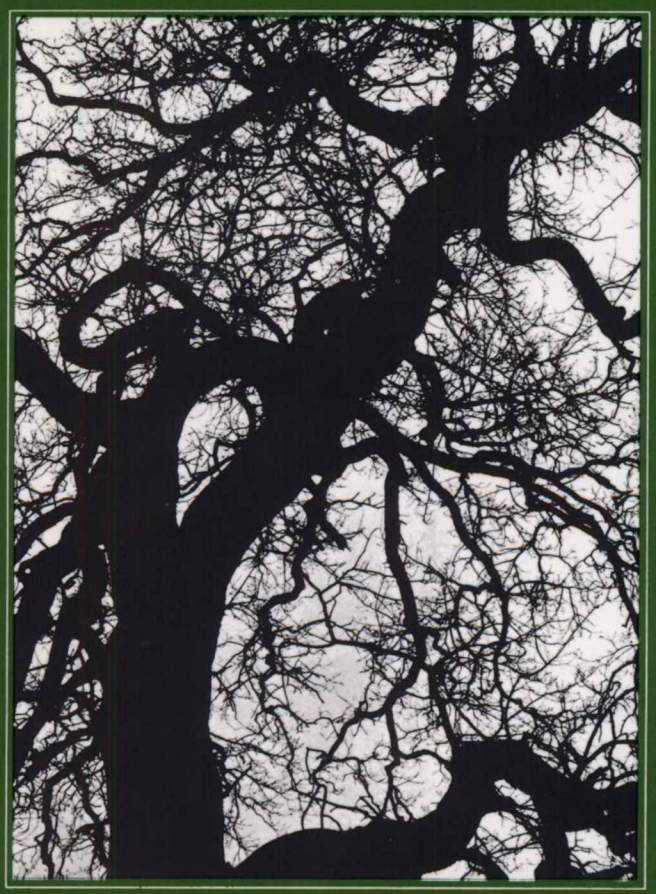
Forests, a growing concern

Proceedings of the
XIXth International Forestry Students Symposium
Wageningen, The Netherlands
30 September - 7 October 1991

John Hummel and Marc Parren (Editors)



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FOREWORD

For the past 18 years, forestry students have met annually in Europe. Participants at these meetings have been largely drawn from universities in the area. The XIXth International Forestry Students Symposium was a departure from that pattern in that the organizing team chose to broaden the thematic scope and participation.
There are a number of reasons why it was appropriate to shift the focus from Europe in 1991. Wageningen Agricultural University, where the Symposium was held, has a long history of involvement with forestry projects overseas. Since 1883, the University's Department of Forestry has provided training for foresters destined for the Netherlands Indies, now Indonesia. Tropical forestry, therefore, has had an important place in courses offered by the Department. A further reason for extending the scope of the Symposium, is the growing concern about the state of the world's forests, a concern shared by forestry students and others throughout the world.

The key themes chosen for the Symposium were land use planning especially with respect to the allocation of land for forests and the decision-making processes leading to wise management of remaining forests. The thematic structure is described at greater length in the Introduction which follows. Presentation of papers which reflected the inter-relation between the two themes rather than those on subjects chosen by particpants themselves ensured cohesion which otherwise might not have been present. Experts from universities, institutes and ministries in the Netherlands were also invited to present papers in order to add depth to the discussions.

The Symposium was opened by Professor Dr H.C. van der Plas, Rector Magnificus of Wageningen Agricultural University. The Seminar which followed was also addressed by Dr Salleh Mohd. Nor, Malaysia, Mr P. Ritsema, The Netherlands, Professor Dr P.R.O. Kio, Nigeria, and Professor Dr Ir R.A.A. Oldeman, the Netherlands. An open discussion involved the audience which included members of the general public.

The Proceedings of the Symposium represent only a selection of the papers presented. These were chosen for their originality or thematic relevance. Some have been edited and may also contain additional information. They have been included although authors have not responded in time to requests by the Editors who, therefore, accept responsibility for any misinterpretations which may have occurred.
The authors and titles of all papers presented are to be found at the end of this volume.

There were three objectives in publishing these Proceedings:

- to provide professional institutions with information about the thinking of forestry students on the state of forests and on their training needs;
- to stimulate exchange programmes among forestry training institutes and other professional organizations;
- and to ensure the future of foresters by demonstrating to the general public that forests are a basic requirement and that allocation of land for forests will continue to be of primary importance for the benefit of mankind.

Apart from the presentation of papers, several field trips took place during the Symposium. These included a one-day excursion to afforestation projects on newly-reclaimed land in the Lake Yssel Polders and to former afforestation projects on wind-eroded sand areas at Kootwijk in the Veluwe District of Gelderland. Together these demonstrated different strategies in two contrasting environments in the Netherlands. Participants were also offered a trip to Amsterdam, The Hague or the Delta works in Zeeland preceded by a guided tour of the coastal dunes. The cooperation of several Dutch forestry institutions in organizing these excursions is gratefully acknowledged.

Organization of the Symposium, participation of students from developing countries, and publication of these Proceedings would never have advanced without substantial financial and staff support from government and industry. Our sincere thanks go to all sponsors both within the Netherlands and elsewhere.

On behalf of the XIXth International Forestry Students Symposium organizing team

The Editors
John Hummel and Marc Parren

Editorial Board
Cecil Konijnendijk, Onno Roosenschoon, Etienne Verlaat and Margreet Hofstede

Preface

Let me first congratulate the IFSS 1991 Foundation for the initiative to hold the XIXth International Forestry Students Symposium. I must admit that I was not familiar with the existence of IFSS until I was invited to participate at this symposium and I am extremely pleased to be able to participate and meet the younger generation of future foresters. I am also extremely encouraged to note the enthusiasm and eagerness of the students in pursuit of their careers. I was impressed by their candidness and their thought-provoking enquiries, not only as to their future prospects in their profession but also with respect to the future of forestry and challenges of the profession in view of the current concerns expressed internationally.

Forestry is indeed currently at a crossroads. It is therefore critically important that the profession gives due cognizance to the challenges ahead for the profession and the discipline of forestry. The global awareness of environment and the concerns expressed by political leaders all around the world are a manifestation of some of the opportunities and challenges before us. Issues of tropical forestry are just one of the many challenging issues before us. The issues of biodiversity and carbon sequestration and the role of forests in the stabilization of climate are some of the issues that have to be addressed in the management of tropical forests. At the same time there is so much yet unknown in the tropical forests, and challenges in research awaits students and professionals alike who have the interests and the inquisitiveness to pursue a career in research. I can guarantee the potential forestry researcher that the challenges of research in tropical forestry are many, varied and extremely exciting. There is a tremendous world yet untapped which awaits the inquisitive mind of the researcher.

While the challenges and problems of tropical forestry have been widely discussed, there are at the same time numerous issues and problems to be addressed in the developed and temperate world. The problems of acid rain and the degradation of forests in developed countries are a real problem and the challenges that need to be addressed here are no less problematic and no less urgent than the issues of tropical forests. With the opening up of Eastern Europe and the former USSR, forestry also has a tremendous opportunity to play an increasingly important role in providing professional linkages between the developed western part of Europe to the developing eastern European countries. These challenges await the young professionals who are due to graduate.

It is therefore timely and extremely encouraging that the International Forestry Students Symposium had attracted participation from all over Europe as well as from the continents of South America, Africa and Asia. I congratulate the organizers for their initiative and wish them success in future organizations. I hope that more students from developing countries will be able to attend future symposia of IFSS and IUFRO looks with pride that these young graduates will in future be members of IUFRO. As IUFRO approaches its Centennial birthday in August of 1992, the linkage which has now been developed with IFSS hopefully will grow and strengthen in the future. IUFRO wishes IFSS the very best in its future endeavours and hopes that IUFRO will be able to contribute and participate towards the success of IFSS.

With best wishes for the future,

Dr. M.N. Salleh
President IUFRO

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Many people have contributed to the XIXth IFSS, but without the enthusiasm of the following forestry students, who formed the organizing team, this symposium would never have been realized.

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Thanks is also due to the Honorary Committee which gave us their confidence at an early stage and which proved to be a source of valuable advice.

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The following persons representing a wide range of academic disciplines, contributed to the content of the workshops as speakers, to share their experiences with us. Ir H Andeweg, Ir W Beekman, Drs AJ Broekhoven, Ir RL Busink, Drs AM Filius, Ir HM Heybroek, Ir JJ Kessler, Dr HJJ Kroon, Ir CJ de Lange, Drs RCF van Meegeren, K van der Meiden, Ir CFWM Von Meijenfeldt, Mrs Ir CH de Pater, P Ritsema, Ir PR Schütz, EJG Swellengrebel, Ir KF Wiersum.

We are highly pleased with the way Ir Ingrid Duchhart, Department of Physical Planning and Rural Development and Drs Jaap Lengkeek, Department of Sociology chaired the symposium. Finally we like to acknowledge Ir Freerk Wiersum for his advice concerning the proceedings, Mrs Ninette Smit-de Zylva for her assistance with the English text and Wim Hummel for the text layout.

Introduction

FORESTS, A GROWING CONCERN.
An increasing demand on a diminishing forest area

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The Netherlands

The growing concern about the world's forests arises from man's increasing demand for forest products and services. But the main reason for our concern is the alarming rate at which the forests are being diminished on our globe. There is an increasing pressure on forests to fulfil the different needs of society, brought about by the steady growth of the world's population, a growth of the world economy, and an unequal distribution of basic necessities. And yet, the existing forest resources are diminishing because of the allocation of land for alternative types of land use. Besides, the quality of the forest is decreasing as a result of processes such as the conversion of virgin forests into plantations and the fragmentation of large areas of forest into dispersed and small forests.

Consequently, it can be said that values of forests are not really understood or appreciated by the world at large. People manage the world and its resources, including the world's forests by their actions. Thus, the root of the growing concern about the forests has to be sought within society itself, where the decision-making process is of major importance.

In spite of the increasing demands for forests, other types of land use continues to take priority over forest land use. In forest management too, it is people who make the decisions about the maintenance and use of the forests. Because people command the central position in the world, the common approach in the proceedings will be the interaction between forests and society - at local, regional and international level. The society's priority of the various actions will be focused upon when analyzing the problems.

The burden of the scarcity of forest products, tangible products as well as intangible services that a forest provides, can be lightened by increasing the land area for forests, or by managing the existing forest resource in an more optimal way. Another option is to lower society's demands, but this is at the moment far beyond the foresters reach. However, if the first two options do not bring about satisfactory solutions, mankind (especially foresters) should consider ways of lowering the (excessively) high demands which are laid on the world's forests.

The problems facing the world's forests are complex and many aspects and causes are interrelated. To solve such problems, an integrated and interdisciplinary approach is required - isolating various related problems holds certain risks. Moreover, by delineating specific problems or problem fields, the complex problem could be separated into workable pieces. An integrated approach involves integrating the studies and discussions during and after the analyses and discussions on more detailed aspects, in order to get insight into the whole problem, or as much as possible related aspects of the problem.

To discuss and study the complex problem of the increasing scarcity of world's forests described above, the problem is divided artificially into two sub-problems (the symposium theme's).

There are two themes:

1. Land allocation: Who is first?
2. Forest resource utilization: How and for whom?

Within the first theme the causes of and arguments about the competition for (forest) land will be discussed. Within the second theme the societal needs for forest products and functions will be projected on the existing forest resources, so that the competition for priorities in forest use and management can be discussed.

The process underlying the growing concern about the world's forests

The division of the growing concern on the fate on the forests into two problems fields presented above may give the impression that there are two separate problems. But this is not the case. When separating problems into two problem fields the first question will be whether or not to choose "forest" as the type of land use for a certain area. This choice will have important consequences for the functions and utilization of that area. If "forest" is the chosen designation or a particular forest is to be maintained in a certain area, then there could be a decision made for several forest functions and forest uses. Such an approach implies a clear-cut separation between forest functions and other land use functions, as well as between forest uses and land uses. This separation is often seen in western societies, for instance, in the Netherlands, where forest areas and agricultural areas are totally separated, and integration seems virtually impossible.

The process of separation into forest (land) use and other land use

As long as forests are numerous and underused, local regulations for its use are sufficient, as utilization problems are mostly related to local user-rights. With development came state intervention and consequently centrally regulated policies resulted in western countries. But, at a later stage, according to van Maaren (1984): 'the benefits to forestry of a stable national regime becomes enhanced, when the more or less authorial approach, that was customary in former times is replaced by more democratic procedures including the delegation of power to local authorities to deal with local questions. Indeed, the detailed nuances of forest policy should be handled locally, within the broad framework of a national or even supra-national forest policy. The importance of such a framework is to secure the stability of the policy: a must for the maintenance of the optimal functioning of the forest.'

Forests are subject to all kinds of activities initiated by society. This society is not homogeneous. There are all kinds of interest groups, operating in different social systems, each with its own demands on the forest, or rather its natural resources. Of course, many people will have an interest in forestry, ranging from satisfying livelihood conditions on subsistence level to tourism, and from production of timber to the conservation of eco-systems (Figure 1).

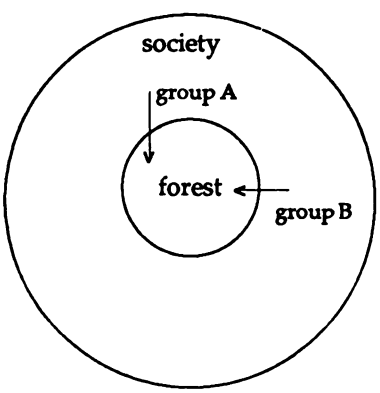


Figure 1. Demands and needs of society on forests

The relationship between demand for forest products and services and the forest resources are the forest functions. The production of wood is one of the main functions, which is recognized in the state forest policy. This production is for industry or for direct use, such as fuelwood and other wood for domestic use in many developing countries. However, the production of forest products other than wood is also an important production function to be considered.

Meanwhile the forest is often also required to provide all kinds of other use functions to the local people. Wise land use can transform forests into agricultural land where trees can still play an important role (like shifting cultivation, agroforestry systems, etc).

Forest lands (and nature reserves) are, furthermore, often the living environment of several communities. The value people attach to the forest differs depending on the interest of the people living in it or in the neighbourhood. Indigenous forest people are part of the forest and respect and honour it in order to sustain it. Often people living outside the forest value forests mainly for its timber production.

In addition to their production function, all forests, in one way or another, have an environmental protection function: in water catchment areas the forest acts as a filter; on slopes it acts as a retainer of soil and prevents erosion; it impedes the march of the desert in arid areas; it plays a role in the protection of wildlife and acts as a gene bank for plant and animal alike; it conserves traditional landscapes. As the demands on the diminishing forests increases, likewise the gradual awareness among the several interest groups to protect the forests increased. However, forests can only fulfil their environmental functions if these are made a prime concern of forest policy.

The use of forests for recreational purposes is an outcome of the modern way of life. The link between nature and everyday life has vanished with "modernity" and "post-modernity". To become aware of this link, outdoor recreation has become a necessity in modern societies. Problems with exceeding carrying capacities and pollution have become prevalent, recently. Problems that are currently not restricted to the developed countries, but are also becoming significant in less developed parts of the world.

Decision-making processes

In the preceding discussion a change has been made from the forest as the major land-cover in which all kinds of functions were present, towards a stage in which the society has all sorts of claims, demands and needs on an ever decreasing forest area (Figure 2). Nowadays, decision- and policy-makers in forestry are trying to reverse the trend of the increasing demand on the diminishing forests, but the arguments they put forward are often not heard. Or their arguments are concerned with the interests of only a few parties involved.

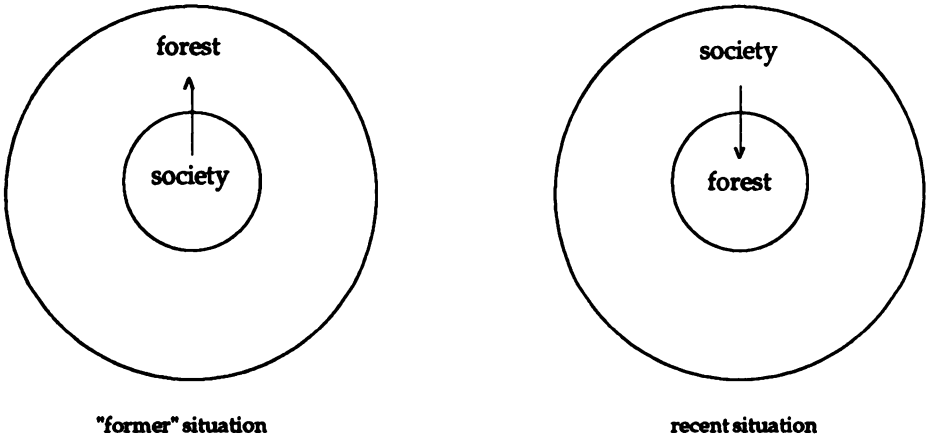


Figure 2. Relation of society and forest in a spatial orientation.

Decision-makers in forestry aspects are often not foresters. Foresters hide themselves in their forests and only come out if they are asked to do so. Important decisions which also affect forest resources are only proposed from the "foresters' point of view". Often a particular area has to be defined as forest land before the forester agrees to be included in the decision-making process. "The forester rules in his own kingdom". A clear allocation of land is therefore needed in which functions of the particular land use type are defined. This constitutes the first main theme of the proceedings.

After the allocation, decisions have to be made about the livelihood options for the several interest groups living inside the forest area. The interests have to be weighed between these parties involved. After evaluating the various interests, a decision can be made to balance them and to allocate the functions to different forest areas.

It is also possible to start with the needs and desires of the society (at several levels) in which case the functions and allocations become clear to the people and to the links between forests and people. For instance it may not be necessary for a forest to be located in the neighbourhood of a city, but it is obvious that the people in the city need forests for a livable environment.

This argument is not only valid for urbanized and developed areas, but also in less developed areas where the same argument can be used for agroforestry and the role of forestry in the battle against desertification and erosion. Arguments have to fit the local community and appropriate decisions have to be made. Foresters should understand and participate in decision-making processes of a society at large, outside their forests.

Land allocation: Who is first?

The competition for land between different interest groups is discussed within the theme of land allocation. Since the forested areas of the world is diminishing, it is clear that other land use forms are preferred at the cost of forest areas. The sections within this theme are examples of competition between different types of land use, for instance between forests and town planning, forests and agriculture, the combat between forests and deserts and between forests and increasing area of eroded lands. In the discussion about land allocation the main questions are:

- Who (or which groups or organizations), prefers a certain type of land use, and who decides in the end (or who has the greatest power to decide)? What is the role of the forester in decision-making processes?
- Which arguments are put forward in favour and against different kinds of land use and in particular forest land use, and which factors in the various cases do influence or determine the choice for a certain kind of land use?

The first question about the preference of a certain type of land use and people's interests in it, and decision-making processes of the allotment of land, is not easy to answer. For instance, a government is a major decision-maker in many land allocation problems. But how do governments make decisions? Governments are not solid and one-faced organizations. They have to consider the interests of many people, and economic reasons weigh heavily. If, for instance, timber is sold by the government, this can easily reduce the foreign debts and governments will be tempted to do so. The decreasing growing stock and the worsening environmental situation in the long term is not of immediate interest of those decision-makers. Decision-makers often neglect to take long term measures into account. The decision-making process is a difficult one and it differs from country to country and even from forest to forest.

Many groups and individuals influence the decisions and actions of a government to a smaller or larger extent. Interest groups, such as the local people who use the land, investors in a certain area and even the foresters in some cases try to have some say in these decisions. What should be the role of the forester in this decision-making process? Should he or she only be an adviser or must he or she have a substantial say in the decision-making process?

The second question focuses on the positive and negative effects of various kinds of land use in different places. In a lot of cases forests have to make way for other kinds of land use. The arguments supporting forest land use have to be developed in order to fulfil the needs (by society) for forests by, for instance, expanding the forest area. However, each location with its own particular population, requires specific choices in land allocation, and different arguments need to be made since local conditions vary from place to place. Forests take a long time to provide economical or non-economical benefits. This long-term perspective is often neglected. In many cases, people use a short-term perspective and do not wait for the long-term benefits. Another problem perhaps, is that to be profitable, forests usually need a large area except for urban forests and agroforestry plots.

So, often the priority is given to other land use forms, but it is the forester that ought to have a major role in pointing at the usefulness and functions that a forest can have in the various situations. The forester should be involved/ participate in the overall land use planning process.

The problem of competition for land exists at all levels, from the local to the international level and from small-scale to large-scale conflicts and areas. At every level criteria, preferences, and priorities need to be set and to be considered.

Forest resource utilization: How and for whom?

The competition for forest land between different interest groups will be discussed within the theme of forest resource utilization. In this situation the land has already been allotted to the land use type "forest". According to van Maaren (1984): 'the relationship between the forest resource and social demands towards that resource is usually defined by the so-called forest functions. These functions are in fact human expectations of what should be supplied by the forest.'

Often without knowing it, the growing concern about the fate of the forests is shared by people from all strata of society, be it a developing or developed, indigenous or modern society. Several interest groups can be distinguished that sometimes even compete with each other. The main problem is how to divide this forest among the different functions so that the needs of the interest groups concerned with these functions are suitably met.

It stands to reason, that forest lands can have diverse functions and cater to a large number of needs and demands. Differences between the importance attached in the developed and less developed countries to the functions of nature conservation, genetic stock and export of tropical hardwood, can be distinguished. The distinction between developed countries and less developed is obvious especially of user groups. One of the major demands in the developed countries is that of outdoor recreation. In the less developed countries, people often need the forest solely for their subsistence.

In most countries the national government plays a major role in the planning and management and decision process of the utilization of forest resources. The government decides on how to balance the various functions of forests in a forest development policy. The government is a representative of its people; it has to fulfil the needs and demands of the people and it represents as best as it may. However, many actors and parties influence the process of decision-making on different levels. Obviously, the designation of functions to a certain forested area cannot be done by blue-print. The interest of the parties have to be weighed and possible functions have to be evaluated, before an acceptable division can be made.

There are several forest functions that are perfectly capable of thriving in the same forest area, for instance, nature conservation and genetic stock in remote areas. There are also several forest functions that can be zoned into a forest in such a way that these functions do not hinder each other, such as recreation on paths in a production forest. But there are forest functions that cannot be realized in one forest, such as logging of forested slopes and a protection function.

In this section the decision-making process of types of forestry and the functions that are present or ought to be present in a forest are discussed. In the discussions about forest resource utilization, the main questions to be posed are:

- Who (or which groups or organizations) prefers a certain kind of forest function and who decides in the end (or who has the greatest power to decide)?
- Which arguments are in favour and which against different kinds of forest functions in a certain forest area, and which factors do indeed influence or determine the choice for a certain kind of forest function?

The traditional foresters looked upon the forests as their domain. Although many foresters cling to this traditional idea with all their might, the influence of other interest groups, for instance, the nature-conservationists and the recreationists is coming on strongly. Each function is more or less preferred by one or more specific user-group. These are, for example:

- forest exploiters: who require maximum profits in a production forest;
- recreationists: who require easy access and a forest that corresponds to their idea of "nature" (however with enough recreational facilities, like benches and paths);
- nature conservationists: who require natural forests with minimum intervention;
- local and indigenous people: who require produce, but also religious artifacts, etc., from the forest;
- scientists: who require all kinds of forests for research purposes;
- governments: who require production and financial benefits from the forest, but also the wellbeing of all interest groups.

All these interest groups want to have a say in deciding on the type of forest functions in a certain forest area, and, of course, they have the right to do so.

But this means that the role of the forester has to evolve, from a forest expert to a kind of forest function manager. He or she has to take into account all sorts of interests of different user-groups, translating these into forest functions, and arranging these functions in the forest in an optimal way. Several tasks of the foresters are mentioned in the papers, including: planners, managers, economists and facilitators, but also extension-workers and educators, salesmen, nature conservationists and wardens. From all these tasks, one can deduce that the foresters of the future will have to be open-minded broadly educated people.

The decision-making process in forest resource utilization

There is a difference in the possibilities of certain desired decisions, and the actions chosen. Both, however, are often obstructed in the fulfilment of the chosen objective; the sustained functioning of the forests, with an appropriate mix of forest functions which cater to the demands and needs of society. There are all kinds of reasons for this lack of proper implementation of decisions, such as the use of an inappropriate valuation system. A lot of non-timber forest products are not suitable for integration into a market system, so they stay unnoticed by the people who do not use them in their daily activities, although they can be of vital importance. Normally, only the market value of the forest is taken into account. Sometimes, the registration of property is also organized in a most unsatisfactory way. For instance, when a nature reserve is planned, the local people (or indigenous people) who have no written claims to the land are often evacuated.

Often there is insufficien: overview by decision-makers on the various claims of different groups on forest products and on possibilities to realize these claims. For instance if a non-timber product becomes interesting for large-scale production, cheaper (often chemical) production-methods are found.

Also a single function is often advocated by specific interest groups. For instance nature conservationists may claim to be reasonably broad-minded, but often consider only their own conservation interests and deny the interests of the livelihood of local people.

Decision-making processes are not only influenced by the direct user groups, but also by external interest groups. For example, in most cases, supra-national bodies impose their will upon developing countries to create nature reserves through preconditions attached to financial aid. A lot of power also seems to be given to multinational organizations, that transport and process tropical wood and therefore determine market prices. And besides, there is the corruption in many countries and the low infrastructural development.

Who should be the main decision-maker(s) depends on the scale of use, for example some decisions can be made on local level: the use of a forest by indigenous people who experience no external interference. This situation hardly exists any more. Decision-making on a regional scale is somewhat more common, for instance a forest can be subdivided into a part for recreation, nature conservation or production. Often this choice is up to the forest owner, be it an individual, an organisation or the district's government.

If foresters cannot cope with the decision-making process, others will make the decisions for them. Foresters should use the power they have to step out of the forests and into the world. They have learned to combine a forester's task optimally and how to use their skills to counsel, to mediate and to facilitate cooperation between the numerous interest groups.

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Tropical forests, a growing concern

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Introduction

Since the Stockholm UN Conference on the Environment in 1972, global awareness about forestry and the environment has increased by leaps and bounds. Whether or not the Stockholm Conference and its report have been the main impetus for this awareness is hard to determine. The report, entitled "Our Common Future", more commonly referred to as the "Brundtland Report", emphasized that the Earth we live on is indeed a fragile planet and that for man's existence there is no feasible alternative to Earth. The world has been developing at a tremendous rate. Air travel has become a common mode of travel and communication has improved in form, efficiency and speed. Physical developments transcend the whole world and indeed every country is aspiring to achieve a "developed" status. Populations have increased and agriculture has expanded in response. However, in the pursuit of development, the environment we live in is threatened. Such issues as climate change, the greenhouse effect, the ozone layer, toxic wastes and many others have reared their heads. One of the major areas of concern has been the tropical forests. How did this all happen and what motivated this increasing concern for the environment and tropical forests?

The global initiatives

Concern about the environment which includes forests, has been widespread and active for a long time. As early as in 1933, a convention on the preservation of fauna/flora in their natural state was adopted in London, while in 1940 a convention on nature protection and wildlife preservation in the western hemisphere was passed. Of particular importance was the Ramsar Convention of 1971, which addressed the conservation of wetlands of international importance, especially for water-fowl habitats. In 1973, the Convention on International Trade of Endangered Species (CITES) was adopted in Washington. Besides conventions, treaties such as the Amazonian Corporation Treaty in 1978, addressed issues of environment and forestry, including tropical forests. The 1972 United Nations Conference on the Environment in Stockholm was a significant global event, at which global issues about the environment were discussed and several options were presented. This initiative was followed by others. A major development was the establishment of the United Nations Environment Programme (UNEP), the U.N. body responsible for environment. In 1980, UNEP, the World wide Fund For Nature (WWF) and the World Conservation Union (IUCN) launched the World Conservation Strategy which echoed ideals of sustainable development, including the conservation of genetic diversity and sustainable utilization of species. It provided the framework and guidelines for national conservation strategies to be carried out by every country. Many countries have initiated their own conservation strategies, but it has not spread worldwide.

In the early 1980s, it became clear that tropical deforestation and misuse of forest resources were taking place at an unprecedented rate. The international community was alarmed and there was an international cry for action. In 1983 the FAO Committee on Forestry Development in the Tropics asked for a plan of action to be prepared for the conservation and development of tropical forests. This led to the preparation and publication of the FAO Tropical Forestry Action Plan (TFAP) in 1985. At about the same time, an International Task Force, set up by the World Resources Institute (WRI), the World Bank and the United Nations Development Programme (UNDP), published a complementary response in three volumes entitled "Tropical Forests: A Call For Action". As there were many similarities in the content of these documents, the two initiatives were amalgamated under a common TFAP title. In 1987, the four cosponsors of the plan collaborated to produce a summarised version. The TFAP was approved by the 9th World Forestry Congress in Mexico in July 1985 and subsequently endorsed by the 23rd Session of the FAO Conference. The TFAP has been described as a centrepiece for a new coordinated approach to solving the tropical forestry crisis, a tool for reorienting, intensifying and harmonizing actions towards

conservation and sustainable use of tropical forests. It seeks to reconcile forestry and conflicting demands from other land uses and stresses on integration, with agriculture and an inter-disciplinary approach. However, the TFAP is not actually a plan in the technical sense. Nevertheless, it provides a diagnosis for the main causes of tropical forestry crisis and indicates the kinds of corrective actions that should receive priority attention. About 70 countries have involved themselves in TFAP activities but implementation of country action plans has not been very successful. There is concern about the rationale of continuing the TFAP in the present form as a result of the independent review of the TFAP in 1990. Actions are now being taken to reorganize the TFAP in order to make it more effective.

The crisis perceived in tropical forestry was recognised by the specially convened Bellagio Conference in July 1987. This high level meeting issued a statement containing 10 major recommendations in an effort to stem the loss of tropical forest resources and gain political support for the implementation of the TFAP. The recommendations cover the need to quantify the costs of inactions, promote community and private sector participation, reform policies, protect tropical forest ecosystems, strengthen forestry research, monitor tropical deforestation, and coordinate international actions. The Bellagio initiative led to the establishment of a Task Force which produced a report on international tropical forestry research. The report was borne in mind in follow up actions, which resulted in forestry research being admitted into the Consultative Group on International Agricultural Research (CGIAR) System. This initiative is now being actively pursued and it will put international forestry research on the same level as international agriculture research.

In 1985, another important initiative was the formation of the International Tropical Timber Organization (ITTO) by the International Tropical Timber Agreement (ITTA), under the auspices of the United Nations Conference on Trade and Development (UNCTAD). ITTO is a forum in which producers and consumers of tropical timber can cooperate to support the growth of the industry. Currently there are 22 producer and 24 consumer member countries in ITTO. Improving tropical forest management and timber processing is among its objectives. ITTO is not a trade cartel and ITTO does not intervene in the world market for timber and timber products. It tries to achieve its objectives by promoting sustainable tropical forest management, timber processing and marketing.

International donors have been extremely active in supporting tropical forestry programmes mainly on a bilateral and regional basis. Individually and collectively, international institutions have developed various programmes to address the issues of tropical forests. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has had a number of programmes addressing issues of tropical forestry, particularly the Man and Biosphere (MAB) Programme, where forestry has been given prominence. The UNESCO Programme of Heritage Sites provides mechanisms to encourage the conservation of threatened and important ecological sites. Countries like Germany, have been extremely supportive of tropical forestry and have launched a series of meetings under the auspices of the German Bundestag to address issues of tropical forestry. This Parliamentary group has published a very comprehensive document on tropical forests, which addresses the various issues and presents recommendations for consideration.

At this moment, 20 years after Stockholm, discussions are being actively pursued in the preparation of the 1992 UNCED Conference, which is the United Nations Conference on Environment and Development, scheduled to be held in Brazil in June 1992. Three major initiatives have been pursued. They include development towards a Convention on Biodiversity, Climate Change and discussions which may lead towards a Convention on Global Forests. These discussions have been long-drawn-out with the participation of many countries. Whether any or all these conventions will be launched in June 1992 remains to be seen, but a lot of effort is currently being mobilized to address the issues in which tropical forests play an important role.

Meanwhile, world leaders have also been sensitized on tropical forests and have issued statements on tropical forests including the G7 and G77 nations, all of which endorsed and supported the need for conservation and sustainable utilization of tropical forests. It can thus be said that tropical forests have been presented at the highest political forum. Leaders have individually and collectively spoken about the need for conservation and sustainable development and use of tropical forests.

Concern has been expressed over the rapid rate of depletion and degradation of tropical forests. One of the major reasons for this concern has been the issue of biological diversity. Although tropical forests comprise about 14% of the Earth's surface, they contain over 50% of the world's species of flora and fauna. There is anxiety about the loss of biodiversity due to uncontrolled exploitation and the conversion of tropical forest having far-reaching consequences for the future of mankind, particularly in the area of biodiversity as a source of chemicals for medicines and drugs, which could hold the key to many of the problems faced by mankind today. Another reason for the concern is the fact that tropical forests, like other world forest types, act as sinks for carbon and therefore help alleviate the greenhouse effect which is now affecting the global climate. It is however acknowledged that tropical forests constitute less than 20% of the total greenhouse gases of the world. Any unilateral action to focus attention on the role of tropical forests as carbon sinks without addressing the more pertinent and broader issues of greenhouse gas emission by industrial countries, would not be just and equitable. In conclusion, the many and well-documented initiatives expressing concern on tropical forests indicate that the concern is well founded but whether these can be translated into actions, which ultimately result in the sustainable use of tropical forests, remains.

Non-Governmental Organisations (NGOs)

One of the key features of the increasing awareness of tropical forests has been the development and role of NGOs. There are numerous NGOs in the world but NGOs in environment and forestry are a fairly recent development. One of the oldest NGOs in the world however, is the International Union of Forestry Research Organizations (IUFRO). IUFRO is a network of research scientists in forestry and active in promoting research collaboration amongst scientists. Other NGOs include societies or associations such as the Commonwealth Forestry Association formed in 1921, the International Union of Societies of Foresters (IUSF) formed in 1969 and the International Society of Tropical Forestry (ISTF). These societies play an important role in enhancing the profession of forestry and promoting forestry among the public.

At the international level are two very well established and well funded NGOs. They are the World Conservation Union (IUCN) and the World Wide Fund For Nature (WWF), formed in 1948 and 1961 respectively. Both were originally set up with specific purposes. IUCN was formed as the International Union for the Protection of Nature to address issues of nature but has expanded its mandate to cover conservation and is now called the World Conservation Union, encompassing environmental issues as well. WWF, on the other hand, was first formed as the World Wildlife Fund but has changed to World Wide Fund For Nature and expanded its mandate to cover nature while retaining its acronym WWF. Both these actions of expansion in mandates, indicate a greater concern on a broader spectrum of issues and the desire to respond to demands of the citizenry and priorities of funding by donor institutions.

The greatest development in NGOs has been in public NGOs which are active in environment and forestry. One of the most active international NGOs is Greenpeace, formed in 1971. While this NGO addresses global environmental issues such as whaling and human welfare, it is also quite active in forestry matters, particularly regarding forest dwellers. Another NGO, Friends of the Earth (FOE) also formed in 1971, addresses wide ranging issues of nature and environment and has been very active in forestry issues. Both Greenpeace and FOE have national and regional branches. They are generally known as citizen action groups, comprising concerned citizens who are active in community issues and environmental education.

The Directory of Environmental NGOs in the Asia Pacific Region (1987) lists 330 organizations in 17 countries. India has the largest number of NGOs totalling 86, Australia has 54 and the Philippines, 35. Malaysia has 12 environmental NGOs. These NGOs have either broad mandates which include the environment or nature or have a specific focus such as animals or birds or trees. Membership can range from thousands to limited or restricted membership. Some are serious academic, study or research groups while others are more militant and extremist. However, no matter how they carry out their mandates, NGOs are continuing to gain strength, accompanied with support from the public. They are a force to be reckoned with and cannot be ignored; they need to be managed. In some countries, governments are influenced by NGOs and unilateral decisions are made without the consideration of all views. A case in point is the action undertaken by some countries to stop the import and use of tropical timbers and to recommend the use of non-wood substitutes.

