remembered: first, that when over-harvesting has occurred it has been a result of lack of, or improper, management; secondly, the critical factor in renewable resource management is protection of the habitat and retention of its viability.

Mr **Bibikov** said that the paper prepared by himself and his colleague, who had been unable to attend the meeting, was intended only to serve to start off the discussion, was very short and had not been circulated in advance or summarized; he would therefore simply read it as it stood.

Panel member Mrs **M.S. Fitter** recalled some of the notable examples of successes and failures of management for sustained yield. Among the former were the saiga antelope of the USSR (built up from very small numbers to the point where an annual harvest of 300,000 could be taken, without adverse effects, from an estimated population of over 2 million); the Pribilof fur seal (brought back from near extinction in the 19th century, by means of a temporary ban on hunting imposed by international agreement in 1911, to the present level, where substantial numbers can be safely exploited for their fur); and the southern race of the white rhinoceros (the numbers of which in the Umfolozi Reserve in Natal were now probably about twice the optimum carrying capacity, despite the extensive export of surplus stock to other parks and to zoos). There was little doubt that by good management these successes could be repeated with the black lechwe of the Bangweulu swamps of northern Zambia (reduced by organized commercial poaching, which had no regard for selection between males, females and young, from several hundred thousand to at most about 15,000); and with the vicuna of the high Andes, similarly reduced by the substitution of slaughter for the old Inca practice of shearing. The whaling situation, discussed in the previous section of the Session, was perhaps the most notorious example of management failure, and the desirability of a moratorium, to allow recovery and meanwhile proper scientific studies of populations (of which there was no reason for thinking some recent optimistic figures were well-founded), should again be stressed. It was always important to remember that the concept of managing stocks for sustained yield makes good sense to the man in the street, whose support is essential when the economic arguments are put, as they should be, to developers and governments.

Mr **Asibey**, panel member, said that the value of wildlife resources for the protein supply of people in developing countries needed emphasis and, at this

stage, was bound to have more appeal than aesthetic or touristic arguments for saving vanishing species. An FAO survey in Ghana had shown that 44% of the animal protein for human consumption was imported, 19% derived from local domestic stock and 37% from wildlife, but more recent studies suggested that the last figure was in fact nearer 60%; in one small area alone the caner-rat or grasscutter (*Thryonomys*) yield had been found to amount to 77 tons a year. If, in addition, account is taken of the fact that 'bush-meat' is still something of a luxury and that, in some cases, it may provide a better mineral balance than beef, the importance of harvesting wildlife rather than insisting on the rearing of range cattle can be appreciated.

Mr **Olindo**, panel member, said there was no inconsistency in a National Parks officer like himself getting involved in the harvesting issue. In Kenya the National Parks covered about 15 or 16 thousand square miles of the 225,000 sq. miles of the country, but were frequently affected by utilization problems in the area outside their boundaries and also by land use activities, such as those which block migration routes of a free-ranging species like the elephant. One result was the well-known elephant problem of the Tsavo National Park, which raised the question whether the population of this species in the park should be managed or allowed to affect the habitats to such an extent that the ecosystem may eventually be destroyed. In making the choice, which at first sight seemed an obvious one, many factors have to be taken into account, including the need for longer observation and more research, the fact that people are going hungry and, conversely, the cultural resistance to the use of wild protein, which makes elephant meat unacceptable to some people.

Dr **Macpherson**, panel member, while supporting the emphasis in Paper (23) on special circumstances in relation to optimum productivity, pointed out that there were also broad similarities, as, for instance, between dependence on wildlife for nutrition in Ghana, as described by Mr Asibey, and in the Canadian North. The special circumstances of the latter turned on the low production and low ratio of animal yield in relation to surface area, which makes exploitation specially expensive, as against the background of an efficient livestock industry and distribution system at lower latitudes. Thus the commercial exploitation of fish stocks at a rate of ½lb. per acre of lake, dependent on cohorts 12 to 16 years of age, can only exist as a small scale industry producing a costly product. Similarly reindeer ranching has, to date, hardly been competitive with southern beef production, despite having comparatively low transport costs: reindeer and caribou carrying capacity ranges from one to the square mile in the Mackenzie delta to less than one per 100 square miles. An acceptable harvesting rate for caribou is 5% of adults (1 year +) per year. Nevertheless the low rates mentioned are compatible with the needs of local people and of recreation-seeking visiting hunters and fishermen.

Another feature of the northern situation is that average recruitment rates of populations is small and fluctuates widely. The near extermination of ungulate populations by adverse weather is known from Greenland and elsewhere, and stocks exposed to such hazards are unsuited to anything but sporadic cropping, so that sustained yield concepts, except in the very long term, are inapplicable. Fluctuations in several species (e.g. arctic fox and ptarmigan) are such that, even if an optimum density can be calculated it may well be unattainable in the present state of knowledge. Several species also, such as birds like the Arctic Tern and Golden Plover, are prodigal users of the earth's surface, while some mammals may migrate hundreds of miles or will breed successfully in only a tiny fraction of their total breeding range. The conclusion is that the perpetuation of arctic biota calls for maintenance of large species populations, exten-

sive areas of habitat, and the monitoring of numbers with a frequency unnecessary in the management of more stable and predictable stocks; all these requirements need a firm research basis. It is also important to remember that 'game' in the far north has social values outside the purely nutritional. The killing of a first large animal, such as a polar bear, marks a man's coming of age and the successful hunter is accepted as the leader of the community. The fact remains that conservation in the far north is an expensive matter and cannot be based on raw economic and material factors, but must take account of a whole complex of nutritional, cultural, recreational and international needs and interests.

Winding up for the panel, Mr. **Perry** stressed that population data for most species, by which trends can be measured, are still fragmentary: even where they are available, economic and social factors also have to be considered. The complex elements involved in the organization of sport-hunting, for example, can become a politically important pressure group and the government can become over-dependent on revenue from these sources. This in turn can lead to the distortion of issues, such as favouring of particular game environments in national planning and opposition to a moratorium, which aims ultimately at sustained yield as opposed to extractive exploitation. A Government Ministry concerned may be more interested in export revenues than wildlife survival, or may lack funds for the research necessary to support proper control of commercial harvesting, or may become the servant of the very industry it was meant to control. When, in addition, we lack, in most cases, any precise information on the impact on species populations of taking large harvests, other than the plain fact that the exploited species appears to be declining, it becomes obvious that 'sustained yield harvesting' is too often a catch phrase rather than a reality.

The subject was then thrown open to general discussion and the following contributions were made.

Granted that we need continuing improvement in harvesting methodologies, the conservationist must beware that there may shortly be no wildlife stock on which to exercise his skills, unless the pressure on society to put its house in order can make quicker progress. The conservation movement has so far been a fire-fighting activity and what is now needed is the study and reform of the pyromaniacs. Social institutions rather than individual decisions will determine the issues. At present in developed countries misapplication of excess capital, due in large part to tax policies, is the major factor, while, by contrast, in developing countries it is the inadequacy of capital reserves, which delays the increased productivity that could take pressure off the land; in both, the problem is to retain or provide a range of choice in environments and life styles. This implies constraints on population growth and the application of technology. The Odums (1972) have provided a rule of thumb formula for striking the balance between man and the environment; J. J. Christian has suggested that populations exist best when at 50% of the carrying capacity of their environment: and Neil Chamberlain (in his book *Beyond Malthus*) has called attention to the overlooked social pressures involved in population growth—**Roland C. Clement** (U.S.A.).

Most animals harvested by man are potential food or prey for other animals. Important instances are the anchovetas off the coast of Peru, which feed the birds which produce the guano for the Peruvian industry, but which are now being harvested or overharvested for direct human use and are consequently decreasing; and, secondly, the krill of the Antarctic seas, which forms the food basis of the baleen whale stocks and consequently the industry which ex-

exploits them, but which is now being considered as a suitable resource for direct harvesting. There is no doubt that any large scale harvest of krill would seriously jeopardize all the efforts to rebuild Antarctic whale stocks to their former abundance—**R.S.R. Fitter** (U.K.).

Reference has been made to the elephant problem in East Africa, which I have studied together with the consequential vegetation changes since 1956. The need for a certain amount of active management is quite obvious to anyone who notes the changes in, for example, the Murchison Falls area (destruction of *Terminalia* woodlands, altered composition of seasonal bushland, extension of open grasslands etc.) and, even more so, in the Tsavo area, where some changes may be becoming irreversible. The basic problem, of course, which has not been specifically mentioned here, is that elephants were able to move freely over much larger areas in the past than they can now.

Another problem worth mentioning in the present context is that of the Walia Ibex of the Semien in Ethiopia. Even after a protected area was established, the impact of man on this highly threatened 'Red Data Book' species, which has always been favoured as an item of diet by the local people, still remains excessive (poaching; cutting of the heath which is the animal's natural habitat, with resulting erosion), so that the decision was taken to remove people living in the area and relocate them elsewhere. But this has raised all sorts of social and moral issues, as well as various alternative ideas for dealing with the problem, such as one that I mentioned indirectly in Session E. 2, namely that of trying to ensure that stocks of the animal itself are established in several protected areas. Probably, as a last resort, the removal of human populations to ensure the survival of an endangered species would be justified, but only if all other measures had been tried and failed—**F. Klötzli** (Switzerland).

**SESSION G**

**CONSERVATION OF MARINE HABITATS**

## SESSION G

*Chairman:* Dr C. Jouanin (France): Vice President, IUCN Executive Board; Membre, Laboratoire d'Ornithologie, Muséum National d'Histoire Naturelle, Paris.

*Authors:*

**Paper (24): Conservation of the Marine Environment**

Dr Raymond F. Dasmann (IUCN): Senior Ecologist, Morges.

**Paper (25): Conservation of Estuarine Regions and the Coastal Zone.**

Dr D. F. McMichael (Australia): Member, IUCN's International Commission on National Parks; Director, National Parks and Wildlife Service, Sydney, New South Wales.

*Panel Members:*

- 1 Dr I. E. Wallen (U.S.A.): Member, Committee on Marine Habitats of IUCN's Commission on Ecology; Director, Harbor Branch Foundation Laboratory, Fort Pierce, Florida.
- 2 Dr Tsuyosi Tamura (Japan): Honorary Member, IUCN's International Commission on National Parks; Chairman, Board of Directors, Marine Parks Center of Japan, Tokyo.
- 3 Mr A. Dunbavin Butcher (Australia): Member, Committee on the Ecological Effects of Chemical Controls of IUCN's Commission on Ecology; Director, Fisheries and Wildlife Department, Melbourne.
- 4 Dr Robert Linn (USA): Chief Scientist, National Park Service, Department of the Interior, Washington, D.C.
- 5 Mr R. E. Boote (U.K.): Member, Committee on Legislation of IUCN's Commission on Environmental Policy, Law and Administration; Deputy Director, The Nature Conservancy, London.

*Rapporteur:* Miss Moira Warland (IUCN).

*Secretariat Member:* Dr Patrick de Rham (IUCN).

**SESSION G: CONSERVATION OF MARINE HABITATS****Paper (24)****Conservation of the Marine Environment**

RAYMOND F. DASMANN

*Senior Ecologist, IUCN, Morges, Switzerland.*

The following represents an attempt to sketch some considerations relating to the marine environment and the problems of conservation of its resources. It is intended primarily as a stimulant to discussion rather than as an analysis of this complex subject.

Those of us who were at the United Nations Conference in Stockholm observed the interesting phenomenon of nearly unanimous agreement of the delegates in calling for a moratorium on the taking of whales. Only the most optimistic conservationist would believe that this indicated any great interest in whale conservation on the part of the nations concerned. The more cynical view is more realistic. Whales were of such minor concern to most governments that the delegates were left free to win points on the conservation Scorecard at no expense to their national interests. On other issues involving the conservation of oceanic resources where the sovereignty or special interests of more than a few nations were involved the results of the conference were far more murky, and it is difficult to see any light ahead.

Nevertheless, whale conservation provides an entry to some of the difficulties of marine conservation. There is no doubt that past exploitation of whales reduced populations of several species to a level of near extinction. There is also reason to believe that for large whales, at least, the days of uncontrolled exploitation are over. Whatever its past faults, the International Whaling Commission is now giving more than lip service to the conservation of large whales, and insofar as the future of these mammals depends on the extent of exploitation by the whaling industry, one can feel more secure about their prospects. One wishes that the same could be said for other fisheries.

Despite this improved picture, there is no reason to believe that the future of large whales is secure. It seems likely that we will soon move into a period of heavy exploitation of fisheries resources in Antarctic waters. Exploitation of the Antarctic krill fishery, the link in the food chain on which baleen whales depend, may soon develop into a major industry. Population levels of whales, seals, penguins, and other sea animals in the Antarctic could well be more drastically and permanently affected by heavy human exploitation of their food resource than by exploitation of their populations directly. A population reduced solely by hunting or fishing pressure will bounce back when that pressure is removed. One limited by destruction of its habitat cannot recover without restoration of its habitat, regardless of how much protection the population itself may enjoy. Some conservation groups have protested the Antarctic seal convention which was drafted in London in February, 1972, and permits a limited harvest of seal populations. Such a protest may be justified, if one considers the Antarctic as a region to be left without appreciable human interference. But in the face of major exploitation of Antarctic marine resources, which may be expected, one sees the need for a much broader scope of conservation

concern and direct intervention, as soon as possible, in the planning for, or prevention of, such exploitation.

The oceans remain an international commons, subject to the tragedy that Garrett Hardin has described in his landmark paper on that subject.<sup>1</sup> The whale problem has shown the need for international agreement and control to effectively protect ocean resources. Without such control there can be no optimism about the future. For three years now, experts on oceanic affairs have gathered in Malta for the conferences on *Pacem in Maribus*, which have called for, among other things, the formation of an international ocean regime to regulate and control the uses of the sea and the sea bed.<sup>2</sup> But in those three years the situation has deteriorated. Instead of international control, we see the phenomenon of nations extending their claims of sovereignty and special privilege to distances ever farther from their shores, seemingly striving to see who can get away with the most audacious pronouncements. Unless international agreements are reached we may expect to see the mid-Atlantic ridge serving as the national boundary between Latin American and African nations. Yet the United Nations Conference at Stockholm showed little indication that nations are prepared to be rational about matters of far less consequence than this.

The problems of marine conservation that face us fall into three principal areas:

### **1. Control of marine pollution**

If one had to give priorities this must rate as the most crucial issue, since on its proper solution the entire fate of all of the living resources of the ocean, and therefore of the planet, will depend. We do not know the limits of tolerance of marine organisms for the many kinds of pollutants, but we have reason to worry that they are being rapidly approached. The massive die-offs of certain sea birds, the failure of reproduction in others, related to concentrations of organochlorine pesticides or to PCBs are indicators of trouble. The reports of the extent of oil pollution and our knowledge of its immediate consequences are another warning. No doubt the Earthwatch programme launched at Stockholm will develop more precise information of the true state of affairs. Undoubtedly there will be new treaties on ocean dumping, oil pollution, and other matters. No doubt these, like past conventions will be conveniently ignored when it is expedient to do so. IUCN's role in this matter is not easy to define. Obviously we must assist in the global monitoring within the areas of IUCN competence, and we have been moving in that direction. Obviously also there is the need to maintain a continuous watch, and to alert governments and international organizations where serious problems appear to be developing. Here we must take care not to raise false alarms, since credibility is all important. Beyond that, we must continue to press for improved national legislation and for necessary international agreements. But these alone will not be enough.

### **2. Prevention of over-exploitation of living resources**

This has been a traditional area of IUCN concern and must rate second on any list of priorities. IUCN has already had some effect, in its alliance with the World Wildlife Fund, on the conservation of whales and other sea mammals and on better protection for marine reptiles. But obviously we have not gone far enough. Our concern is for all life and not just those species that attract

our eye through their size or their peculiar scientific interest. We have scarcely begun to touch the problem of conservation of fish populations, let alone the great variety of marine invertebrates—from shells and corals endangered by pollution, overcollection and habitat destruction, to those species taken directly as food resources. Control of over-exploitation of any species must be a goal, but we cannot fall into the trap of opposing exploitation where it can be, or is being, rationally controlled. Again an alert watch is needed along with an intention to bring pressure to bear on governments or international organizations where problems are found to exist.