However, while NGOs do play an important role in increasing public awareness and public concern, the public must be wary of irresponsible organizations that carry out activities which are extreme and heavily biased. Such groups often fan public sentiments for their own benefits which may not exactly be in consonance with the organizational goals and objectives. The public should not be gullible and willing to accept everything they are told. However, they need to be informed and educated about the truth. They should be allowed to make decisions without being pressured or misguided in any way. As most of these NGOs are funded by voluntary contributions from the public, they are entitled to ensure that their funds are indeed used for good intentions and purposes.

Measure of awareness: a Malaysian example

In order to measure public awareness of the environment and forestry in Malaysia, a review was made of articles and news items on forestry over the last few years, which have appeared in local newspapers during the past few years. Originally it was proposed that all the major newspapers in Malaysia from the period of 1972 to 1990 be examined. However, examining every issue within the limited time was found to be impractical. Therefore a selection had to be made. Articles and news items according to author, tone and coverage of the article and location of the article in the paper were identified and analyzed. It appeared that there was a definite increase in the number of articles from 1972 to 1990, culminating in 1987. While only four articles were published in 1972, this number increased to a maximum of 359 in 1987. Although the number of articles dropped in 1989 and 1990, it was still considerably higher than the 1980 figure. It is also interesting to note that the highest number of contributions came from the public, which accounted for nearly one-third of the articles in 1987, the year that the NGOs were quite active. Politicians and government officials were also quite active in writing or talking to the press. Students however, were notable bij there absence! An analysis of the tone of the letters/articles, reveals that 59% were supportive of tropical forests. This was rather surprising! From the remainder, only about 9% were critical, 14% were complaints and the remaining 18% were neutral. The low number of critical articles was rather surprising and could be an indicator of the general state of forestry in Malaysia. These articles were mainly feature articles followed by letters to the press being a far second. Only once in 1984 did forestry reach the headlines of the local newspaper.

Table 1. Articles published in major Malaysian newspapers by categories.

Year (total)	Author				Tone of article							
	Pol.	NGO	Govt. officer	Public	Critical	Supp.	Complaint	Neutral	Headlines	Front P&	Feature	Letters
1972												
4	-	3	1			4						
1976												
33	3	3	18	9		26	2	4		1	2	
1980												
69	39	11	11	9	6	50	5	8			1	
1984												
271	79	57	79	54	30	158	42	39	1		23	1
1987												
359	77	58	88	129	32	165	83	76			21	12
1989												
160	30	26	52	38	17	108	7	21			10	4
1990												
117	24	10	44	38	8	76	2	29			10	-

Pol. - Politician Supp. - Supportive

This analysis (Table 1) is interesting as it gives an indication of the extent of support from the mass media. Since Malaysia has a high percentage of literacy, numbers of articles appearing in the local press, can be considered as a fair indicator of the state of awareness of forestry in the country.

Conclusion

The concern for the environment, nature and forests, especially tropical forests, has grown significantly over the past few years, so much so that The international TIMES named planet Earth as Man of the Year in 1988. The health of planet Earth is our common responsibility. While the tropical forest issue is an important one, there are other, equally if not more important issues to be addressed, which have a much greater impact on our planet Earth. These issues are intricately linked to each other and need to be addressed collectively and not in isolation. Any action must be based upon the universal principle of justice, equity and sovereignty for all nations. Developed countries must prove through concrete actions, that they are taking up the environmental issues seriously and are committed to undertake unpopular and difficult decisions. The principle of "polluters pay" must apply at all levels, be it local or international. We have a shared but an equitable global responsibility.

The responsibility lies not just with our leaders but with each and everyone of us. This last decade of the 20th Century offers us a historic opportunity for action which we must not miss. Global environmental trends pose an urgent threat to life itself while the waning cold war lifts a heavy psychological and economic responsibility from governments. Thus, this new found freedom must be directed to address this certain threat, which is often invisible to the individual.

Countries within the tropics are developing, some of which are truly poor, laden with burdens of large populations and economic debt. Developing countries cannot afford to preserve their tropical forests as global heritage or carbon sink unless developed countries are willing to contribute towards that objective. At the same time developed countries must address their own economic life styles and be willing to reduce their heavy per capita consumption of energy, natural resources and ecological services. The current environmental challenge rests equally upon the beliefs and actions of individuals, institutions, governments and upon international cooperation. To quote the Langkawi Declaration, adopted by the 1989 Meeting of Heads of Governments of the Commonwealth in Malaysia which represents a quarter of the world's population:

> "The success of global and national environmental programmes requires mutually reinforcing strategies and the participation and commitment of all levels of society - governments, individuals and organisations, industry and the scientific community"

The world awaits UNCED 1992, when the challenge of shared leadership will address these urgent problems. It will put to test the courage and willingness of all nations to commit themselves to saving Mother Earth for future generations. We should all pray that the conference will make the correct decisions.

Our environment, a growing concern

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Introduction

The environment, a growing concern is the theme of this paper and I will restrict myself mainly to the situation in the Netherlands. I will discuss the role of the government, and notably that of the Ministry of Agriculture, Nature Management and Fisheries in the care of the environment.

In a growing economy, the quality of nature and the environment is inevitably a matter of some concern. We can safely say that the environment has become a matter of growing concern and that it will become a major political issue in the decades to come.

Biologists had been sending out warning signals at an early stage. Rachel Carson's "Silent Spring" warned us about the state of the environment way back in 1963 and urged us to be aware of our individual responsibility and to do something about it. It was quite clear in its message that we had to devolve responsibilities to our governments. It cannot be helped: governments will have to do more.

Moved by public demand the government has responded to these issues with the Pesticides Act, the Waste Substances Act, and measures regarding fertilizers and animal manure. These policies illustrate the change in attitude towards nature and the environment. Not long ago the care of the environment was a marginal issue, not very different from other issues discussed.

This changed abruptly in the early 1980s. A number of pollution scandals, serious cases of soil pollution and the concept of acid rain were brought to notice, placing the quality of the environment at the centre of public attention.
The effect of acid rain damaging the lakes in Scandinavia, the trees in the Netherlands, but especially in Germany, Sweden and Norway is an issue that keeps cropping up in the papers and in current affairs programmes on radio and television. The seriousness of the situation has only slowly dawned on us. What is more, the different kinds of damage have a cumulative effect. It is not only the acid precipitation and the eutrophication of natural environments, it is also the desiccation of landscapes, the deterioration of water quality and last but not least the threat of climatic changes. All this has an impact on the health and chances of survival of our forests. The Ministry of Agriculture, Nature Management and Fisheries conducts an annual forest health survey to monitor the effects of air pollution and other stress factors on our trees. In spite of the Ministry's policy on acidification abatement these health surveys show that our trees are in a critical condition:

52% are healthy;
29% are less healthy;
15% are in poor health;
4% are unhealthy.

If we, as does public opinion, take these forest health figures as a measure of environmental health and we find that only half of our trees are classified as healthy, it will be clear that conditions are serious and urgent restorative measures need to be taken by policy-makers and citizens. The state of the environment has evolved from being a minor matter to a matter of growing concern which has brought us to the theme of this paper.

The growing concern

The different kinds of damage inflicted on the environment have an enormous impact on our society and on our way of life. How these effects are linked is not always clear: it is often quite difficult to pinpoint the exact source of air pollution, for instance. More often than not, it is the effect of a number of sources: industrial emissions for instance, motorised traffic, domestic and industrial energy consumption and acid deposition from intensive livestock production, for instance. Similarly, the reasons for desiccation of the landscape and the deterioration of water quality are many, including the large-scale improved drainage techniques for the benefit of agriculture and the increased industrial and domestic water consumption.

Getting to the source of these problems and looking for preventive solutions is far from simple. Sometimes we can do no more than compensate for the negative effects. These problems demand resourcefulness and administrative and managerial skill. It is not always possible for the government to avoid unpopular measures. There will undoubtedly be clashes of interest. It is the task of the government to minimize these risks.

It is a good thing that the Dutch government is willing to take this up. The government endorses the sustainability principle outlined in "Our Common Future", the report of the World Commission on Environment and Development and laid down as the government standpoint on Brundtland which was adopted earlier this year.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The standpoint has its consequences for the government's national policy but also for the policy of the Netherlands in the international context. I will return to this latter aspect when talking about the tropical rain forest.

The Ministry of Agriculture, Nature Management and Fisheries has always considered the protection of forests and nature areas to be of paramount importance. This is illustrated by the Forestry Act, the Estates Act, the Town and Country Planning Act. In addition, from 1900 onward, the government has been buying more and more land in order to manage and thus safeguard areas of natural value. Education and research are also promoted to provide professional management and extension.

As to forestry and nature areas, we have not yet achieved what we set out to do, however. With present-day developments, the forestry and nature area policies and the general environmental policy begin to overlap. And then there are the developments in other sectors. In the course of the 1980s there has been a spate of laws, amendments and regulations which at present function as direct guidelines or have a direct effect on forests and nature, such as:

- The Long-Term Forestry Plan.
- The Nature Policy Plan.
- The National Environmental Policy Plan.
- The Third Policy Document on Water Management.
- The Fourth Policy Document on Physical Planning.

The guiding principle of all these policy documents is the concept of sustainability. It also has its effect in the area of Traffic and Transportation, Housing, and Industry. The government aims to restrict mobility and motor traffic, it wants to promote energy-saving building and production methods, to encourage the recycling of raw materials and so on. In this respect the Agricultural Structure Memorandum is a good example, the aim of which is to promote sustainable farming. The policy instrument of land development is further refined to realise the environmental objectives outlined in the Memorandum. In its fight against manure surpluses, the Ministry of Agriculture, Nature Management and Fisheries has recently taken measures which are not always popular with farmers, yet are indispensable to clean up the environment. For this reason "Nature Management" was added to the name of the Ministry of Agriculture and Fisheries some years ago. The Ministry is responsible for the sustainable quality of the rural area in the economic as well as the ecological sense.

The general public has become more aware of the environment and the government has outlined its environmental policies. This may sound promising. Yet it is not enough. We still have to go a long way before we have achieved our objectives. We are just beginning to comprehend the scale of the problem: the extent of the damage done to the environment. There is still a lot of work ahead of us.

I am pleased therefore that events such as this international forestry students symposium, may spark the first enthusiasm in students to commit themselves to the environmental cause and keep at it. As I have said earlier, without the administrative and managerial skill of the government we cannot do much to protect the environment, forests and nature. An additional problem is that when the environment is involved several policy areas overlap. For the forester this means that apart from his traditional training in the planting and tending of forests he has to take in other elements as well: elements such as the understanding of managerial processes which go beyond the discipline of forestry as such. He has to learn to make these his own.

Relationships between forestry and other areas

Forestry always has links with various other areas too:

- Forestry and climatic change.
The Netherlands may have the money to buy all the wood it needs on the world market, but a measure of self-sufficiency in silviculture remains important to avoid putting too much strain on wood resources in other parts of the world, notably on the tropical rain forest. The establishing of forests in the Netherlands coupled to rotations with maximum levels of biomass, contributes to climatic balance. The idea is to collect the largest possible quantity of CO_2 from the atmosphere and to lock it up for as long as possible. For this same reason the use of wood rather than other raw materials which consume energy and require combustion is encouraged.

- Forestry and recreation.
Forests have a great amenity value in an industrialised and urbanised society such as ours. A landscape ornamented with forests and landscape elements is considered to be an important ingredient of the quality of life. Wooded areas in the Netherlands with amenity value offer great opportunities for the development of tourism. That is why there are links with town planning, landscape planning, several regional developments and forestry.

- Forestry and nature.
Forests are rich in nature values because of the microclimate they create. These nature values can be enhanced by active management or by the absence of human intervention. Dutch productive forests also have a great potential in this area. In our Nature Policy Plan forests form the links in the ecological network that is to be developed and safeguarded nationally. Forests, with their powers of purification and their sustainability, can also function as buffers to the more vulnerable nature areas.

- Forestry and water.
Clean water is becoming a scarcity in our society, it is also becoming more and more expensive. Integrated water management is vital to ensure a sustainable water supply and the conservation of nature values. In nature areas and particularly in water catchment areas forests function as buffers between water supply and the not very expensive maintenance of water quality. The function could be further developed by afforestation.

- Forestry and other land uses.
The manageable and professional forestry that has been developed for our regions is a ready form of sustainable production. It is therefore obvious in all respects that wherever land is taken from agricultural production for reasons of structure policy, forestry is one of the alternatives. Another aspect is also worth mentioning. As long as other land uses are not yet sustainable from an ecological viewpoint, they may be harmful to forests. It is the forester's task to be actively involved in proffering possible solutions, whether then concern a more favourable spatial order or restrictive conditions for other land uses and/or industrial production.

Time and again, the forester needs to know more about other fields besides his own. Know-how and insight are required to pursue an effective policy. The programme for this symposium indicates that the organizers have these key words at heart. This approach holds great appeal for me.

An international context

To conclude here are a few words on forestry in an international context, that is, the tropical rain forest. In 1991 the Government Memorandum on Tropical Rain Forests was accepted by the Second Chamber of Parliament. In my opinion the Memorandum offers a transparent analysis of the reasons why tropical rain forests are among the most threatened ecosystems in the world. The pressure exerted by other land uses, commercial wood production which comes down to deforestation with no concern whatsoever for sustainable management, including the debt difficulties and the role of the West in this matter, all are discussed. Consequently, all we are often left with are severely degraded landscapes of only limited value.

Solutions are sought by the following means:

- lessening the debt burden in relation to protection of the tropical rain forest by national governments;
- aid to developing management systems providing for sustainable management without giving up essential functions and ecological values and wherever possible improving restoration by afforestation;
- enforcing national government authority and social support in the countries concerned, for example by land use planning;
- contributing in an international context to international regulations;
- critically assessing the import of tropical hardwood into the Netherlands and making it subject to conditions for sustainable management in the countries of origin.

The tropical rain forest has a significant function both nationally as well as internationally. Attention is drawn to the economic potential for a country to the long-term conservation of the tropical rain forest. To the Western world the rain forest matters because of its value to nature, its function as genetic pool and its climatic balance. An enormous biomass, and therefore a large quantity of CO_2, is locked in the tropical rain forest. Research is being carried out into possible policy lines in order to tackle the problems adequately. The development and implementation of this policy is a formidable task for foresters.

Land allocation: The Nigerian experience

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Introduction

In Nigeria, the problem of land allocation to the various sectors of the economy is directly influenced by the prevailing land tenure system in the country. The largest land using sector is agriculture and the majority of the rural farmers practise subsistence agriculture. The success of shifting cultivation depends on the fallow period which is directly influenced by population pressure, the land tenure system currently in practice, and the ease with which people obtain land.

There are no reliable data on the proportion of land allocated to the various land using sectors in Nigeria, hence it is not possible to examine trends in land allocation directly. Land tenure is a major factor that influences land availability to the various sectors and has been well studied and documented. In this paper an attempt will be made to examine the land allocation problems in Nigeria by reviewing the various Government policies over the years aimed at improving the existing land tenurial systems.

As most of these policies were expected to rationalize the factors that influence land availability for both public and private projects including agriculture, problems encountered in their implementation and the level of success or failure will be used as indicators of the land allocation experiences in Nigeria. We will attempt to dwell much more on the experience and problems of land allocation for forestry development in Nigeria.

Traditional land tenure

Timmons (1964) defined land tenure as 'the body of rights and relationships between men that have been developed to govern their behaviour in the use and control of land and its resources'. Udo (1990) explained 'that the land tenure system comprises the customary and legalized rights to the use and control over land (and water) which constitutes the most basic resources of man'.

The traditional land tenure system in Nigeria and most West African countries is the communal land tenure system, also referred to as group ownership of land. This has been pointed out by various authors (Elias 1951; Meek 1957). The ownership structure may differ, between communities but the essential feature of the practice is that the land belongs to the group with every individual deriving rights of ownership from the group to which he belongs. Elias (1962) pointed out that 'ownership of land is that of the group and the individual member has mere possession'. Possessing land can be said to be more than sheer physical control by the allottee as he can exclude others from using the land provided he has not committed a breach of any customary rules relating to holdings by group members.

The group may be a family, a village or a group of villages. To be part of the group one has to be either born into the group or absorbed into it. The importance attached to group survival in rural areas is reflected as the group control issues of land allocation to members to raise food crops. This is done in such a way to ensure that each member of the group is able to produce enough food for his immediate family. If a member is unable to do this, probably because of poor soils, the group, or some members of the group would provide alternative land. The group maintains a firm control over its land and its members such that no member may of his/her own accord, accept, absorb or accommodate tenants and strangers on the group land, without prior approval of the group.

In Nigeria, it is customary to recognise the right of anyone who plants a crop to harvest his crops. This situation does not extend to some other crops, like wild oil palm trees, *Parkia biglobosa*, shea butter tree, etc., which are communally owned. This means that if any of these trees exist on a member's field, he has no exclusive right over them as any other member of the group can harvest the fruits at maturity.

Customary tenancy exists especially in the southern states. A customary tenant is one who has been granted clearly defined rights to farm or fish in a given area of land belonging to another person in return for tributes. The tenant only had a right of occupation and his interest is inheritable by his children, who must also seek the approval and consent of the landlord.

The comunnal tenure system was in existence in virtually all the northern parts of Nigeria, before the invasion of the Fulanis and the eventual adoption of the Islamic land laws in all the areas conquered by them. Under the Islamic land laws, the land does not belong to anybody, hence all have equal access to the use of land.

The colonial land tenure system

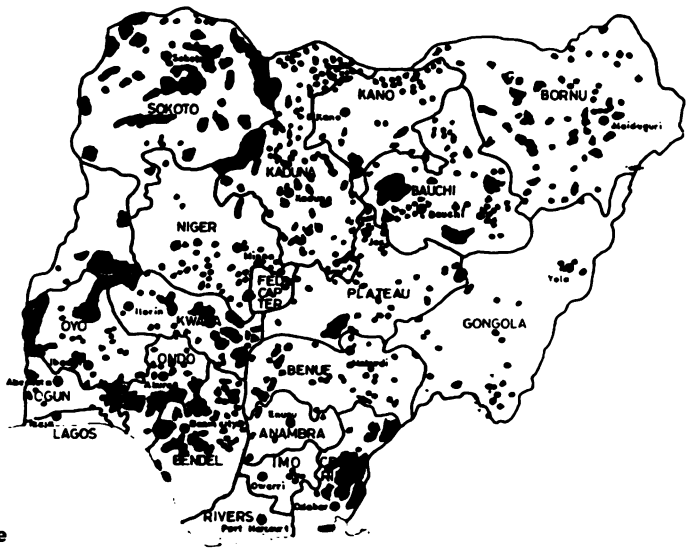
During the colonial period in Nigeria, there was no formal land law in the southern parts of Nigeria. Lands in this part of the country were still administered under customary tenure. There were no tribal lands under the control of a central tribal authority, even though each ethnic group occupied a contiguous territory (Udo, 1990). The situation was not the same in the northern states, probably due to presence of the British who had conquered the area by defeating the Fulanis.

The first land legislation enacted in the protectorate of Northern Nigeria was The Land Proclamation No. 8 of 1900, which merely stated that no person other than natives could acquire interest on the land. It also declared, that all lands "inherited" by the crown from the Royal Niger Company was classified as public land. By 1902 however, following the defeat of the Fulani rulers by the British, in parts of the Northern States, the British Colonial Administration of Lugard declared that all 'rights to land which the Fulani took by conquest from the people' were henceforth vested in the British monarch and his descendants (Lugard, 1965).

The Land and Native Rights proclamation No. 9 and the Land and Native Rights ordinance No. 1 of 1916 were other attempts at modifying the land tenure systems in practice in the Northern states. These series of ordinances clearly indicated the complete take-over of land by the Colonial governments in the area, by initiating and prohibiting the transfer of land. These laws actually succeeded in ensuring the traditional security of tenure which the people enjoyed in the area, before the advent of the Islamic era. Early in the 20th century the Colonial government introduced the idea of individual ownership of land in the cities (Lagos especially).

Prior to the advent of the British colonial rule in Nigeria, there were no forest reserves, except patches of lands preserved by the people for religious purposes. The new tenurial concept of forest reservation was thus introduced by the imperialists. The basic objective of this was to halt forest destruction and obtain title to forest lands by various strategies in different communities, which led to the existence of six variants of forest tenure in Nigeria (Adeyoju, 1979; 1984). These include state forests / forest reserves, communal forests, protection forests, protected forests, protected forest species and private forests (Adeyoju, 1976).

The creation of most of the existing forest reserves was carried out by ordinances and Government proclamation. The Forestry Proclamation of 1901 empowered the High Commission to constitute as forest reserves, any vast or forest lands at the disposal of the government. The implication of this was, that constitution of forest reserves committed to recognize some vital economic and soil elements, such as land capability classification for agricultural production. The outcome of implementing this proclamation, following the enactment of the Forestry ordinance of 1908, was the creation of reserves that displaced many farming communities. For example, a substantial portion of land in the Benin division and the Calabar area were put under government reserves. The situation is still reflected in the Nigerian modern state, as by 1900 the bulk of land under forest reservation today, had been constituted (Figure 1 and Table 1). However, as the former Nigerian nation state was characterized by powerful Obas, and "Kings", almost all the constituted G< vernment forest reserves were handed over to the local authorities. Between 1934 and 1941, these reserves were proclaimed native authority reserves.



Scale

State Capitals ● Boundaries International ▬ Boundaries State — Forest Reserve Overlay
Note: All boundaries are approximate

Figure 1. Forest reserve map of Nigeria.

Table 1. Distribution of permanent and reserved forests in Nigeria (Source: Skoup & Co, Ltd., 1986)

	State	Total land area km²	Area of forest within state in km²	Forest reserve as percentage of land area
1.	Anambra	17078.13	355.86	2.08
2.	Bauchi	65487.35	8243.75	12.59
3.	Bendel	38882.84	5729.13	14.73
4.	Benue	45528.17	1765.00	3.88
5.	Borno	119132.14	7380.35	5.20
6.	Cross river	27214.15	6419.35	23.59
7.	Gongola	94528.54	2716.25	2.87
8.	Imo	11534.42	91.07	0.79
9.	Kaduna	69392.85	8960.70	12.91
10.	Kano	43743.94	2077.08	4.75
11.	Kwara	60.113.08	9189.35	15.29
12.	Lagos	3514.16	26.57	0.76
13.	Niger	67286.58	3529.16	5.24
14.	Ogun	17179.69	2731.54	15.90
15.	Ondo	200070.30	3298.03	16.43
16.	Oyo	36892.29	6822.77	18.49
17.	Plateau	55291.52	4025.31	7.28
18.	Rivers	17687.51	241.76	1.37
19.	Sokoto	91960.06	20095.03	21.85
20.	Fed. Capital Territory, Abuja	6537.61	246.91	3.77
	Total	909055.33	93944.97	10.33

Current land use policy in Nigeria

On March 29th 1978, the Federal Military Government of Nigeria promulgated the Land Use Decree which was later incorporated into the nation's constitution, in September of that same year. The provision of this Decree remains up to date, the most recent government pronouncement on land use and allocation in Nigeria. Earlier in this paper, we examined the land tenure arrangement in Nigeria, which we said was generally communal. There had been much criticism against the existing traditional tenurial system, especially as it affects agricultural and rural development policies of Government. The FAO report entitled "Agricultural Development in Nigeria 1965-1980", made the following observations and recommendations in the chapter dealing with land tenure and related social problems:

- that the elaboration of policy on land tenure was a matter of increasing urgency;
- that it would take time to work out satisfactory policy lines which would be acceptable to all communities within the states, and that it would take even longer to publicise the Government's ideas on the subject sufficiently to enable new proposals to be implemented without friction;
- that a national commission for land policy consisting of representatives from all the states be established at an early date, to advise the Government on the promulgation of a land policy suitable for the needs of agricultural development, and also on the details of how the new policy would be implemented;
- that the legitimate aspirations of the people who were short of land, could only be satisfied by inter-regional cooperation in settling them in areas which were underpopulated (FAO, 1966; 336-8).

The difficulties of acquiring land by the Government for development have also been stated, despite the existence of a law that empowers the Government to compulsorily acquire land for public use. According to Udo (1990), the impact of this acquisition policy has been minimal and highly spatially restrictive. Land constraints were cited in the third National Plan 1975-1980 as having caused problems in the implementation of some public and private development projects. The Government found it difficult to pay compensation to land owners in view of the high costs, especially in the urban areas.

The uneven distribution of the nation's population and of the natural resources which are exploited by the Government, are some of the problems that have led to uneven pressure on land resources. In effect, in some parts of the country, people had access to unlimited tracts of land for agricultural purposes, in other areas the per capita land available to the subsistence farmers was reduced to such a drastic level, that the agricultural production was hardly sufficient for subsistence. Consequently, the adversely affected communities resorted to migration, either to work as farm labourers or as tenant farmers, or move to the urban centres to search for paid jobs (Udo, 1975).

Provisions of the 1978 land use decree

The land use decree vested all lands in each state in the Governor of the state, who is expected to hold the land in trust and administer it for the use and common benefit of all Nigerians. The second section of the general provision directs that for each state, all lands in urban areas shall be under the control and management of the Governor, while all other land shall be under the control and management of the local Government of the area in which the land is located. There is also the provision for each state and local Government to establish a Land Use and Allocation Committee and the Land Allocation Advisory Committee respectively. The roles of these committees were advisory in nature, especially to the Chief Executive on land matters in their area of jurisdiction.

The third provision states, that only the Governor may declare parts of the territory or the state in which he governs, to be an Urban Area by an order published in the Gazette. The Governor is empowered by law to grant the statutory right of occupancy, which shall be for a definite term, to any person for all purposes and rights of access to such land. He also has power to demand rental for granted land to any person, the value of which he can revise from time to time, as may be specified in the certificate of occupancy. Such rents may be waived wholly or partially, as the Governor deems proper.

A statutory right of occupancy, once granted, extinguishes all existing rights to the use of the land in question. The local Government has power over land in rural areas only, and may grant customary rights of occupancy for the use of land for agricultural, residential and other purposes. Except with the consent of the Governor, no single customary right of occupancy may exceed 500 hectares if granted for agricultural purposes, or 5,000 hectares if granted for grazing purpose. A local Government also has power, like the Governor, to acquire any land within its area of jurisdiction for public purposes by revoking any customary rights of occupancy on any such lands, subject however to the following exceptions:

- lands within an area declared to be an urban area;
- land which is the subject of a statutory right of occupancy;
- land already compulsorily acquired by the Federal or State Government; and
- land which is the subject of any laws relating to minerals and mineral oils.

Acquired lands are subject to the payment of just compensation for the value of their owners' unexhausted improvement on the land at the date of revocation, but not for the market value of the land itself.

The provisions of this decree are too exhaustive to be enumerated here. The implication of this decree on current land allocation issues in Nigeria can be examined, so that its impact on the major land using sectors can be evaluated.

Socio-economic implication of current land use/allocation policies

Though attractive, the land reform in Nigeria as contained in the numerous provisions of the land use decree, has not been effectively implemented due to several reasons. Tai (1974) has said that the extent (and success) of implementation of a land reform programme varies with the degree of political commitment of the ruling elite. According to him, a country cannot effectively implement its land reform programme without strong political commitments, even if some of the other relevant factors are favourable. Other factors outlined by him include:

- administrative competence and financial capacity of government;
- the presence or absence of political stability in the country;
- the extent of landlord resistance; and
- the awareness of the peasantry.

The ineffectiveness of the Nigeria Land Use Decree has been attributed to the nonchalant attitude of government officials, charged with its administration and implementation. According to Udo (1990), this is a reflection of the degree of commitment or non-commitment of the ruling elite. Another clear factor was, that of the unstable political situation, as illustrated by the frequent changes in leadership. The degree of commitment to the provisions of the land reform was again found to differ between the various leaders that came to power.

In effect, the social implication of the land use policy is far more serious after, than before the decree. While the Government has successfully used the instrument of compulsory acquisition of land "for public use" at all levels, the land owners have increasingly exploited the people, especially in the southern states of the country. It is noteworthy, that the old land tenure in practice in the rural areas has remained unchanged, and the attempt to bring about a redistribution of land through land consolidation has not worked.

The effect of this situation in the socio-economic life of the rural dwellers are numerous and include:

- Reduction in farm size due to continuous fragmentation of holdings. The situation seems to have worsened with the massive retrenchment of workers in urban areas, which have led to an increased pressure on the available farm lands in the rural areas of the South.

- Reduction in fallow period; shifting cultivation is the traditional farming practice of the Nigerian rural dwellers, whose success depends largely on the length of the fallow period allowing for soil nutrient replenishment. The reduction in the fallow period adversely affects food production and farm income to the farmers, and hence reduction in living standards.
- Soil degradation and erosion are now a common occurrence in the southern states.

In the northern states however, the situation is a little different for two major reasons:

- The land use decree was fashioned in accordance with the prevailing land laws previously in existence in the area.
- The land in the area was abundant because of the low population density.

The provision of the decree did not contain clauses, that could motivate southerners to move up north for farming purposes. This led to inadequate domestic food production to feed the population.

Land use policy and forestry

With the promulgation of the Land Use Decree, most Nigerian foresters felt that the time had come to achieve the 20 percent reservation target set by the Colonial Administration. According to Adeyoju (1979), the decree implies that all lands have been nationalised, and that the forest services now have a unique opportunity to not only make up for the substantial losses as a result of the "dereservation spree" of the last two decades, but also to extend the forest enterprise into new areas. Accordingly, the high rate of dereservation became one of the major problems to confront the Nigeria forest estate. The rate increased so alarmingly that in 1989, the Presidency had to issue an order, prohibiting all state Governments from dereserving any portion of the existing forest reserves in the country.

In some states, a few legally constituted forest reserves have been lost to agriculture or are in danger of being lost to other forms of land use. In one state, for example, a Governmental order was issued to dereserve all forest within a 16 km radius of urban centres, with the result that about 223.01 km^2 of forest reserve was dereserved (Skoup & Co., 1986). The extent of recent dereservation/encroachment on forest estates in some states, where information was available as of 1986, is presented in Table 2. The tendency towards dereservation is greater in states of high population density due to pressure of agriculture, grazing, ranching and urban development.

Table 2. Extent of forest dereservation/encroachment (Source: Skoup & Co. Ltd., 1986).

State	Area affected (km^2)
Bauchi	223.01
Bendel	527.50
Borno	496.32
Kaduna	1307.24
Kano	1113.00
Kwara	335.38
Niger	273.84
Ondo	53.44
Oyo	88.44
Plateau	1106.81
Total	5524.48

From the foregoing, one could say that even the land use decree could not help the massive encroachment on the nation's forest estates.

Conclusion

The issue of land allocation in Nigeria is influenced by three major factors. Firstly, the land tenure system practised in the southern parts of the country is the communal or group ownership system, which has been found to be responsible for a variety of problems associated with agricultural and rural development. In the northern states, the communal land ownership system gave way to the system of central control as dictated by the Islamic religion, following the conquest by the Fulanis and the eventual introduction of Islam. Secondly, except in the area of forest reservation, which was accomplished without consultation with the indigenes, the colonial administrators made no formal attempt to intervene in the existing land tenure system in the country. Thirdly, the Land Use Decree, that was promulgated in 1978 (about 18 years after independence), aimed at nationalising land to allow for an easy access to land for development.

We have reviewed the effects of these land allocation policies in Nigeria on agricultural production and the state of forestry, against the background of the size of holding in the rural areas, the length of fallow periods, land degradation and the pressure on existing forest estates. In spite of the Land Use Decree, the overall picture is that of fragmented land holdings with a complex network of ownership, whose provisions are mainly significant in legal transactions involving real estates. As a result, it has been difficult to introduce private forestry, since it is virtually impossible to procure contiguous land holdings of sufficient size to make such a practice possible.

There is a greater need than ever before, for a land use classification which embraces community fallow lands and officially designated forest reserves. A similar exercise in Malaysia had led to the redistribution of the uses of land, such that prime fertile pieces of land under forest reservation were released to the faming community in return for marginal agricultural lands, which were then reforested.

We are certain, that if such a survey is undertaken in Nigeria, it will result in a dramatic increase of land under forest cover. Meanwhile, agroforestry is the only viable means of reversing the current deforestation trend, and a lot of research effort is being devoted to its popularization and effectiveness on land in private ownership.

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Forest resource utilization

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Introduction

I was invited to prepare this paper for the International Forestry Students Symposium in Wageningen. It is quite a special paper, being authentically academic in a period of declining academic freedom and excessively bureaucratic universities. University students of old, chose their teachers freely among those being known and available to them. Traditions like the German Wanderschaft (i.e. a hike from university to university during several years), Anglosaxon tutoring, or Asian searching for a guru, enhanced free student choice, unlike tight curricula organized and judged by civil servants.

What is the connection between such academic affairs and forest resource utilization? The connection is so direct that it may be overlooked. It is however essential to durable and responsible forest resource utilization. The key is the new generation of foresters. Indeed, older generations of foresters do not hold this key. The new generation of foresters alone, hopefully but not self-evidently inspired by their seniors, will or will not determine forestry in the next century. And the choice of teachers is made by them today.

The professional and human capacity needed for this key position is the subject of the present paper. A short review of the realities to be faced by foresters in a strikingly indifferent world, is followed by a contemplation of the nature of forest utilization, leading to a short profile of the kind of forester that presumably would be able to use forest resources wisely.

An indifferent world

There are two prevailing misunderstandings among foresters. First, that universal solutions for wise utilization of forest resources may be reached by imposing some school of thought, e.g. industrial or commodity forestry, social forestry, protection forestry, or nature preservation forestry. Fierce fights are still common among schools and prove that indeed the forestry world has remained very much closed in upon itself.

The second misunderstanding is, that foresters seem to believe that the world cares about their profession and their conflicts. Every school of thought offers to decision-makers what it deems all-important. Some schools endlessly emphasize wood and economy, others the combat against poverty by village forestry, still others biodiversity and forest reserves. Many try to infiltrate fashionable problem fields, e.g. by propagandizing greenhouse effect forestry, acid rain silviculture or biodynamic forest management.

All these foresters are indeed right, no sarcasm intended. Among foresters, the proportion of charlatans certainly is no higher than in other professions. What is more, from the hard-nosed timber forester to the starry-eyed wilderness forester, including the great-hearted social forester, our profession is particularly rich in good, specialized professionals.

Still, why does the world increasingly bypass foresters and ask other professionals to solve forest and land use problems? Why is forest policy nowadays so often made by lawyers, economists, the media, action groups and pure scientists? Why is forestry in many countries reduced to commercial wood growing, and why are other forms of forest resource utilization distributed among services, enterprises and professionals in nature protection, natural resource management, recreation or agriculture?

Fundamentally, the world around us is largely and profoundly indifferent to the paradigms of forestry. The survival of forests is absent from the minds of perhaps as much as 90% of the world population. If the thought once or twice crosses the minds of a minority of human beings, the notion generally has very low priority compared with food, jobs, marriage or fun.

Many foresters therefore emphasize forest products (wood!) and services, presenting forest survival as a mere production factor instead of a basic concern. In their hearts, most consider the forest to be an area of vital human interest. Their public silence about this matter keeps foresters in a rather closed world where colleagues understand each other, but often feeling misunderstood by others. The conflicts among schools "selling" forests in different ways, is then aggravated by conflicts with any forester suspected of lacking solidarity with the unspoken doctrine.

Foresters are by no means the only ones with a secret; take lawyers or medical doctors for instance. However, forestry is the profession needing the most space and time, square km and centuries, against the most unpredictable results, because of the certainty of accumulation of diseases, pests and accidents over the years. Hence, classical forestry practice withdrew to faraway regions with much forest and few humans. This was a true and great success. Since 1820, most European countries tripled their forest area if small, and maintained it if large.

Today, no region is faraway because of new transport technology, no region guarantees low population densities thanks to medical science and migration, and no large forest land use surfaces can be ensured on the long term. Today, few foresters can live secluded lives. Their new success formula inevitably will be to live by their scientific wits. This is also normal in many other professions.