Conservation of marine species involves conservation of marine habitat meaning all of the intricate food chains and webs of the ocean and the physical environment that supports this life. A species by species approach is hopeless. We can strive, however, for an effective system of marine parks and reserves, and in this area IUCN has already achieved some considerable success. Yet the success of marine parks, even more than terrestrial parks, depends on what happens to the environment around them. If currents or stream flow bring in pollutants or fail to bring in nutrients, the life of the marine reserve will not survive. Protection of a marine reserve necessarily involves protection of watersheds on land and of the quality of the oceanic water that flows through the reserve. It is a difficult, but not impossible task and we must be moving ahead with it much more rapidly.

In this area, IUCN should not be afraid to back some grandiose proposals. For example, why not an Antarctic International Park? I do not mean a small piece of that continent, I mean the whole continent and its surrounding waters down to a depth level of perhaps 1500 metres. We have lived without exploiting its resources up until now. Under the Antarctic Treaty it has been a *de facto* scientific reserve. It is one of the few areas where international agreements have actually worked. Why not keep it that way? In association with this proposal, I would suggest the dedication of all the sub-Antarctic islands, not now supporting human populations, to be dedicated along with their surrounding waters as islands for science, under the terms of the proposed convention which IUCN has helped to draft. Again, we have lived without exploiting these resources, and could well continue to do so. New Zealand, I believe, has already offered this degree of protection to its sub-Antarctic islands. Such proposals would lead to really significant additions to the world system of marine parks and reserves.

### 3. Control of exploitation of sea-bed mineral resources

We have thus far seen only the tip of the iceberg that we will soon encounter when massive exploitation of submarine resources begins. The unfortunate consequences associated with oil-well leaks in the Santa Barbara Channel and the Gulf of Mexico stand to be repeated in many areas of continental shelf, including the North Sea and the Arctic Ocean. A significant percentage of the world's petroleum resources happen to be under the continental shelves and beneath varying depths of water. There is no reason to believe that these will not be exploited. It is of the greatest importance that effective environmental protection be provided before such exploitation becomes more extensive. One could press for moratoriums on development in environmentally sensitive areas, pending the development of improved techniques. One must insist that the environmental impact be fully evaluated. But this is only a beginning. Enough manganese, copper, nickel and other metals of great importance to civilization lie in nodules on the ocean floor to satisfy present needs for a

long time into the future. The techniques for mining those nodules are being developed. The environmental disturbance associated with such underseas mining is likely to be of no small order, unless provision is made, before the problem begins, for proper environmental protection. But, unfortunately, much of this exploitation will take place in the international commons, or no-man's land. Who is to require the measures for environmental protection? Who is going to enforce them?

All these areas for marine conservation converge into a consideration of the one essential factor, the absence of which has led to past failures and to continuing dilemmas, the need for international control. I believe that IUCN must get behind the drive for an effective international ocean regime, one that can not only reach agreement on measures for environmental protection, but will have the money and the authority to effectively enforce those measures. We will not reach the ideal situation immediately, but various proposals, such as that presented by the United States in 1970, have already been made. If we want effective conservation of marine resources we have no choice but to urge and support every step that is taken toward the establishment of the international machinery that will be required.

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**SESSION G: CONSERVATION OF MARINE HABITATS****Paper (25)****Conservation of Estuarine Regions and the Coastal Zone**

D. F. MCMICHAEL

*Member, IUCN International Commission on National Parks; Director, National Parks and Wildlife Service, Sydney, New South Wales.***SUMMARY**

Although the coastal zone is of great importance to man, scientific study of this region has been inadequate and man's influence on it has been recognized only in recent years. The ecosystems of the coastal zone meet many of man's requirements, but these requirements vary in significance from place to place. The alienation of coastal lands and the modification of their contained ecosystems is intensifying as a result of increasing population pressures, but there is still opportunity to preserve significant areas in a satisfactory state.

In order to achieve this, adequate surveys must be made to identify the irreplaceable areas, both of natural or cultural significance, and those of economic or development importance. Following such identification, land use planning with adequate zoning should ensue, which must be rigidly adhered to.

For nature conservation purposes, a biological and ecological survey of the coastal zone is a prerequisite. International assistance from scientifically advanced countries, may be essential in some instances. Despite the impact of pollution and other undesirable effects from man's activities, estuarine systems are relatively resilient, and may be managed to achieve defined goals. The control of pollution is essential and if this is combined with adequate planning and control of land use, the coastal zone should continue to serve man's conservation and development requirements.

**RESUME**

Bien que les zones côtières présentent une grande importance pour l'homme, leur étude scientifique a été jusqu'ici des plus insuffisantes et l'influence de l'homme sur ces régions n'est reconnue que depuis peu. Les écosystèmes côtiers répondent à de nombreux besoins de l'homme, besoins qui varient suivant les régions. L'aliénation des terres littorales et la modification résultant de leurs écosystèmes s'intensifient à mesure qu'augmentent les pressions démographiques sur ces régions; mais il demeure encore possible d'en préserver d'importants secteurs dans un état satisfaisant.

Pour y parvenir, des études doivent être entreprises en vue de déterminer les zones qui sont irremplaçables du point de vue naturel ou culturel et celles qui présentent un intérêt sur le plan de l'économie ou du développement. A la suite de cette étude, des plans d'aménagement prévoyant une zonation adéquate doivent être établis et rigoureusement respectés.

L'étude biologique et écologique des régions littorales est une étape préliminaire indispensable de la conservation de la nature. L'aide scientifique internationale apportée par des pays avancés du point de vue scientifique peut se révéler essentielle dans certains cas. Malgré l'impact de la pollution et les autres effets indésirables des activités humaines, les systèmes estuariens sont relativement résistants et peuvent être aménagés de façon à répondre à certaines nécessités particulières. La lutte contre la pollution est essentielle et, si elle est intégrée à une planification appropriée de l'utilisation des terres, les régions côtières devraient continuer à satisfaire tout à la fois les impératifs de la conservation et ceux du développement.

### CONSERVATION OF ESTUARINE REGIONS AND THE COASTAL ZONE

Despite the fact that mankind has had an intense interest in, and a close relationship with the coastal zone throughout the world from time immemorial, it is only in recent years that this relationship has been the subject of investigation by scientists. While marine scientists have paid particular attention to the estuarine and coastal regions, in contrast to the deep oceans, their research has been primarily directed towards the physics, chemistry and biology of the sea and its contained organisms. Marine ecology has been oriented towards an understanding of how marine and coastal animals and plants are adapted to the vicissitudes of the environment which characterise the land-sea interface. Man, as a component of the coastal ecosystem, has been largely ignored.

It would probably be true to say that the great size of the oceans has led man to assume that they were beyond his power to affect them. The apparent effect of tide and current in dispersing and diluting materials which enter the estuaries and coastal waters has generally removed from sight, and therefore from consideration, those materials which are the product of human activity. Everyone has an innate belief that what is cast away into the sea will eventually disappear—somewhere. And so it does, but recently, partly as a result of more careful investigation and partly because the numbers of people living in the coastal zone and the volume of their wastes entering the sea have increased greatly, some of these things have been reappearing, often in the most unexpected places. Studies of ecosystems on a world scale are helping to reveal the *overall* impact of man on the coastal zone. For example, Judson (1968) has calculated that as a result of man's activities, the quantity of eroded material moved annually by rivers to the oceans has increased from  $9.3 \times 10^9$  metric tons to  $24 \times 10^9$  metric tons.

The lesson which marine ecology has taught us is that the coastal waters of the world are not after all so vast as to be impregnable to man's assaults, and that the coastal zone, like any other component of the biosphere, requires sensitive handling if we are to keep it in a healthy state which will yield the greatest long term benefit.

Since the theme of this conference is conservation for development, I propose to consider ways in which all countries, but especially those which still have an opportunity to choose what happens to their coastal zones, can make the best use of those areas by proper planning and consideration of the probable consequences of ill-advised developments.

In the first place, we should recognize the several requirements of man which can be met by the ecosystems of the coastal zone. Among them, not necessarily in order of importance, are the following: Ports and Harbours; Recreation; Fishing; Shipping routes including navigational aids; Wildlife habitat; Coastal mining (e.g., heavy-mineral sands, oil, etc.); Agriculture; Urban development;

Sewerage and waste disposal; Industrial development; Scientific research. We should at once note that these requirements vary from place to place, both in absolute and in relative terms.

For example, the recreational value of the coast varies significantly with latitude, from almost zero in the very high latitudes, to a peak in the temperate and sub-tropical regions, and declines again in the equatorial zone. The reasons are both climatic and geographic. A look at the global map reveals that the bulk of the world's land and of the human population, is in the temperate and sub-tropical regions. While there are undoubted recreational values to be found in some coastal areas of the tropics (as indeed there are in the arctic), the extensive development of mangrove communities over much of this coastline diminishes its significance for recreation, though the same mangroves may enhance its value for fisheries or for protection against major climatic perturbations.

In the second place, we should recognize that the populations of the coastal zone throughout the world are increasing more rapidly than are those in areas distant from the seas. Consequently the alienation of coastal lands for a multitude of purposes and the modification of their contained ecosystems is accelerating and this trend is likely to continue. Hence, in order to meet the varied requirements of man from his coastlines, there is an urgency attached to the problem of sound coastal zone management.

In the third place, however, we should also recognize that with the notable exception of some highly industrialized areas, the marine environments and many of the associated terrestrial systems making up the coastal zones are in remarkably good shape. In my own country, with its 12,000 miles (19,300 km) of coastline, only for a relatively short distance in the vicinity of the five or six major coastal cities such as Brisbane, Sydney, Melbourne and Perth, is the marine environment showing obvious signs of stress. Even in areas intensively affected by major industrial and urban complexes in the United States there appears to be still a high level of ecological stability, and the factors which are known to be damaging may well be controllable;—in other words, the patient may be sick, but he is far from dead.

In the fourth place, we must also admit that there is a great lack of scientific knowledge of oceanic systems. Despite the recent attention paid by many countries to the study of their coastal seas including estuaries, the very high cost of marine science and the complexity of the systems involved makes the accumulation of knowledge and the formulation of general principles a very slow process.

What then can be suggested as guidelines for those nations who would choose to make the effort to protect their coastal zones and estuaries against destruction? What are the greatest threats to these precious areas and how can they be overcome, or their worst effects avoided or controlled?

Any nation faced with this problem must as a first step, determine the existing state of its coastline. A survey of the nature of the coastal zone, and its current uses (with especial reference to those uses which cannot be dissociated from the coast), should be made. The survey ideally would yield a series of adequate maps, illustrating among other features topography, marine hydrography, vegetation distribution, geology, communications, land use and, possibly most important of all, land tenure (ownership).

Such surveys need not be so detailed as to take years to complete, and thus delay planning and decision making. Many of the necessary details will already be available, from government, commercial or international sources; but the

active cooperation of all groups should be sought in order to compile as accurate a picture as is possible.

The second step has been suggested by Dasmann (1971) as identification of the 'irreplaceables in the environment'—which he describes as 'the most valuable natural or cultural areas which should be maintained in a largely unmodified state for the foreseeable future. These are areas which for scientific, aesthetic or recreational reasons, or because of the values attached to the cultural heritage of a nation, must be preserved'.

Dasmann then recommends that steps should be taken 'to have these areas set aside and fully protected from any development or exploitation that would damage them'. He then suggests 'look at the rest of your land and decide how it should best be used'.

While agreeing with Dasmann that this procedure represents an ideal approach, there are for any nation, and particularly developing nations, likely to be fundamental conflicts in such an approach. As was stated in the IUCN Bulletin outlining the theme of the 11th General Assembly—'Conservation and environmental planning cannot succeed without taking into account the legitimate and necessary needs of human societies for the use of the resources involved'.

Thus what may be properly defined as 'irreplaceable' in a natural or cultural sense, may also be irreplaceable in a development or economic sense. A good example may be found in my own country, and especially in the State of New South Wales. Here we have a largely self-governing State, which by world standards could only be described as 'developed', yet one in which economic and industrial development is still proceeding rapidly.

The major industrial-urban complex consists of three nearby cities, Newcastle (population 250, 000), Sydney (population 2, 720, 000), and Wollongong (population 186, 000), each having grown around a natural or artificially improved harbour. These three cities form an economic-industrial-urban complex of great magnitude and significance to Australia, and the area has been described by Renwick (1969) as the 'East Coast Complex of Australia'.

In order to minimize the impact of such a complex on the coastal zone, it could be argued that it should not be encouraged to grow even larger, but that new areas for industrial growth should be identified at distances sufficiently remote to prohibit coalescence and synergistic effects. Yet the identification of such growth areas rests largely on the availability of harbours suitable for development as ports, and these are infrequent on the New South Wales Coast. Relatively few locations on this coast offer any potential for major port development and only two—the Clarence River estuary in the North, and Twofold Bay in the South—could seriously be contemplated as the basis for decentralized development. A third, Port Stephens, lies only 40 km north of the Port of Newcastle, and if developed would only add to the huge East Coast Complex. All three areas, however, would almost certainly be defined as 'irreplaceables' in a cultural or natural sense. The Clarence River area offers major potential for the development of tourism and open-space recreation and is already under active government promotion for this purpose (including several National Parks and Nature Reserves). Port Stephens in addition to the disadvantage of its proximity to existing industrial development, is a superbly scenic area with immense open-space recreation potential for the people of the Newcastle area, and it too would be identified as 'irreplaceable'. Twofold Bay is another area of extraordinary scenic beauty, and is bounded to the north and the south by National Park land. It represents the site of an early settlement—Boydton—which saw the development of the whaling industry during the period of 1843-47, and now contains some interesting old buildings—few and

far between in Australia. Twofold Bay, therefore, qualifies as 'irreplaceable'. No conservation planning which insisted that these three areas should each be given absolute protection is likely to succeed if they are also regarded as irreplaceable potential ports. In fact, Twofold Bay has been selected for the construction of port facilities to service the export of wood-chips, made from vast areas of surrounding forest lands unsuitable for logging or plantation purposes. Within this region, several 'irreplaceable' areas have been selected for National Park and Nature Reserve dedication.

I would, therefore, expand Dasmann's definition of 'irreplaceable' to include those areas which are essential for economic or agricultural purposes, without which the nation would be unable to attain specific development objectives, and for which no reasonable alternative areas are available. I have chosen to use harbours as an example—but there could be many others—e.g., zones of mineralization, areas essential for fisheries, rice-growing, or other forms of coastal agricultural activity which may well be vital to the national interest. While some solutions (including the reduction of the rate of population growth to achieve optimum stable population size) might be suggested as alternatives to increased agricultural production, or to the spread of urban and industrial centres, these are usually long term solutions only, and cannot resolve the immediate problems facing almost all coastal States.

The next step is perhaps the most critical—and that is the planning of coastal land use. The irreplaceable areas, both natural/cultural and economic/agricultural, must be given first consideration, and zoned or reserved for those purposes. Where necessary, top priority should be given to either (a) the retention of such lands in public (Government) ownership (or their acquisition by Government); or (b) the zoning of the lands under an effective (i.e. enforceable) land use planning scheme for the purposes selected.

Developed areas must be identified, and included in the plan with appropriate limits on growth clearly indicated. Such limits will be affected by many factors—including existing size and the practicability of controlling or limiting further growth; the proximity of irreplaceable natural/cultural features which might be affected by continued growth; the existing rail, road and other communication systems; the geological, geophysical and geomorphological features affecting the extension of developments; and the significance of agricultural or other rural economic activities in relation to these developed areas.

Finally, on the basis of the identified irreplaceables, both natural/cultural, and economic/development, coupled with the existing developments and their growth limitations, the remaining coastal lands can be considered in relation to the foregoing. Obviously the planning of use in these areas will depend on a complex of factors, not the least of which will be population size and trends, and the national goals determined by political philosophy and availability of resources.