Today's forest resources: unobserved, unstable, unprotected, unloved

The world's general indifference toward forests and forestry has consequences. Too little effort is made to monitor forests, hence too many forest regions remain unobserved and too many forest statistics are mere estimates. Investments for high-quality management are scarce, so forests remain unstable and unprotected against most natural and human impacts. Finally, forests are among the low-priority environments remaining rather unloved compared with cities, parks or farmland. For example, EC forestry subsidies used to be some 10% of those for agriculture, per hectare, and less than 1% of international development funds are used for forestry. Utilization of such an undervalued resource is not easy.

The traditional method of utilization is still valid. Forests may not be observed for their own sake, but they are clients for monitoring standing timber or threatened species. Forests may not be stabilized but anti-erosion or anti-desert greenbelts will. Forests may not be protected as such, but wildlife has friends for its beautiful eyes. Finally, the general public may not love forests like foresters do, but it will love them as wood factories, playgrounds or beautiful landscapes.

Thus forest policy is often confided to or dictated by wood merchants, biological scientists, reporters, land converters or agriculturists. This is no utilization policy of the forest resource, but of a few resources yielded by forests. Realistic foresters can still justify their profession and obtain the means to do their job by letting their clients' mouth water at the thought of some of the products or services. However, no realistic forester should personally have such one sided views, which weaken integral forest resource management. Client's views are small truths, barely significant compared to the forester's whole truth. Again, this situation is common in many professions.

Nothing but the whole truth about forests and society should fill the forester's professional vision. This truth, a hint of which is the expression "multiple-use forest", may be first approached by an analogy.

Compare a forested region to a big city district with different streets. Along each street are various buildings, each with many rooms, from storerooms to museum halls. Each room contains diverse objects. To find one's way, maps are needed at nested scales: of the district, per street, per building and per room respectively. If a client requires a particular object, this can be located on a shop-room map, the shop on a street map and so on.

The very best foresters of 50 years ago could tell exactly where in "their" forest one could find mice, or mushrooms, or rattan palms, or timber trees. They had accurate sets of maps in their heads. For the utilization of a forest, decision-makers or other clients either went into that forest with a forester, or they trusted his knowledge. The basis of this knowledge was life-long experience, scientifically arranged. Many managed forests in the world bear witness to their success.

A forest master-map is of little interest to the world at large, and a trump card in the forester's hand. Foresters should team up with forest ecologists looking beyond oversimplified analyses of populations and biomass of "useful" plants in mathematically decomposed forest ecosystems. Using modern computation gear, such teams today can produce forest maps with an enormous mass of data in an unprecedented grid of nested scales.

Maps made by such a team using powerful computers spanning long periods, will develop into information systems that live longer and cover more features than any individual forester's mind map. The data these systems will increase in value, because of their potention, as the system grows bigger, older and more complex. Moreover, visual expression of data on maps moreover delineates features which could not be seen before. Maps of root systems or light-and-shade patterns on the forest floor are recent examples. The computer, from a mere data processor, has become a tool for observation!

A few decades ago, the human mind could only dream of such powerful information systems. Today's computing tools have eliminated the chores of data processing by hand. Automatic correction and comparison of data files are now feasible and cheap. They require four stages. First, like in today's GISs, map overlays must describe mutually congruent or deviant patterns, also between near geographic scales. The second stage, statistic and analytic, proves and describes correlations, e.g. "patterns of ion concentration are with 99% certitude correlated with root hair density patterns". This stage leaves forest ecosystems mathematically decomposed in pairs or sets of correlated traits, at the same or different map scales.

The third stage is not yet operational, because new techniques are still being developed to organize automated interactions among data files or maps, simulating complex interaction webs among factors and structures. The result would be mathematical recomposition of forest ecosystems. Pending this development, ecosystem recomposition remains "in the hands of the human brain". The fourth stage is the experimental explanation of those few statistical correlations among the millions outlined, e.g. in students' theses, which mean something in the recomposed mind model of the forest.

Nowhere have such complex information systems as yet been built systematically or consistently. However, in China, Germany and Indonesia examples of operational fragments prove that it can be done. To continue developing such systems energetically is worth the effort. They are the operational successors of the forester's intuitive map of a whole forest with its resources and handicaps. They also promise harmony between the client's wishes and the forester's central concern: forest survival. This is not an empty promise, judging by the operational results of the systems under development, e.g., in Kalimantan, Indonesia. Those who hate computerized systems of this kind should realize how much direct and loving experience of a forest is needed to paint such an electronic portrait of a forest.

Forest resource utilization: portrait, puzzle, project

Let us assume the forest user to be the client, the forester as the designer and sometimes also the manager of a project to satisfy the client, and the local forest as the means to do this. Other papers trace the profile of the clients, their forest requirements, and the ways and means to keep them satisfied and not to counteract each others goals. Land allocation ought to be the Wild West with other means, to peacefully paraphrase Bismarck's "war is politics with other means".

The role of the forester as a go-between is something to note. The client, if a farmer, usually designs forest systems himself (agroforestry) and only requires some advice. If the client is urban, his requirements frequently show imperfect knowledge of forests. This client needs guidance and a good forestry design, or he will mine the forest regardless of its properties. There also are anonymous clients. This is often so

for Forest Services, dutifully serving "the People of Treeland". Most often, each of the citizens or groups forming "one people" have options distinct from and/or conflicting with, their neighbours. Clients of forest services are faceless.

It is vain to try and use the concept of "multiple-use forests" to solve the last mentioned conflicts. Let us inspect a forest information system again, with its maps, or just let us use our mind map. There is every reason then to deny that "multiple-use" can include the combination of all conceivable uses, in all forests, for a target group including all citizens with all their options. Forestry is not one single type of land use, but a mosaic of land uses, each with its own utilization pattern of the forest resource.

The portrait of forest resources sketched in an earlier paragraph, makes a great puzzle of forest resource utilization when compared to the above portrait of the users, clients or "target groups". In many cases, clients do not find what they desire in a forest, and in other cases, forests are destroyed by overharvesting what the users want. This puzzle can be solved by carefully considering the scale of the forest for planning and operations.

Serving one target group is a considerable social risk. Creation of a conservation forest makes a small target group happy but causes a coalition of opposing groups, e.g. agriculturists, wood merchants, commercial tourist firms, and all ministries but one. Creation of farmers' forests may unite opposition of enterprises, bureaucrats and sometimes conservationists. This puzzle may be solved by determining the minimum of happy groups needed to make sustainable forest utilization feasible. These groups should combine to form a minimal critical mass, always considering the social scale. A group is more than the sum of its members, and a movement is more than a sum of groups.

A concept to fit the social and the ecological puzzles together to achieve real solutions is nested "multiple-use". A forest region may contain, agricultural estates, a national forest reserve, a timber estate, and villages with agroforests, side by side. The timber estate, for instance, might show a mosaic of uneven aged stands, each with even aged monocultures, various mixed forest stands, and roadside plantations. In one mixed stand, e.g., one may find hardwood trees, conifers, birds, deer, mushrooms, blueberries and other useful plants or animals side by side. Each organism, again side by side, includes useful parts, e.g. fruits, steaks or chunks of wood, and parts that cannot be readily used.

Just like natural hierarchically nested forest ecosystems, described elsewhere, planning and operations should be designed to use products in such a way that cost-benefit ratios, damage and risks are all minimized, whereas fringe benefits and forest survival chances are maximized. To do this, generally a one scale level is optimal for human intervention with the knowledge and technology available at the time of decision. One of today's errors is that too often obsolete technology is taken for granted. This is why some foresters maintain that clearcutting shows the above minima and maxima, and that selective cutting does not. Another error is to consider money only and leave budgets incomplete: there rarely is room for expensive contingencies and there often is blind faith in statistic yield forecasts.

An example of a promising way of using forest resources in some arbitrary forest district would be:

- extract pulpwood by clearcutting (scale: stand mosaic; happy group: industrialists);
- extract quality wood selectively (scale: stand; happy group: artisans, small industries);
- extract fruits from young regeneration patches (scale: patch; happy group: probably farmers, tourists, local children);
- extract mushrooms from roadsides (scale: part of stand; happy group: farmers or tourists);
- leave 10% of the forest for "natural development" (scale: stand mosaic, later silvatic mosaic; happy group: conservationists);
- entry fee for tourists, sell souvenirs and maps (scale: district; happy group: tourists, we hope);
- negotiate tariff for wind protection of neighbouring agricultural fields (scale: forest district; happy group: farmers, ministries).

It is important to split up "the forest" into nested units. Although at first sight these multiple uses are borne by the whole forest district, a second look reveals a well-designed distribution among and even within stands. The impact of tourists takes place at another scale than that of timber-people or

conservationists. All are happy, or so we suppose, and all believe they are served by one forest. in fact, some are served by trees, others by forest patches, others by stands, still others by the whole district. At the more detailed scales this always was practised in traditional agroforestry. At the scale of whole stands and larger, modern forestry applies this reasoning today. The moment has come to combine the two.

Careful use of scale and systems hierarchy in portraits of forests and people is the key to the puzzle of forest resource utilization. Scaling the facts shows single-use and multiple-use to be nonsensical concepts, unless compared at the same scale. However, no hectare of forest equals any other hectare of forest and no human settlement is equal to any other. The potential array of solutions for the design of good, sustainable forest resource use therefore requires specific, tailor-made projects including monitoring motions. Humans cannot create perfection, so there always has to be a monitoring loop of periodical assessments and corrections.

The means for complete and routine establishment of portrait-puzzle-project sequences in forest resource management are operational information systems and technology, plus the capability to sell plans to target groups with all respect due to them, and without expert arrogance. The latter asset cannot be taught at Universities. The establishment of the right kind of information systems and advanced forest technology, e.g. smart tools and bio-compatible chemistry, has not systematically started as yet, but there are promising beginnings.

21st century foresters to use 21st century forest resources

Success stories cannot be repeated. European forestry III, like Rambo III, is liable to attract both little attention and the wrong kind of attention. After several great successes of European forestry in the last two centuries, nothing less than a new kind of World forestry is now required. The European experience is there as a treasure-house of knowledge and insights, but the world has changed so much that these often lack direct relevance for the next century.

This is why some current words have been replaced above by others, e.g. "portrait" for "model". No 21st century forester should take the 20th century forestry concepts for granted. The term "model" was claimed as an exclusive property by so many scientific schools that its meaning is now obscure. Moreover, an artist's portrait is more complex than a calculated scientist's model. Next-century foresters will have to deal with complexity and shed current oversimplifications. This is the only way to master the complex forest utilization patterns needed by densely packed, complex human populations.

Only mastership in handling such complex utilization patterns will motivate decision-makers to consult foresters, and make foresters' decisions masterful. Foresters can only reach such mastership by making forestry whole again. When conceiving the use of any forest whatsoever, let us momentarily forget such items as wood production, wildlife, minor products and, soil protection, but see these details in their context.

The first priority is not how to reach one particular objective. It is, how to weave one objective into the whole forest, with its countless ecological properties, people and utilization impacts. For such weaving, a professional needs big information systems, in which feedback loops link together major and minor forest components, inputs and outputs, in a web of interactions. From such forest portraits, any excess utilization type is clearly seen as its own enemy, like clearcutting stimulating soil acidification.

Working with information systems coupled to observation devices from satellite to rhizoscope (root-observer device) scale is one routine to be mastered by successful 21st century foresters. A second requirement is mastery technology. Technical tools are always to be regarded with a weary eye, because there are so many illusions invading the minds of builders and users. For instance, pesticides, fertilizers and wood extraction machines were borrowed from other rural or urban land users and still many foresters are blinded by illusions about their use.

A new generation of forestry tools should include preprogrammed machines, capable of recognizing tree species, diameter classes, bird songs, chemical plant components or soil properties. Operations can be

parametrized by such recognized forest or organism properties; machines working only and automatically under prescribed conditions. New chemical substances, biodegradable and keying specific non-toxic ecosystem regulation effects in very small dosages are the advanced tools that need to be developed. Machines and chemicals are not bad, their indiscriminate use often is.

If young foresters take forest resource utilization seriously, they must know that they will only be taken seriously if they are superb professionals themselves. Tropical rain forests are the most complex forests known, but industrialized northern societies are also among the most complex that ever existed. Hence, forest resource utilization in the next century will originate from both the tropics and the northern regions. This will strengthen the tropical impact, because it is less risky to simplify tropical forests carefully than to complexify simple forests, northern ones or plantations, to meet the demands of clients. On the contrary, the feasibility of social engineering never has been convincingly proven, so Northern impact on world forestry developments probably will become less powerful. Paraphrasing the botanist E.J.H. Corner, one may say: "Without a tropical orientation, forestry is lost".

Finally, forest resource utilization of whatever kind and at whatever scale will have to become and remain business-like in a modern sense. This means dealing with city people, from bankers to media specialists, for advertising and selling, but not on their terms. The management plans sprouted from a professional, complex forest use design. One of the severe requirements of the young forester will be, that he/she should be able to formulate the essence of a problem and its solution on one piece of paper. Here, the difference with many a 20th century forester is, that the younger ones will not believe the sales talk to be the whole truth, although they respect the client sincerely. Forestry will remain a profession with a secret, but hopefully this secret will be made operational in a way compatible with 21st century conditions, inspiring short problem-and-solution statements.

The profile of a forester able to design and implement responsible forest resource utilization patterns in the next century is: mentally able to deal with high complexity and interdependence, marked by tropical experience, capable of using advanced information and monitoring systems, ready to apply new and refined eco-technology, very communicative and sincerely respectful to society as a whole and the clients in particular. It is for today's students to agree or disagree with this ambitious image, and to choose their education accordingly.

Land allocation: Who is first?

Urban forests: The significance of these forests and the importance of the cooperation between city planners and foresters

URBAN FORESTRY AND FORESTERS

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Introduction

Forests and forest-like vegetation have been an integral part of cities as long as there have been cities. Famous examples are: the Bois de Boulogne, Hyde Park, Central Park and the Zoniënwoud which are all found in or nearby big cities (Paris, London, New York, Brussels), a feature they share in common.

These forests are part of the subject of this paper. Forests or forest-like vegetation in or nearby cities are called urban forests. Urban forestry has only been a recognized discipline within the forestry profession since the early 1970s. From that moment on, much attention has been paid to this field of forestry, especially from foresters in the USA and Canada. Miller (1988) defines urban forests as:

> "The sum of all woody and associated vegetation in and around dense human settlements, ranging from small communities in rural settings to metropolitan regions."

Lok and Mars (1989) state that urban forestry is defined by the extent to which the urban community or structures can influence the decisions made regarding a certain forested area. If one considers this definition as being valid for the North-West of Europe, then the decision making processes in these countries would provide a framework within which all forestry activities in this region would be defined as urban forestry. For example, a small country like the Netherlands is so densely populated that the entire country can easily be classified as urban. What one understands as urban forestry and what does not, offers interesting material for discussion.

Miller (1988), when considering trees in the city, makes a useful distinction between arboriculture and silviculture. In this paper the silvicultural aspect is dealt with, i.e. the aspect of forests or forest-like vegetation. Arboricultural aspects, the planting and care of (individual) trees, are not dealt with in this paper. When looking at urban forests, the question as to what could be regarded as a forest remains a difficult one. A clear judging system should be developed to prescribe the minimum areas for independent functioning forest ecosystems.

In this paper the function of urban forests in the past, present and future is studied. The need for cooperation between planners and foresters is emphasized.

A short history of urban green spaces and forests

For a long time man's attitude towards forests has been a dualistic one of love and hate. Although the forest was "unsafe" and "wild" people depended on it for hunting and for gathering all kinds of forest products. The nobility in the early middle ages recognized the value of the forests. They enjoyed the forest as their private hunting grounds and in times of war the forest served as a kind of economic reserve.

From the 10th century on, the city gained importance. Together with early urbanization the bourgeoisie became an important class in society. They started to clear the forests surrounding their cities to get rid of these "dangerous places". People at that time wanted to manipulate and subjugate nature.

From the beginning of the 15th century and throughout the Renaissance the attitude towards nature changed. The (rich) people regarded the countryside as arcadic; as a kind of paradise. People like Rousseau, for instance, contributed to this image. The bourgeoisie began to establish estates, to enjoy nature and gain prestige, often situated at the outskirts of the city. The city walls were used for recreational purposes, the well-to-do went for walks there. The walls were planted with trees and shrubs for recreation and aesthetic appeal. The less well-to-do citizens were provided with newly planted forests just outside the city - like the Haarlemmer Hout in the Netherlands - but these forests were primarily used for practical reasons (wood, shelter); recreation was a secondary aspect. In other countries parks owned by the nobility were opened for the public, such as Hyde Park in London as early as 1635 (van Rooijen, 1984).

An important reason for establishing new parks is enhancing the respectability of the city. Beautifying principles were added in the new parks, often in the Romantic style, which meant a lot of green alternated with monuments and monumental buildings.

The ideas of Haussmann were practised all over Europe from the middle of the 19th century until the beginning of the 20th century. Villa-parks were created and the city was surrounded by a impressive avenue (as can be seen in Vienna and Paris). The city wall had lost its importance as the most important recreational facility. The end of the 19th century also brought a growing interest in the well-being of the working class. More public green space was created and Ebenezer Howard came up with the idea of the garden city (van Rooijen, 1984; Miller, 1988), a small and independent part of the city surrounded by public parks and gardens and with low-budget housing.

The demand for recreational facilities was no longer just a question of the more beaux riches. The Industrial Revolution brought with it the deterioration of the healthy living environment in the city. More urban green space was needed. During the first decades of the 20th century, large parks were created in the outskirts of the city, for example, the Amsterdamse Bos established in 1934 (Balk, 1978), offering various possibilities for recreation, but became a part of the city due to the continuing urbanization. A significant part of these parks consisted of forest-like vegetation.

After World War II the demand for recreational facilities grew even bigger, while the amount of spare time and mobility increased. More artificial landscapes for recreation were developed including places for swimming, playing, etc. But many people began to dislike the "imposed" and "clinical" nature of the parks and other recreational facilities. They wanted a more natural, more spontaneous and less human-shaped landscape, i.e. a more "natural" forest. Urbanization meant that many forests in the so-called green belt, the green area surrounding the city, were cleared, for instance, in the region of Paris 15,000 ha of forests were cleared within one century (INRA, 1979).

The shift in demands towards a wider range of recreational possibilities such as a more active, extensive recreation (cycling and hiking) in a more or less natural environment requires new efforts from city and country planners in cooperation with (as we will see later) foresters.

Another important development is the idea of the so-called Compact City (van Rooijen, 1984), in which new buildings are situated within the real city frontiers (not at the outskirts). The result will be that artificial green zones will disappear and the urban green belt will be enlarged and improved.

Functions of urban forests

In the previous paragraph we saw that recreation played an important role in the development in urban forests. But, the offer of recreational facilities is not the only merit of urban forests. The ecological importance should not be left unnoticed. Urban forests influence the so-called urban ecology (urban meso-climate). What would a city be without trees or forests? Only human structures of concrete and steel, with the wind blowing vigorously and the sunlight reflecting mercilessly from the buildings. Higher temperatures and lower humidity levels will be noticed within cities. The noise of the traffic during the rush hour would not be filtered before it reaches our ears. Germs and pollution would poison the air more than ever (INRA, 1979; Miller, 1988). Forest-like vegetation and individual trees act as a buffer against these problems. Urban forests also play an important role in watershed management.

As already mentioned, the need for recreation is an important one, but people have other needs that are essential yet may be not as obvious and tangible as the need for recreation. The trees in the park or the forest outside the city reminds us of the changing seasons. Trees are a symbol of nature and life in the often harsh city environment. They have an informative and symbolic function (Coeterier 1990). Part of the information is the increasing awareness of the important role that nature still plays in our industrialized world. Education will help people to realize and appreciate the important role that urban forests play in their life.

These are only a few of the functions that urban forests have. One could also think of the production function for timber as can be seen in German urban forests. All these different functions show how important urban forests are. They also indicate the problems that the planners and foresters will encounter when thinking about the functions that urban forests (new and old ones) must fulfil in the future. Which function should be regarded as the most important one? How can the different functions be realized at the same time? The aspect of recreation only demonstrates the problem: some people prefer an intensive form of recreation like playing soccer in the park, others prefer a more extensive form of recreation like walking in the woods in solitude. How can these very different kinds of recreational demands be combined in a certain area?

The need for urban forests

Urban forests are very important in providing a livable urban environment for city dwellers and their function will become even more important in future. People often move out of the city to live in a quieter area (like the rural area). The rural areas will become (and often are) overcrowded. To entice the people back to the city and to relieve the countryside from an invasion of all kinds of buildings and infrastructural works, it is necessary to create an attractive living environment in the city and use the urban greenbelt as a buffer to stop city expansion towards the countryside (in urban peripheries).

In the Netherlands such plans have been worked out. The so-called Green Heart of the Randstad, the highly urbanized western part of the Netherlands, an area including large cities such as Rotterdam, Amsterdam and Utrecht, must be kept "empty". In the plan called "Randstad Green Structure" new forests, especially close to the cities are planned. Recreation is to be concentrated here. Where new urban forests are planned however, other forms of land use must disappear. These new forests must not disturb the landscape, they must be adapted to it. Together with the question as to which functions must be served, these are all problems foresters and city and country planners have to deal with.

In many cities of the Third World the population growth, and thus the urbanization, still continues. Mexico City is such an example. The green space is filled and the space that is still left is overloaded and rapidly loses vitality and quality. Measures must be taken to conserve the existing green space and to create new urban green space in order to stop ecological degradation of the region (Contreras, 1983). Something that must not be forgotten is that the micro-climate of a lot of big cities all over the world is spoilt by smog.

Questions to be raised are as follows: How can new green spaces, especially forests, be realized? Where must they be planted? Some planners want the city to become "city" again and fill the artificial green spaces with new buildings, the idea of the Compact City (van Rooijen, 1984). In this case the urban forests should be concentrated in the urban green belt. Connecting different forests in this region with corridors i.e. Minneapolis (Vala, 1983) or even connecting the greenbelts of different cities (Randstad Green Structure) could create an interesting structure of urban forests. Others want to have more green zones in the city itself, so more forests inside the city boundaries. What will be the best in a specific situation?

The need to cooperate

More urban forests are needed. But this is not a case just for the city planners or foresters. When there is a plan to create a new forest on a piece of land, the planner must know that forests are dynamic. The forest may need more space than the piece of ground offers (Reuver 1989). When foresters are involved

in the planning process from the beginning, these kinds of problems can be foreseen. The planning process is not finished when the plan has been prepared. There must be feedback and monitoring to get the desired results.

When a forester is asked to create a new forest near a city, it would be helpful to know beforehand what the other expectations of the forest are. Production will surely not be the main goal. The demands should be analyzed together with planners, sociologists and others.

It would be wise to inform the public from the beginning of the project. Then people will know what is going on and will not be unpleasantly surprised, as has often happened in the past.

If the project is to be a success, not only on the short term, but also in the future cooperation between city and country planners and foresters is a must. Foresters know the problems involved in establishing forests in or nearby cities (soil conditions, required tree species and provenances) and the proper care that should be taken to reach and maintain the desired result. This is also important when one knows that the aim is to create more urban forests against lower costs. How can this be realized? And, furthermore, the wish for more natural forests?

Some points for further discussion

The need for more urban green space and especially more urban forests has been agreed upon. But where should these forests be situated? Inside the city boundaries or in the city green belt? Or even on a different spot? Planting new forests would imply that other forms of land use have to disappear. What are those? When new forests are planted, planners and foresters must find a way to fit the forests into the landscape (not just "fill up the place").

The most important function of (new) urban forests in the future will probably be a recreational one. But the other important functions must not be ignored. How can different functions best be realized at the same time (multiple-use)? What will be the priorities? The desire towards more natural forests is also something to keep in mind. What would be the best way to do this?

Planners must know the consequences of their ideas. Foresters can provide important information about the possibilities and drawbacks of forests. Consequently, foresters will be required to play an important role in urban forestry. Just what the tasks of the "modern" urban forester will be certainly remains to be answered.

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URBAN FORESTRY AND FORESTERS IN FRANCE

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Introduction

The trees in the urban and peripheral urban environment appear in different compositions. They can be isolated trees in the streets or in squares; they can be found in lanes, parks and gardens, in arboretums and of course in forest stands in or nearby towns. All these trees form a kind of plant network: the urban forest. For us the term "urban forest" is therefore the sum total of this entire "green tissue".

In the course of the centuries, the tree has asserted itself in the city, termed the "URBS ecosystem" by Duvignaud. It was primarily a symbol, a sacred thing and a resource providing wood, fruit and shade for the inhabitants and the cattle. In recent times, the tree has become appreciated particularly for its contribution to the quality of life, for embellishing, so improving the urban environment (Holodinsky, 1990). Indeed, since World War II and after the "great period of concrete" with which the housing problem was solved, a yearning for a more pleasant urban environment emerged. At the same time the ecological movement gained a foothold in society. A need for trees made itself felt as early as the 1970s and even more in the 1980s. Even in French law, more notice is taken of taking account of vegetation, especially trees, by the authorities (Thonon, 1982).

Nowadays, the urban forest faces different problems and a variety of constraints, which are not always new and which strongly influence its management.

Influence of history and consequent protection

There are clear traces of human intervention, mainly in the peripheral urban stands and the large domains (Boulogne, Vincennes, Fontainebleau), witnesses of a stirring past: clearings, destruction, reconstruction and reshaping. 'In France peripheral urban forests are among the oldest cultivated and managed forests to satisfy the economical needs of the society. These very old human interventions must be taken into account if one wants to understand the problems that arise in urban forests' (Decourt, 1979). The Bois de Boulogne is a typical example of what these large domains (which are now protected) have endured (Paquet, 1986).

The Bois de Boulogne was named after a chapel built in 1320 by the inhabitants of Menuls lès St Cloud in honour of Notre Dame de Boulogne sur Mer after a pilgrimage there. After a while, the village was given the name of the chapel. The Bois de Boulogne has established by a royal edict in 1479. At the beginning it was a part of the forest of Rouvray that soon became a highly appreciated royal hunting territory. Colbert, under the reign of Louis XIV, made the first management plan for the Bois the Boulogne in order to produce oak for shipbuilding and to help game management by creating straight rides and star-shaped crossings. It then became a place for leisure, especially under Louis XV and the Regency. The Bois was plundered during the revolution. Its destruction was almost complete. Napoléon ordered extensive works to reconstruct it, but after the defeat at Waterloo the allies occupied Paris and the Bois de Boulogne was once again almost completely destroyed. It was then reconstructed during the Restoration. In 1848 it became the property of the French people. Under Napoléon III works were undertaken by Varé and Alphand to restore the Bois. It was again partly destroyed during the war in 1870. Since that date measures were taken to maintain the Bois de Boulogne in a forested state. The present management started in 1929. In 1957, the Bois became a National Heritage ("site classé") and subsequently any modification (except for normal working operations) to the Bois without authorization from the Ministry of the Environment is forbidden. This protective regulation is as a "straight-jacket" to the management, but the situation is not so clear nowadays.

Fontainebleau is also interesting from this point of view: so many administrations are involved in maintenance, preservation of historic buildings, etc. that managing the domain as a whole has become cumbersome.

There is a common structure to be found in these famous domains used by the French kings to relax. They show the trace of history: a castle, surrounded by French and English gardens which in turn are surrounded by gardens, forest parks and forest stands. The further away from the castle the wilder the surroundings become.

History is also apparent in individual trees that were planted, for example, during important events or to celebrate them. City planners, like Haussmann, left their mark which are still visible today: lines of plane trees (*Platanus x hybrida* Brod.), certain gardens, etc.

The historical aspects strongly influence the management of the urban forest, essentially because many types of protection laws are derived from it. But this is not the only aspect the managers have to take into account.

Management of green spaces. The case of Paris

Except for the two outlying and fortunately protected Bois (Bois de Boulogne and Bois de Vincennes) the city of Paris does not have any free space that could function as a green space reserve (Guérin, 1990). The green spaces and plantations of Paris are managed by the D.P.J.E.V. (Department of Parks, Gardens and Green Spaces). It consists of a general administrative service and a technical service that supervises 10 divisions, 8 for the management of the green spaces, one for the management of lanes and one responsible for the tree nursery. So the city of Paris has a specialized service to manage all its green spaces (although, trees in lanes (85,000 trees) and trees in cemeteries have only come under the D.P.J.E.V. since 1986). This task has not been put into the hands of foresters, contrary to what happens in other countries, although they can take part in it: the division of the Bois de Boulogne includes 1 forestry engineer, 2 agents and 6 forest workers among the 312 employees (in 1986). The goals are different from the ones of a "normal" State Forest. The silviculture is not a dynamic one. The treatments are often of a sanitary character. The natural regeneration is eliminated in the forest parks so that they look "clean". Most of the forest parks are therefore aged and present a structure of old high forest under which only a few young trees ("baliveaux") can be found: those that have been damaged during the logging of the old reserves or that are retarded in their growth performance.

Thinning in parks and gardens is systematically neglected because they have a bad reputation by the authorities and the general public. Nevertheless, this process is essential because the planners often plant too densely to compensate for the poor natural regeneration. Without any thinning and with the systematic replacement of each tree cut, as was done some time ago in Paris, the trees suppress each other and eventually die when they are overshadowed. Moreover, the gardens get a bad appearance because they are insufficiently opened up. Flowers, bushes and lawn cannot grow any more. Managers must therefore plan thinnings and execute them. That means that they must be able to explain and convince the general public of its necessity (Guérin, 1990). This brings us to the main constraint and its consequences: the pressure exerted on the management by the public and its representatives and the need for information about the reasons that guide the managers.

The social role of the urban forests

As mentioned above, a need for trees has made itself felt by society since the 1970s. After World War II the relationship between urban population and trees changed. It is no longer seen as necessary to fell trees. Whether as a individual or in more complex structures like lanes, parks or gardens, the tree has an important social role which strongly influences its management.

It became part of the struggle of the importance of biotic and abiotic elements, a natural element in a mineral environment (Services des Espaces Verts de la Ville de La Rochelle, 1990). The individual tree,

in connection with architecture, may be above all a plant relay between us, human beings, and the natural kingdom, the immobile and the living at the same time. It has become the reassuring accomplice of the lonely townsman (Rumelhart, 1990).

The tree is also the "green memory" of the country people who have settled down in or around a city, expressed by the yearning for greenery in the form of an individual plant or in a more organized structure. For example the urban hedge could be considered as an equivalent for the field hedges in the countryside. Second generation city dwellers know where their parents lived only by what they have been told. They have a "green memory" too, but without any image in their minds. Thus a phenomenon of uprooting appears. The urban population wants to find in town a part of what they have left in the countryside. For example someone who used to live in the "Massif Central" likes to find a chestnut-tree (*Castanea sativa*) near his house.

The tree has become an element of compensation. The previous primary needs for building material, fuelwood, fruit, etc. have now been replaced by others. Nowadays the main function of the urban forest is that of recreation. It is no longer managed for the production of wood; other forests have that function. Consequently another type of management is required. Nowadays, different social activities are offered to the public: cycling, nature walks, botanical trails, sport, etc. People go for a walk in the forest to get some fresh air, to relax. In the forested area of the Bois the Boulogne, the main goal is to offer the public a "real" forest atmosphere at the gates of Paris. The park zone, essential for the landscape, consists of an open area where the public can relax without constraint. In short, the main management goal is to provide the public with "the forest at home".

Some parks and gardens have been created solely for recreation from the start, like the Parc Monceaux. Others have acquired this function slowly, like the Bois de Boulogne since the end of the reign of Louis XIV.

To return to the social function, a study of 40 towns with less than 10,000 inhabitants each has recently been carried out (Luginbuhl and Cros, 1991). It deals with the way the tree is perceived and its relationship to the inhabitants and the authorities. The authors noticed a revival of the tree in the town's management policy. The authorities are forced to take into account the social diversity of the population. The social origin of the authorities also influences the way in which they manage the tree patrimony of their town. The way the parks and gardens are organized often reveals the succession of the different mayors in a town.
The tree is considered to be a decorative element, but also as an important element in the management and building of the urban landscape in order to structure it. Thus the authors of the study distinguished a short term policy (decoration) and a long term policy (structuring of the landscape). The study concludes that some trees can be seen as modern or designed for big towns, while others are more traditional, more rustic and are to be found in villages.

The tree also has a patrimonial value depending on the rarity of the species and its characteristics (dimensions, shape, colour), the year it was introduced in France (for example the first *Taxodium distichum* in Rambouillet, or the first *Robinia pseudoacacia* by Robin) or its location in the town. The tree is a symbol and a signal. Planted on special occasions such as historical, political, religious, social or family events, the tree marks the great stages of the history of a country and its people. It is also a signal in the landscape. It shows a crossing, a danger; it signals the approach of a village, etc. (Durand, 1990). It expresses the changing of seasons to the urban population.

The ecological role is also well perceived. The trees house an important micro-fauna. They are a refuge for small animals like squirrels and birds, and therefore they are often preserved until they die. Many studies on dynamics of bird populations in towns carried out show the extent to which the scientific community are interested in trees as elements of the urban bio-environment. They form a "green screen" with a moderating role (temperature, moisture, etc.). They muffle the noise caused by traffic. They purify the air by intercepting part of the pollutants, especially dust and liquid pollutants (oil).

Nevertheless, the tree can apparently be absent from a town without any serious consequence. Venice is very famous for being a picturesque and pleasant town, though there are very few trees. The same applies for Cordoba, Toledo, Nürnberg or Edinburgh. Trees can be rare, even absent. Trees, but not plants. Towns do not necessarily need trees to be seductive (Rumelhart, 1990).

The social role of the urban forest is one of the first that must be taken into account. It is the very "spark" of the management. Public opinion can prevent the manager from acting, if his intentions are misunderstood.

Management constraints caused by the character of the town itself

The urban environment is hostile to plants for many reasons. People may dislike the leaves and fruit the tree produces and it can block the view as it grows. Too often it is treated as a simple piece of urban "furniture". It is surprising that a tree persists in producing sprouts and leaves even after being injured by cars or being drastically pruned, after being damaged by road works, after absorbing salt spread on the streets, etc. A tree growing under such conditions will often have to be cut prematurely and will often be found rotten, stained by fungi or attacked by insects. The ultimate management costs are then higher, because the trees have to be replaced and the wood has no commercial value any longer.

The growing conditions in the urban environment differ considerably from those in the natural environment, especially for the roots. The physiology, the growth and the functioning of the root system in the urban environment are almost unknown. This offers scientists an unexposed field for experiments. We must have homogeneous populations of trees of known origin to manage the urban forest correctly. These tree characteristics have only recently been taken into account, but unfortunately only in towns that are large enough to have a specialized service for green spaces.

The state of urban forests at present

The main management problem at present is the ageing and the renewal or restoration of the urban forests. 'We inherit a plant patrimony designed during the 19th century (...). Most of the lanes in our towns were planted between 1830 and 1900. This old heritage is difficult to manage for, in many cases, it has not been renewed in time. Moreover, it has repeatedly been mistreated, and quite often no longer responds to our present objectives.' (Durand, 1990).

For the reasons given above, urban people are very attached to the presence of trees in their environment, but they are even more attached to the trees in their own neighbourhood - to their trees - to the trees in the places where they go for a walk. They rally easily when they think their trees are in danger, sometimes correctly, but often because they have been badly informed. There has been noticeable progress in this field. Some towns now publish leaflets or inform the public by means of informational signs, to make them aware of the need for management measures.

A long term management plan is needed. "Doesn't the practice of long term planning point to the foresters to bring their knowledge of the trees to the town?" And can the french foresters not "get out of their forest" like their foreign colleagues? Can a productive function not be envisaged? Commercial exploitation obviously is not and never will be the main aim, it will simply be the consequence of good management, i.e. appropriate care and good knowledge of the trees.

Conclusion

The management of the French urban forest appears to be very complex because of its many roles and also its different origins and variety of regulations. It has long been neglected, but the development of its social functions and the public pressure have encouraged a long term policy, though there is still much to be done. Towns should gradually make an inventory of their tree patrimony. They will have to collaborate with the other users of the urban space, with the arboretums, botanical gardens and plant nurseries to enable a diversification of the plantations. Tree knowledge needs to be improved. Last but

not least, the efforts of the managers will have to be substantial to make up for the previous lack of information, a situation unfortunately not specific to the urban forest.