Having prepared a master plan for the coastal zone, it is essential that it is implemented effectively. There are, of course, many different philosophies of Government which can influence this. Where ownership and management of resources, including land, by Government is the rule, there is possibly a greater chance that coastal zone planning decisions will be adhered to. Where private enterprise is recognised as having a vital role in resource utilization, there is perhaps a greater incentive to develop essential resources efficiently and rapidly, with risk capital and technological skills being applied from both national and international sources. But in either case, without some stringent control over the alienation of 'irreplaceables' the planned conservation and development of the coastal zone is doomed to fail. Steers (1970) and Dasmann

(1971) have emphasised the problems arising from local government control of coastal planning and of conflicting responsibilities among 'single-purpose' agencies, each pursuing their own end without reference to overall consequences of their activities in relation of those of other groups.

However, our concern is with conservation of nature, and it appears to be almost universally accepted that the major role in the protection of natural areas lies with Government Agencies. Let us then explore the steps which the nature conservation movement might take to ensure that its interest in the coastline is recognized and protected. In some countries with strong Government nature conservation agencies, there will be less need for active involvement of independent conservation organizations (other than to assist, and where necessary, critically appraise, the work of the Government Agency). In other countries, where as yet nature conservation has not been recognized as being of sufficient importance to warrant the establishment of a Government Agency under legislation giving it sufficient strength to be effective, the role of the independent groups will be of vital importance.

Again, Dasmann (1971) has outlined a programme with which I agree almost completely, and which parallels the national programme outlined previously.

The first requirement is for a biological and ecological survey of the coast. In most areas of the world, there is still very little known about the nature and distribution of organisms, and their interrelationships, and as far as the coastal zone is concerned, this is even true of those few countries with a long tradition of biological research.

Unfortunately, the coast has seldom been studied by biologists as a single system. There is almost always a separation between those biologists concerned with the sea itself, and those interested in adjacent land systems. A much greater effort at integrated studies of the ecosystems which transgress the land/sea interface is required. This is especially true of the estuaries, with their mud flats, mangrove swamps, salt marshes and similar habitats. Recent studies by a number of scientists have shown how complex these systems are, and how significant they are for a great variety of marine organisms (see Lauff, 1967, for a summary of current knowledge). We need to know a lot more about how estuaries work, and the limits of interference which they can tolerate.

Some countries may lack the scientific talent to undertake such biological and ecological surveys. I believe that through United Nations Agencies, and also such agencies as IUCN, and through regional cooperation, help could be provided by scientifically advanced countries in many cases. Furthermore, the non-government nature conservation organizations can frequently play a valuable role in identifying areas of special biological or ecological interest. IUCN has already given consideration to ways in which it might assist in such a programme. Dasmann (1971) records that at a meeting of the Marine Habitats Committee of IUCN in Rome in December, 1970, the following recommendations for specific projects were made:

- (1) Promote the selection and creation of nature reserves and other protected areas in the marine environment, and particularly in coastal waters, for scientific educational and recreational purposes, and develop guidelines for the management of such areas including rules of conduct for those using these areas.

Initially IUCN will examine existing and potential marine parks and reserves and develop guidelines for their management and protection.

- (2) Promote national and international measures for the protection of rare species, species groups and communities threatened with extinction. Specifically, IUCN should work closely with the Coral Reef Group being established by FAO and the International Association of Biological Oceanographers. IUCN has already established working groups concerned with whales, seals and marine turtles. It is proposed to develop other groups within the Marine Habitats Committee to be concerned with coral reefs and other endangered ecosystems.
- (3) Promote the compilation, interpretation, synthesis and dissemination of information pertaining to changes in the marine environment, particularly those believed to be related to human activities. To this end IUCN has developed a major project for a continuing review of the health of the oceans for which funding is now being sought.
- (4) On the basis of information derived from the above activities, promote public awareness of the need for conservation of the marine environment and recommend action appropriate to other international or national organizations.

IUCN is currently seeking financial support for these projects.

Following adequate scientific study Dasmann suggests that decisions can be made as to what areas need most to receive full protection from damaging forms of development. He suggests the 'these will include areas to be designated as scientific reserves (strict nature reserves) in which no other form of use other than carefully controlled scientific research is to be permitted, areas to be designated as special reserves to protect particular resources but in which forms of use not damaging to these resources will be permitted, and areas for National Parks or their equivalent in which certain forms of public recreational use are encouraged'. Naturally these strict nature reserves and National Parks will include both areas of coastal land and submarine areas (marine parks and reserves).

He further points out that 'once such areas are established and protected, much of the basis for the head-on collisions between conservation and development will be removed'. In the case of fisheries, there need be little conflict. Some areas of special value should be left undisturbed by fishing, but certain types of fishing need not conflict with 'marine park' values, especially where pelagic species are concerned.

Finally, he suggests that 'for areas of the coast other than those with high value for conservation, development and exploitation may be permitted. It will remain always essential, however, that these activities proceed under strict supervision and control so that use of resources does not imply environmental damage. Control of pollution is, of course, of major consequence and perhaps in most areas of first importance' ..... 'There is little doubt that the control of pollution will be the most expensive item in the total cost of reconciling conservation and development. On the positive side, it may be noted that many forms of coastal development now considered highly undesirable from an environmental point of view would be acceptable if their pollution output was to be controlled'.

There has been a tendency in recent years to point to the problems of industrial pollution and other forms of interference in estuaries and to stress the potential disaster confronting the world's coastal ecosystems (e.g., Darnell, 1971). However, a less pessimistic approach would indicate that estuaries do have considerable tolerances for disturbance, and that given certain protection

they can survive as areas of enormous productivity and as relatively stable ecosystems, side by side with man's developments.

These conflicting attitudes have recently been pointed up by Holden (1971) and Schubel and Pritchard (1971) in regard to Chesapeake Bay on the eastern coast of the United States. Holden, in reviewing a National Science Foundation Report 'The Chesapeake Bay', wrote 'Ominous signs may be read in seasonal fish kills, oil spills, and the 28, 000 acres of oyster beds and 39, 000 acres of clam beds that have been closed due to pollution' and went on 'Is the bay dying and if so, what can be done to save it? Decisive action will have to await more detailed understanding of the bay'.

Schubel and Pritchard, however, pointed out that fish kills were known long before industrialization and pollution of the area, and that the area of oyster beds closed remained reasonably constant over 10 years, and has not increased in the past four years, while the area of clam beds closed has actually decreased over the past five years. They further claim that 'the general trend of the total catch and the total value of Chesapeake Bay's commercial fisheries has been upward since the 1930' s, and that the large fluctuations in production of individual fisheries which have occurred, may be mainly the result of natural fluctuations common in estuarine systems.'

They continue 'The Chesapeake Bay is certainly threatened with change by man's activities. Some changes have already occurred, but, by most currently accepted standards, the main portion of the bay is healthy. It is because of its healthy state that it bears close watching . . . . sewage, pesticides, herbicides and sediments pose the greatest 'threats' to the bay. These by-products of man's activities have the most demonstrable effects in leading to 'less desirable' conditions in the estuary. Studies of the effects of thermal discharges have failed to document any substantial damage from present inputs'.

Finally, in commenting on Holden's statement that 'decisive action would have to await more detailed understanding', Schubel and Pritchard write. 'There are certainly countless unanswered scientific questions—there always will be. But the general features of many of the important processes in the bay are known and understood, and scientific predictions can be made. *In many respects, scientific information has developed at a faster rate than management's ability to utilise it. Decisions of how to manage the Chesapeake Bay, of how to 'order its progress' require not only scientific inputs, but social and economic inputs as well. Management problems rarely have unequivocal answers. They are very frequently value judgments, and natural scientists have no particular talents for making such decisions* (my italics).

These views seem to me to sum up very precisely the problem of conservation of the coastal zone and especially its estuaries. Scientific knowledge we must have in order to understand the systems, but this does not solve the problem. The value judgments which will be made will be as much influenced by social and economic factors as by scientific data. The job of the nature conservation agencies is to establish the value of conserving the irreplaceable natural features of the coast in social and economic, as well as scientific terms. Economic data which prove the value of an attractive coastline for tourism and recreation are now readily available (e.g., Clawson and Knetsch, 1966). But the social advantages to a community in maintaining areas of natural beauty or cultural significance are more difficult to establish. Public education by nature conservation agencies and organizations, though long term, offers the only real hope.

I do not propose, in this paper, to deal at length with the problem of marine

pollution. Much has been written on the subject, and there are now numerous published reports of studies on particular aspects of pollution of estuarine, coastal and oceanic waters by industrial effluents (including heavy metals), pesticides, agricultural chemicals, sewerage and domestic wastes, oil, radioactive discharges and heat. I believe that they are all controllable problems, given sufficient determination by government, industry and society and the expenditure of sufficient funds. Some, such as pesticides, will continue to affect marine ecosystems for a long while, even after their use is brought under strict control. Others have only transient importance.

But controlled they must be if our coastlines and estuaries are to continue to meet man's varied needs. Perhaps more important than the complete cessation of pollutant inputs, is the correct siting of potential pollution sources in relation to 'irreplaceable' natural areas. The whole value of coastal and marine parks and reserves may be lost by bad land-use planning which locates pollution sources in sites which will lead to damage of the reserved areas.

Finally, I would stress the fact that the coast, perhaps more than any other comparable system, offers the potentiality for extensive multiple use. The sea can be sailed on, fished in, swum in, lived by, enjoyed, and studied scientifically without significantly affecting its value for any other of these purposes. But only if it is treated with respect and sensitivity, and if its value to the community overall is placed above its value to the individual.

#### ACKNOWLEDGMENTS

I must pay tribute to the writings of Raymond Dasmann, who has so ably dealt with the problems of conservation of the coastal zone in several papers and who has played an active role in the formulation of IUCN policy in this area.

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## SESSION G: CONSERVATION OF MARINE HABITATS

### Discussion

The Chairman, Dr **Jouanin**, introduced the authors and panel members, for this, the final Session of the Technical Meeting, which unlike the previous Sessions consisted of a single section only, devoted to a topic which had recently become of great concern to IUCN.

Presenting his paper, Dr **Dasmann** explained that it had taken the place at rather short notice of the one which the author originally invited had been prevented from completing, and therefore aimed at no more than briefly summarizing a few of the main problems of the marine environment. It began with the whaling controversy, which had received some attention in the previous Session F, and stressed the point that the only effective solution was international agreement and control, in place of the tendency hitherto for interested parties to attempt to extend still further their national sovereignty. The second topic, control of marine pollution, was perhaps the most crucial at the present time and he had tried to define IUCN's particular role in this issue. It was closely bound up with the third problem, the prevention of over-exploitation of the resources of the sea, in which one of the most important aspects was the establishment of an adequate series of marine parks and reserves, including the possibility of an International Park for the whole of Antarctica. Finally, the need for international machinery to control the exploitation of sea-bed mineral resources, which was daily becoming a more and more critical issue, was emphasized.

Dr **McMichael** said that his paper aimed at reviewing the broad principles of marine conservation planning and did not attempt to discuss the details of management. Thus it did not specifically refer to the current problem of the extensive damage to coral reefs by the Crown of Thorns starfish (*Acanthaster*), although the activities of man in adjacent coastal regions, with which the paper was much concerned, might well have something to do with the outbreak. It was, however, stressed that coastal ecosystems show high fluctuations in population dynamics and ecological interactions, so that they tend to have a built-in tolerance; alarm at phenomena such as *Acanthaster* may thus be overdone. His main plea was for the formulation of effective policies and planning in coastal regions, in which the stages were—identification of irreplaceable elements, the planning itself, and the implementation of plans and effective enforcement. In all these, international advice and assistance have an essential role.

Panel member Dr **Wallen** said that in the understandable preoccupation with coastal zones, the conservation needs of oceanic waters, accounting for about 70% of the surface of the globe, must not be overlooked. There were several important interrelationships, including the problems concerned with the disposal of terrestrial wastes. To protect coastal zones and merely shift the dumping of wastes to the high seas was quite inadequate. Three points in regard to marine parks need emphasis: first, the importance of mangrove belts which should always be treated as an integral part of marine ecosystems; secondly, the need for constant monitoring of park areas, by regular transects, to check their condition; and thirdly, close attention to the effects of sedimentation and bringing them under control, perhaps by providing the Governments concerned with realistic model rules for management.

Panel member Dr **Tamura** suggested that one of the main problems was the relationship between marine currents and pollution. This was clearly demonstrated in Japan, where the marine parks do not extend beyond the ten fathom line and include adjacent coastlands and islands. The Black Current sweeping along the coast has a direct bearing on oil pollution and perhaps even on the previously mentioned starfish 'explosion' in shallow waters. In seeking to identify and control the sources of pollution, some important aspects are shipping movements (which may need to be restricted), sewage disposal, factory wastes and coastal erosion; all of these present acute problems in a densely populated country like Japan and, in the circumstances, the future of marine parks in the Inland Sea cannot be regarded optimistically. There are many other factors, some of which may be relatively easily controlled, such as oil drilling and mineral exploitation; others, such as the organisms introduced by the erection of structures in shallow waters and the disturbance of parks by the activities of visitors, are more intractable.

Mr **Dunbavin Butcher**, panel member, supported Dr Dasmann's assessment of marine pollution as the most critical issue, since as Dr Wallen had pointed out it could potentially affect over two-thirds of the world's surface. He also agreed with, but would go further than, Dr Dasmann in emphasizing the importance of terrestrial watershed protection for marine resources. Watershed erosion leads to siltation and this is an especial threat to estuaries, which act as traps for the silt-load carried by rivers before they reach the sea. Estuaries provide the link between the land mass and oceans and their value is out of all proportion with the area they occupy. He would not altogether agree with Dr McMichael that 'estuarine systems are relatively resilient', though the author did later add the phrase 'given certain protection'. Taking into account, also, the impacts of industry, housing and recreation, there is no doubt that the sea coast and estuaries constitute one of man's most treasured possessions, but are distinctly fragile. Many Australian examples could be quoted to support these views, but he would only mention two, both in Victoria: Port Phillip Bay (on which Melbourne is situated and which is already highly used) and Westernport Bay (still with only a small population, of high recreational value but the site of imminent major industrial development). Both are in urgent need of further multi-disciplinary studies, to identify the options open for the future. Value judgments will have to be made and should not be shirked: if some coastal areas deserve to be sacrosanct, declare them so; this will help avoiding conflict between conservation and development, which need not exist if it is remembered that when we talk about conservation we are talking about the conservation of man; the term is otherwise meaningless. IUCN's role in the process should be to try to encourage and promote the adoption of the principles on which choices and national action should be based.

Panel member Dr **Robert Linn** said that, in illustration of several points made in the papers and by previous speakers, he would like to quote the example of the barrier islands or outer banks of the eastern U.S. coast, especially around Cape Hatteras and the Cape Lookout National Seashores of North Carolina. The islands are usually long, but a mile or less in width; the area between them and the coast is of major importance in the ecosystem, shallow water of great productivity and the nursery ground for important commercial fisheries. Protection of these islands is a long established policy but, until recently, little understood. It has been discovered that the coast is, in general, subsiding and the ocean level rising, currently at the rate of about 3 feet a century. The effects of the latter led to complaints by the island inhabitants about coastal erosion, based on the fact that if the outer barrier is eroded away, the mainland will be more vulnerable to storms. The original policy, therefore, in-

volved a program of revetments and other structures, including the artificial creation of large barrier dunes. But none of these measures bears much relation to the processes by which the islands have maintained themselves since the Pleistocene, of which one important aspect was the 'overwash' deposit of sand on the bayward side. The old policy would inevitably lead in the long run to erosion of both sides of the barrier islands, their eventual disappearance, the loss of the productivity of the bay areas and exposure of the coast to greater erosional forces—in fact everything which it is desired to prevent. It is a good example of the fact that, while it is often necessary to act before all the facts are known, certain basic but sometimes quite complicated knowledge is needed before *wise* action can be taken. In this case, no action at all would have been better than the measures adopted, and problems resulting from such inaction—like those of the property owner who finds his island 'marching westward', as a result of the natural processes of erosion and deposit, but his legal boundaries not being adjusted to take account of this situation—are socio-legal not ecological or conservation ones.