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A SMALL CASE STUDY ON THE FOREST AREAS SURROUNDING OSLO

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Introduction

Oslo, the capital of Norway, is surrounded by forest areas of approximately 1700 km². These forest areas, collectively called "Oslomarka", are characterized by good timber production and diversity of species. The ecological "Oslofield" is well known by ecologists around the world. Oslomarka is situated in Norway's densest populated area and has many users. Consequently the management of this forest often leads to heated discussions. By using the Oslomarka as an example, I will try to give you an idea of what we in Norway define as urban forestry, and how we try to solve conflicts.

Historical introduction to Oslomarka

At the beginning of the 17th century Finnish immigrants began settling in the forests near Oslo (Oslo was at that time a small town with 3000 citizens in an area of just 4 km²). Almost all small farms still in existence in Oslomarka are of Finnish origin. Forestry, iron production, tar and charcoal making, hunting and fishing are activities that have taken place in the forests since time immemorial. Many places in Oslomarka have during the years been used as grazing fields for cattle and sheep.

The use of Oslomarka for recreation has a relative short history. It was not before the middle of the 19th century that citizens of Oslo began using Oslomarka for recreation on a noticeable scale. As Oslo was rapidly expanding in that time, conflicts about the water arose. The watercourses in Oslomarka had been used for generations for timber floating. The fast growing industry needed power, and the increasing population of Oslo needed clear drinking water. Conflicts still arise over water, but then between other parties involved.

In the second half of the 19th century several skiing associations were founded. These associations were rather exclusive, and were dominated by people from high social classes. The associations used Oslomarka as a training area, and many of them built cabins in the forest. The people living in the forests were hospitable and they offered food and lodging for a symbolic fee. As the number of skiers and ramblers increased, commercial sport-restaurants started to develop. The first "café" in Oslomarka has opened in 1889.

Just as people began to use Oslomarka for recreational purposes, the commercial forestry underwent great changes. People with an education in forestry from Germany, and later from the Agricultural University of Norway, introduced new ideas in forest management. From the 1920s on, an effective network of forest roads has been established to ease the timber transport. At the beginning of this century an extensive drainage of peatland was carried out. Since World War II, clear-cutting systems have become predominant.

The present situation

The population of Oslo has dramatically increased these last 150 years, from 18,305 citizens in 1835 to 451,099 in 1987. Combined with improved effectiveness in silviculture and forest techniques, this is the reason that most of the people that one would come across in Oslomarka today are there for recreational purposes. The number of people living in the forests is decreasing as a result of the changes in forestry and agriculture.

Ownership structure

There are nearly 2000 forest owners in Oslomarka. 83% of the area is privately owned, 16% is owned by municipalities such as Oslo, and only 1% belongs to the state. As the large number of forest owners indicates, most properties are rather small in size. However, the properties surrounding the city borders are large. The property that is of the greatest significance to the inhabitants of Oslo is owned by the municipality of Oslo. It comprises 17,500 hectare, and is situated around the city. The main difference between the other forest properties in Oslomarka and the Oslo municipal forests is that the latter does not consider commercial timber production to be the main priority.

When talking about ownership structure it is important to be aware of the right, established by law, of free access to any forest in Norway. There are no fences in Norwegian forests, and unless you are an expert on border signs, you will not know when you cross over from one property to another. In any forest, regardless of who the owner is, everybody has the right to camp, to indulge in sporting activities and to pick berries or mushrooms.

The multiple-use of Oslomarka

Oslomarka is a real multiple-use forest. Commercial forestry, with the exception of the Oslo municipal forests, has first priority in the utilization of the area. The productivity is higher than the average in Norway. The annual cut in Oslomarka is approximately 600,000 m^3, which is 3-4% of the national quota, while the commercial forest area amounts to only 2% of the total commercial forest area in the country. The dominant species are Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*) and birch (*Betula spp.*). Spruce and pine belong to the commercial species. Oslomarka is the object of an intensive silviculture: planting, clearing, thinning and harvesting operations. Harvesting and transport are nowadays mostly carried out by harvesting machines and forwarders. In Oslomarka a forest road which can carry even the biggest timber trucks is never far away. Because of the mechanization of the forest operations, few people are employed in forestry compared with 30 years ago. In this connection the many indirect effects of forestry must not be underestimated.

Oslomarka is of invaluable importance to the citizens of Oslo providing the opportunity to get away from the city noise to get some peace of mind. About 600,000 people from Oslo and neighbouring districts use Oslomarka for recreational purposes. On a nice winter's sunday we may estimate that about 100,000 skiers use the forests. The centre of Oslo is linked by tram with the hill of Holmenkollen (which is famous for its ski-jump) and the surrounding forests. Therefore it is not unusual to see people dressed up for the wilderness, or wandering with a pair of ski's on their shoulders in the middle of the town. For those who want to drive to the forests, parking places with a capacity of 10,000 cars have been built at the edge of the forests.

People are different. Some like to follow paths and tracks, some like cycling or walking on the existing roads, and others wish to leave the roads to find places where nobody has been before. Oslomarka offers all this. The forest roads are built to ease forest operations and timber transport, but most of the people using these roads do this for recreational reasons. There are plenty of marked paths both for summer and winter use. In the Oslo municipal forests a variety of sport facilities such as ski-jumps, slalom-ski-slopes and illuminated ski-tracks have been built from municipal funds. The preparation of slopes and ski-tracks are largely carried out by the Forest Service of Oslo.

Oslomarka has a diversity of animal species. The conditions for animal life are better in Oslomarka than in most other conifer forests around the country. Moose (*Alces alces*), roe-deer (*Capreolus capreolus*), hare (*Lepus capensis*), fox (*Vulpes vulpes*), squirrel (*Sciurus vulgaris*), badger (*Meles meles*) and beaver (*Castor fiber*) are common mammals. Moose often cause trouble when they try to go downtown. There are a lot of different bird species. The mating games of black grouse (*Lyrurus tetrix*) and capercaillie (*Tetrao urogallus*) can be witnessed at dawn in the springtime. Except for the Oslo municipal forests, where the animal life is protected by law, hunting is possible with the permission of the land owner. Fishing is permitted in the lakes that are not used as drinking water reservoirs, provided that a fishing license has been purchased. The most common fish species are trout (*Salmo trutta*) and perch (*Perca fluviatilis*).

Oslomarka includes areas in 18 municipalities scattered over four counties. Twelve of these municipalities including Oslo are totally or partly dependent on water supply from Oslomarka. Oslo is a large power-consumer. Most of the energy used in Norway is hydroelectricity, therefore high-voltage cables are necessary to secure the power supply of Oslo. Unfortunately, most of these high-voltage cables must go through the forests. The need for more urban space is a constant threat to the forests.

Conflicts

With all these different interests, conflicts arise over the use of Oslomarka. We can sort out the users into two groups: 1) those whose activities depend on the forests, and 2) those whose activities will decrease the forest areas. The two groups cannot cooperate and it is a political question whether the municipality wants forests or urban areas. The citizens of Oslo are concerned about their forest. This was clearly expressed in 1946, when 30,000 people marched in the streets demonstrating against the construction of a high-voltage cable through the forest.

As for urban forestry, I will only deal with the group which has forest as a common denominator. This group consists of those who depend on the forest for their income and those who use the forest for recreational purposes.

Timber production and recreation should be balanced so they can coexist. However these two interests have lead to many discussions throughout the years. Modern silviculture can best be characterized as large-scale clear-cuts, monocultures, an extensive network of forest roads and the use of big forest machines. This has provoked public opinion which opposes commercial forestry. This opinion is the basis for several interest groups. Some of them focus on the environmental effects and effects on animal life, some of them are more concerned about the forest as a park and the effects of modern forestry on the landscape.

In the 1950s and 1960s the discussions about the management of Oslomarka were rather heated and the dialogue was not as objective as it should have been. The foresters stuck to the principle that large-scale clear-cutting and planting was the only and biological correct way to manage the forests. Many of them were very convinced about their infallibility and when the professor of silviculture at the Norwegian agricultural university pointed out from a newspaper article, that other methods of silviculture existed, he was considered to be a traitor to their cause. The Forest Service of the Oslo municipal forests was the main target of the public's negative reactions. It would seem a bit unfair considering the work the Forest Service has done for recreational purposes. Nevertheless, it was, and still is the Forest Service's responsibility to make ski-tracks, mark paths and so on. The interest groups had a dualistic view of forest roads. Some wanted a complete untouched nature and did not tolerate the idea of a network of roads in the forests. Others saw that the roads could help the old and the handicapped to get out into the forests and also that the roads were ideal for cyclists.

Hunting is an activity that can hardly be combined with other recreational activities in the forests nearest to Oslo. Because of the high standards that are required for drinking water, the lakes that are used for water supply cannot be used for other purposes. All these conflicting interests made it clear that specific regulations for the Oslomarka area were necessary. At the time of the discussion, forest legislation was inadequate to deal with all the conflicts around an urban forest.

The need for new guidelines

In the 1970s discussions about Oslomarka became more constructive, multiple-use plans were made by the different forest owners organizations and forest legislation was subsequently changed.

The parties involved in Oslomarka could not agree about who would have the jurisdiction of the areas. The forest owners were not very keen on special restrictions for Oslomarka. No matter what the restrictions were, limitations on forestry activities would be the result. The other parties wanted as many restrictions as possible to be imposed on forestry activities and wanted the Ministry of Environmental

Protection to have the authority, creating an unfavourable situation for forestry. If a forest area of Oslomarka's magnitude were managed by a ministry with no forestry competence, there would be serious doubts as to whether timber production would be taken care of in the proper way.

The solution was found by changing the forest legislation. The purpose of the act until 1976 was 'to promote forest production, afforestation and forest protection'. In 1976 additions were made, such as: 'Emphasis shall also be given to the importance of forests as a source of recreation for the public, a major element of the natural scene, a living environment for plants and animals, and as hunting and fishing areas.' One of the new paragraphs stressed the need for stricter and more detailed regulations in 'areas which are of particular value from the point of view of outdoor activities and environmental protection.' That same year provisional regulations concerning forestry in Oslomarka were introduced. Until that year, Oslomarka had been managed just like forests everywhere else in the country.

Permanent regulations concerning forestry in Oslomarka were introduced not before the year 1984. Since the regulations were based on forest legislation, the authority was still in the hands of the Ministry of Agriculture. A decision was made to delegate the decision-making to county level. On account of the recreational value of Oslomarka, the regulations contain restrictions on silviculture and forest operations. Special rules for the use of pesticides are given, forest roads cannot be constructed without permission of the forest authorities, the use of exotic species and peatland draining are prohibited. Clear-cuts are no longer allowed to exceed 5 ha, except for areas far from the urbanized regions, where the maximum clear-cut area is 7.5 ha.

Oslo municipality forests

The forests owned by the municipality of Oslo are in a special position. These are the most frequently used forests for recreational purposes in Norway. Therefore, the Forest Service of Oslo must have guidelines that take care of the wishes and needs of the citizens. The management of the municipal forests is accountable to the city council of Oslo. The Forest Service of Oslo municipal forests differs from the rest of the country. Instead of trying to get maximum profit from timber production, their main job is to make the forests as suitable as possible for outdoor activities. Since 1974, one of the main objectives for the management of the municipal forests is formulated as follows: 'in any conflict between the differing interests, concern for nature conservation, outdoor recreation, water supply, animal life and fishing shall take precedence over maximization of the economic returns from the forestry operations alone.'

In the municipal forests, a different type of silviculture is now carried out. Various harvesting methods are used and clear-cutting is adjusted to local conditions. Protecting the landscape is nowadays an important task for the forest service. The use of motorized vehicles on the forest roads or cross-country are prohibited. The chief forester can issue permits to those living or working in the area and, for example, to associations running bus tours for senior citizens or handicapped people. Because of conflicts between different recreational activities there are restrictions on specific activities in the areas including: restrictions on horse riding and prohibition of human activities in or close to the lakes used for water-supply. Animal life is protected in the municipal forests, and hunting is only carried out by the Forest Service when the elk population is increasing too fast. Some of the forest areas are protected for recreational or scientific purposes, pursuant to the law of nature conservation.

Conclusions

The special forestry regulations in Oslomarka do not guarantee that all conflicts will be solved. The regulations are critically assessed again and again, and I think they always will have to adapt to changing conditions.

The timber production of Oslomarka is a resource of great importance for the community, but the utilization of this resource is dependent on support from the majority of the people. Today a green wave rolls over the political landscape in Norway. Many nature conservation organizations consider commercial forestry as an enemy of the environment. It is the forestry's responsibility to convince them that this idea is incorrect.

One's view on forest utilization also depends on the economic situation in general. I do not think that the intensified harvesting after World War II was a coincidence. Measuring the values of the recreational use of urban forests is difficult, but the huge number of users of Oslomarka speaks for itself. Nevertheless, forest owners may think it unfair that they lose some of their income because other people make claims on their forest for purposes such as recreation. Therefore I think that the best solution would be municipal owned forests close to the city, like the Oslo municipal forests. Here citizens can, by their freedom of political choice, choose the forest management they want.

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URBAN FORESTS IN THE TROPICAL CONTEXT: the case of the Forêt Classée du Barrage de Ouagadougou, Burkina Faso

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Introduction

In the Saharan and Sahelian countries urban forestry must be integrated in the general context of the fight against the desertification process. But also at the overall protection of the environment everywhere else on our globe.

The process of forest degradation can be seen in developed as well as developing countries (like Burkina Faso) affecting all forest types. The Centre Technique Forestier Tropical (1989) stipulates that about 7.5 million hectares of dense forest (i.e. 0.62% of the actual surface) is lost each year, mainly for agriculture. This leads to serious degradation of the vegetation and the soil. In developed countries the phenomenon of environmental degradation is presented in terms of urbanization and industrialization, while in developing countries (for example in Africa) this phenomenon can be best seen in terms of bush fires, wood cutting and shifting cultivation. Urbanization is only recently becoming a growing concern.

This will be demonstrated by presenting the Forêt Classée du Barrage de Ouagadougou case. First the overall state of the forests in Burkina Faso will be presented.

Forests in Burkina Faso

Burkina Faso (formerly named Haute-Volta) is situated in the centre of West Africa, at the inner belt of the river Niger, and encompasses about 27.4 million ha. The climate is of the soudano-sahelian tropical type, characterized by two seasons: a dry season (6-9 months) and a rainy season (3-6 months) with rainfall fluctuating from 400 to 1400 mm. As a consequence the country is mainly dominated by savannas, steppes and some closed forest remnants along streams, the so-called riperian forests. The latest land use area figures and the status of the forests are presented in Table 1.

Table 1. Total land use area estimates and status (106 ha). Figures based on Comité Interétats de Lutte contre la Sechéresse au Sahel, FAO, IUFRO (1989).

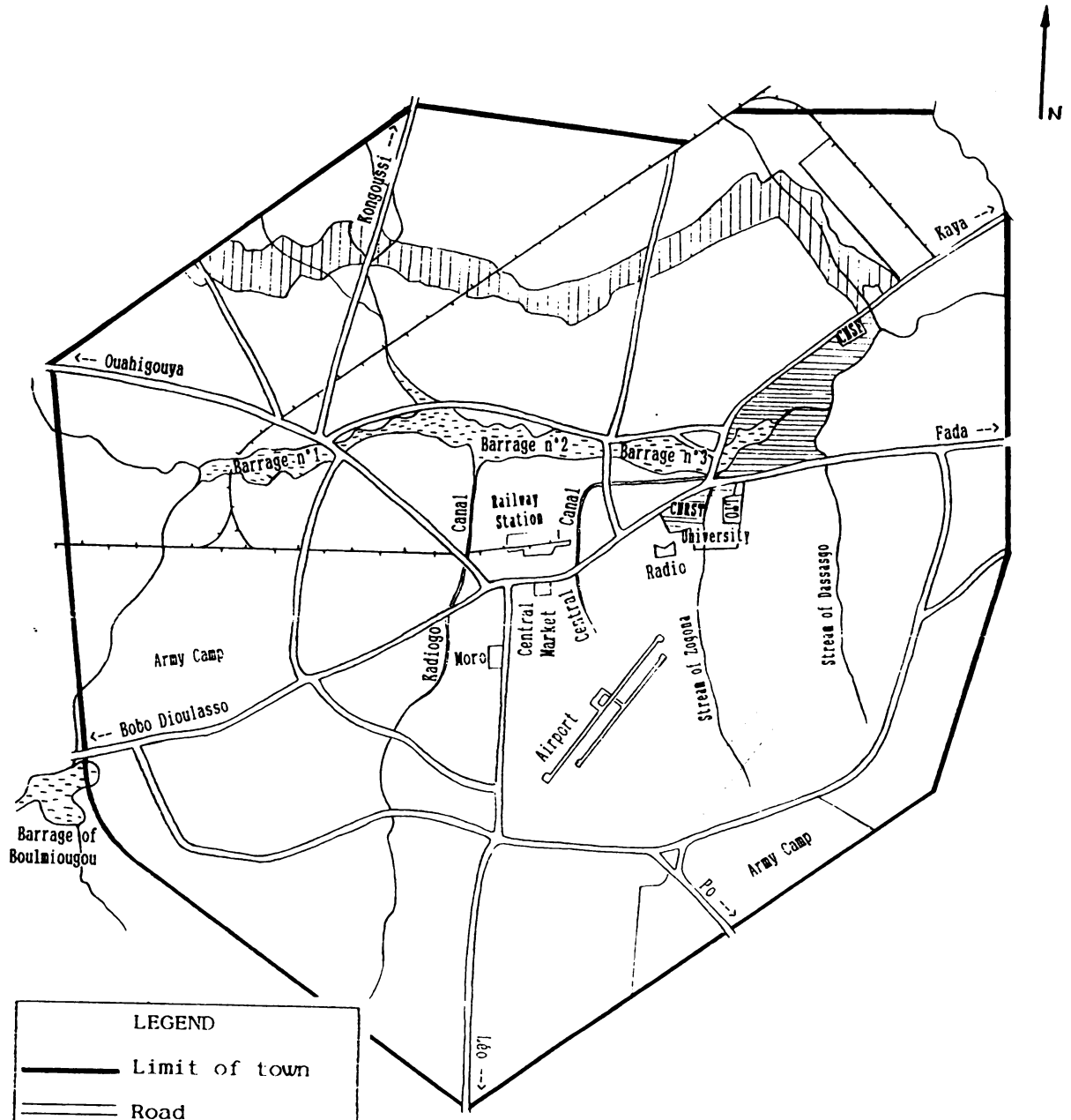
Woodlands	15.4	56%	
reserved forests	3.8		14%
unreserved forests1	1.6		42%
Agricultural land (including fallow)	5.8	21%	
Unproductive surfaces	2.9	11%	
Others	3.3	12%	
Total	27.4	100%	

The case of the 'Forêt Classée du Barrage de Ouagadougou'

Situated in the north-eastern part of Ouagadougou (see Figure 1) the FCBO covers an area of 210 ha. Reservation and hence fire protection by the Forest Service are effective since 1953. The area is geographically situated at 12°49' northern latitude, 1°49' western longitude and at 300 m altitude.The annual rainfall amounts 850 to 900 mm. There is a rainy season from May to September which reaches

BURKINA FASO

Ouagadougou City



Source IGB October 1982

its peak in July/August and a dry season from October to April, subdivided into a dry and cold period from December to February and a dry and hot period from March to the start of the rainy season in May/June (Sawadogo, 1990).

The vegetation of the FCBO can be characterized as a savanna mosaic of natural and artificial tree formations. The natural tree formations are dominated by *Acacia spp., Anogeissus leiocarpus, Butyrospermum paradoxum subsp. parkii, Combretum aculeatum, Combretum micranthum, Guiera senegalensis* and *Pterocarpus erinaceus*. While the tree plantations are made up of *Acacia nilotica var. tomentosa, Anacardium occidentale, Azadirachta indica, Eucalyptus camaldulensis, Gmelia arborea, Khaya senegalensis and Tectona grandis*. Also riperian tree species like *Mitragyna inermis* and *Ficus gnafalocarpa* can be found along the stream of Dassasgo (see Figure 1).

The FCBO has an important function to play in combatting the desertification and pollution processes in and around Ouagadougou. Urbanization and its related problems are becoming imminent in Burkina Faso. The FCBO contributes to the prevention of desertification, since it favours soil restoration by preventing erosion and by protecting the environment. The FCBO contributes to noise diminution, it forms a catchment area of dust and it fulfills a not negligible aesthetical function. According to Guinko (1984) the FCBO is the only collecting area of medicinal plants within a 50 km radius of Ouagadougou. This is also a threat since many plant species disappear due to the application of the uprooting technique. Recreation of the urban population in the forest is another function it fulfills. The FCBO is also of scientifical importance since it is a study site of the Centre National de la Recherche Scientifique et Technologique (CNRST) and the Centre National de Semences Forestières (CNSF). The FCBO is located on old fallow land and of scientific interest to follow the forest dynamics.

The FCBO though protected is suffering from negative human influences. Bognounou (1991) summarizes these influences in terms of insufficient supervision and protection, pollution by rubbish dump and draining oil, poor water drainage in certain parts of the forest and forest degradation due to collecting activities as we saw before.

The role of foresters

The foresters should make a continuing effort to convince politicians and members of legislative bodies about the importance of forestry activities. Especially the direct and indirect benefits it offers as for food production and rural development. This can be best done by demonstrating successful projects and by showing that they can have short term as well as long term benefits (FAO, 1985). The forester should ensure that forestry is regarded as a vital part of national plans regarding food security, conservation and prevention of desertification. A growing public awareness of environmental protection and the planting of new green spaces is also necessary.

Conclusion

The FCBO is a symbol. It is a National Patrimony to be safeguarded, because it is of utmost importance for plants and animals. Consequently, it must be protected against negative human interventions. However, in spite of its protection, it is an established fact that the FCBO is not fully protected.
Thus, the attitude of the urban population towards the FCBO must change. The citizens of Ouagadougou should become aware of the importance and the limitations of utilization of the green spaces in town and the necessity to protect them.

In order to solve the problems, many questions have to be answered. A growing public awareness of protection of the environment or planning new green spaces? Who is responsible, the people or the authorities? And what is the role of the foresters is this process? Challenges for the future.

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Forestry as an alternative land use form for agriculture in the EEC

FORESTRY AS AN ALTERNATIVE LAND USE SYSTEM FOR AGRICULTURE IN THE EEC

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Introduction

At the moment there is an over-production of agricultural products in the countries of the European Economic Community (EEC) (Philipp, 1987; Weiger, 1988; Cijffers and Pebesma, 1989). At first this may seem a strange problem because there are other parts of the world (and also parts of Europe outside the EEC) where food supply is insufficient. Nevertheless, there is an artificial high price level for agricultural products in the EEC and is the main cause of this over-production. This paper investigates the extent of the problem and the attempt of afforestation of agricultural land as a solution to this problem.

Brief description of the problem

The basis of the agricultural policy of the EEC consists of the following economic and social objectives (Landbouw Economisch Instituut, 1985):

1. To raise agricultural productivity by stimulating technical improvement and by assuring both rational development of agricultural production and optimal use of production factors, especially labour.
2. To reassure the families in rural areas a reasonable living, especially by raising the income per capita of those working on farms.
3. To stabilize the internal market.
4. To reassure the supply in the European Community.
5. To guarantee a reasonable price level on delivering to the consumers.

(Strategic motives and the wish to be, to some extent, independent from other countries might have played a role as well).

An artificial price level for agricultural products was introduced as a means of achieving the objectives listed above, especially objectives 2 and 4 (Commisie van de Europese Gemeenschap, 1985). There are minimum price levels guaranteed by the EEC for many products (such as corn, milk (butter), beef, sugar, wine). When certain quantities of these products cannot be sold for the minimum price, the intervention system of the EEC comes into operation. The surpluses are bought, stored and sometimes sold later or exported at subsidized low prices (Cijffers and Pebesma, 1989).

As no mechanisms for coping with the situation were built in, this policy resulted in growing surpluses in the internal EEC market. In 1988 17 Mton of corn, 1.4 Mton of butter, 785 kton of beef and 900 kton of milk powder were stocked in the stores of the EEC. These surpluses cause expenditures that the EEC can no longer afford. The net costs of the agricultural policy of the EEC (expenditures of the European Orientation and Guarantee Fund for Agriculture minus the incomes from subsidized exports) increased from 11.8 billion ECU (European Currency Unit (1 ECU = ± US$1.25) in 1982 to 21.1 billion ECU in 1987 (Cijffers and Pebesma, 1989).

Demarcation of the problem

As the over-production of food occurs within the common EEC - market, the problem of the surpluses is essentially a West - European problem. As the problem seems to be a European problem, it would be logical to consider the problem on an European scale. But of course there are big differences between the

different member states of EEC. The situation in the northern states is quite different from that in the southern states. The differences include the availability of land, products (e.g. the surpluses of milk from the northern member states, the surpluses of wine from the southern), population densities, wealth, availability of capital for investments, etc.

The European agricultural policy also has an influence on the world market (e.g. the subsidized exports of food products cause lower prices for those products worldwide) (Cijffers and Pebesma, 1989).

As already stated, over-production is caused by an artificial price level. Supply and demand are no longer kept in balance by the price mechanism. Over-production and price levels are economic subjects. The prices of food within the EEC and awards by subsidies to change land use patterns are made up by a common European policy. The farmers are one of the most important target groups because the future of their enterprises are endangered. So the political, economic and social aspects of the over-production problem are the most important. However, other aspects (e.g. legal aspects such as the land use laws in the various countries of the EEC) or silvicultural aspects (the possibilities for the afforestation of agricultural fields) also contribute to a better understanding of the actual situation.

Possible solutions for the problem

There are several ways of reducing the agricultural over-production in the EEC. The solutions based on an alternative use of agricultural fields will be discussed in the next section. Other possible solutions include:

Lowering prices. This solution is certain to reduce the surpluses. Socially it is not a very acceptable solution however. The income of farmers will drop and marginal areas will once again be placed in a disadvantageous position (Weiger, 1988).

Production quotas. This means limiting the amounts of a certain product that may be produced on each farm or on each hectare to within the price system of the EEC. This solution would only be feasible when the production can be accurately controlled. It will lead to more bureaucracy and obstruct development into a healthy production structure (e.g. investments or modernization; Cijffers and Pebesma, 1989).

Extensification of the agricultural production. This means reducing the production per surface unit by reducing the inputs of production factors such as energy, machine power, fertilizers, pesticides, labour etc. Probably, the most important input factor that should be reduced is energy. It is closely related to machine power, fertilizers and pesticides. This solution would have the most positive effects on the environment, landscape and recreation (Weiger, 1988). Ecologically oriented agricultural systems and/or agroforestry systems could be used in this option. The financial position of the farmers would deteriorate. The costs of grants and intervention measures of the EEC could become really excessive (Philipp, 1987). Financially, this solution would only work if consumers are willing to pay more for products from extensive cultivated areas.

Alternative use of agricultural land. The land could just be left fallow (with a risk of erosion), "landscape parks" can be propagated or special biotopes "nature parks" can be established (Philipp, 1987). What these solutions have in common is that they give no financial return. Therefore, they cannot be used on a large-scale.

Cultivation of new agricultural products (fibres, oil, fuels like alcohol) can also be propagated. The risk of intensification remains, however. The incomes of the farmers drop. At present, there is not enough knowledge about the use of such products (Philipp, 1987).
Afforestation of the agricultural fields is also a possibility. This option will be discussed in greater depth.

Afforestation as a solution for the problem

Afforestation of agricultural land as a means of lowering agricultural over-production in the EEC was first suggested in the Mansholt plan (Mansholt, 1969). The EEC produces only 40% of the wood it consumes. An over-production of wood is not expected in the next few decades (Verlaat, 1991).

Böhlmann states that afforestation of agricultural fields would solve this problem and is economically and ecologically attractive (Böhlmann, 1986). Delorme calls afforestation the most logical solution to reduce the over-production (Delorme, 1987). Philipp mentions that afforestation in some areas does not change the price levels that lead to over-production. The farmers might chose to continue the cultivation of products of which already surpluses exist. In this situation the farmers can change their product mix or intensify the cultivation of the fields remaining in production (Philipp, 1987).

Different forms of afforestation can be distinguished, such as:

1. Production of biomass (woodchips) in short rotations (between 2 and 12 years) for energy or industrial (chemical) purposes (Weiger, 1988).
2. Production of paperwood or low-value saw-wood in medium rotations (15-40 years) (Weiger, 1988).
3. Afforestation with high-value forest species under traditional silvicultural systems. The objective should be to produce a high quality of timber. This option would have positive effects on the environment; it would offer jobs in forestry, especially in areas with a low forest cover. Besides, it would improve the landscape and increase the high natural and recreational values of forests. The land will then be kept out of agricultural production (Philipp, 1987). Schulz states that a decrease in the supply of tropical wood would give rise to an increase in the demand (and consequently the prices) for oak wood and other high quality timbers in Europe (Schulz, 1989).

The question as to whether the afforestation of marginal (less productive) or high productive grounds should be done remains open. Cijffers and Pebesma conclude that afforesting high productive grounds (in Great Britain and Ireland) would be an effective solution for the problem of over-production (the production decreases rapidly) and much wood would be produced (Cijffers and Pebesma, 1989). Some advantages and disadvantages of afforesting high productive and marginal grounds as found in literature are presented below:

Afforesting high productive grounds:

Advantages:
Efficiency: Surpluses diminish rapidly and much wood is produced (Cijffers and Pebesma, 1989).
Justice: Production is lowered where over-production occurs.
Environment: Cultivation on high productive grounds is mostly intensive. Much energy, fertilizers and pesticides are being used (Weiger, 1988). Afforesting high productive grounds could be combined with extensification of marginal grounds.

Disadvantages:
Income position: The income of the farmers would deteriorate if the best grounds were to be afforested (Philipp, 1987).
Personal preference: The individual farmer will probably prefer to keep his best soils for agricultural production to get the better results from his daily work.

Afforesting marginal grounds:

Advantages:
Optimal product allocation: Producing on high productive land is mostly cheaper than on low productive lands. As long as prices for agricultural products are average higher than for wood, in a free market situation these lands would remain cultivated with agricultural products (Cijffers and Pebesma, 1989).

Disadvantages:
Scale: Large areas (more than 20% of all agricultural land) should be afforested to arrive at the desired lowering of production (Philipp, 1987; Cijffers and Pebesma, 1989).
Jobs: Afforestation may lead to more unemployment and depopulation of the marginal areas (Mutsaers, 1983). The position of the southern member states would deteriorate (Cijffers and Pebesma, 1989).

This list is by no means meant to be complete. There are still a lot of questions left. What are the ecological and social effects? Will the cultivation on marginal land be intensified when high productive lands are afforested? What should be done when in future the demand for agricultural products rises again?

The Dutch situation as an example

The Netherlands is one of the most densely populated countries in western Europe. Only 8% of the area is covered by forests (Centraal Bureau voor de Statistiek, 1985). Therefore, the demand for products and services from the forest is very high. In the long term plan for forestry in the Netherlands, the government has assigned the following priorities to the different functions of the dutch forest: 1. Recreation, 2. Wood production, 3. Nature, 4. Landscape. This could indicate that wood production is an important function of the Dutch forest.

Currently, 8% of the wood used in the Netherlands is produced in the country itself. The Dutch Government wants to raise this figure to 25% before the year 2050. Increase in the wood production in the Netherlands should could be achieved by a more efficient use of the already existing forests and by afforestation of the following areas before the year 2050 (Ministerie van Landbouw en Visserij, 1985):

35,000 ha. New afforested area (mainly by the state).
15,000 ha. Non-permanent production plantations.
8,000 ha. Road and boundary plantations (mainly by the state).

Especially the establishment of non-permanent production plantations should be effectuated by the private sector (Ministerie van Landbouw en Visserij, 1985). It is possible for farmers to participate in the EEC set-aside programme and to afforest their fields with fast growing species. If the rotation of these plantations do not exceed 25 years, the plantations will not be subject to the existing forest law. This means that after the harvest of the wood there will be no obligation to replant. Permission should be applied for and registered in advance (Ministerie van Landbouw en Visserij, 1989). Afforestation by the private sector is subsidized by the Government in many ways (Ministerie van Landbouw en Visserij, 1985).

The decision of the farmers to afforest will primarily be determined by economic considerations (the farmer is an entrepreneur; Parmentier, 1980). Other motives such as psychological or personal, however, also play a role (Hanke, 1986). A few examples of the rentability of non-permanent production plantations will be presented in this section (Table 1). In the Netherlands the species most suitable for production plantations with a rotation of 15-25 years, is poplar, *Populus spp.* (Ministerie van Landbouw en Visserij, 1989). For plantations with a rotation of 30-40 years on more acid or other less suitable land, the planting of spruce, *Picea abies* , might be considered. The cultivation of spruce however gives lower returns however (Directie Bos- en Landschapsbouw, 1989).

These returns are in most cases insufficient to make a living. The average returns from agricultural cultivation are higher (Cijffers and Pebesma, 1989). Returns could be increased if the farmer does some of the work himself, or if farmers earn extra off-farm income. Farmers with fields less suitable for agriculture will not make the higher average returns from agriculture anyway. Or, as a farmer in one of the northern provinces in the Netherlands put it: A smart farmer who owns some marginal agricultural lands, plants trees nowadays!

Table 1. Returns of production plantations of Populus spp., clone: "Agathe F.". The following conditions are assumed: Rotation period of 15 years; Individual protection against predation; Grants yr 1: ECU 2278; yr 3: ECU 243; N = 400/ha; removal of stumps included. Amounts given are the average returns in ECU/ha/yr with an interest rate of 7% (Ministerie van Landbouw en Visserij, 1989).

Average increment (m^3/ha/yr)	Total Production (m^3)	Return (ECU/ha/yr)	
		Standing timber	At the road
9.5	142	208	298
14.5	217	253	377
18.5	277	279	437

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NOTES ON THE AFFORESTATION OF AGRICULTURAL LANDS IN PORTUGAL

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Introduction

One of the EEC's main objectives since its founding in 1956, is to guarantee farmers a stable and high income and simultaneously fully satisfying the EEC's agricultural requirements. This policy was stimulated by the introduction of controlled prices for agricultural products instead of a laissez-faire policy of prices determined by the supply and demand of an open market. The outcome has been the regular existence of surpluses due to over-production stimulated by the fixed high prices.
Surpluses generate high EEC expenditures. A decision has been made to reduce both the amount of money involved and to eliminate the surpluses. It would mean the rethinking of the entire EEC agricultural policy.

What type of policy would be needed to lower the production levels?

As a decision has been made to decrease the agricultural production, several alternatives were looked for and found:

1. Lowering of prices
   The lowering of the prices of the agricultural products, giving smaller profits to the farmers, would generate a decrease in production. However this measure would bring high social costs because it would reduce the income of the farmers and at the same time obstructing rural development of those regions.
2. Production quotas
   As de Klerk (see Chapter 3) has already explained, this means limiting the quantitative produce of a certain product at farm level to within the price system of the EEC. This solution is only feasible when the production can be accurately controlled.
3. Extensification of agricultural production
   A less intensive agricultural system using a smaller amount of production factors will lead to a lower production per ha. This alternative is very advantageous for the environment, but it will reduce the income of the farmer.
4. Alternative use of agricultural land
   The conversion of agricultural land to other land use purposes is yet another manner of decreasing the existing production levels. The areas to be converted could be used for:
   - Landscape parks and natural parks - This alternative is not very popular in less affluent EEC countries, because the financial returns are negligible.
   - Afforestation - This alternative will also lead to a decrease in agricultural production and the farmers income. Nevertheless, the farmers will be compensated in the form of subsidies and the benefits of the final crop when the trees are felled.

The Portuguese choice

The Portuguese politicians favoured the alternative use of agricultural land as will be explained next. This has mainly been determined by the physical conditions of Portugal.

- Seventy percent of Portugal's land surface does not possess the right characteristics for agricultural purposes because the soil is poor, the land is steep and divided into many small strips.

- The EEC shows an annual wood deficit of over 100 million m3 (Soares, 1990).
- The growth rate of Portugal's forests is higher than those of the northern EEC countries due to the favourable climatic conditions: even better than in the other Mediterranean countries, because of the high level of rainfall. The availability of water in Portugal is three times higher than the Mediterranean average (Soares, 1990).

The discussion about reforestation now concentrates on the question as to whether we should afforest the marginal or the high productive grounds. It would seem to be wise to opt for the marginal grounds. The afforestation of high productive grounds would lead to a strong reduction of the farmers income and it would increase the Portuguese dependency on imported agricultural products.

What measures have been taken in Portugal so far?

In 1991, in cooperation with the EEC, the Portuguese government organized a programme called "Afforestation measures in the agricultural lands". The aims are: the improving of the existing forests on farmers property and the introduction of slow growing species in the afforestation programmes. The latter aims at a multiple use forest, producing both fruits and wood.

Incentives are provided by way of grants of a non-repayable nature as well as in the form of a subsidy depending on the type of farm. A percentage of the total investment will be compensated (Table 1) to stimulate farmers to afforest.

Table 1. Non repayable grants as a percentage of total investment (Source: Decreto-lei no. 81/91; 792-793. Lisbon, 1991).

Improvement of existing forests	- groups of farmers	80%
	- individual farmers	70%
Afforestation of farm land	- groups of farmers or local authorities managing marginal lands	80%
	- full-time farmers	70%
	- others	60%

Another way in which farmers can be stimulated to afforest is by the provision of subsidies. These subsidies constitute one of the main innovations of this programme. They consist of a subsidy per afforested ha for a period of 6 to 20 years. This subsidy varies according to the type of farm, the acreage and the number of trees planted per ha (Table 2).

Since this programme is new, no results are available at this stage. In the next sections the expected pro's and contra's of the programme are presented.

Some of the expected negative impacts

Unemployment and rural exodus might constitute the main negative consequences of afforestation on marginal land. Urbanisation will take place if no solutions are found to avoid the problems which have obviously led to the mass emigration that took place in the first half of this century. The large scale afforestation programmes of marginal land with *Pinus pinaster* in the 1930s and 1940s boosted the emigration in those days. At that time the rural economy was strongly based on cattle grazing, heavily depending on large areas of marginal land. This land could be used freely. Large scale afforestation led to reduction of these grazing areas, therefore almost eliminating the means of existence for the small farmers. To many of them there was no other option then to emigrate.

Table 2. Fixed ECU afforestation subsidies (Source: Decreto-lei no. 81/91; 792-793. Lisboa, 1991).

Afforestation acreage		
First	20 ha	150 ECU/ha
From	20 to 100 ha	90 ECU/ha
From	100 to 150 ha	45 ECU/ha
Type of farmer		
Full-time farmers, part-time farmers and groups		100 % of the above value
Others		60 % of the above value
Number of trees per ha		
A table and formula are required to calculate the subsidy		

Nowadays Portugal has a policy to develop the poorest regions of the country. This should be realized by improving the infrastructure and stimulating industries and touristic centres thus improving the conditions and opportunities in those rural areas. However these measures have not been made with the necessary speed and intensity to avoid a rural exodus. The adverse effects will show a loss of ancient cultures and an even smaller Portuguese agricultural production. An ever increasing dependency on other EEC countries for these products might be the outcome. In a country where the rate between the exported and imported agricultural products stands at 0.75 (1989), any alteration in the production value must be carefully devised.
A rural exodus and large scale afforestation could lead to a deterioration of rural roads and paths hindering the combating of forest fires and pests.

Some of the expected positive impacts

The conversion of farm land to forest lands should be implemented according to soil conditions. The land use planning maps according to soil properties show an appreciable forestry potential. As only a part of these soils are covered with forests, it is logical to conclude that the afforestation will lead to a more rational use of the soil and accordingly generate more income. Besides, an increase of the production of high quality timber is to be expected.

What is the future of the Portuguese forestry sector? Taking into consideration the international timber market

The ongoing afforestation projects in the EEC are no a threat to the Portuguese position in the market in the short or medium term. These projects are still of a minor scale and will not float the market with large quantities of timber within the foreseeable future. However when considering the long term effects it is impossible to ignore the EEC's need to raise its production which might change the market. The target rate of reduction of the present EEC deficit, currently totalling over 100 million m^3 per year, will probably correspond to the EEC's increase in demand. So the Portuguese interests will not be affected very much.

The same cannot be said about the possible consequences of the FAO Tropical Forestry Action Plan (TFAP). This programme includes sixty tropical and sub-tropical countries and initiates huge afforestation schemes in these regions. Although the TFAP was mainly intended to preserve the natural forests and promote their renovation, there is no doubt that part of these grants are devised to increase afforestation with fast growing species (Soares, 1990). The tropical countries see these afforestations involving species

for pulp or low value lumber, as the logical solution to stop the cutting in their natural forests. Having this in mind we can presume that the Portuguese cellulose industry will have to face fierce competition in the future.

The afforestations in the former USSR forms a threat to the Portuguese forestry, but will only be felt in their first felling cycle. As for the Canadian tendency to obtain a stronger commercial position it is impossible to guess what will happen. Canada already possesses a huge forestry potential ready to enter the market (Soares, 1990).

Conclusions

The afforestation of agricultural land is of interest to Portugal, since many land use units are very suitable for that purpose. However a decrease of the agricultural acreage will enlarge Portugal's dependency on agricultural imports. Agricultural productivity should be increased in the remaining farms by providing new incentives and by expanding extension activities.

Forestry should not only be seen as a source of high quality timber, but also as a way of protecting the environment and enlarging of recreational areas.

Questioning the effects of this afforestation policy on the rural communities it can be assumed that it will bring some important alterations to their modus vivendi. It is foreseeable that the workforce surplus will be forced to find new jobs in other places. To avoid this rural exodus and to preserve its cultural value quick measures will have to be taken to offer them attractive alternatives.

The impact of the changes brought to the rural landscape by afforestation must be carefully analyzed. The areas to be converted are, at present, very beautiful and are part of our traditional landscape. Another issue not to be forgotten, and often neglected by the authorities responsible, is the effect that the environmental impact of these afforestations will have. These regions are the habitat for many endemic fauna and flora species; a highly significant aspect.

Although it is vital that the Portuguese government favours this programme, it should not neglect the necessary assistance to the agricultural sector to increase its production level.

Recommendations

To assure that the afforestations succeed and benefit society in general I would like to make the following recommendations:

General aspects
- That a common forestry policy within the EEC countries is defined.
- That there be more measures to assist agriculture in Portugal.
- That forestry extension teams would be set up to support and advertise this programme.
- That the afforestation subsidies are actualized.

Technical aspects
- That studies be made on the environmental impact, especially on fauna and flora, and studies to balance the afforestation areas in the landscape in the preservation of regional characteristics.
- That tree nurseries are established.
- That better and more effective forest fire prevention measures are set up. New afforestations eliminated some farms which had constituted natural barriers against fire, therefore:
  - more incentives to forest research are needed;
  - pests and diseases in forest stands should be prevented.

Social aspects (rural exodus)

- That the rich cultural heritage in craftsmanship (handicrafts) should be promoted.
- Opportunities for tourism in the rural areas should be optimized. To reach this goal the following measures should be taken:
  - improvement of infrastructure;
  - restoration of castles and monasteries;
  - facilitate touristic fishing and hunting;
  - advertising the excellent rural gastronomy.
- Small-scale industries should be supported and promoted. This will absorb some of the excess workforce.

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This paper is partly based on two speeches that were given by the Portuguese Forestry Director-General Mr. Joao Soares in 1990.

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Desertification: The role of forestry in combating desertification

DESERTIFICATION AND RESOURCE USE POLICY.
Two cases: Alentejo, Portugal and Alberta, Canada.

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Introduction

There has been a great deal of debate on how the term "desertification" should be defined. It is therefore convenient that a meaning, both rigorous and appropriate be assigned to the cases discussed herein. This should contribute to a more effective comparison of the two apparently unrelated situations - one of declared desertification, the other the potential thereof. Initially, by taking a historical perspective, we may be able to look forwards and hopefully avoid repeating mistakes (in policy and practice) which have already proven destructive.

Desertification may be defined as a multiplex process of land degradation occurring in a previously fertile area, with a consequent loss of potential for biological productivity of species diversity, and of support for the livelihood of local populations. This process can be examined at many stages along a continuum between "healthy" ecosystems and desert (Dregne, 1986; Fantechi and Margaris, 1986). It may lead to such a state of degradation of the natural system, that regeneration does not occur, even if left alone. The threshold of irreversibility, i.e., "point" of no return in the formation of true desert, depends in each case on the causes, the time factor, and the type of system subject to such change (Secretariat of the United Nations Conference on Desertification, 1977).

Many different factors can cause desertification; especially in combination. They are generally grouped as climatic change, degree of aridity and drought, and damaging or destructive human activity. For example, consider the effects of soil acidification due to air pollution, of mining, or of deforestation, but also the natural vulnerability of certain regions, or the impact of prolonged drought in semi-arid zones.

Different combinations of causal factors, however, have the same effect: the ecosystem becomes less diversified and resilient with a smaller resource base, therefore less able to respond positively to further change (Warren and Maizels, 1977; Warren, 1986). Monotony is anathema to sustainability; a system's vulnerability to degradation is inversely proportional to its versatility, that is, its dynamic stability.

In an attempt to examine this common effect of varying factors, we can compare two distinct regional-level situations, one in Alentejo province in southern Portugal and the other in the province of Alberta, Canada. There are many differences between the two: social, economic, climatic, geological and biological, as well as scale. Nonetheless, even though the areas concerned are very distinct bio-regions, both experience large seasonal temperature variation and more or less scarce precipitation. There are also similarities in terms (real or potential) degradation processes, in certain contributing factors, and even upon superficial examination.

Desertification in Alentejo, Portugal

In southern Alentejo, it is public knowledge that desertification is in progress, and the results are easy to see. Any measures to combat it, however, is not so obvious, except perhaps at the level of technical proposals awaiting implementation (Camacho, 1989). Sometimes, the "spreading Sahara" or the advancing desert is mentioned as being the "natural" threat to these regions, but studies of possible climatic variations have been inconclusive. Local human activity may be deemed the principal, if not the only cause of the degeneration observed, especially when looking for solutions to the problem (Garduño, 1977; Auberville in Dregne, 1986).

For many thousands of years, man has exploited the land, already vulnerable due to the semi-arid Atlantic/ Mediterranean climate (long, hot, dry summers and mild, rainy winters). This has led to extreme degradation of soil quality, topsoil erosion, increasing hydrological stress and diminishing vegetation cover; also to human desertification (abandonment of the land; Camacho, 1989).

Traditionally it has been used for pasture but the compound of deforestation in ancient times and inappropriate cultivation has had both cumulative long-term and acute recent effects. The national Wheat Campaign (begun in the 1930s) has had a particularly destructive influence (Camacho, 1989). The cereal, unsuited to local conditions, is grown in spring and summer without the use of proper soil conservation techniques. Consequently, bare fallow land is then subject to heavy winter rains.

The problem is one of land use allocation. Actual land use (i.e. its social, economic and political determinants) must change in order to stop further erosion and desertification and remedy existing damage.

Desertification in Alberta, Canada

In the Canadian provinces of Alberta and Saskatchewan there are areas affected by severe drought and soil erosion: historical parallels exist between cereal culture and desertification (Warren and Maizels, 1977; Dregne, 1986). However, at this juncture another form of human intervention is more pertinent to our central theme - a recent project to harvest approximately 221,000 km² of virgin boreal forest in northern Alberta.

In 1987/88 the provincial government actively marketed this publicly-owned resource, leasing timber rights and allocating public funds for mill construction and expansion incentive loans and infrastructures, in a secretive and disputable move to create jobs and to recover from the failures of past financial ventures. Environmental restrictions (and possibly business logic) were sufficiently ignored for the offer to be quickly accepted by some companies whose activities were being limited elsewhere (Nikiforuk and Struzik, 1989).

The project has raised important questions about decision making on, and the future effects of, forest resource utilization to such an extent that public reaction to its (after the fact) announcement has reached unprecedented levels.

Some of the questions raised are: use by whom? what for? why now? to whose benefit/profit? at what risk? The major political question is, who decides, and how? In this case the government implemented a new policy without public knowledge, discussion or consent, convinced that it was acting in the public interest, with the stated objective of diversifying the local economy. Yet "forest management" and pulp, paper and lumber-mill agreements were entered into without a previous assessment of either public opinion or the ecological components of the affected areas (Nikiforuk and Struzik, 1989) - a prerequisite for proper land use planning and environmental impact assessment (Moen, 1990).

To consider the Alberta forestry project in the context of desertification would be justifiable in part, because of the natural characteristics of the region. Possible hazards include microclimatic changes locally and in areas further south that are already subject to desertification due to effects on precipitation, snow retention or prevailing wind patterns and, furthermore, run off rates, and extreme pollution both onsite and downstream - in this case, in the Arctic which is a highly sensitive region.

Further considerations include the need for study of degradation processes and the opportunity which such a large-scale project could provide (e.g. in weather prediction, mathematical modelling, environmental assessment and monitoring programmes; El-Baz, 1986). This also would include the extent of damage to local and migratory animal populations and to the native flora, as well as the social and economic impacts, on issues such as hunting, tourism, and the public concern for nature conservation. Not least is the large proportion of unknown factors, including risk factors, involved.

In the longer term projected global climate changes, whether to hotter or colder, drier or wetter conditions, will demand resilience on the part of all natural and human systems - so again, stability through diversity must be maintained (Hare, 1977; Warren, 1986). It is doubtful whether clear-cut harvesting can contribute to this; and while the argument for economic diversification must be taken into account, the questions about "realistic" time frames, development goals and stipulations of sustainability remain (Camacho, 1989).

Alentejo and Alberta compared

One obvious similarity between Alentejo and Alberta is the negative impact that human activity may have on the biodiversity, the potential productivity and the ecological balance. More specifically, the government decree of the Portuguese Wheat Campaign is comparable to Alberta's present "Aspen Campaign"; in both cases, political and financial dictates are major factors while social and ecological aspects have been largely ignored.

Another similarity is that direct population pressure is not a cause. In Alentejo, human desertification continues for economic reasons; in northern Alberta the population has always been small, causing little pressure on the forest ecosystem. Population influx due to the projected development, however, is more likely to aggravate pressure on that system than to aid in sustaining it.

The indirect pressures in both cases result from global problems: unbalanced, often exaggerated consumption of resources, and the supremacy of financial systems in dictating human activity. To mitigate or avoid such pressures, multidisciplinary, long-term perspectives rather than linear, short-term views are badly needed (Ramphal, 1991) - something that we as students and foresters have to offer.

Another approach to combat desertification, apart from immediate measures of protection, afforestation, agroforestry, and so on, is to pay more attention to problems not just related to forestry or local land use; to address development issues (Kates et al, 1977; Ramphal, 1991) such as the unequal distribution of resources, world trade and international debt; to examine increasing demands or needs for all resources - land, water, air, energy, as well as forest products - and the possibility of finding alternatives or lowering expectations, respecting limits of consumption or "growth".

Discussion and conclusion

To "conclude" in terms of forestry methods and resource use policies, some points need discussing:

Land use allocation and implementation:

How should destructive, often traditional patterns be changed?
Some concrete suggestions would be: the providing of incentives for afforestation and forest stock improvement (Runnals, 1991); the promoting of slow-growing tree species and new agricultural crops or mixed use, thus diversifying production; the use of appropriate techniques, and the provision of compensation for slower returns (Camacho, 1989).

Natural resource use and decision-making:

What is wrong here? How should these situations be avoided? It is imperative to provide more scientific and informed public input (by professionals, NGO's, students, etc.) in the decision-making process (Fantechi and Margaris, 1986; Bourque, 1991). A public forum for examining issues affecting the common good is urgently needed. Information and the use of the media should be universally accessible, to permit transparency and more effective planning.

Natural resource planning, including forest resources, must become a central element of government policy (MacNeill and Munro, 1991) so that environmentally risky and controversial projects such as those in Alberta and Alentejo can be, if not avoided or cancelled, then improved upon.

A scientific and legal basis should be firmly established (Moen, 1990; Bourque, 1991) to permit such improvement, to address short, medium and long-term needs, and to adapt economic activity to ecological principles and the ideal of harmonious sustainability.

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FOREST POLICIES AND POLITICS IN SPAIN; An expression of values and priorities

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Introduction

This paper studies the situation in Spain. A case study may help to focus on a concrete situation which can lead to further discussion internationally and globally. The priorities expressed in forest policies in Spain as they have developed since the Spanish Civil War in the late 1930s, will be presented. It will be shown that in Spain, forestry is not used to combat desertification, but merely for economic reasons. This priority has caused considerable ecological and social damage.

In the present economic system it is important to differentiate between forestry of the First World countries and that of the Third World countries. First World countries are able to export pollution and desertification to poorer countries. The population is aware of the negative effects of industry and the over-exploitation of the land. Those countries are well organized and rich enough to undertake actions. In Third World countries disasters as a result of desertification are such that the people who work on the land directly suffer from the consequences in a very radical way. This happens in African and Asian countries where large groups of people are forced every year to flee from the advancing desert, a process described by René Dumont in his book "In favour of Africa, I accuse".

Spain must obviously be counted among the First World countries because, together with the rest of the European countries, it participates in the over-exploitation of Third World countries through the mechanism of unequal market conditions. This mechanism of unequal exchange leads to a consequential over-exploitation, degradation and desertification of their land. At the same time international pressure, in this case the EEC, has had a very negative effect on the forestry situation in Spain. This country is being used as an important producer of pulpwood and paper. The influences of the EEC on forestry in Spain will be examined in this paper.

In Spain, there is a conflict of interests between government or industrial lobbies and the traditions, customs and economy of the people, with regards to Spanish forest policies and politics. Spain will be examined as a traditional mediterranean country with a great expanse of dry and thin soil, where cattle are an important source of income (note: the following text is strongly based on Groome, 1990).

Artificial plantations for production in the Spanish state

After the Spanish Civil War, a start was made in Spanish forestry politics and policies, to abandon the traditional concept of forests as multi-functional and integral entities. Emphasis was placed on the creation of new tree masses for industrial purposes, and less attention was paid to the improvement and conservation of the existing woods, which were already threatened. The main objective was to intensify the capitalization of the forestry sector and its economic and industrial orientations, whereas the creation of employment and the flow of material among different productive rural activities were considered to be of secondary importance (Prats Llaudaró, 1956).

What is more, forestry technicians considered a decline in the rural employment figure to be beneficial. Almost no attention was paid by the government to the economic necessities of the rural population, nor to their cultural and traditional values. It was even suggested that the population should be concentrated in small communities in economic forest areas, which would concentrate services. This would be financially attractive to the Nation (Ortuño, 1964).

These policies, together with their subsequent suppression of agricultural and cattle farming activities, met with resistance from the population. There were provoked fires, illegal exploitation of land and

general indifference to social care of the afforestations (Bustamente y Santos, 1966). A larger production of wood could not be absorbed into the local market, so industries of transformation were thought necessary, justifying even larger forestry projects (Lama, 1958; Ortuño, 1964). Meanwhile, the importance of woods for their protective function and for the production of traditional materials (fuelwood, cork, resin, etc.) were neglected (Abreu, 1963). The National Institute of Nature Conservation (ICONA) was supposed to be less economically orientated, yet it used exactly the same arguments as the government. The wood deficit was used as a threat to the steadiness for the integration of Spain in the EEC (Ruiz Sánchez, 1976).

Within the administration, a group of forestry engineers underlined the importance of adequate treatment of the existing natural resources, proclaiming that the low production was only due to the poor state of the existing woods. They argued that the care and improvement of these resources were a lot more in agreement with the geo-climatical conditions of the country, even if this was a much slower process. A large portion of the land was too dry and mountainous, and the soil too thin to allow forest farming methods (García Díaz, 1962).

They thought that improvement of existing woods would be beneficial not only to the forestry sector, but also to agriculture, cattle rearing, population security, health etc. This group argued for a horizontal integration of woods and interests of the population. The woods, to this group of forestry technicians, had a social function as well as an economic one, and they objected to the separation of production and protection (García Díaz, 1948).

They considered that woods should have large cutting-periods, natural and irregular masses and should exist of a mixture of conifers and broad-leaved species: a mixture of pines, beeches, and oak species. These woods would then be more resistant to destruction by fire and plagues (García Díaz, 1955).

The administration, however, promoted the idea of teaching the population to overcome its irrational dislike of trees. Moreover, they stimulated the migration of the rural population to urban areas. Remarkably, the administration tried to conceal its purely economic aims by social and environmental arguments. They argued that it was necessary to absorb rural unemployment, that soil erosion would be contained, and that recreational areas could be developed. Finally, manual labour had to be reduced to 15 per cent of previous figures, as the costs were found to be too high (López Balazote, 1978).

Examples of how the adminstration tried to conceal their economic aims are:

- the use of fast growing species with the official motive of avoiding erosion (Mesanza, 1955), and
- the use of Eucalyptus in Almería (South Spain) to combat drought.

One of the reasons ICONA was created in the beginning of the 1970s, was to introduce environmental concepts and criteria into forestry policies. However, leading figures of the official forestry administration as well as persons with substantial interests in the industry sector became influential. Because of this no real change of direction or mentality became significant.

Integration of forest and cattle farming

Traditionally, shepherding activities have always been very important in the Mediterranean countries. Until the 19th century, the cattle industry was protected and privileged, and of great importance to the national economy because of the commercial value of wool (Klein, 1920). Later on, even after readjustments in the interests of different rural activities, shepherding remained an important source of income. Ever since the Civil War, however, shepherding has been polemic and considered by forestry specialists to be damaging and incompatible with forest farming.

Papanastasis (1984) argues that 'segregationist politics in the Mediterranean were based on partial analysis of irrational shepherding practised traditionally, and did not include any reliable technical information or important social, practical and economical considerations.' And that in general these politics tended to fail because 'they did not take into account the needs and customs of the local population

or suggested viable alternatives of forestry shepherding for the poorest part of the population' (Papanastasis, 1984). Forestry technicians of several Mediterranean countries have insisted on the integration of forest and cattle farming, stressing the role of fruits, tidying function of cattle, and improvement of the quality of the forest in order to increase the production of fodder (Flippo, 1952; Giornano, 1952). In Spain, the results of these studies have not been put into practice. And since the integration of Spain in the EEC the situation is becoming more and more dependent on exogenous conditions. Cultural and physical factors were not taken into account.

Repercussions of Spain's integration in the EEC

For the Spanish forestry sector the entering of Spain into the EEC has been important from the start. Way back in 1965, a forestry engineer said: 'Expansion through our forestry riches will be firmly settled with the incorporation in the EEC, an evident objective of our economic development' (Martín Lobo, 1965). Since Spain became part of the EEC, mono-cultures have rapidly increased. First, this is due to the communitarian deficit in wood and transformed forestry products, and second, because of the agricultural adjustment with indirect consequences for forestry due to the economic marginalisation of large areas of agricultural and grazing lands. These effects were most felt in the dairy sector, but also in the olive and vines sector (Ministerio de Agricultura, 1986; Banco de Bilbao, 1987).

The emphasis of forest policy was on fast growing species: 'For these lands, and partly for lands without trees, a national plan of forestry must be established with fast growing species, such as eucalyptus, pines and poplars' (Fernández Tomás, 1985). Besides the EEC has stimulated the conversion of agricultural land for alternative use, resulting in forest mono-cultures. According to the technicians of the EEC: 'There are possibilities for Spain to be converted into an exporter of wood and forestry products in the future, because of new plantations and an increase in production of existing woods.' The EEC offered aid for new plantations of fast growing species of up to 80 per cent of the costs (Kreysa, 1987).

Another factor promoting mono-cultures is, strangely enough, the EEC aid to fight forest fires: in 1986 30 per cent of the costs for operations for diminishing of fire risk were compensated, such as fire-breaks and the clearing of dry materials in the plantations (Commission de la Communauté Européenne, 1986). Only on one occasion did the Economic and Social Committee of the EEC mention that forest policies were themselves the real cause of a lot of forest fires in Spain, and suggested 'the cultivation, where possible, of mixed woods and woods of deciduous trees' (Bureau Européen de l'Environnement, 1986). Apart from this, the general tendency of ICONA is to ask for more aid in order to prevent fires in the fast growing pinewoods, where the fire risk is extremely high.

Since the reforestation programme has been put into practice, there has been an exponential increase of forest fires, which must be seen as a consequence of forest policies (ICONA, several years, Colmenar, 1985) and is due to the following factors:

- Socio-political factors: provoked fires in community lands taken for reforestation during Franco's dictatorship.
- Economic factors: accumulation of dry material and consequently a higher fire risk through lack of social care or adequate forestry treatment.
- Administrative factors: fires of dry material accumulated through prohibition of cattle-feeding, recollection of fuelwood, etc.
- Forestry-climatological factors: massive use of pyrophitical coniferous species which easily ignites under dry climatic conditions.

As a result, more and more laws have been introduced for fire-prevention (Groome, 1990). It has been suggested that, 'unless the problem of forest fires is solved, the Spanish forestry sector will never develop properly from an economical point of view' (Kreysa, 1987). However, aid from the EEC is not conditional upon a change of policy. On the contrary, the EEC promotes a continuation of reforestations with pyrophitical species.

Another factor which influences Spanish forestry, although indirectly, is 'the acid rain problem in the North and Central European woods, which endangers the productivity and existence of those forests. The EEC may have to increase its dependence on Spain for forestry products until the problem is solved' (Groome, 1990).

As has been said before, it does not seem advisable to separate forestry aspects from cattle farming and agriculture. Negative consequences of expansion of mono-cultures with fast growing species in mountainous and dry areas are already noticeable, in the form of erosion, emigration of the rural population, and forest fires. It may be concluded, that 'it seems that actions undertaken by the EEC are more in the interest of the Central-European countries or of the South-European forestry lobbies than in the interest of a genuine care for a rational management of the great variety of woods in the EEC area' (Groome, 1990).

Discussion and conclusion

To conclude, I would like to mention four thoughts which could serve as points for discussion. The case study of Spain shows that if forestry is to be used as a method to combat desertification, this has to be done after a careful study of all the different circumstances.

Firstly, the forestry technician has the responsibility of being aware of his or her own explicit criteria. It must be clear that any motive (e.g. aid, combating desertification, employment) is very probably also going to be used to conceal other interests which have nothing to do with the land or the population. Secondly, there are dry parts on earth, for example in the South of Spain, with a good balanced flora and fauna, and a very rich variety of species, which have to be regarded and respected in their own right. Thirdly, at this moment the natural vegetation has to be regarded and respected as the strongest arm against degradation. This should be considered even before planning forestry. And, finally, the local population must be made aware what needs to be done. If any forestry-project is to be successful in the long term, the population must feel secure about their health, well-being and income and must have means for expressing their ideas and take part in decision-making.

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DESERTIFICATION IN THE UPPER-EAST REGION OF GHANA; socio-economic and environmental problems and the role of forestry

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Introduction

Desertification which is an issue of global concern is gradually becoming a problem in Ghana. The United Nations Governmental Programme and the United Nations Development Programme were duly noted in May and June 1983 by the United Nations General Assembly in its resolution 39/1688. Ghana was consequently put on the list of countries eligible for assistance from United Nations Sudano-Sahelian Office (UNSO) to combat desertification (UNSO, 1986).

There are two important types of vegetation in Ghana, namely closed forest and savanna. The rainfall in the forest is bimodal, usually not less than 1350 mm per annum and is thus not affected by desertification. The savanna can be found along the coastline and further in the interior with different characteristics. The coastal savanna has a double peak rainfall with an unreliable peak and thus prone to desertic conditions (Asare, 1986). The interior savanna consist of derived savanna, a transition between forest and savanna, the so-called Guinea savanna with one wet season lasting 7-8 months and a dry season of 4-5 months. The driest type of savanna, the so-called Sudan savanna which occurs in the north-east tip of the country is characterized by an arid climate with a mean annual rainfall of 400-1200 mm, the length of the rainy season only lasting for 3-5 months (Abu, 1986). It is the northern part of Ghana that is affected by desertification. This is manifested by the prevailing unfavourable climate and vegetation types.

Definition of desertification

Desertification is defined by the United Nations Environmental Programme (UNEP) as a process whereby the productivity of semi-arid or sub-humid habitats is reduced to a level characteristic of deserts. This ecological deterioration involves changes in vegetation cover (replacement, reduction, destruction etc.), erosion of surface deposits (soil), consequent modification of animal life and soil biota, increased aridity of micro climate etc.

This process, occurring world-wide, is associated with man's extensive and intensive utilization of semi-arid lands for pasture and farming. The definition further explains that this ecological degradation may, at certain places, be transient. This implies that the system will regain its natural vegetation and its associated ecological processes if the causes of desertification are removed (e.g. by exclosures).

Desertification in Ghana

Desertification which is a result of interaction of climatic and human activity is gradually taking place in the northern part of Ghana, which includes three regions: the Northern, the Upper-West and the Upper-East Regions.
In order to have a closer look at the issue it is appropriate to select one of the regions as a case study. Here the Upper-East Region will be considered since desertic conditions in this region are well acknowledged. The region is characterized by an arid type of climate with a mean annual rainfall of 400-1200 mm, lasting 3-5 months (Abu, 1986). The monthly totals of rainfall increase gradually from April to a maximum in August or September and decrease sharply in October. The dry season extends from November to March and the dusty wind originating from the Sahara, known as "Harmattan" reaches its peak in January (Gyampoh, 1986).

Causes of desertification in the Upper-East Region

The causes of desertification in this region of Ghana is a combination of adverse climatic conditions and human activities. The primary cause is that of human activities such as population growth, bushfires and farming systems. These human activities are further accelerated by the adverse climatic conditions which are considered as a secondary cause.

Human over-population

The current population growth in the northern part of the country including the Upper-East Region is estimated to be about 4% per annum. This means a doubling period of about 25 years. This is the highest population growth rate in the country (Abu, 1986). Gyampoh (1986) reported that the Upper-East Region has a population density of 58 persons/km^2 as against the national average of 51 persons/km^2.

The cause of the population increase includes improved medical care. Parents place a high premium on large families since more hands are able to cultivate the land or to tend the cattle herds. People tend to settle away from riparian areas (also due to the occurrence of river blindness). The population pressure builds up on the upland areas thus causing soil erosion and land degradation eventually leading to desertification (Benneh, 1986).

With this increase of the human population, an ever increasing acreage has to be cultivated to feed the population. More marginal land is put under cultivation by clearing, thus making the land more barren and worsening its already impoverished fertility (Abu, 1986). The impoverished soil is vulnerable to wind and water erosion thereby initiating or accelerating desertification.

Firewood is the main source of energy for cooking in the Upper-East Region of Ghana. The daily scramble for firewood from an already impoverished environment is worsened with the ever increasing population. To satisfy the demand for firewood the less distant areas from homesteads have been exhausted, and thus remote areas are now being encroached upon. Asare (1986) reported that one full day (24 hours) is required to gather three days worth of firewood and that women have to cover about five kilometres to collect firewood. It has also been reported by Abu (1986) that in more desperate areas 15% of the agricultural hours are spent on gathering firewood and that families spend as much as 20% of the families income on buying firewood from firewood contractors.

It is thus evident that with an ever increasing population accordingly the firewood requirement increased. As a result more land will be devoid of trees that might hold soil particles together to prevent erosion etc. We should also not forget the fact that in an effort to offset firewood deficiencies cow dung is used as fuel at the expense of soil fertility. Thus the result of this deforestation is that the soil surface is exposed and placed at the mercy of wind and water erosion leading to desertification.

Over-population of cattle

This part of the country carries most of Ghana's cattle population. In certain areas such as the Navrongo and Bawku Districts, the density of cattle is about 103 animals/km^2 (Gyampoh, 1986).

The impoverished soils with its attendant periodic drought show years with low crop yields. The people have secured themselves against drought hazards by investing in more livestock. This provides security in that when the rains fail some animals may be sold to meet the family's basic needs such as food and clothing. Since animals are liable to die during drought, a large herd is a protection against total loss (Benneh, 1986). In addition one's wealth is measured in terms of the number of cattle one possesses. Cattle are used in exchange for a bride, as a dowry for a son. All these factors have led to an increase in the cattle population.

Most ruminants are controlled by semi-nomadic herdsmen. As most of the grazing lands have already been exhausted, the animals are often herded to areas where they can find grasses and where they can

browse. The large herds of cattle move around in search of grazing lands, and the soil is subjected to compaction such that infiltration is reduced leading to run off of water and also to the reduction of vegetational regrowth (Akwensivie, 1986). The cattle and sheep mostly reared here are known to be selective feeders and cause a decrease in the palatable grass species over time thus reducing the value and quality of the grazing land (Gyampoh, 1986). Areas that are especially intensively grazed are to be found around water sources.

Overgrazing is a combination of mutually effecting factors. First, an exposition of the soil to direct solar rays destroys soil micro-organisms. Second, a reduction of infiltration capacity exposes the soil at the mercy of the run offs. This leads to sheet erosion, blowing away the rich top soil resulting in the loss of silt, clay and organic matter (Gyampoh, 1986) that hold soil together against desertification. As mentioned in recent reports, large herds of cattle are migrating from neighbouring Burkina Faso to the Upper-East Region. These herds even increase the pressure on the land, which leads to an even higher degradation of the physical environment.

Bushfires and its effects as a cause of desertification

Besides farming and cattle rearing, hunting is widely practised as an occupation in this part of the country, especially during the dry seasons. The vegetation is burnt to drive animals out for hunting. Fires are also set to prepare the land for farming due to the high labour costs. Fires also enable fresh and palatable grasses to sprout for livestock to graze on (Akwensivie, 1986). Other causes of fire are careless disposal of cigarette butts, smouldering match sticks and improperly quenched cooking fires.

Directly or indirectly, bushfires are a major cause of desertification. They destroy the soil organic matter resulting in losses of nitrogen and sulphur in the gaseous form. They destroy the soil texture by reducing the percolation ability of the soil leading to rill and sheet erosion. They also destroy the earthworms and the microbial population essential to the proper and natural functioning of the soil as a medium for plant growth. They may increase the acidity of the soil thereby limiting the performance of some vegetational species (Gyampoh, 1986). Bushfires may also result in the elimination of some plant species that may be useful in holding soil particles together.

Bushfires expose the soil to hazards of both wind and water erosion. They lead to a reduction in the ability of the soil to support vegetation and to the elimination of certain plant genetic stock thus reducing what used to be savanna into a more open shrub or grass savanna (Gyampoh, 1986).

Farming practices as a cause of desertification

Owing to the low income in this part of the country farmers practise a kind of shifting cultivation with land left fallow. This is because they cannot purchase fertilizers and hence leave the land to regain its fertility. Since such soils are already unproductive and are unable to support any vegetation, leaving such land bare exposes it to further agents of desertification.
Monoculture as is commonly practised here, exposes the land to desertification in times of disease outbreak (Ovington, 1974). Mixed cropping is practised with millet and sorghum as they are the main diet of the people. Since both crops require the same type of nutrients they exhaust that region's nutrients when planted on the same piece of land, as is practised in the northern regions (Gyampoh, 1986). Alternation or combination with other crops permit additional soil layers to be tapped for nutrients.

Most farmers use ridges, mounds, beds, and heaps as barriers to differentiate one farm from another. Where these are improperly aligned they accelerate erosion even more then flat land, thus initiating rill and gully erosions.
The practice of weeding without applying any mulch results in loss of soil and soil fertility and also promotes erosion, thereby encouraging desertification.
Removal of farm residues for fuelwood and animal feed soon after harvesting, coupled with the early preparation of the land awaiting the next farming season, exposes the land to long periods of drought. Thereby the land is made vulnerable to agents of erosion as well as destruction of the biological, physical

and chemical properties of the soil. The land is unable to support any vegetation growth thus promoting desertification.