Summing up the panel's comments, Mr **Boote** said that they had nearly all ended with a call for international action, but he believed it was unrealistic (as demonstrated at Stockholm) to expect the establishment of a World Commission for the Management of the Oceans until the 21st Century. Meanwhile, it is essential to maintain the pressure, and the main problem now is to bridge the communications gap and reduce the time-lag between scientific discovery (and all the knowledge already available in such organizations as UNESCO and IUCN) and its application by industry and the professions (which include the Law and the Social Sciences). IUCN should aim to act as a catalyst and stimulus in the promotion of three plans:- (1) a Liaison Plan, to identify key industries and professions and the kind of approach to each of them, nationally and internationally, which would have the most effective impact; (2) a Management Plan, to provide guidelines for all users of marine resources (including transport, mineral exploitation, fishing, recreation, settlement), aimed at maintenance of ecological health; and emergency drills for meeting accidents and disasters, especially in critical areas; and (3) a Futurology Plan, to ensure that the necessary research is undertaken and controls planned *ahead* of possible developments. Planning of this sort would be a proper follow-up of Stockholm and give the UN and Governments something positive to work towards, thus fulfilling the theme of the present Technical Meeting—conservation *for* development.

Opening the subject for general discussion, the **Chairman** said that he would like to make one or two preliminary comments. His remarks and the contributions which followed are summarized in the concluding pages of this report.

The frequency with which what are in effect marine conservation problems are referred to in the Press—discharge of wastes at Toulon, closure of oyster hatcheries by pollution at Arcachon, the fishery resources of Iceland—is evidence of an intense public interest. The two papers that have been presented view the problems from the widely different angles of the open seas and of the coastal interface, but nevertheless it has clearly emerged that there is a close connection between the health of the ocean and that of the coasts. One point not yet mentioned concerns the growing exploitation, now unfortunately commercialized, of shells, especially of tropical species. Another is the menace, which still affects remote oceanic biotopes, of introduced species, Kerguelen being a notorious example which, despite its size and small population (now largely confirmed to the personnel of the scientific station), has suffered great damage from rabbits and other introduced species—**C. Jouanin** (Chairman).

In New Zealand, pressure of coastal development for industrial and residential use has been accelerating and significant areas are already spoiled or endangered. In 1966, a survey of 5000 miles of coastline was launched to identify areas of scientific, historic, scenic, recreational and conservation interest, of which 1130 miles have been covered and another 730 nearly finished. But it has proved difficult;—some key purchases have been made but funds have been hard to raise and forward planning haphazard. However, recently the Government has allocated N. Z. \$1 million for the next five years, to cover purchases, including small islands, and the survey is to be extended to include lake shores and river margins. One artificial barrier, which it is hoped will eventually be eliminated, is the fact that existing legislation makes the high water mark the boundary between the jurisdiction of two quite separate agencies where land or water acquisition is concerned—**R. J. Maclachlan** (New Zealand).

Attention is called to the recommendations concerning the protection of the last natural coasts in Europe, which were adopted by the International Society of Phytosociology meeting at Rinteln on the Weser, in March 1972, for its 16th Symposium, attended by 150 scientists from 17 countries. The points covered by its recommendations included the gravity of the biological and aesthetic threats caused by industrial and touristic development, the extreme biological fragility of dunes, estuaries and sea-cliffs, and the loss to science which would follow their destruction, the dangers to soil and sea fertility, the desirability of prohibiting touristic and industrial structures from being sited right on the shore, the need for the creation of international, national and local marine parks and, above all, the urgency of the situation which demands immediate action before it is too late—**F. Klotzli** (Switzerland).

Je souhaite que l'IUCN intervienne en vue de sauver les rares rivages encore à peu près intacts sur le littoral septentrional de la Méditerranée. Je songe surtout aux côtes méridionales de la Turquie, presque pas peuplées, difficilement accessibles de l'intérieur et demeurées à l'abri, ou presque, de toute pollution, qu'elle vienne de la terre (agriculture, industrie) ou de la mer (mazout). Voici une scène à laquelle j'ai assisté le 20 juillet 1969, dans une petite baie sauvage, près de Kekova, entre Kas et Finike (Turquie s.-o.): un beau yacht battant pavillon italien; sur le pont six personnages en combinaisons de caoutchouc noir; toute la journée ces six pêcheurs sous-marins accumulaient sur un rocher plusieurs centaines de kilos de magnifiques poissons multicolores et de crustacés. Le soir, ils en prélevaient quatre pour leur dîner. A l'aube, au moment où le yacht s'apprêtait à appareiller, un coup de feu claqua: le phoque visé (il y a encore quelques phoques le long de cette côte) ne fut heureusement pas atteint. Le yacht disparut bientôt derrière un petit cap; sur le rivage le tas de poissons abandonnés commençait de puer... Aucun Grec, aucun Cyprite, aucun Turc, aucun Syrien, aucun Libanais ne prend part à notre 12ème réunion technique. Le moins qu'on puisse dire des gouvernements de ces pays, c'est qu'ils n'ont guère été vigilants jusqu'ici en ce qui concerne la protection de la vie marine le long de leur côtes. Ce serait une belle tâche pour l'IUCN que de les aider dans leurs efforts (car ils sont de bonne volonté, mais leur opinion publique ne les suit pas)—**O. Reverdin** (Switzerland).

New Zealand has for some years now given strict protective status to five groups of subantarctic islands it administers: all are reserves for the preservation of flora and fauna, except for a small part of Campbell Island occupied by a meteorological station. Entry is controlled and permit policy is in the hands of a multi-disciplinary scientific committee headed by the Director of National Parks. The Committee encourages and guides research and, early in

1973, a scientific expedition with New Zealand, Australian and American (National Science Foundation) personnel will be going to the Auckland Islands. In principle, New Zealand supports the proposed 'Islands for Science' Convention but would like some points clarified, e.g. the extent of waters surrounding the islands to which protection would be given—**P. H. C. Lucas** (New Zealand).

Professor Reverdin in his remarks about the eastern Mediterranean did not mention Israel, where at least some start has been made by the creation of reserves in the north near the Lebanon border and also between Haifa and Tel Aviv. There should be no need to prohibit sport-fishing if countries maintained sufficient protected areas to act as reservoirs: these areas would have to be kept completely free of disturbance, except possibly for allowing some viewing of the marine life (which would soon build up after protection even if not outstanding to begin with)—**A. Yoffe** (Israel).

With reference to Dr Linn's remarks about the influence of natural factors on the barrier islands of the eastern U.S. coast, the trouble is that conservationists too often look backwards, wanting to re-establish what *was*—their conservation memory is a product of their own life-period and is not based on a knowledge of long-term, natural changes. The natural world is what it is because of evolutionary processes and, although we can and should attempt to predict changes, we must always remember that uncertainty rather than certainty characterizes many biological processes. First-Aid actions based on knowledge and wisdom (the two are not synonymous) are necessary and long-term plans must be formulated, but we must protect the natural world against the tendency of conservationists to play at being God—**J. B. Cragg** (Canada).

Mr Butcher has already criticized Dr McMichael's optimism as to the extent to which coastal waters are capable of absorbing pollution, and referred especially to the adverse effects of sedimentation on estuaries. Specially important in this connection is the physical obliteration of coastal or estuarine areas of wetland, tidal flat and open water. There can seldom be recovery from this process. The changes involved have international implications but action and solutions lie within the sovereignty of coastal states, so that much could be done if everyone of us continued to exert pressure on his or her government, to create park and reserve areas, and above all to tackle the fundamental problem which can only be solved through regulation of the use of private property in such a way that the destruction of public resources is prevented—**J. S. Gottschalk** (U.S.A.).