Sometimes trees are felled in the vicinity of the farm because:

1. They occupy valuable farming space.
2. They may cast shadows on crops preventing them from getting optimal sunlight.
3. The trees may be harbouring rodents or insects that might destroy their crops.

Under these circumstances, one cannot conclude that the actions of the farmers are irrational, because they do this to achieve certain goals or to protect their interests. The felling of trees may be done out of ignorance, because the importance of environmental conservation is often not known. Environmental awareness is gradually being unfolded to farmers through agroforestry practices.

Nevertheless, farmers have always attached importance to trees. Trees left on the farms are meant to serve one or all of the following purposes rather than protection of the environment:

1. As a source of firewood.
2. For medicinal purposes.
3. For fruiting purposes, e.g. mangoes, oranges, avocados, peas, etc. or they offer palatable edible leaves for either humans or livestock.
4. To provide shade on the farms where the farmers can rest or take their meals in the afternoons, away from the scorching sun.

The role of forestry in the combating of desertification

Since exploitation of fuelwood is one of the causes of desertification, the planting of fast growing species around homesteads and marginal lands will ease the fuelwood pressure on the natural vegetation and therefore curb desertification.

One of the consequences of overgrazing and burning is the exposure of the soil to wind and water erosion and the lowering of the infiltration capacity of the soil. Growing trees, such as the leguminous ones, will serve as wind breaks, enriching the soil with nitrogen, providing fodder for the livestock and protecting the soil from the hazards of the scorching sun. The combined effects will curb desertification.

Planting trees around parks, avenues, institutions, dams and dugouts helps to reduce the rate of evaporation from dam surfaces and it keeps temperature at a minimum level. Trees also provide shade, shelter and beauty as well as enhancing the microclimate (Nsenkyire, 1986).

Agroforestry

Agroforestry is a land use system in which wooden perennials are deliberately combined with herbaceous crops and/or animals on the same piece of land. Agroforestry although already used for centuries has now been picked up by modern science as a farming system (Steppler and Nair, 1987) and is now part of Ghana's forestry practices.

In agroforestry farming systems, the perennial shrubs serve as windbreaks, they reduce run-off and evaporation. The trees could provide fuelwood as well as feed for livestock. Leguminous tree species could improve the quality of the soil by nitrogen fixation. This could also ensure an increase in agricultural production thus improving nutritional requirements. In effect agroforestry helps to increase farmers income as well as to curb deforestation by never leaving the land bare and hence protecting the land against desertification.

Decision making processes - socio-political context

As a result of the prevailing vegetational and harsh climatic conditions in the Upper-East Region the social life of the people has been affected economically, culturally and health wise. Less fertile grounds supplemented by irregular rainfall regimes have resulted in low productivity and poor living standards. The increasing scarcity of firewood has diverted the food sources from protein rich food such as hard beans to other means. Hard beans need prolonged cooking and thus need considerable amounts of firewood. This affects the nutritional requirements of the people, especially of the very poor who are not able to afford meat as a substitute. Though large numbers of cattle are reared in this region meat is quite expensive, because of the expanded trade links with the southern half of the country.

In the present situation the local people have a voice in the actual decision making processes of the Upper-East Region. Local people have representatives at the District Assemblies who present the views of the region at the meetings with state officials. Thus, before implementation of the decisions, the State takes into consideration both the wishes and demands of the local people as well as the environmentally related consequences. The people have the right to complain or express their views through their representatives about the activities of other interest groups which they find to be harmful to their environment and their existence.

In order to address the problem of desertification and environmental degradation, the State has authorized the National Energy Board to develop an intensive educational campaign on the use of liquified petroleum gas for cooking. Improved stoves which use less firewood and which are efficient have been developed. It is also believed that the introduction of electricity to this part of the country enabling the people to use it for cooking will ease the pressure on the forest for firewood.

The state has also encouraged afforestation programmes with fast growing tree species. As a result of a public education campaign on the importance of trees the local people have understood the necessity to grow trees. Most of the afforestation exercises are carried out by local communities, farmers and school children with financial and food aid by non-governmental organizations such as the World Food Programme and Africa 2000 Network of the UNDP. The seedlings are supplied by the Forestry Department. The superstition that whoever planted a tree died before it matured, is gradually fading away. Nowadays people are showing an increasing interest in tree planting exercises.

To combat bushfires, public education campaigns are being executed. Communities are encouraged by the National Fire Service to form Anti-Bushfire Voluntary Squads. This Service teaches the volunteers the skills in combating bushfires. The Anti-Bushfire Laws were also strengthened and those who engage in illegal burning are punished. The practice of using of bushfires to clear the land for farming and hunting is also prohibited by law.

It is noteworthy that the public education campaigns about the dangers of desertification are gradually creating an awareness among the local people. Step by step they are made to understand the need to protect themselves against any future calamities caused by desertification. Some good results have already been achieved, still, one has to understand that the people's attitude cannot change overnight.

Conclusions and recommendations

Bushfires, wrong farming practices, improper management of livestock, and the indiscriminate cutting of firewood are considered to be the main causes of desertification in Ghana. People must change their attitude towards these practices, otherwise the process of desertification will continue to expand in the northern part of Ghana.

The following recommendations can be made:

1. The inhabitants of each village should be stimulated to establish their own woodlot to satisfy their individual firewood requirements. This will decrease the pressure on the natural forest for firewood. The quest for firewood is one of the potential causes of desertification.

2. If agro-sylvo-pastoral farming systems using nitrogen fixing multi-purpose trees are adapted by farmers in the Upper-East Region, an increased income for the farmers will be ensured to offset poverty. This will generate a higher and more stable income from the sale of crops and animals.

The rational approach of combining agricultural and forestry production will provide a platform for ecological conservation, as trees will stabilize soils against agents of erosion. Some species can also enrich the soils with their nitrogen fixing ability. Trees will provide shade for the cattle and the leaves of the trees when pruned can serve as fodder for the animals. These agro-sylvo-pastoral farming systems can assure sufficient income, meat and food for the farmers. This approach will meet the short term agricultural and long term forestry production, which will ultimately decrease the problem of desertification.

3. A mechanism or method should be set in motion by the Ministry of Agriculture, whereby the people will be taught the proper pasture and range management practices by experts in that field. This will enable them to adapt sound methods in rearing their livestock with minimal damage to the environment.

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MINING AND DESERTIFICATION. A case study of the impact of a tin mine in Indonesia on desertification

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Introduction

Tin-mining can have a positive impact and can be beneficial to national development. However no matter at what scale the mining is practised there will always be some negative impact; it will create a desert-like landscape with hardly any vegetation cover. It should be obvious, therefore, that control of these negative impact is as important as the mining activity itself.

Natural formation of a desert-like landscape is unlikely in Indonesia due to the prevailing rainfall distribution. At present there are no natural arid areas, and semi-arid areas are very sparse.

In this paper, the subject of desertification will be presented by means of a case study of tin-mining on Bangka Island. Some environmental changes caused by tin-mining will be illustrated. The paper emphasizes the natural vegetation succession and the role that forestry can play in combating desertification due to mining. Although only data concerning the hydraulic mining method are presented, this issue is also relevant to other methods of mining.

Desertification and the natural succession process

There are many definitions of desertification and all of them emphasize the same points. They includes changes caused by human intervention or by climatic changes, irreversible reduction of the vegetation cover and the formation of a desert-like landscape. Desertification is the impoverishment of arid, semi-arid and some sub-humid ecosystems caused by human activities. It is the process of change in these ecosystems that tins to reduced productivity of desirable plants, alteration in the biomass and in the diversity of life forms, accelerated soil degradation, and increased hazards for human occupancy. Desertification is the result of land abuse.

When vegetative cover is reduced the land will become barren or will be invaded by undesirable species. Gradually the loss of fertile topsoil by wind will tin to erosion and, consequently, unproductive land. In natural situations, bare land is colonized by invading species which can withstand the harsh environment. Such plants are termed pioneers. As they become established, they alter and improve the environmental conditions and permit the growth of primary species. This process is called succession in which eventually a "climax" situation will be reached, in which the vegetation is perfectly adapted to the prevailing soil and climatic conditions.

Tin-mining and land use on Bangka Island, South Sumatra

Any use of land by man imposes stress on the system; technology is often meant to minimize the stress while maintaining or increasing productivity. The application of technological innovations can reduce the threat of desertification or even restore the unproductive soils. But the fact that it also can hasten the desertification process should not be forgotten. The development of new technologies increases the human control on the environment. With the acceptance of new technologies population densities have increased and the early evidence of accelerated erosion, salination and the formation of a desert-like landscape is clearly visible.

Changes in land use or land use allocation are especially seen between forestry and other interest groups, such as the mining lobbies. Such is the case of tin-mining on Bangka Island, a case study which is presented here.

The land clearance for mining activities leaves the land barren and erosion takes place. The stream channel around mines are usually choked with sediment and the air around mine-dumps is full of dust. Mines often brings toxic wastes into the environment which will virtually eliminate any plant growth. Additionally, traffic to and from mines disturbs the soil surfaces. A whole range of environmental problems emerge from mineral exploitation.

Physical and chemical properties of the soil

The construction of dams, overburdening by trucks, leaching of the soil and the occurrence of tailings are components of tin mining activity that can have a serious impact on the physical and chemical properties of the soil. The change of soil texture and morphology are physical alterations, whereas a change in the organic carbon contents, cation exchange capacity (CEC) and total base complex belong to the chemical alterations.

The construction of dams and overburdening by trucks result in loss of top soil and changes the soil profile and horizon. Leaching causes the separation of fine and coarse textures. As a result the clay fractions decrease from an average of 23% to below 8%, while the sand fractions increase from an average of 70% to over 90% (figures are only valid for hydraulic mining). With the development of a coarser texture, changes in the soil properties occur, such as a decrease in nutrients and water holding capacity, and an increase in permeability. This situation will not benefit plant productivity.

A soil profile no longer exists. The top soil layer is essential for plant growth, because the highest level of chemical, physical, and biological activities takes place in this layer. The slow development of the top soil gives a picture of a retarded natural growth. The development of vegetation on tailings takes more than 40 years. Dam construction and overburdening of the top soil causes the loss of organic matters and the leaching of clays and bases. Clays and organic matters are important fractions in controlling soil chemical characteristics, such as the cation exchange capacity (CEC).
Tin-mining has been the cause of the loss of soil organic carbon (C-organic). The original C-organic capacity ranging between 1.7% to 3.5% became less than 0.1%. In time, the organic matter proportion can increase, but the original state can never be retrieved. After 40 years, the C-organic fraction would only be 0.6% to 1.6%, with an average of 1.0%. Likewise, cation exchange capacity (CEC) also declines from a range of 7 to 11 ml/100 g to an average of 4 ml/100 g after 40 years. CEC is controlled by organic matter and clay colloid which is irreversible, while organic matter increases with vegetation succession. Therefore remedying the soil chemical properties cannot be naturally achieved without an additional input from outside the ecosystem.

Plant productivity

The clearing of land to establish a mine diminishes the plant productivity of that land. Little or no transpiration occurs and evaporation increases. Consequently, the temperature of the surrounding air will become higher than the air temperature outside mining areas. Moreover, owing to the increase in wind velocity around the mine, evapotranspiration increases and accordingly the water requirements of plants.

Mining causes the formation of a big pit, 3 to 8 meters in depth. The pit consists of sand quartz and colin clay, which is unproductive land because of its poor physical and chemical properties. Sand quartz is very poor in nutrients; it hardly erodes. Colin has a weak structure and it easily cracks when becoming drier. The drier the cracks, the larger they become and the lumps of soil formed will then harden. No plants can grow under such condition no plants can grow. Because the pits have a higher surface run off and water infiltration rate, the ground water level in the tailing area and the surrounding cultivated land also drops. The increased need for water and the decreasing water availability cause a decline in plant productivity. The change of physical and chemical soil properties considerably lowers the soil productivity which is difficult to reverse.

Vegetation structure and composition

Land clearing, overburdening and tailings have substantially changed the vegetation structure and composition. These activities have left the land barren. Luckily, the structure and composition of the vegetation is dynamic, thus in time deserted tailing areas will recover. However the monitoring of the vegetation shows that the succession which takes place after mining is different to that of the undisturbed areas or, in other words, the impact is irreversible. The succession process monitored from 1924 to 1989 in a tailing area shows that until now the process has just reached the shrub state with low plant densities. The change in vegetation structure and composition also causes a change in microclimate and a decrease in the quality of the wildlife.

Combating desertification through forestry

The majority of reclamation cases of abandoned mining areas requires the establishment and maintenance of a vegetation cover. Only forestry can achieve rapid visual restoration of a vegetation cover, surface stabilization, or reduction in air pollution, and besides, a wide variety of land use possibilities at acceptable costs. As a measure to control land degradation, afforestation is directed towards:

- control of wind erosion and speed;
- control of water run off and its consequent erosion;
- aesthetic improvement;
- shade;
- food production;
- production of other plant products;
- control of sediment.

Mine waste clearly fails to meet many of the criteria of a good natural soil. However, many natural soils also show one or two undesirable characteristics of a good soil. Nonetheless, evolution has resulted in the selection of plants adapted to difficult circumstances. Man can also intervene, altering the soil and permitting standardized crop plants to be grown.

As soon as the compacted soils and tailings are removed and the land is levelled, it can be replanted. Planting is aimed at preventing soil erosion and restoring of a soil. Grasses and little shrubs are planted, meanwhile trees mainly of the *Leguminosea* family are planted on land dominated by shrubs.

Rehabilitation areas scheduled for settlements, industries and trade, recreational sites and/or open green space can all be achieved through reforestation and/or afforestation. Plants can serve as a windbreak against wind velocity, assist in wind erosion, help to stabilize sand dunes, reduce soil loss, provide fuel wood, provide browse for animals, improve the appearance of arid and dry landscapes, and provide shade and recreational sites.

The selection of species to be planted can be approached from two angles: by selecting species that accept poor soil conditions which have a tolerance of the inhibiting factor (ecological approach), or by selecting particular species which can alter the condition of the soil and rendering the site suitable for their growth.

Conclusions

Tin-mining was a serious negative impact on the environment. When the vegetative cover is removed, it will be replaced by bare land or undesirable species and finally result in an unproductive and desertic type of land. Tin-mining causes a change in physical and chemical soil properties, a loss of the top soil, a change in soil morphology and the cracking of surface soil and also a decline of the cation exchange capacity (CEC). Mining also reduces plant productivity, altering vegetation composition and structure, and causing the loss of vegetation potential.

Pioneer species can be an ecological and economical solution to restore a vegetation cover. But even pioneer species have their limitations, particularly in the case of extreme soil conditions like the one presented in this paper, for which few if any pioneer species exist. Moreover, such an approach may not achieve the rapid results desired nowadays. But as we all know, an ecological approach is usually the best approach since having nature to cure itself would mean that the negative impact will be limited.

Active human intervention to amend the soil condition enables quicker results, but at considerably higher costs for site preparation. It will also require a long active human involvement. Artificial alterations of soil properties are usually temporary and unless repeated and maintained, the vegetation may revert to the poorer natural succession quality.

Forestry has a dominant role to play in combating desertification in mining areas. This can be achieved by planting selected tree species, the skill and knowledge of only a forester can provide. In order to avoid the problems of the past one should consult the forester at an earlier stage.

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AGROFORESTRY, ANOTHER IDEALIZED CULTIVATION SYSTEM?
A try-out of an old traditional cultivation system in a new jacket

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Introduction

Agroforestry is an agricultural technique; a technique to serve certain objectives. It can be developed by farmers as well as by "outsiders". The economic considerations of the use of agricultural techniques are often more important than ecologic urgencies to the farmer (or to be more precise the agricultural household production system). Does this attitude correspond with the expectations of decision makers and designers of agroforestry systems?

What is agroforestry?

Definitions

There are numerous definitions of the term agroforestry; consult Wiersum (1981) for an overview. Most of the definitions have the following characteristics in common:

- The production of woody perennials is combined with that of herbaceous crops and/or animal products.
- The production components are combined temporally or spatially.
- The production components are part of one land management unit (a unit of land).
- There is interaction of the different production components.

Agroforestry is more or less a way of using land. Social or economic values and objectives are not incorporated in its definition and although agroforestry can help to achieve such objectives, there are other production systems that do so.

The definition given in ICRAF's Development & Design User's Manual (1987) is presented here, because it includes the four elements mentioned above and limits agroforestry to a way of using land:

> "Agroforestry is a collective name for the land use systems and technologies in which woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately combined on the same land management unit with herbaceous crops and/or animals, either in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economic interactions among the different components."

What does an agroforestry system look like?

The presence of a woody production component is the constant factor of any agroforestry system. The production of woody perennials on one land use unit is combined temporally or spatially with that of herbaceous crops and/or animal products. Any combination of agricultural with forestry production will do! Hence terms like agroforestry, sylvo-pastoralism and agro-sylvo-pastoralism all refer to the same thing: Sylvo-agriculture or Agroforestry if you like.

Farm land surrounded by a wind shield of *Azadirachta indica*, the Javanese taungya system or the *Leucaena leucocephala* pastures on the island Lombok, Indonesia, are a few examples of agroforestry systems. What they all have in common is the fact that they are all spatial combinations.
Temporal combinations are sometimes more difficult to imagine. Shifting cultivation is one such example. Land unit management, including (fallow) periods where trees are deliberately planted or land is left fallow, are more evident examples of such agroforestry systems.

Old or new, does it matter?

A question often repeated is whether agroforestry is something new or an old wine in a new bottle. The above mentioned shifting cultivation is an example of a traditional agroforestry system. In the Netherlands the traditional orchards are familiar in which fruit production is combined with cattle raising just like the treegardens (pekarangan) in South-East Asia. All over the world traditional combinations of agricultural with forestry production are to be found. Probably this combination is the traditional form of agriculture; forestry being a naturally integrated part of agriculture. The expression often used in agricultural systems with different production components is mixed farming.

The techniques and ecologic principles used in both agroforestry and mixed farming are principally the same. Many agroforestry systems partly consist of traditional production elements. If there is a difference between agroforestry and mixed farming it must be at their point of origin. Mixed farming systems have been developed step by step over the years by its users into agricultural production systems. Relative outsiders (researchers, extension agents, community development fieldworkers) have only recently designed agroforestry (ICRAF, 1987).

Whether the "newness" of agroforestry causes problems depends on its objectives and the design of the agroforestry system. One should not forget that traditional systems can be completely outdated, because they are not adapted to current ecologic and economic demands.
Therefore the question should not be whether it is old or new, but whether it is adapted or not to the contemporary situation.
ICRAF (1987) gives three criteria that determine the quality of agroforestry design:

1. Productivity.
   The overall productivity/input-ratio has to increase as a result of the introduction of the agroforestry technique.
2. Sustainability.
   Conservation goals have to be achieved while appealing directly to the motivations of low income farmers, who may not always be interested in conservation for its own sake.
3. Adaptability.
   Technology has to fit into the social as well as the environmental characteristics of the land use system for which it was designed.

Agroforestry and the competition for land

Political instability, population growth, environmental degradation and economic stagnation. In the prevailing stressful socio-economic environment a farmer (agriculturist and pastoralist) has to satisfy his household's needs and at the same time he has to support his government by growing cash crops and by paying his taxes. He is surrounded by other farmers who face the same problems and he has to deal with a government pushing him into certain directions concerning the land use.

When we consider agroforestry as a possible tool in the process of land allocation, two aspects that are not covered by the agroforestry concept itself become noticeable.

1. Who makes the decisions about land use, produce, agricultural production system and who will be exploiting the land? Why is this party interested in agroforestry systems?
2. What will be the balance between the ecological soundness and economic potentials of the system to be introduced?

Who decides and why?

Shortage of land is often contained in a certain socio-economic setting. Different groups with various interests place claims on the land. As long as no one group is powerful enough to determine the land use priorities, the one with the first claim will have the strongest argument.

Who are these different interest groups?

1. People with actual access to land: agriculturists, pastoralists, hunters, forest services etc.
2. People who want to have access to land: investors in land or cattle (i.e. merchants, government employees, military, religious organisations), women, the landless poor, refugees etc.
3. The government that depends on the revenues of agricultural production determined by international market prices.
4. The urban population.
5. Foreign institutions for international cooperation.

Generally, it is the government that plays a leading role on issues such as land allocation. It is the active agent in making laws or avoiding to make appropriate ones or even by direct intervention. What are the arguments put forward by the different groups to influence the government in this decision making process?

1. Those who have access to land do not form a homogeneous group. Pastoralists argue with newly settled agriculturists that occupy their traditional pastoral lands. Which argument will count most? traditional usufruct rights or tilling of virgin soils by hard labour?
2. Among those who want access to land the diversity is even greater than in the first group. Investors can be very progressive in experimenting with new and promising techniques while poor settlers may not be flexible enough to take any ecologic limitations into account.
3. A government cannot freely make decisions because it is bound by international agreements and conditions of support and aid. The government is not always only working for the benefit of the country. It can also bequestioned with what (ethnic) group it associates itself?
4. The urban population that has lost its links with the rural environment can influence decision-making processes through their political support.
5. Foreign institutions can impose ecological, social and economic fringe conditions to the assistance they provide and so impose the setting of priorities.

What alternative does agroforestry offer when setting priorities?

Because of the nature of agroforestry it would seem that different production objectives and ecological conditions could be combined into one system. Different levels of interest could also be combined. Short term household requirements (i.e. food) would be combined with middle term development of cash crop production and long term conservation objectives.

It all sounds very positive, but agroforestry can also be used as an excuse for getting a better grip on people and the resources available. Settlement can be a prerequisite for participating in an agroforestry project. In such a political climate even the act of planting trees lays heavy claims on land by the planter. Often the traditional usufruct rights of others are denied. Just to illustrate the problem, a Tamacheck herdsman in the north of the Sahel may be confronted with new fences when approaching an agroforestry settlement scheme.

Economics versus ecology

When introducing agroforestry the forestry component is deliberately integrated into the agricultural production system. This component adds valuable elements to the land management unit the farmer is working on for instance, it can produce food (fruits, nuts and vegetables), produce cash crops (coconuts, sago, leaves) or produce fodder. The interaction among production components can also be beneficial.

One could think of production of inputs for other components (green manure, wood for tools, fences), improvement of the micro-climate (protection of soils, crops and animals against sunshine, high temperatures and wind). The total production per unit of land will increase because off a more efficient use of soil nutrients and sun radiation.

Does a farmer regard agroforestry in the same way? At first glance agroforestry offers him both economic and ecologic advantages. A farmer however has to deal with a number of needs that must be met with the limited set of production factors at his disposal. Consequently, it might be useful for him to introduce woody elements and livestock in his production system. A farmer could never aspire to being a "sylvo-agriculturist". The resources of most farmers are far too limited to enable investment in unsafe experiments. Therefore, where land and labour are the determining production factors, as an outcome of innovation the overall productivity/labour input ratio on the short term has at least to remain equal or even better to increase.

This is the fundamental problem of introducing any new technique. Agroforestry systems must be advantageous to the farmer on the short term. When dealing with agroforestry one is working on the level of individual households. People need to be convinced.

The first guideline for the introduction scheme has to be the economic impact of the measures and not their ecological effects; even when it is an ecological problem that urges intervention. This limits the scope of application of agroforestry. The steps forward in the development process are often small and reaching the aimed goal takes a lot of time.

Conclusion

There are no inherent objectives in agroforestry. Hence it can be used by anyone for any objective. It can be used either to help people build up a new living or to increase the influence of settled agriculturists on the expense of migrating pastoralists. The expectations of agroforestry systems differ enormously from group to group.

Agroforestry systems have to be designed around the social problems that cause ecologic problems, for instance. The systems have to offer revenues to the user on the short term. It is only then that the user will be willing to invest production factors in middle and long term developments. Agroforestry systems are introduced at an individual household level. Therefore a development programme based on a well designed agroforestry system will progress slowly but steadily.

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AGROFORESTRY AND ITS PROMOTION FOR SUSTAINABLE LAND USE

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Introduction

People fulfil their needs by utilizing natural resources. Today, owing to rapid population growth serious competition among human beings occurs. One of the outcomes has been the destruction of forest land to convert it into agricultural land or other land use. Land allocation policies for agriculture and forestry do not appear to be able to meet the increasing demand for their respective products. Indeed, such a policy has, in many cases, resulted in rapid deforestation leading to a serious degradation of ecosystems and diminution of arable land. Agroforestry integrates forest management, food production and environmental conservation and appears to be a promising alternative system of land use. Interest in the concept among an increasing number of people and institutions has thus gained a tremendous momentum.

The term agroforestry conveys different meanings to different people. The concept is therefore used here in a general sense to define any sustainable land use system that maintains or increases total yields by combining tree (perennial) and agricultural productions on the same unit of land, either simultaneously or sequentially, using management practices that suit the social and cultural practices of the local people, and the economic and ecological conditions of the area. Agricultural production may imply annual or perennial plants for food or industrial raw materials, or it may imply animal products. Fortunately, in many tropical countries some traditional, integrated agricultural and forestry practices still exist, which can be used as suitable examples to illustrate the present situation (Kartasubrata, 1991).

Tropical deforestation and agroforestry

The tropics comprise 38% of the land surface on earth, about 45% of the world's population and most of the developing countries of the world. In the tropics, forests account for about 40% of the vegetation, although agriculture, for which only 10% of the total area is used, is the main economic activity (ICRAF, 1987).

With the increase of human population, man's activity in the forests and the use of forest and forest products have also increased. This has led to exploitation and over- or misuse of forests to such an extent that vast areas of once forested tropical lands have permanently lost their forest cover. The degradation of other vast areas is beyond recovery. The word deforestation is used collectively here to denote all the maladies inflicted on forests by human activities. The process of deforestation is proceeding at such an alarming rate in the tropics that many authorities and researchers believe that by the end of the century much of the tropical biome will have been reduced to impoverished remnants - if not destroyed altogether. The figures compiled by the United Nations Environment Programme - (UNEP, 1980 in Nair, 1982) - indicate that from 1975 till the year 2000 266 million hectares in Central and South America, 15 million ha in Africa south of the Sahara and 48 million ha in Asia and the Far East respectively will have been replaced by non-forest vegetation types. These areas represent 29%, 7.5% and 16.5% respectively of the existing forest areas in these three continents.

The largest loss of tropical forests is due to the conversion of forests to agricultural land, principally by the practice of shifting cultivation in an inappropriate manner and by the creation of new settlements in forest areas. Because of demographic factors such as increased population and migration, and in some instances due to governmental policies leading to a reduction of the land available for shifting cultivation, the area available per family has been considerably reduced. The governments of these regions, confronted with mounting economic problems, cannot desist from commercial exploitation of the forests in order to raise money for essential development, nor can they effectively prevent the shifting cultivators and settlers from felling the forests. It is therefore essential that a system that would permit both forest

land and marginal lands rated unsuitable for profitable production systems, to be utilized for the production of food and/or animal husbandry be evolved, simultaneously ensuring that a protective forest cover is maintained and/or restored in the tropics. A system, which produces as well as conserves, is agroforestry.

Concepts and principles of agroforestry

Agroforestry is a collective name for land use systems and technologies in which woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately combined on the same land management unit with herbaceous crops and/or animals in some form of spatial arrangement or temporal sequence. In agroforestry systems both ecological and economical interactions exist among the different components (ICRAF, 1987).

According to King (1978), agroforestry is a general term which embraces the following components :

Agri-silviculture: the conscious and deliberate use of land for the concurrent production of agricultural crops (including tree crops) and forest crops.
Sylvo-pastoral systems: land management systems in which forests are managed for the production of wood as well as for the rearing of domesticated animals. Note, in this system the animals are kept and permitted to graze within the forests. Sylvo-pastoral systems should therefore be distinguished from systems in which forage (either herbaceous or shrubby) is grown in combination with trees. The last mentioned are agri-silvicultural systems.
Agro-sylvo-pastoral systems: systems in which land is managed for the concurrent production of agricultural and forest crops and for the rearing of domesticated animals. This system is, in effect, a combination of agri-silviculture and the sylvo-pastoral system.
Multi-purpose forest tree production systems: systems in which forest tree species are regenerated and managed for their ability to produce not only wood, but also leaves and/or fruits suitable for food and/or fodder.

Agroforestry practices in Indonesia

The population growth is a national problem. The annual national growth rate stands at 2.3% and is considered to be relatively high. The total population is over 180 million. Even though the country is endowed with a large land area (±190 million ha) its demographic features and arable land distribution are not favourable (ICRAF, 1987).

In Java and Bali, forests have declined to a mere 22% of the surface area to that at the beginning of this century (Kartasubrata, 1991). The high population pressure on forest and land resources poses a permanent threat to stable forest and land management, because of the steady encroachment and increasing use of steep slopes on higher elevations for food crops without proper soil conservation measures.

On the outer islands (Sumatra, Sulawesi, Kalimantan, Irian Jaya and another 13,000 islands), there are still vast areas of "new" land but the carrying capacity of these areas - mostly covered with tropical rain forest - is low and fragile due to their soil properties and environmental and geological characteristics. Although the population in these areas is still small, their land use related activities of low input shifting cultivation, have already had a negative impact on the land resources.

Sustainable land use as part of the country's objective (i.e. sustainable development) is a primary concern, now and for the future.

Agroforestry: a sustainable land use system

The belief that agroforestry is one of the best strategies for sustainable land use has been taken for granted in Indonesia for several reasons :

1. Historically, most of in Indonesia was once covered by forest. Agricultural systems were integrated with forests. The remnants of these integrated systems can still be seen in many rural areas, as villagers retain a large part of their land in mixed gardens dominated by trees. The more consolidated type of land use and ownership on Java has favoured the continuance of mixed gardens, now looked upon as one of the most stable land uses on non-irrigated land. On the outer islands some forests are being maintained under customary law as an economic resource for the villages. The status of these forests however, is weakening and not well respected anymore, due to increasing mobility of the population and the growing demand for arable land.

2. Although industrial development in rural areas is a desirable objective, jobs outside the agricultural sector are still not available, and employment is dependent on agriculture. Nevertheless, the rising increase in pressure on land means that alternatives need to be found. To meet the demands, agroforestry has been introduced in buffer areas in order to prevent deforestation. In Java, especially in the teak forest area, the historical success of the tumpangsari system (taungya) has become the basis for developing agroforestry, in order to protect the "threatened" areas or so called socially fragile areas from further deterioration and encroachment.

3. Rapid deterioration of dry farmlands due to excessive food crop production gave rise to increased concern and the recognition of the protective role of trees. Since 1974, tree planting programmes have been launched for degraded farmlands or open marginal lands, especially on steeper slopes.

Agroforestry systems and technologies promoted in Indonesia

Nair (1987) distinguishes agroforestry systems and agroforestry technologies. Agroforestry systems consist of extensively used agroforestry practices. Agroforestry technologies indicate improvements or innovations, mostly through scientific intervention, which can be applied to the best advantage in the management of the systems. The most prominent agroforestry technologies that Nair mentions are: improved fallow, integrated taungya, alley cropping, multi-purpose trees on farm lands and multi-crop combinations.

In Indonesia there are several traditional agroforestry systems, such as "Kebun Talun" (Garden - Mixed Treegarden) and "Pekarangan" (Homegarden) systems in Java and Multistoried Agroforestry Gardens in Sumatra. There are also agroforestry practices, usually integrated in forest development programmes, which can be categorized as agroforestry technologies and can be implemented on forest land as well as on private land.

Traditional agroforestry systems

"Kebun-Talun-Pekarangan" (Garden - Mixed Treegarden - Homegarden)

Widagda et al (1984) describe the "Kebun-Talun" system as one usually consisting of three stages: "Kebun" (Garden), "Kebun Campuran" (Mixed Garden) and "Talun" (Mixed Treegarden). The first stage, emerging after clearing the forest is the Kebun, where annual crops are cultivated. The crops from the Kebun are consumed by the farmer's family and partly sold as cash crops. After two years when the planted tree seedlings allow less space for the annual crops, the garden evolves gradually into a Mixed Garden, where the annuals are mixed with half-grown perennials. The economic value of the Mixed Garden is less than that of the Garden, but the biophysical value increases, because the mixed nature of Kebun Campuran enhances soil and water conservation.

After harvesting the annual crops in the Mixed Garden, the field is usually abandoned for two or three years and becomes dominated by perennials. This stage is known as Talun (Mixed Treegarden), the climax stage of the Kebun-Talun system. The Talun can be converted again into Kebun, but can also be managed as a sustainable, multi-species and multi-purpose forest with a selective felling or harvesting system, forming the ideal village forest.

The vertical structure of Kebun-Talun is different at each successional stage. There are three horizontal layers during the Kebun stage: creeping plants (e.g. peanut, soyabean, cucumber and melon), vegetables (e.g. chili pepper and eggplant) and food and cash crops such as maize, tobacco, cassava, or leguminous vines (e.g. wing bean or long bean) supported by bamboo poles. The horizontal stratification in the Kebun Campuran (Mixed Garden) is more complex because of a mixture of annuals and perennials. At this stage, shade tolerant plants, like taro, occupy the space below the one metre height level, while cassava forms a second layer one to two metres high. The third layer is occupied by bananas and trees using the space above a height of five metres. Typically, there would be scattered trees, banana patches, and a dense shrubby and shade-tolerant understorey.

The Talun (Mixed Treegarden) stage is dominated by a mixture of perennial trees and bamboo. This stage can vary in composition, such as woodlots (firewood and building materials), bamboo and mixed perennials.

Multistoried Agroforestry Garden System in West Sumatra

Michon et al (1986) report on the Agroforestry Garden System in Maninjau in West Sumatra. The system is characterized by an intensive integration of forest species and commercial crops, forming a forest-like system. The intimate association of different species provides both subsistence and commercial products which supplement rice production. This complex agroforestry system is managed by a combination of cultural practices and respect for natural processes of vegetation production and reproduction. It represents a profitable, sustainable production system and constitutes an efficient buffer between villages and protected forest.

The composition of the system is as follows:

- Cultivated annual crops: chili (*Capsicum annuum*), egg plant (*Solanum melongena*), maize (*Zea mays*), beans (*Vigna sp., Phaseolus spp.*), cucumber (*Cucumis sativus*), etc.
- Tree crops: *Durio zibethinus, Pterospermum javanicum, Toona sinensis, Cinnamomum burmani, Myristica fragrans, Coffea canephora*, etc.

Agroforestry technologies on forest land

"Tumpangsari" (Taungya)

The Tumpangsari technology is the most important method of establishing man-made forests in Java covering an area of 30,000 ha to 40,000 ha per annum. Tumpangsari means co-occupation for a limited period of food crops in young tree plantations. Therefore Tumpangsari may be categorized as an agroforestry (agri-silviculture) technology, i.e. a temporal type of the system (Kartasubrata, 1986).

The Tumpangsari technology is prescribed in detail in similar technical instruction papers of the Perum Perhutani (State Forest Corporation) published in 1974 and 1977. The implementation of Tumpangsari includes four main activities: (1) site preparation; (2) seed preparation; (3) planting; and (4) tending. The spacing of the main crop (teak) is usually lx3 m, and Leucaena is planted in a dense row between the teak rows. The annual crops are planted in the 1.5 m wide strips between the teak and the Leucaena rows (Kartasubrata, 1991).

"Inmas Tumpangsari" (Intensified Taungya)

The increasing population pressure and the resulting growing need for food in rural areas has led to the intensification of agricultural practices, including Tumpangsari. Intensified Tumpangsari includes the following technologies (Kartasubrata, 1991):

- Use of high yield agricultural crops
- Improved soil conservation and tillage methods
- Use of fertilizers
- Use of insecticides if necessary
- Correct timing for planting and fertilizing that take rainfall into account

Integrated Tumpangsari (Integrated Taungya)

A recent development of the Tumpangsari technology is what we may call the Integrated Tumpangsari (Integrated Taungya). This Tumpangsari method is integrated as a technology package in a social forestry program, i.e. the Perhutanan Sosial (PS) programme. The PS programme was initiated in 1984, organized by the Directorate General of Forest Utilization of the Department of Forestry and Perum Perhutani with the support of the Ford Foundation. Bratamihardja (1987) points out certain important characteristics of this programme:

1. Active participation of villagers as a result of the realization of the equal partnership principle.

2. Bottom-up approach in which communication with and participation by forest farmers begin in the planning stage.

There are two important key activities which will ensure successful implementation of the PS program in Java, i.e. the establishment and development of forest farmers associations for the integrated Tumpangsari technology, adapted to the respective locations. In the common Tumpangsari method the farmers are entitled to plant food crops between the young forest trees for only about two years. The integrated agroforestry technology allows the forest farmers to also grow fruit trees, grasses and other kind of plants between the timber trees, after consultation with Perhutani personnel. The plant material for the forest as well as the non-forest trees are provided by Perhutani. The farmers may harvest the fruits, fuelwood, grasses, medicinal and other plants during the rotation period of the forest crops.

Problems and constraints in promoting agroforestry in Indonesia and suggested approaches to overcome the problems

Problems and constraints arising when developing agroforestry differ from place to place, but the complaints and recommendations reported are usually similar and repetitive.

Shifting cultivation areas

The problem with shifting cultivation in the tropical forest areas in Indonesia (Kalimantan, Sumatra, Sulawesi, Irian Jaya, etc.) cannot be handled by the forestry agency alone. It should be tackled by good coordination among related agencies in their programmes and projects in the area. The key to success in solving the problem with shifting cultivation is to provide alternative jobs to absorb the workforce in permanent agriculture, which should be done by providing them with irrigated land. However, irrigation is a limiting factor in shifting cultivation areas. Currently, possible work for shifting cultivators are jobs on the nucleus estates (oil palm, rubber), or in reforestation projects including those of agroforestry.

Public forest lands on Java

Since Perum Perhutani and the Ford Foundation began their social forestry programme on forest lands with Integrated Tumpangsari as the technology package, several problems have arisen. The problems may be categorized as social and tenure problems, lack of project staff as well as technical problems.

As the social forestry projects are established on degraded forest lands under conflicting conditions between the Perhutani and villagers, the first step would be to restore good relations with the villagers which needs tact and goodwill from both Perhutani field workers and farmers and their leaders. To achieve this objective, forest farmers groups have been established, in which "bottom-up" and "top-down" communication between Perhutani field workers and the participating forest farmers is exchanged.

A second constraint concerns the allocation of Tumpangsari plots to participating farmers. Although equal shares of a standard size of 0.25 ha per farmer should be allocated with priority being given to the most needy villagers, in practice, many deviations from this principle occur.

Because the number of interested farmers is usually greater than the available Tumpangsari plots, many interested farmers have to be disappointed. What is sometimes done is that lots are reduced in size, in many cases down to 0.1 ha per lot. Consequently revenues fall far behind the needs of the people, often not exceeding 10% of the total income of the landless, namely, the poorest villagers. It is obvious that besides the Tumpangsari, other employment for the participating farmers is needed if they are to make ends meet.

The selection of participants is, moreover, usually not free from subjective considerations. For instance, Perhutani prefers experienced and loyal participants rather than newcomers; a deviation from the "needy first" principle. In many cases priority is given to friends and family. Village leaders, official and unofficial, usually get larger shares, sometimes more than twice the standard size to secure their continued interest and participation in co-running the programme. These practices are indeed potential areas of friction and unrest among the participants. To overcome this problem, selection of participants sometimes takes place by lottery in addition to fixed allocations to farmer/village leaders.

Conclusion

The growing demands for food and timber and the fact that more attention is currently being given to the development of rural areas implies that improvement of agroforestry practices requires greater urgency. This will enable the traditional indigenous systems, which are essentially already well accepted by the rural poor, to be used as a basis for further development. The development and propagation of agroforestry in the future will affect the well-being of millions of people living in remote places where the struggle for a good life cannot remain a matter of indifference. Although agroforestry is not the panacea for all social and environmental problems, it is a challenge to land use planners to make full use of its enormous potential.

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FORESTRY AND REINDEER HUSBANDRY; Characteristics of two land use types within the same area in Sweden

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Introduction

In the northern parts of Sweden, Norway, Finland and the Kola-peninsula of Russia reindeer are being reared by the "Saami" (Laplanders) population. On a quarter of the Swedish land surface, reindeer husbandry and forestry are being combined within the same area. Although the land is owned by the State, some companies and private citizens, the Saami have user-rights to let their reindeer graze the area.

This paper describes how two different systems, two different cultures and two different people use the same land, and the problems that arise in respect to the two land use types within the same area.

The "Saami" (Laplanders)

There is no universally accepted definition of the Saami. As a general rule, a person whose native language is Saami and/or who regards himself as a Saami is considered to be one. The total Saami population can be estimated at between 45,000 and 65,000, including 15,000 - 20,000 in Sweden, 4,000 - 5,000 in Finland, 30,000 - 50,000 in Norway and about 2,000 in Russia.

The traditional habitats of the Saami comprise the northern parts of the Nordic countries and adjoining areas of Russia. In these areas the Saami constitute a minority and are an indigenous population and the oldest known ethnic group. The Saami regard themselves as one people living in four countries.

The Saami population has never formed any state in the accepted sense. Their society is based on the "Laplanders" (a community of families, which migrate seasonally from one hunting, fishing and trapping area to another). The "Laplander" works with and follows a particular, self-contained herd of reindeer between the various seasonal grazing areas.

The colonization of "Norrland" (the far north of Sweden) began during the 16th century, mainly along the coast. As agricultural colonization expanded, the Saami lost ground. A boundary of the Saami territories became necessary and this boundary was drawn in 1751 and marks the frontier of present-day Lapland. Colonization was encouraged by the state until the mid-nineteenth century, when regulations were issued for the protection of the Saami. The purpose of the farming limit was to ensure that the regions North and West of this limit would be reserved for the Saami. The actual effect of the boundary, however, fell short of this purpose. Still, the strongest acknowledged rights of the Saami are located above this boundary.

The reindeer grazing legislation has divided the Saami population of Sweden into a reindeer herding group and a non-reindeer herding group. Reindeer herding is reserved for Saami who are members of Saami villages. These Saami, today numbering about 2,500, also have certain other rights, such as fishing and hunting rights. However, the great majority of Saami have no special rights. Finding it hard to maintain their Saami identity many of them are assimilated into Swedish communities. It is believed that without the reindeer husbandry, the Saami culture is bound to disappear and this is one of the reasons why the Saami have been given special rights.

The Saami have their own language, bearing the impression of a lifestyle close to nature. The Saami language is comprised several "languages" or "dialects", some of which differ to such an extent that Saami from different areas are unable to understand each other. However, their common origin and language makes the Saami of the Nordic countries consider themselves to be one people. They regard the national boundaries as something forced upon them from outside.

The reindeer (*Ranginus tarandus*)

The reindeer belongs to the deer family and lives in the northern parts of Canada, Alaska, Greenland, Russia and the Nordic countries of Europe. It can be found on the tundra, on bare mountains and the "Taiga" (the coniferous forests). The reindeer came to Scandinavia about 12,000 years ago. Wild reindeer can be in the northern parts of Russia. The American forest-caribou (*R. tarandus caribou* Omelin) lives in a belt from Alaska all across Canada to the Atlantic coast. The American reindeer is bigger than the Eurasian tundra reindeer (*R. tarandus tarandus*).

There is no significant difference in behaviour between the wild reindeer and the tame one. Both migrate all year round to the most favourable grazing areas. In winter, the reindeer usually feeds on lichen which is found under the snow and hanging from trees. During summer its food consists of different kinds of grasses and herbs.

Reindeer husbandry in Sweden

About a quarter of the Swedish land surface, i.e., approximately 8 million ha, is commonly used for reindeer husbandry and forestry. However, each year only a few parts of the area are used for reindeer herding. Some parts are used very infrequently, as they importantly constitute "reserve areas" for periods of bad grazing conditions.

Two types of reindeer herding can be distinguished, i.e., "mountain reindeer herding" and "forest reindeer herding". The main characteristic of "mountain reindeer herding" is the very long migration distance between summer grazing areas in the western barren mountains and the winter grazing areas in the East. The winter grazing areas of the "forest reindeer herding" is near the eastern coastland, and the distance to the summer grazing areas in the inland is relatively short.

Also the shape of forestry varies somewhat from the eastern area to the western, mainly due to much better biological and economical conditions near the coast in the East.

The law states that during the period of october 1st to april 30th reindeer husbandry is allowed from the Norwegian border down to the Baltic Sea. However, from april 1st to september 30th it is only allowed West of the "Odlingsgränsen" (a specific border lying north - south). Consequently, the Saami have to make their reindeer migrate in the spring. Instinctively, the reindeer migrate along specific routes and problems have arisen during the migration process. Nowadays often the migration routes have to change due to large-scale clear-cutting areas, construction of roads, an increase in tourism facilities, etc., which confuses the reindeer.

Reindeer husbandry and forestry are also influenced by other forms of land use. Furthermore, basic natural conditions vary from one area to another. The overlapping of the two forms of land use is located in a part of Sweden where the land use conditions are unfavourable and the socio-economic situation is weak. Negative external effects can even worsen these conditions and this situation. Each form of land use, also the present reindeer herding, depends on a market, an infrastructure, a social service, and other societal factors, which could not exist as they do without the contribution from many forms of land use/industries/activities.

The relationship between forestry and reindeer husbandry

The relationship between forestry and reindeer husbandry has been the subject of an intense debate in recent years. According to Leif Mattson (1981), the reciprocal influence between forestry and reindeer husbandry can be expressed in four general statements:

1. it involves both negative and positive effects;
2. it concerns both biological production conditions and rationality in the use of natural resources;

3. negative aspects of forestry on reindeer husbandry mostly effect the winter conditions, while the positive aspects mostly effect the conditions during the other seasons;
4. because of the difference in geographical location of the summer grazing, "forest reindeer husbandry" benefits more from the positive effects of forestry than "mountain reindeer husbandry".

There is a rather clear opinion among both reindeer keepers and representatives of forestry, that in solving the problems in the relationship double land use must be included as a precondition. This opinion has also been strongly expressed by government and planning authorities. The effects of various activities from one land use form should not make impossible the other land use form. It must be stated, though, that it is primarily the representatives of reindeer husbandry who claim that the relationship involves problems.

In Sweden there has been a basic change in forestry practices, from the dominating selection system of the 1920s, 1930s and part of the 1940s to clear-cut felling systems. The transition in the 1940s was largely due to the demand for a long-term high production of wood for the forest industry, a demand which the old forestry method could not meet. In the 1950s, restoring the forests became an important ambition, which in large areas meant clear-cutting and additional regeneration measures in order to establish high productive stands to replace the former forestry low productive stands. Besides this concern for future wood resources, actual economic conditions also contributed to a trend for "large scale forestry". From the early 1950s to the early 1970s, roundwood prices were maintained at about the same level, while labour costs increased considerably. The result mechanization which demanding larger treatment units and a larger proportion of final felling of the total felling volume.

The rather heavy fluctuation in the reindeer population is characteristic of reindeer husbandry during the past fifty years. Around 1930 the reindeer population totalled approximately 300,000 animals. In 1940 it dropped to about 160,000, then increased to about 250,000 in the mid-1950s. After decreasing to less than 200,000 during the early 1970s partly because of bad climatic conditions, the numbers have considerably increased to nearly 300,000 at the present.

Another characteristic for the past fifty years is the expansion of technology used in reindeer husbandry. Particularly in the area of transport, technical innovations have gained importance: snow mobiles and cars as well as aircrafts have become essential tools in the trade. The land is used in the traditional manner characterized by use of a large area and long migrations of the reindeer herds.

These developments within forestry and reindeer husbandry have altered the relationship between the two land use forms, which can be briefly described as follows:
During the 1950s, the problems for reindeer husbandry increased mainly due to the expansion of the large-scale clear-cut felling system. During the following decades the felled area each year remained abour constant. Additional problems for the reindeer husbandry were caused by the introduction of mechanization in forestry, which resulted in a higher percentage of separate felling areas and "radical" methods within primary production, such as mechanical soil scarification, chemical regulation of tree species and fertilizing by aircraft. Furthermore, in the 1970s, the intensity of primary production activities increased.

Fluctuations in the reindeer population imply a varying influence on the primary production of forestry and on the rationality of fellings. However, the relative influence of the reindeer population on the latter diminished gradually, especially in the 1960s and 1970s. This change was not because of the development in reindeer husbandry but as a result of the more mechanized felling systems. In this situation the presence of reindeer in felling areas is less problematic than in the former felling system when the work was done by hand and using horses.

Acceptable and non-acceptable forestry practices from the reindeer keeper's point of view

It appears that problems existing between forestry and reindeer husbandry are basically due to their competitive forms of land use, originating in the different principles of action. Forestry is characterized

by thorough and concentrated changes in the forest ecosystem with a strict division in stands, while reindeer husbandry is characterized by slow and minor changes in the forest ecosystem and with a clear need to migrate between several areas. So from the reindeer keeper's viewpoint the structure of the forest in respect to ages of the stands is of paramount significance.

Problems for private landowners

A problem for private landowners is the destruction of tree plantations during the winter when herds of reindeer try to find food under the snow on clear-cut areas. Although, it is not a big problem, for some landowners it gives rise to a significant loss of money.

Another problem arises during the hunting season in those parts where the reindeer are not allowed to be (between april 1 and september 30). Some herds of reindeer do not migrate up to the mountains in the spring. These herds cause problems for the dogs used in the hunt. This may seem like a small problem, but, in Sweden, hunting is a very emotional and sensitive subject and means a lot to the people, especially to those in the northern parts of Sweden.

Conclusions

In this paper I have tried to describe some problems involving the double land use between people involved in forestry and reindeer husbandry in Sweden. There is a conflict between these two groups as well as between reindeer keepers and other groups. From my point of view, the main problem is whether or not we want the Saami culture to survive? If the answer is yes, the Saami population must be allowed to continue their reindeer husbandry. This does not mean that forestry should be forbidden in these parts of Sweden, but I think forestry has to take more careful consideration of reindeer husbandry than it does at present.

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Forests on slopes: The role of forests in the battle against erosion, with special reference to tropical countries

PROTECTION OF HILL FORESTS IN THE TROPICS

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Introduction

In several developing countries severe erosion can frequently be seen in mountain watersheds.

In areas of rugged topography, long steep slopes present a major reclamation problem. Once the vegetation has been removed from the unstable topsoils of these slopes, even the hardiest natural vegetation will not become re-established naturally, unless the slope is reduced to what is known as the "critical slope angle for vegetation". This angle can only be regained naturally by the action of continued erosion over a long time-span, which is unacceptable. Therefore, special techniques are needed to make steep slopes gentler and shorter and to provide a stable ground on which vegetation can be established. In some regions topographical and soil degradation problems are supplemented by an unfavourable climate. In arid regions, scant rainfall, high evapotranspiration and prolonged periods of drought occur. Slope stabilisation and soil improvement techniques must be tailored to cope with these different environmental situations. Erosion control focuses on the restoration of soil cover and on reducing runoff. Mechanical structures (e.g. terraces, dikes, drainage channels) increase the water infiltration capacity.

Vegetative possibilities for reclamation

Areas which are sensitive to erosion quite often show deficits in wood and non-timber forest products failing to satisfy the needs of the local population. The introduction of integrated systems such as agri-silvicultural ones open up new avenues to help solve these problems. At places where agriculture is no longer possible and where reafforestation is a necessity to stabilize the environment, one should opt for the planting of multi-purpose trees. Multi-purpose tree cultivation offers many ecological advantages as well as revenue to the farmer. The remaining natural forest stands have to be protected and the felling of trees has to be regulated and controlled. The degradation of the environment can be halted, concurrently ensuring the availability of forest products for future generations.

The choice of plant species is of vital importance when restoring degraded lands. To reach the optimum soil productive potential, the chosen species must be able to accomplish a wide range of purposes. When soils have become seriously deteriorated, it is not easy to establish even hardy, indigenous species without applying site improvement techniques. Pioneer species capable of establishment under refractory soil conditions need to be selected.

Planting trees and shrubs

Active erosion processes usually take place on the more degraded sites. So the trees and shrubs to be planted should be deep rooting and resistant to harsh conditions. Species that can be multiplied by root cuttings are particularly useful. The following species can serve as transitional vegetation in different environments: *Acacia spp., Prosopis spp., Albizzia spp., Tamarix spp., Cassia spp., Leucaena spp., Gmelina spp., Casuarina spp., Euphorbia spp., Gymnosparia spp., Eucalyptus spp., Gleditsia spp.* All these species are rapid establishers and form a good plant cover to the soil. The rooting systems of these trees and shrubs serve to stabilize soil structures and later on will provide benefits such as fruits, fodder or fuelwood.

The permanent forest estate must be protected against uses that are potentially destructive or competitive. Particularly in young or newly established forests grazing by domestic animals often reduces or even

destroys the vegetation cover. Fencing in this juvenile stage is essential to protect this land against the potential danger of erosion (Figure 1).

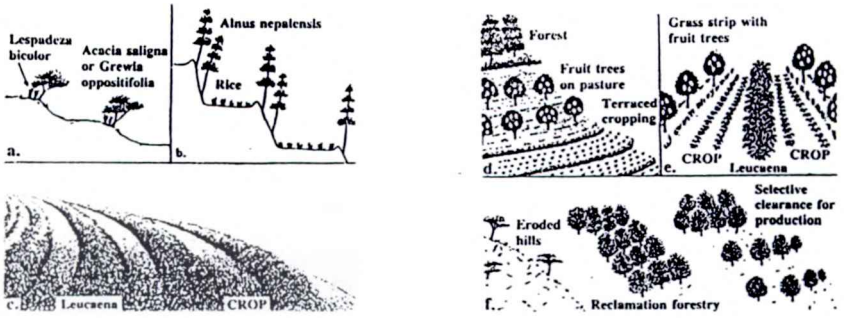


Figure 1. Examples of agroforestry in erosion control (Source: Young 1991).

a. Trees on terrace risers, Ethopia
b. Trees on risers of irrigated terraces, Nepal.
c. Hedgerow intercropping with *Leucaena* laid out on a slope
d. Model for land use as alternative to shifting cultivation, north-east hills region, India
e. Plan view of suggested land use on slopes, combining barrier hedges with trees on grass barrier strips, Philippines
f. Possible development of reclamation forestry into productive use by selective clearance of contour strips

The harvesting of wood and non-timber forest products automatically implies an impact on the forest lands and its surroundings. Several extraction devices and methods have to be discussed because they could have a negative influence on the soil's susceptibility to erosion. The planning and construction of roads for the exploitation should be aimed at minimizing erosion. It is necessary that roads are fully protected against avoidable erosion.

Grassing - sodding

It is often desirable to establish permanent woody vegetation on eroding areas. Initially a temporary cover of grasses to stabilize the topsoils may be necessary followed by reforestation, at a later stage.

Mechanical consolidation of unstable slopes

Erosion control on crumbling slopes

Treatment of such slopes is expensive and should only be executed when the protection of areas downstream is vital. Protective walls on slopes have to be constructed with crumbling material. The foot of these walls must be protected, preferably with shallow-rooting plant species. Note, species with strongly penetrating roots can damage the structure.

Erosion control on sliding ground

Landslides of unstable, water saturated soil material takes mainly place on steep slopes with a layer of loose soil over a clay, schist or marl formation.

If the thickness of the potential sliding layer is greater than the rooting depth of species adapted to the area, it might be that the reclamation by planting will be ineffective. The additional weight of the planted vegetation may even increase the hazard of landslides. Indirectly, this danger increases due to the

additional amount of water held in the soil as a result of the improved infiltration capacity. Stabilization of these areas can only be achieved by a combination of mechanical and biological controls: drainage, consolidation of the moving mass, diversion of water to prevent soils being washed away.

Brush mulching

A cover of brush over the eroded area can sometimes stabilize erosion scars (Figure 2). This is done by starting at the foot of the slope and by gradually moving upwards. The brush will later be covered by earth brought down from above by runoff water. This gradually builds up a deposit on which plant cover can be established. The brush must be anchored by means of stakes driven into the soil. The entire system should be anchored either by wattles or by a sill laid out at the foot of the system.



Figure 2. A brush cover put on a bare erosion slope with anchoring bij stakes; wattling at the lower edge (Source: FAO, 1976).

Contour ploughing

On eroded land with low slopes, establishment of trees or grasses can be encouraged by contour ploughing, to retain water, reduce runoff and erosion and maximize infiltration capacity (Figure 3). Ploughing can also be alternated with broad-based ridges or terraces, where the soil is ploughed on contour between the terrace or ridge lines.

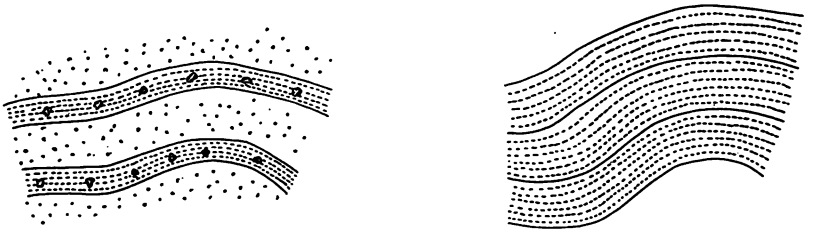


Figure 3. Contour ploughing (Source: FAO, 1976).

On natural rangelands, where soil and grass cover are of a reasonable quality, small furrows 10 to 12 cm deep and 1 to 2 m apart will improve surface water retention without destroying the herbs.

Strip-cropping or cultivation

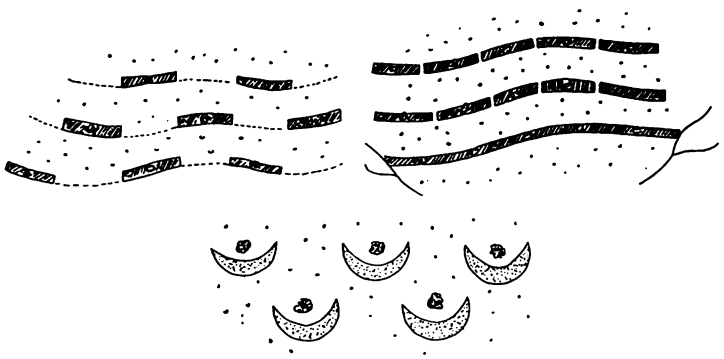
This consists of planting strips of grass, clover or similar plants between strips of cultivated rows of crops on or adjacent to the contour. It is one of the best and most economical methods of erosion control where the erosion hazard is moderate and the slopes are not too steep.

Terraces

Terraces are constructed to reduce surface runoff and erosion and to retain water for plant growth thereby increasing the water infiltration capacity. In high precipitation areas, the terrace network is usually designed with a slightly longitudinal gradient to drain excess water. In dry regions, the terraces designed precisely follow the contour so that the maximum amount of surface water can be captured. Standard terraces must have sufficient channel capacity to take care of the maximum runoff expected for the design period (usually 10 years).

Level terraces

It should be emphasized that contour terraces should only be built on permeable soils and on low slopes. On permeable soil and steep slopes they could cause soil creep, scuffing and slides. Level terraces are built without a longitudinal gradient so that all the water received from the drainage areas at higher levels can be impounded and absorbed by infiltration. Thus, they must be large enough to contain the runoff even from the heaviest expected rains. They can be built along contour lines, either as long or short structures. Short terraces (Figure 4) should be no more than 3-6 m in length. Very long terraces must be broken into separated compartments by constructing small berms across the terrace at regular intervals of 3 to 4 m. This minimizes the effect of errors in levelling. They can also be grassed or otherwise protected against erosion. In deep and gulled soils, individual crescent shaped terraces are usually the most appropriate.



Figur 4. Short terrace of 3-6 m long (Source: FAO, 1976).

In high precipitation areas it may not be economical to build level terraces, because of the large water storage capacity needed. However, in dry regions terraces can be useful in retaining the limited amount of water from infrequent rains.

Graded channel terraces

This type of terrace, designed to function as a water course for excess run off, is built with a slight longitudinal gradient to remove water from heavy rains into either a natural gully (which should be stabilized) or an artificial waterway. Waterways must be planned before construction to determine the direction of the grade. The longitudinal gradients of the terrace must be sufficiently low, such that the velocity of runoff does not exceed the maximum velocity that would cause serious erosion of the terrace.

Banquettes and gradins

This type of terrace is the most economic and the one most suitable for reforestation and pasture improvement on steep slopes. It is also recommended for impermeable soils. It is a terracing technique developed for arid and semi-arid climates for growing horticultural crops, reforestation and pasture

improvement. The banquettes and gradins are laid at maximum intervals computed as a function of the slope and rainfall intensity. They can be laid either with a slightly longitudinal gradient, to remove excess water through a waterway, or they can be constructed level to increase the opportunity for infiltration.

The banquette (Figure 5) is most commonly used on slopes with an inclination of less than 40%. The shape is well suited to mixed cultivation. Fruit trees can be planted on the berm and crops can be grown in the channel (fruit trees such as olive, almond and fig).

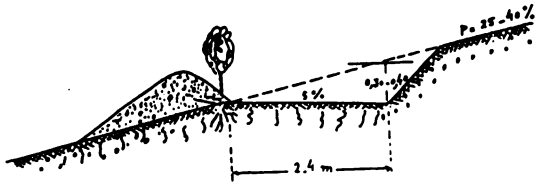


Figure 5. Banquettes (Source: FAO, 1976).

The gradin (Figure 6) functions well on slopes with an inclination between 40 to 50%. The sub-soil however must be firm and permeable. A gradin is most suitable for the planting of fruit trees, afforestation and pasture improvement. For pasture improvement the side slopes should be reduced to facilitate the establishment of grasses and the movement of livestock.

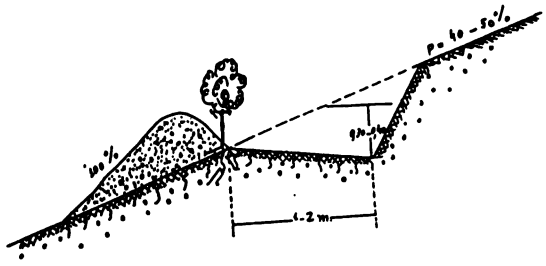


Figure 6. Gradins (Source: FAO, 1976).

A V-section gradin (Figure 7) is the best choice for slopes greater than 50%. After construction, bare soil should be stabilized with grasses or rocks.

The steppe method

This is essentially a type of terracing used in areas where the slopes are shallow. In low-rainfall areas it is recommended that the usable soil be gathered and piled in the terraces. A layer of soil should also be left in place between terraces, to conserve moisture in the lower layers of the soil piles.

Terrace maintenance

If terraces are not maintained, they will certainly disappear. Terraces which break down are dangerous, because the run off is concentrated at the breaking points and can quickly lead to severe erosion and even failure of the entire system. Careful inspection and maintenance, particularly during the first year after construction, is essential. It is also important that terraces are inspected after heavy rains and that immediate repairs are made where necessary before erosion can begin to become a problem.

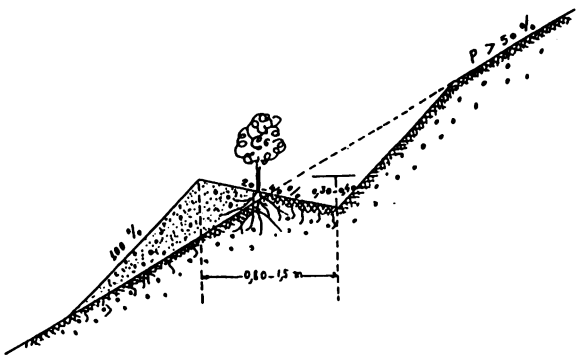


Figure 7. V-section gradins.

Terracing is expensive and time consuming and deserves careful thought and planning. It is not the solution to all the problems and often only a temporary measure to aid the establishment of vegetation.

Conclusions

The afforestation of steep slopes can best be done by using a mixture of multi-purpose trees. Besides soil protection it offers the opportunity of additional revenue.

There are several methods for the consolidation of unstable slopes. In my opinion terracing is the best method to make steep slopes gentler and shorter, and to provide a stable ground for the establishment of vegetation.

The permanent forest estate must be well protected against destructive competitive uses, as a forest is the most efficient way to prevent erosion on steep slopes.

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CHILE: FORESTS ON SLOPES AND THE PROBLEMS RELATED TO SUBSISTENCE FARMERS

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Introduction

A general introduction on soil erosion on slopes in Chile will first be presented. Special attention will be paid to the problem of small subsistence-oriented, rural land owners. Erosion is often the result of different economic, cultural, social and technical problems. The factors that contribute to erosion and their possible solutions will be analyzed.

Since the arrival of the Spanish in America there has been a constant population growth. This has led to a steady increase in pressure on the environment, more and more land has been cleared for agriculture and pasture at the expense of nature, accelerating the process of deforestation and causing soil erosion. To meet the rising demand for food, a gradual over-exploitation of agricultural land has occurred. Many farms are located in hilly areas that were originally covered by forests.
This process can be seen in many countries, including Chile.

Historical background

Competition between agriculture, cattle raising and forests

This struggle began in the Pre-Colombian era, and intensified after the arrival of the Spanish in Chile. The need to create space for agriculture and the increase in mining activities (mainly in semi-arid regions) led to the destruction of large areas of forests.

The arrival of settlers in the south of Chile (e.g. the Germans in Llanquihue and Valdivia) resulted in intensive destruction of forests since they used fire to clear the forests for agriculture. These fires extended over several hundred thousands of hectares and lasted for years.

The abundance of the resource, and the belief that it was inexhaustible, led to this irrational abuse that left vast areas bare. These areas were very vulnerable to erosion and are practically unproductive nowadays.

The gold fever in California and other events in the 19th century stimulated the export of wheat from Chile. This caused over-exploitation of the "Coastal Mountain Range", thus degrading thousands of hectares of land (Contesse, 1990).

Agricultural over-exploitation and the use of forests

Between the end of the nineteenth century and approximately 1950 the relationship between the people and the forest changed. The forest industry began to develop, based on the production of lumber in rudimentary installations, primarily dedicated to the supply wood for construction purposes.

The relationship with the forest is nowadays not as destructive as in the foregoing period, but it still can be characterised as irrational and degradative. Creaming of the forests takes place in which the best trees of the forest are harvested, causing soil erosion and a deterioration of the genetic stock. Moreover, settlers and illegal occupants of the State Forest Reserves continue to clear mountain terrains with axes and fire to conduct subsistence-oriented agricultural activities (Contesse, 1990).

The promotion of plantations of exotic tree species since the 1950s

Towards the middle of the twentieth century the situation became very tragic. Nineteen million hectares (some 25% of the total land surface) were affected by erosion, four million of which were severely degraded.

The State began to stimulate reforestation using exotic species, which in the beginning was mainly *Pinus radiata* but later *Eucalyptus spp.* as well. In 1974 the "Decree Law No. 701" was created. Under this law, subsidies of up to 75% of plantation costs to afforest waste lands are provided. This applies only to plantations that have a plant survival rate of at least 75%. The law also includes subsidies for tree pruning. This measure initiated a rapid increase of exotic species in the planted area. Today, there are 1.5 million ha of pine plantations and about 100,000 ha of eucalyptus plantations.

There is no doubt that this policy had an important positive effect on the erosion problem in several zones, and also stimulated the further development of the forest industry; an industry which that is increasing in economical importance. But there still remains a destructive pressure on the original forests (for instance, the collecting of firewood continues). Over-exploitation of hilly areas for agricultural use can be seen, especially on the land owned by small rural land owners who work on a subsistence level (Contesse, 1990).

As can be seen throughout history, the present erosion problems are not only of a technical nature but also have very complex social, economical and cultural dimensions. These too have to be taken into consideration.

General aspects causing incorrect soil management and erosion

The ignorance of adequate management techniques is an important factor leading to erosion, especially among small rural land owners whose outdated management systems can be traced to their ancestors. Nowadays, although sufficient knowledge is available concerning slope management, there is a lack of good communication channels to reach the people who really have to deal with the problem.

The inadequate management of slopes (especially on land used for agriculture where there ought to be forest) is closely linked to other factors, such as a biased agricultural mentality. This mentality has taken root in the population under different historical and economical pressures. The small land owner whose hilly land inherited from his father was deforested more than a century ago, will most probably continue using the soil in the same way as his ancestors did, but for different reasons. The decision making processes of the farmer are determined by three factors. First, he often ignores or is unfamiliar with better forestry or agroforestry techniques. Second, he is part of the subsistence economy which makes it very difficult for him to reverse the process of soil erosion, since he has no economical support. Finally, in spite of low yearly production due to short-term planning (caused by the subsistence level), the farmer will have a greater annual cash flow from agricultural production than from forest production, despite soil deterioration.

Another basic reason for the over-exploitation of sloped lands is the pressure exerted by rural and urban communities on the land use. The combined need for firewood, food and timber leads to the over-utilization of the soil on small farms (de Camino, 1985; Peña, personal communication). In numerous cases, a small piece of land means subsistence for a great number of people. The number of people is often more than the land can support using the prevailing land use system. So it will be obvious that over-exploitation of the land will occur.

Pressure exerted by the market, unfavourable marketing conditions and price levels of all kinds for products are factors that especially affect the small farmers. They also influence the over-exploitation of forests on slopes and land that is presently used for crop-farming and cattle grazing (de Camino, 1985).

Solutions

Priority should be given to radical changes in agricultural, livestock and forestry practices. Attempts must be made to develop activities in a harmonious, integrated way by introducing new techniques which must be, (and this is very important), 'adapted to the ecological and socio-economical situation prevalent in the region involved.'

At present there are several forestry and agroforestry techniques that can solve or at least help to solve the erosion problem. I would like to stress that it is very important that forestry engineers should consider the tricky situation of the subsistence farmer. Although a well managed forest is an excellent option to protect the soil from an environmental point of view, this solution will probably not be the most appropriate for a small land owner faced with the problem of erosion. The small land owner must be assisted to find solutions which permit him to have a decent annual income. In the case of afforestation the planting period is followed by many years without any income. In a subsistence economy, it will be impossible for the people to survive this period unless they get external support.

An interdisciplinary vision is needed to study these situations. Agroforestry techniques may provide solutions (Ríos, 1979). However, the introduction of agroforestry techniques will only solve some of the problems. To solve the problems, the various influencing factors and disciplines which have a direct or indirect influence on erosion must be studied (de Camino, 1985).

Before starting a project it is of utmost importance that the affected people are consulted. A preliminary study will be essential. This can be done by spending some time in the project area talking with the local people and analyzing their problems. Only then will we be able to understand the relationship between the different factors that affect their development (Peña, personal communication). It is important that the external agent should orientate and not impose him- or herself at this stage.

Solutions should also be generated by the farmers themselves, with adequate external technical support. The principle of participatory development is very important enabling the rural community to be committed to the innovations that will eventually take place. The knowledge of small farmers should not be underestimated. They usually have specific and valuable knowledge of the conditions of the soil, vegetation, water and climate that the technician may not be aware of (de Camino, 1985; Peña, personal communication).

Another important aspect is the education and training of the farmers and the rural population. This must be done using the appropriate language and with the support of professionals in the areas of sociology, information and education. This is vital if an erosion control programme is to be successful, because it will permit the continuation of the projects when they are handed over to be completely controlled by the local people themselves.

The organization of people in cooperations or communities is very important. It will permit small rural land owners to support each other in their development plans (horizontal cooperation), to combine the marketing of their products and to improve access to regional authorities (Ocaña, 1987). Clear land titles and the regulation of land tenure is also of importance; a problem affecting many small rural land owners in Chile (Contesse, 1990).

The government ought to provide several types of direct or indirect incentives. An example of a direct incentive is the granting of loans, which might be short-term loans, to finance crop production to cover an entire cultivation cycle. These loans could be paid back after the harvest.

Soft credit with a long repayment period is needed for different activities such as reforestation, watershed management, silvicultural treatments and pastoral activities. Revolving funds (consisting of an initial contribution from the State by way of a loan or a grant) can be used for short-term loans to the small rural landowner, especially for input and working capital. The provision in kind such as tools and other equipment is another incentive that one should keep in mind.