Attention should be paid to recent progress made in the Aegean Sea, as a result of measures taken last year (1971) by the Greek Government to abate oil pollution, by a system involving the fining of careless tanker captains, and surveillance from the air by airforce and airline 'planes. As a result much of the pollution has shifted to other waters and this is where IUCN should come in and urge other Governments to take similar measures. The support of the phytosociologists' resolution, mentioned by Dr. Klotzli is welcome and should be publicized. As to actual methods of control, national legislation is the starting point, as several people have pointed out, and again IUCN could help more, by providing assistance and models to make such legislation more perfect and internationally coordinated. The *Pacem in Maribus* organization, which has been mentioned, and the U.N. Seabed Committee at Geneva, of which the Chairman is at present the Ambassador of Sri Lanka, have an important role and should be supported and consulted—**P. Dohrn** (Italy).

At the 'Forum' on Arctic Conservation, which was held a few nights ago in association with the present meeting, reference was made by several experts

to the various aspects of arctic oil exploration, shallow-water drilling, pipelines, super tankers, north-west passage voyages, and so on. It needs emphasizing that risks involved in these developments are aggravated by the power, depth and unpredictability of ice movements, the scarcity of navigational information and aids in the seas concerned, the slow rate of disappearance of oil in cold environments and the lack of data about the behaviour of oil in pack ice. The necessary research should be promoted by IUCN and undertaken *now* before the inevitable problems and accidents arise—**A. H. Macpherson** (Canada).

The risks of oil pollution in the oceans are always spreading and it is doubtful if many places are now left which are wholly free from them: thus recently on a visit to the Salvage Islands, where the terrestrial habitats are still fairly intact, the beaches were found to be smothered in oil—**C. Jouanin** (Chairman).

Returning to the question of coastal and estuary conservation, the fact, referred to by Dr McMichael that 'the coast has seldom been studied by biologists as a single system' is an inevitable corollary of the nature of coastal ecosystems: the marine environment has a 'legal climate', which may be as important as the mean annual rainfall, and economic forces may be at work which are even more compelling than changes in salinity.

Inventories and surveys of biological and physical components, as a basis for planning coastal conservation, are a basic need, but the ecosystem needs a wider approach: the question to be asked is not so much 'what is there'? as 'what is going on'? The constantly varying processes to be assessed cover a wide range—dredging, sport-fishing, land valuation and taxation, salinity, waste disposal, population, regional income, level of land use control. This is the approach adopted in the studies being undertaken by Cornell University in a Long Island estuary: the 36 important variables or processes at first identified have been increased to 58, and the question we are trying to answer is 'what would happen to all the other things going on if we changed each one of the variables'? Or what, for example, would be the directional effect, if the level of a certain variable is increased? The relationships are presented in a matrix table, so that no moral judgments of effects have to be made and we can classify them in the case of each variable as, plus, minus, nil, countervailing (cancelling out), operating through an intermediate variable, or simply unknown.

Such a planning tool, as exemplified in this two way matrix, can help citizens and decision-makers see *relationships* rather than things. Some of the cause-effect relationships may be fairly obvious but others often remain hidden until too late and the result is unnecessary confrontation between interest groups. Each proposal for planned change or each naturally changing variable should be examined for its myriad effects in the system: this offers an operational tool in planning while we wait for the quantitative bio-physical data to come in and possibly refine our initial informed assessments—**Lawrence Hamilton** (U.S.A.).

While the need for interdisciplinary studies emphasized by the previous speaker is agreed, it should be pointed out that for many coastal situations the complex of biological facts is already largely known and could rapidly be made available to planners. Incidentally, I described estuarine systems as 'resilient' not because they are not vulnerable to pollution but because they have a capability of recovering rapidly once the source of pollution is removed—**D. F. McMichael** (author of Paper 25).

The Marine Mammal Council, comprising U.S. and Canadian scientists, is sponsoring a greatly expanded research program. It is important it should be coordinated on a global scale through the IWC, IUCN and UN agencies. My

own interest is centred on pollutants; and the evidence of pollution by pesticides, PCBs and heavy metals in marine mammals and other organisms, such as krill, has been mentioned. Recently we have found indications that even the snows of the Antarctic plateau are contaminated. Other aspects include the influence on the aggressive behaviour of mammals exerted by pesticides, through the production of endocrine hormones by increased enzymatic activity in the liver; also possible influences on population levels. All of this, and the conservation of marine mammals in particular, needs a coordinated and fully integrated research effort—**Tony Peterle** (U.S.A.).

The development of deepsea ports in the estuary of the Fraser, where the important Reifel Wildlife Sanctuary is situated, and contamination by tanker traffic from Alaska through navigationally hazardous straits to a Washington State refinery, carry an unprecedented threat to the 14,000 miles of British Columbia coastline and its resources—**Mrs L. Boyce** (Canada).

The references made to visitor impact on marine habitats, especially marine parks, need some further emphasis. The Chairman referred to the menace of uncontrolled and now commercialised shell-collecting, to which coral collecting and exploitation should be added and, of course, spear fishing, at least by spring, rubber or explosive guns (which have been prohibited in Seychelles' protected areas). In connection with observation facilities in marine parks, in which public interest is mounting rapidly, not everyone is likely to be a competent skindiver and more use should be made of submarine observatory tanks and attention paid to further design development of glass-bottomed or, rather, glass-sided boats. Political action is most effective when based on personal experience: if people are to mind about marine habitats, it is important to let them see them, to enter into them or at least look at them through a window—**Peter Scott** (U.K.).

The Council of Europe and other European bodies and some governments, are all increasingly concerned by the pressure of leisure activities on the sensitive habitats of the sea, particularly the Mediterranean (which were so well illustrated by Professor Reverdin). It is essential for conservationists to establish close liaison with the manufacturing side of the 'leisure industry' and with bodies concerned with sea or under-water sports and recreation: the aim must be, and is in all their interests, to ensure that these activities are related to carrying capacities of particular marine environments—**R. E. Boote** (panel member).

The problem is to get regulations of marine parks accepted as they now generally are in terrestrial parks. In South Africa, we have accepted a compromise by which fishing is not totally prohibited, but can only be done by handline from the shore and the handline must be of more easily breakable material than nylon: no spearing of fish, no fishing from a boat or by nets, no commercial fishing, no catching or gathering of bait either in the water or on shore, are allowed in the marine parks or on their adjacent coasts. We believe that a compromise of this kind fully satisfies the requirements of conservation—**R. Knobel** (South Africa).

Damage due to non-degradable plastics has not been mentioned. A visit to Japanese underwater parks revealed that some areas had been made quite sterile by being 'paved' with sheets of plastics, especially empty plastic bags, which had completely inhibited the growth of marine plants and will no doubt continue to do so for a long time to come. It is essential that plastics should be kept out of marine, lake and other water bodies and, preferably, made biodegradable. If Japan could take a lead in the technological developments re-

quired to achieve this, it would do a service to the marine environment of the whole world—**H. J. Coolidge** (President, IUCN).

One conclusion which could be drawn from the wide ranging discussion is that a definition of 'marine park' is needed: the following might be appropriate, but it should be emphasized that it applies only to *parks*, where regulated human use is an important criterion, and not to marine nature reserves or other areas designated for conservation purposes only—'A marine park is a marine area located within the territorial waters of a country and includes the sea floor, the water column above it, and the adjacent coastal area necessary for its preservation and utilization'—**Tsuyosi Tamura** (panel member).

The discussions have shown the great interest in the subject and have also benefited from the fact that there has been more time available than at the previous Sessions. Even now, a number of important factors have not been mentioned at all or touched on very briefly, for example the impact of aquaculture and the ecological effects of eliminating some species and favouring others in closed waters; there is also the whole complex of problems involved in the introduction of exotic species, which is also linked with aquaculture, and so on. Much more research is clearly needed and much more work has to be done even in arriving at definitions, although Dr Tamura, the doyen of marine conservation, has just made a useful contribution. Perhaps, it still did not sufficiently take in, or indicate the importance of, the terrestrial element of a marine park, which extends up to the watershed; or its limits on the oceanic side, which Dr Dasmann has suggested might be set at the 1500 metre mark. Lastly, the legislation needs much attention. The coastal ecosystems have too long been regarded as a *res nullius* legally: they should be treated not as 'no-man's land' but as *everyone's* property and protected accordingly. In short, much still has to be done and it is difficult at this stage to decide whether to be optimistic or pessimistic—**C. Jouanin** (Chairman).

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