Indirect incentives can be in the form of tax privileges, technical assistance, facilities for direct and timely access to markets, transport facilities, road maintenance, education and training and the establishment of information centres.

Social incentives tend to include all the measures that could improve the quality of life of the rural people and rural communities, such as electricity and health services (de Camino, 1985).

In short, to stop erosion and degradation of sloping terrains it is important to devise/invent production systems which harmonize the mentioned aspects of the conservation of the ecosystem, concurrently adapting them to the prevailing social, economical and technical conditions.

Case study: *Jubaea chilensis* cultivation in the Central Zone

The development of productive alternatives for the Central Zone of Chile based on the use of the palm species, *Jubaea chilensis*, will be presented next.

Characteristics of the Central Zone

The Central Zone is situated approximately between latitude 32 and 37°S. The physical conditions are roughly equivalent to those of the south of Spain. The Central Zone has a temperate mediterranean climate with an annual rainfall ranging from 200-800 mm, most of which is concentrated in the winter months June-August. The Central Zone mainly consists of slow-growing sclerophyllous forests which are well adapted to the area.

Forestry problems of the Central Zone

The high demand for timber and firewood and the clearing of land for agricultural purposes has decimated the sclerophyllous forests. These forests have been converted into agricultural and pastureland. On slopes with low productivity, the clearing of the forests has resulted in loss of soil productivity resulting in serious socio-economical problems in the region.

Palma chilena, *Jubaea chilensis*, a high yield crop for slopes

Palma chilena is to be found in the sclerophyllous forest and favours a wide range of habitats. The palm is seen along water courses from 200 meters above sea level up to 1000 meters above sea level on soils of granitic origin.

In the past it was irrationally harvested. More knowledge about its biology and silvicultural requirements is needed. The species has a slow growth rate, reaching maturity after 40 to 50 years and producing fruits that look like little coconuts with a diameter of about 2.5 cm. These nuts growing in bunches at springtime mature at the end of summer. When planted at a density of 400 to 500 plants per hectare a good yield can be obtained. Fencing to avoid damage by livestock is necessary.

Advantages of palm plantation

The palm has a lot of interesting characteristics which makes it very attractive for cultivation.

- It has a great adaptability to the environment, with a survival rate of 90 % under existing forest cover.
- The planting costs are low, of about US$ 5/ha compared to that of Pinus radiata amounting to US$ 150/ha. So it is attractive from an economical point of view. Initial costs are low so small land owners who have financial limitations can participate. Furthermore, the management costs are low, because fertilization, thinning and pruning are not necessary.
- It offers stands with an open crown cover enabling silvo-pastoral systems to be introduced.
- It has fruits which are used to make sweets and honey. They have a pleasant taste and are sold in Chile at a price of approximately US$ 1/kg. Each palm can produce about 4-5 kg per year, therefore 500 palms/ha can provide an annual income of US$ 2000/ha. Harvesting the nuts consists of picking up the nuts from the ground, which is very easy, cheap and does not require any special skill.

- It produces honey. Honey production requires the harvesting of the palm. When mature a palm produces ±400 litres of sap, the raw material for the honey. The extraction process is as follows: The tree is uprooted at the end of the winter, and left lying there until spring, when the stems are cut and the apex is cleaned and sharpened like a pencil. The sap flows slowly and is stored in a receptacle. Twice daily, the apex is washed and shaved to maintain a good flow of the sap. Subsequently, the sap is boiled and concentrated finally producing 80 to 90 litres of concentrated honey. The price of the concentrated honey is US$ 20/kg. It is important to remark that the final commercial product contains only 3% of the concentrated honey. The rest is a mixture of nut juice and sugars. The concentrated honey has a very strong taste. A palm honey factory needs only 30 palms to produce 90,000 litres of honey per year.
- Although the palm forest has less crown cover than the sclerotic forest, the management and the harvesting of the palm is less destructive to the soil, because it is not a slash and burn system. Additionally, the use of heavy machinery is not necessary for removal of the trees.
- It is possible to have a forest understorey enabling the production of fodder for pasture or shrubs that could yield marketable fruits contributing to the local economy.
- Finally, we can say that the palm's use allows an important annual profit from a small area, which is of considerable importance to small farmers (González, 1985).

Discussion

We have here a tree species with high potential for profits for small farmers, but income from it will only be generated from it after 40 years. Consequently the palm is not very attractive to small land owners. The question is how can the resource be made attractive to small farmers? It would seem wise to stimulate the farmers by providing grants, subsidies or other types of governmental incentives to make efficient use of the land. For small farmers who live in a subsistence economy, a long term investment is not practical. One should not forget that subsidies and grants give distortions in the local economy and a long-term dependence on the state.

The great dilemma is how the technical solutions to control erosion can be harmonized with the socio-economical and cultural situation of small farmers.

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FORESTS AND SOIL EROSION IN EAST KALIMANTAN, INDONESIA

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Introduction

East Kalimantan is the second largest province in Indonesia, covering a total area of 21.1 million ha. The area under the jurisdiction of the Ministry of Forestry covers 17.3 million ha and is usually referred to as the forest area, though not all the surface is covered by forests anymore. Part of this forest area, covering 11.9 million ha, is handed out to concessionaires. Each year, from 1979 until now, approximately 70,000 to 140,000 ha of forests have been exploited by the concession companies.

Damage to the forests of East Kalimantan is also caused by aspects such as shifting cultivation, transmigration programs, coal mining, pepper plantations and forest fires. The typical factors and agents that cause accelerated erosion in East Kalimantan will be described.

Research on erosion in virgin forests in East Kalimantan showed that weathering and erosion are in a dynamic equilibrium, even though litter transport and land flow occur. However, if the thin but highly protective litter cover is removed, denudation rates increase sharply by rain splash detachment (Besler, 1987). As soon as the vegetative cover is opened up, the hilly topography with high precipitation rates favours soil erosion. Deforestation increases while reforestation is difficult and expensive both practically and politically. Environmental degradation, including soil erosion, river siltation, the water quality problem and loss of genetic material is going to be a big problem in the near future (Stadtnuller, 1989).

Erosion relevant issues

Logging

Since the 1960s timber companies have logged some 2.5 million ha of virgin forest. They have caused major environmental damage and soil erosion by using heavy equipment and improper technologies. Abdulhadi et al (1981) calculated that 30% of the mechanically logged areas are permanently lost for timber production by skidder trails, hauling roads and log-yards.

All studies on erosion in humid tropical forests during, and after logging, indicate that the erosion rate increases and is even higher if logging is followed by fire (Ewel and Conde, 1980). Abdulhadi et al (1981) provide infiltration values for undisturbed forest and for extraction paths in a lowland dipterocarp forest at Lempake near Samerinda, East Kalimantan (Table 1).

Table 1. Rate of water infiltration in undisturbed and disturbed soils of a logged over lowland dipterocarp forest at Lempake (Abdulhadi et al, 1981)

Site	Rate of water infiltration in cm/min	
	mean	range
Undisturbed soils	4.62	2.26 - 6.66
Disturbed soils	0.63	0.01 - 2.26

A study carried out by Intasothi (1974) at Sebulu near Samarinda showed that the A-horizon decreased after logging. Four years after harvesting only the A-horizon had recovered in the slightly disturbed areas whereas soil structure and bulk densities had not (Table 2).

Table 2. Bulk densities under virgin forest and in heavily disturbed areas two and four years after logging at Sebulu near Samarinda, East Kalimantan (Intasothi, 1974).

Locality		Bulk density (g/cm^3)
Virgin forest:	surface soil	0.96
	subsoil	1.36
Heavily disturbed area, 2 years after logging:	surface soil	1.40
	subsoil	1.35
Heavily disturbed area, 4 years after logging:	surface soil	1.50
	subsoil	1.36

Abdulhadi et al (1981) report that in their study area, some six months after logging, bare ground was heavily invaded by pioneer species. But it must be emphasized here that this secondary forest cover does not protect the soil as well as primary forest does, neither does it easily compensate the physical damage to which the soil already is exposed (compaction, loss of soil structure, removal of organic matter). Thus, further erosion is to be expected in the heavily damaged forest areas months or even years after logging. Ruslan and Manan (1980) report after their study area in South Kalimantan that erosion in surface run-off decreases since abandoned skidding roads are invaded by trees, grasses and shrubs.

Shifting cultivation

On the outer part of the island, about 90% of the land farming is practised by means of shifting cultivation (Donner, 1987). In East Kalimantan two different forms of shifting cultivation can be differentiated:

- Traditional shifting cultivation in remote forest areas.
- Shifting cultivation using more modern equipment and more closely linked to commercial markets.

Traditional shifting cultivation systems are relatively stable and self-sustaining because of the long fallow periods in the cultivation cycle and low population densities in those areas. For example in the remote Apo Kayan plateau, nearly 10,000 Dayak people possess a well developed knowledge of the forest where they practise a stable-forest-maintaining-form of shifting cultivation with long fallow periods. This is however not always the case. Shifting cultivators who have access to more modern technology like chainsaws, fell trees at an accelerated rate to clear land to produce rice for nearby markets (USAID, 1987). The negative environmental effects of this rice growing practice includes accelerated soil erosion and loss of soil fertility. It is also known that transmigrants failed to practise a stable shifting cultivation because their rotation cycles were only four years or less (Secrett, 1986).

Traditional shifting cultivation does not cause a lot of damage to forests as other activities do. These cultivators have made their livehood in the forest for hundred of years and should therefore be considered as an integrated part of the forest. Since 68% of the total forest area belongs to timber companies and 30% is designated as part of the permanent forest estate as forest reserves. At present shifting cultivators face serious problems of land accessibility, forcing cultivators to shorten their traditional rotation period. We have to do with a human problem and to solve it strong social awareness by the policy makers is required.

Transmigration

Transmigration is a non-forestry policy that influences the forest negatively. Basically, transmigration is a resettlement project in which people from the over-populated island of Java are moved to the thinly populated outer islands. During the fourth Five Year Plan (1984-1989) about 3 million ha of land were being allocated for transmigration purposes. Forest land made up some 80% of the transmigration sites

(SKEPHI, 1989). In the transmigration scheme each family receives 2-3 ha of land for cultivation. By the early 1980s this programme had relocated 3.5 million people to the outer islands of which half a million to East Kalimantan.

An additional aim of the transmigration project was to stimulate agricultural productivity on the outer islands and thus to develop the resources of the country for the domestic and the export markets. This aim however has not completely been achieved. As early as 1973 it was found that 26% of the total land area under cultivation was practised by transmigrants (Babcock, 1986). In most cases improper initial land clearing practices using heavy equipment and burning were responsible for the removal of topsoils and soil compaction. This is particularly pronounced in soil with a high clay content (Stadtmuller, 1989).

The negative aspects as mentioned above should not get the upper hand since there are also many positive stories of successful transmigrants to be told. As only 6.6% of the total area of East Kalimantan is suitable for agriculture (TAD-BAPPEDA, 1982) another type of transmigration called HTI-trans (Timber Estate Transmigration) has been carried out since the early 1990s with the cooperation of the Ministry of Forestry and the Ministry of Transmigration. This type of transmigration is resettling people from over-crowded islands to the timber estates on the outer island. The transmigrants will be working for the companies which run the timber estates.

Relocating people from densely populated areas to the isolated island Kalimantan with its harsh conditions is brave work. In principle, the idea is good, but relocating people without providing an infrastructure is almost pointless. In many cases the problems faced are caused by a lack of available accurate information before executing the programme. Also the analysis of environmental impacts has not been properly built into the system.

Forest fires

Fire alters hydrologic properties of soils by burning litter, organic matter and vegetation. Erosion increases because the soil remains exposed to the direct impact of raindrops, and the soil infiltration capacity may be substantially reduced. The forest fires that occur in East Kalimantan can be divided into two main groups: the small-scale fires initiated by shifting cultivators and settlers to open up forest areas or abandoned farm plots, and the large-scale forest fires like that which occurred in 1982/83 and damaged approximately 3.5 million ha of primary, secondary and swamp forests (Lennertz and Panzer, 1983).

The overall effects of the 1982/83 fire have been catastrophic for the environment and, as Lennertz and Panzer (1983) point out, after this fire, soils may have been or become damaged as the result of:

- physical, chemical and morphological changes;
- destruction of pedo-fauna and flora;
- rapid mineralization and leaching;
- increased erosion.

Shimokawa (1988) studied the effects of fire on rain splash and sheet erosion in Kutai National Park, which was partly affected by fires. Erosion rates under unburned forest were significantly lower than under burned forest, as can be seen in Figure 1. Infiltration rates, although generally low in the whole study area, were correspondingly higher under unburned than under burned-over forest (Table 3).

Table 3. Comparison between infiltration rates in unburned and burned/secondary forests in Kutai National Park, East Kalimantan (Shimokawa, 1988).

Forest	Rate of water infiltration in mm/min	
	mean	range
Unburned natural forest	0.58	0.01 - 2.25
Burned/secondary forest	0.31	0.02 - 1.00

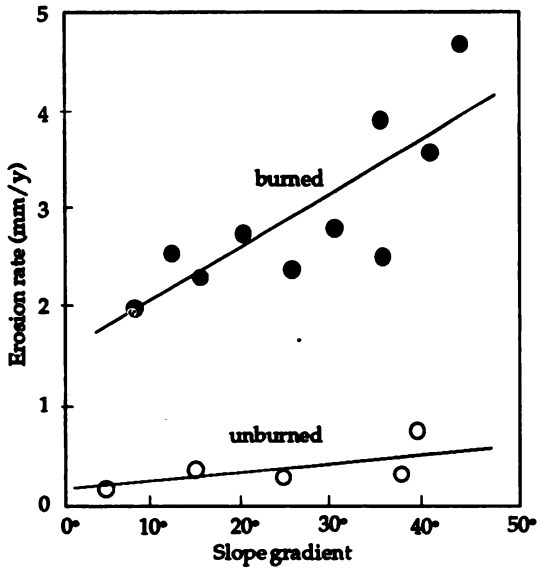


Figure 1. Erosion rates caused by rain splash and sheet erosion in unburned and burned areas in Kutai National Park, East Kalimantan (Shimokawa, 1988).

Forest fire is regarded to be a natural-cause destruction and is quite difficult to deal with, especially in large forest areas such as on East Kalimantan. It requires good coordination from the highest policy makers to the rangers and all related forest aspects should be considered.

Alang-alang grasslands

Alang-alang (*Imperata cylindrica* (L.) Beauv.) is a grass that easily establishes itself on fallow land and burned areas and partly covers every watershed on the outer islands (Manan, 1980). It is generally associated with a low soil pH, low soil fertility, highly leached soils and a lack of organic matter. Alang-alang develops an extended system of underground rhizomes and its roots produce an exudate that may inhibit the growth other plants (Donner, 1987). It competes fiercely with other plants, it is very difficult to eradicate and it forms a serious problem for reforestation activities. Areas covered by alang-alang are prone to fire and show high surface run-off as well as high soil erosion rates (Wiroatmodjo, 1980).

In 1981 some 400,000 ha were already covered by alang-alang in East Kalimantan (Kartawinata et al, 1981). Taking into account the above mentioned ecological properties of the grass and the fact that it is expanding at a tremendous pace (as can be observed in most parts of the province), alang-alang constitutes a major environmental problem in East Kalimantan (Stadtmuller, 1989).

Pepper plantation

The environmentally damaging practices of pepper plantation include clear weeding for about ten years. After that time, the plantations are abandonned due to declining yields. Erosion rates of plantations are estimated at 50-120 tons/ha/yr and recovery after abandonment is expected to be very slow. The research results reported by Hatch (1980), who worked in Sarawak, Malaysia, indicate that soil conservation practices (e.g. terracing) may reduce soil loss to an acceptable level (Table 4).

Table 4. Annual soil loss under primary forest, terraced pepper and traditionally cultivated pepper in Sarawak, Malaysia (Hatch, 1980).

Soil cover	Slope angle	Soil loss	
Primary forest	47%	0.1	tons/ha
Terraced pepper	58%	1.4	tons/ha
Traditional cultivated pepper	47%	62.7	tons/ha

Another relevant issue is that pepper vines in East Kalimantan are commonly planted on dead ironwood poles. In many other parts of Indonesia they are supported by living poles providing better soil protection.

Fortunately, in East Kalimantan pepper plantation is only practised in a few places where transportation is no problem. At the prevailing high market prices of pepper, the alarming erosion rates could turn out to be a big problem if the traditional cultivation techniques remain unaltered.

Coal-mining

The Indonesian government foresees an annual production of 17 million tons of coal during the 1990s. This target is based upon recent discoveries of coal in Sumatra and in particular, in Kalimantan. This prospect has attracted foreign investors to East Kalimantan to participate in joint ventures. Since most of the mining activities will be open-cast mining and located on undulating land and hillsides, the environmental consequences will be grave. They will include deforestation, denudation of vast areas, washing away of topsoils, the weathering of the material beneath it and discharging of large amounts of silt into the drainage system of rivers (Donner, 1987).

The Indonesian Parliament Commission for Industry, Mining and Energy have insisted that damage to the environment and nature must be avoided and that nature conservation must be observed, but doubts remain about the realization of relevant programmes. The above mentioned environmental impacts of the coal-mining activities have already become manifest in several mining areas on East Kalimantan. Rehabilitation of these areas will prove to become very difficult and expensive (Stadtmuller, 1989).

Conclusions and Recommendations

1. Soil erosion is a big problem for non-forested areas in East Kalimantan. Solving the problem requires a serious commitment from every person involved.

2. The watershed management concept is strongly recommended in the execution of environmental-based development programmes, including a proper analysis on the environmental impact on planning development projects in Indonesia.

3. The future forest development in Indonesia must pay more attention to social issues; the growing attention on social issues is a world trend we must not neglect.

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Forest resource utilization: How and for whom?

Recreation, nature conservation and extension: Extension as a means of integrating forest functions

RECREATION, TOURISM AND NATURE CONSERVATION: EXTENSION AS A MEANS OF INTEGRATING THESE FOREST FUNCTIONS

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Introduction

Forests and other natural areas are areas of attraction to recreationists and tourists. They form the most essential element of outdoor recreation and the tourism product. All kinds of groups of recreationists, tourists and nature conservationists are attracted by certain kinds of features in natural areas. And all these groups have a varying impact on forests and other natural areas. Nature conservationists and foresters are concerned about the negative impact. They want to take several kinds of measures to improve legislation to reduce the negative impact of recreation and tourism. Extension can be one of these measures.

According to Gunn (1988;23) the movements and ideologies of recreation and conservation have often polarized into open conflict. Deeper examination of these ideologies shows greater compatibility and interdependence rather than conflict. Tourism and recreation depend upon clean physical environments and protected resources: the very foundations of conservation. Conserved lands gain greater public support for protection when the public has some knowledge of and access to the protected resources. Extension in and outside the area can be a suitable instrument to gain this greater support. Furthermore, a greater cooperation of the many agencies concerned with tourism, recreation and conservation is needed so that the symbiotic qualities of these forces can flourish.

Attractions and interest groups

The natural scenic beauty of an area can highly motivate a visit to a certain area. Such areas are often associated with certain activities, such as driving for pleasure, cycling, hiking, picnicking, camping and wildlife viewing. Remoter areas even can offer opportunities for adventure-oriented tourists (Inskeep, 1991;78).

Flora and fauna can be very important attractions. In addition to general interest recreationists and tourists visiting these places, there are those with special interests such as bird watchers and amateur botanists. Controlled hunting of wildlife can be an attraction in some places. Examples of flora and fauna as attractions are the game parks of East Africa and South Asia and the redwood parks of California, which attract visitors from all over the world (Inskeep, 1991;78).

Special environmental features such as high mountains, unusual geological formations, caves, geysers, hot springs, etc. are important attractions for both sight-seeing and special interest recreationists and tourists. Activities associated with special environmental features include: mountain and rock climbing, spelunking, etc. (Inskeep, 1991;79).

National and regional parks are very specific natural attractions. The IUCN (International Union for Conservation of Nature and Natural Resources) - the World Conservation Union - has specified categories and criteria for establishment of parks and conservation areas. However, the concept of national parks varies between countries. In the USA and Canada the parks must be publicly owned, with no or little development allowed. In the UK parks may include private land, agricultural activities, and villages, where development is controlled and public access is allowed (Inskeep, 1991;80).

In many of the natural attractions described, especially in the case of national and regional parks in developing countries, the local population is dependent on the land in more ways than one. It is often the only place where they can earn their livelihood. They use it for agriculture, fishing, hunting, gathering and have several types of land-ownership and usufruct rights (see for instance Hummel, 1991). A large amount of these natural attractions, certainly where forests are involved, are planned and managed by foresters and forestry agencies.

Stages of development between recreationists, tourists and nature conservationists

Gunn (1982;16) has written that in a certain area, nature conservation agencies and outdoor recreation and tourism development agencies can coexist, as long as there are no major land resource claims. 'Whatever contact that did take place was casual, polite and tended to support their independence.' But as soon as both sectors gain importance in the area, they will claims on the same land resources. Conflicts will rise between both groups in planning and management. One group will emphasize the negative impact of recreation and tourism on the environment, and the other, the obstruction of recreation and tourism development.

Gunn thinks that both groups can reach a symbiosis. According to him they have mutual interests: '(...) tourist elements stimulate interest in the landscape, heightening the access to and understanding of the environment, an important component of conservation. Conservation, as a social value is supported by the popularisation of the landscape by tourism interests' (Gunn, 1982;16).

He continues by stating that even synergism must be possible. Nature conservationists as well as recreation and tourism planners can work together on joint objectives to develop recreation and tourism and conserve nature at the same time. Extension can be a suitable instrument to integrate the different functions in one and the same area.

Negative impacts of recreation and tourism in forest areas

If, in a forest, the functions of nature conservation and recreation are both important, conflicts between these two functions are very likely to arise. This will become more apparent if certain recreation activities are incompatible with the function of nature conservation in that area. Or when the intensity of the recreation activities is so high that it is certain to damage the environment.

Damage caused by recreationists and tourists

Damage to forests by inappropriate visitor behaviour is a large problem faced by many forest agencies. Gramann and vander Stoep (1987) mention five types of violations which lead to forest damage (Table 1). Damage reduces the scientific value of forests, detracts from the aesthetical quality of recreational experiences and diverts money that might be spent on other forest management activities, to the repair and prevention of visitor-caused damage (Gramann and vander Stoep, 1987).

Table 1. Five types of violation (Source: adapted from Gramann and vander Stoep, 1987)

- **Unintentional violations.**
  Unintentional violations are those solely committed because visitors are unaware of the regulations in a particular area.
- **Releaser-cue violations.**
  Environmental cues (in the form of the behaviour of others or traces of that behaviour) promote normative violations.
- **Uninformed violations.**
  Visitors damage resources only because they are unaware of the effects of their actions.
- **Responsibility-denial violations.**
  Visitors damage resources because they do not accept the responsibility for the consequences of their actions.
- **Status-confirming violations.**
  Status-confirming violations are motivated by the desire to confirm one's membership in a deviant reference group.

Administrators of forest management areas should deal with this damage directly. The direct approach regulates overt the visitor behaviour through rationing, activity prohibition and enforcement of regulations. The indirect approach relies on design and information-based techniques (including extension) to alter behaviour in a manner protective to forests. Indirect management has the distinct advantage of rarely being controversial. In addition, with indirect protection strategies, the perception of freely chosen behaviour - an important dimension of outdoor recreation experiences - is preserved. Finally, the indirect approach is frequently less expensive and requires less manpower than surveillance and other direct techniques (Goderie, 1986; Gramann and vander Stoep, 1987)

Extension may reduce many of the violations, mentioned before, especially the unintended and the uninformed. It will, of course, not eliminate all visitor induced damages to the environment. Some violations will always occur. Figure 1 shows the violations and some suggestions to prevent and/or reduce them.

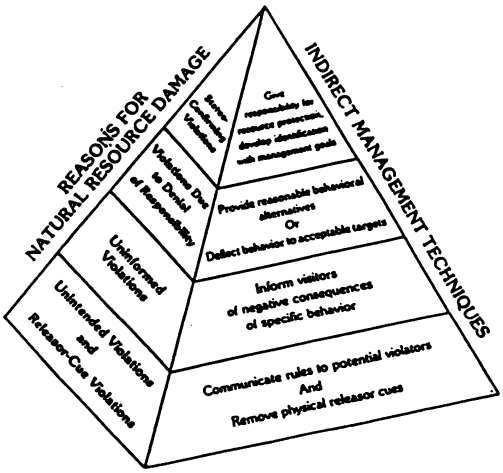


Figure 1. Types of violations and some suggestions to prevent and /or reduce them (Source: Gramann and vander Stoep, 1987).

Extension as a means of integrating forest functions

Extension in this case is a communicative activity with the aim of promoting an ecologically sound behaviour in a certain target group (compare van der Wouden and Ester, 1983;16; van Meegeren, 1986;28). It will have its largest impact if the existence of a problem caused by a certain behaviour is not known, as there is little or no information of how to handle it, and if the given information suggests a relatively cheap or easy solution (van der Linden, 1980;107).

In the "cultural vision" environmental problems are caused by a disturbed relation between man and nature. In this case, the role of extension is to stimulate contact between man and nature, so that man appreciates nature more and feels more responsible towards it (van Meegeren,1986;5).

For this type of extension an influencing model of four stages is used (van Meegeren, 1986;28):

1. the experience of nature;
2. understanding and appreciation of nature;
3. respect and a positive attitude towards nature;
4. ecologically sound behaviour.

It must be stated that awareness of ecologically unsound behaviour in itself does not lead to automatic and definite change of behaviour. Making people aware, without further action is unsuccessful most of the time (van Meegeren, 1986;12).

The choice of instruments to be used, must be based on the understanding of the main problems and the desired changes to solve these problems. Of course the choice will also be based on the existing possibilities, restrictions and costs of the instruments to be used (van Meegeren, 1989).

In most cases extension will consist of a combination of measures, and even then uncertainty of the effectiveness remains. If the behaviour of recreationists and tourists in fragile areas has to change, measures have to be taken to ensure that ecologically sound behaviour becomes attractive (e.g. better facilities, rewards, incentives) and/or ensure that existing negative behaviour becomes unattractive (van Meegeren, 1989).

Extension can be part of a management plan for a particular nature reserve. According to Inskeep (1991;80) evaluation of parks and their facility development should include the present important concept of park development and operations, aimed at educating the visitors about what they see with the emphasis on ecology and conservation. This approach is very compatible with the tourist's tendency to learn more about the environments they visit.

Conclusions and recommendations

There are indicators that foretell a marked increase in all kinds of nature recreation and tourism in the near future. It is obvious that forests are important in recreation and tourism. This function should exist without reducing environmental values.

A sound planning and management structure is a precondition. Integrating the functions of recreation as well as nature conservation is important to decision-makers and managers involved in recreation, tourism and nature conservation. Recreation-zoning or integration must be introduced and managed correctly. Equally important, is the forest management's attention on matters of extension and education.

Outdoor recreation cannot exist without natural resources. The conservation of nature can be stimulated by recreationists and tourists. If there is no knowledge about a certain area, there will be little social basis for protection and preservation of the environment. Forests and other natural areas gain greater public support for protection when the public has some knowledge of, and access to, protected resources.

Damage to forests caused by inappropriate visitor behaviour is a large problem faced by forest management. Extension may reduce many of the violations, mentioned before, especially the unintended and the uninformed. Nevertheless, it will not eliminate all visitor induced damages to the environment. Some violations will always occur.

To solve problems related to inappropriate visitor behaviour and the integration of forest functions in one and the same area, several kinds of measures have to be taken. Extension is only one of them. A combination of measures and regulations will provide the best perspective for success. Extension often has a supporting role for the benefit of other measures. Extension can familiarize the public with certain facilities and laws and regulations, instruct them on how to use these. It can also stimulate the acceptance of environmental protection policies and motivate ecologically sound behaviour.

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THE DEVELOPMENT OF MANAGEMENT PROGRAMMES TO MITIGATE DAMAGE CAUSED BY RECREATION ACTIVITIES IN NATIONAL PARKS IN INDONESIA

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Introduction

To safeguard adequate examples of natural ecosystems of Indonesia, the Directorate of Nature Conservation and Wildlife Management has an ultimate target of about 20 million hectares of reserve areas. This is about 10% of Indonesia's land surface. New legislation has also been formulated which provides the necessary legal framework for the development and management of those reserve areas. However, conservation is not an easy task, particularly in Indonesia. A glance at the map of Indonesia shows the scattered distribution of the islands; communication between the islands is difficult and administrative problems formidable. There are equally formidable differences in cultural and linguistic traditions both within and between islands (Carter, 1978).

Administrative difficulties restrict the progress of an enlightened nature conservation policy, and commercial interests inevitably sometimes conflict with conservation ideals, in Indonesia as well as elsewhere. In Indonesia, there is also a lack of field staff, the number of guards is still too small for the size of the reserves they are assigned to protect. Furthermore, the education in nature conservation, especially in management techniques need to be improved.

Since the Directorate General of Forestry became the Ministry of Forestry, considerable progress has already been made in their task of management of parks and reserves. The Indonesian government has also been supported by the FAO as well as the WWF. In 1971, the Indonesian Wildlife Fund (IWF) was formed. In 1974, the United Nations Development Programme Wildlife Management Project was started. In 1978, a training school for field officers was opened, funded by the Dutch government. At present, PPA (Wildlife Management and Nature Conservation) is attracting more graduates from Indonesian universities. The PPA has become better known and the important work they carry out is visible.

Progress is also being made in conservation education for the general public supported by the Ministry of Education and Culture, Ministry of Forestry and the World Wildlife Fund. The meaning and desirability of nature conservation is being promulgated in the press, among civic organizations, and in the national Scouting movement, all of which increases public awareness and attracts more students and other assistance.

This paper tries to briefly describe the management of national parks and reserves in Indonesia, the problems that have arisen in the management tasks and the possible solutions to these problems.

Management of parks and reserves

Management of national park and reserves involves the control of wildlife populations, habitats and soils, besides man's intervention to achieve specific goals known as Management Objectives. It involves the application of methods and techniques which, through ecological and biological research, have proven appropriate to achieve the management goals. It gives practical guidelines to personnel responsible for the implementation of the management measures (Moseley et al, 1976).

Management programmes common to all parks fall into four groups (Moseley et al, 1976, van Lavieren, 1983):

- Resource Management and Protection (Conservation Management).
  1. Wildlife Management.
  2. Habitat Management.
- Estate Management (Physical Development).
  Estate management deals with the management and maintenance of buildings, roads, trails, fences, boundary markers, visitor facilities and other park structures.
- Recreation Management (Visitor Management);
  Although the objectives of nature conservation and recreation are important, recreation in national parks is not always compatible with conservation and protection. Recreation management deals with the provision of facilities for visitors and the controlling of visitor use. (This paper will emphasize the discussion on the integration of extension programmes in recreation management to prevent or reduce visitor-induced damage).
- Administration and Maintenance.
  Administration and maintenance deals with the housekeeping of the parks. Its function is related to personnel, finance, procurement, contracts, and the upkeep of all park installations.

Recreation Management

Recreation is one of the national park functions as stated in the park objectives (i.e. to provide appropriate recreation facilities consistent with the National Park Act regulations). Recreation is a broad term; it can include tourism for both local and domestic visitors, it can include educational projects for schoolchildren, or the general public, etc. (Burrell, 1973). Recreation is important to awaken public awareness and understanding of natural ecosystem functions.

According to MacKinnon (1988), as a by-product, management of conservation areas for recreation can lead to preservation of traditional and cultural values, enhancement of national pride, maintenance of a quality living environment and local employment opportunities. Visitor use may also generate some income from visitor fees, income from employment of personnel involved as guides and park staff, as well as create income for local communities by the provision of simple, traditional accommodation and visitor services.

Damage caused by visitor (recreation) activities

Beside the above advantages, recreation can result in damage to parks, caused by inappropriate visitor behaviour. Damage reduces the scientific value of forests, detracts from the aesthetical quality of recreational experiences and diverts money that might be spent on other forest management activities to the repair and prevention of visitor-caused damage.

Management programmes to mitigate problems caused by recreational activities

A conservation area opened for recreation activities has to provide facilities and services which are required for specific types of forest or park recreation. The administrator should plan special programmes to control damage and to provide facilities for visitor use in a proper way. These programmes should be included in the Recreation Management. Ideally, administrators of park (forest) management use a direct and an indirect approach in his/her Management.

The Direct Approach

The direct approach regulates visitor behaviour overtly through rationing, activity prohibition and/or regulation. The direct approaches according to van Lavieren (1983) carried out are:

Zoning
The park is divided into zones for both conservation and administration purposes, i.e. to ensure a proper balance between visitor use and conservation. The zoning plan defines areas in the park in accordance with acceptable use and development, indicating acceptable uses, developments and means of access applicable to each zone. The different zones can be distinguished as:

- A Sanctuary zone in which visitor use is prohibited.
- A Wilderness zone in which the area provisions for visitor use are limited to nature trails, hiking trails, mountaineering, semi-serviced campsites. In this zone, visitors are brought in close contact with nature, without making them feel lost in the wild.
- A Semi-intensive Use zone in which facilities for the convenience of visitors may be located near a feature but not so close as to detract from the natural feature or its setting.
- An Intensive Use zone in which visitor services are located. This is the area where the main visitor facilities are concentrated. This area is often linked by roads and provides access to the medium (semi-intensive) and low use (wilderness) areas.

Rationing
Visitor use-patterns usually show peak days or peak periods. Control of visitor numbers should be considered when overcrowding becomes a serious threat to the conservation objectives of the park, deteriorating the individual visitor's experience. Once the visitor capacity has been reached, visitors should be advised to visit the park on other dates. It may even be necessary to periodically close (a part of) a reserve to visitors during critical wildlife breeding seasons or periods of adverse weather, e.g. floods or drought, or to give the staff a chance to repair damaged facilities and clean up the area for another visitor influx.

Control of activities
In principle, all activities which can be classified under active recreation should not be allowed inside the park area. Commercial recreation should not be part of the park objectives. This kind of recreation can be found elsewhere. Activities which should not be allowed inside the park include:

- sports (golf, tennis, swimming-pools etc.);
- speedboating, spearfishing and certain other kinds of fishing;
- all kinds of activities that produce noise,
- commercial distractions such as theatres, cinemas, disco bars etc.

Regulations and Law enforcement
Each country has it own laws and regulations concerning the conservation and protection of natural resources. Parks also have certain particular regulations based on the specific physical condition and objectives. Park staff have to carry out certain routine activities, such as supervision of visitors and enforcement of park regulations. Conservation laws, acts, regulations and decrees will not contribute much to conservation and protection if not enforced and controlled by a reliable, well trained and disciplined corps of guards.

The Indirect Approach

The indirect approach relies on design and information-based techniques (including extension) to alter behaviour in a way that the protection of the park is ensured. Indirect management has the distinct advantage of rarely being controversial. In addition, the perception of freely chosen behaviour, an important dimension of outdoor recreation experiences, is preserved under indirect protection strategies. The indirect approach is frequently less expensive and requires less manpower than surveillance and other direct techniques.

Environmental design in the management of parks
Environmental design is a process and an approach to alter human behaviour, which is currently evolving in psychology and related fields. The attitude of modern man to the environment characterized by emotional and intellectual orientation from the natural environment, results in behaviour that promotes certain use of natural resources (Krasner, 1980). Waters (in Krasner, 1980) states that the environment is the principle controlling agent of behaviour, but that its effect depends on the person involved.

Bad environmental design sometimes results in unintended damage, caused by unpleasant or uncomfortable conditions. Development of visitor or recreational facilities should be based on sound environmental design. Heavy visitor use or traffic concentrated in small areas and around a single animal have resulted in severe stress on sensitive species, unnecessary habitat destruction and deterioration of visitor satisfaction.

Constructions should be situated and designed to harmonize with their surroundings. Roads, trails and shelters should all be constructed to cause as little damage as possible to the natural environment. Provision of good, well-laid-out paths and other visitor facilities, information boards etc., with proper and sound environmental design ensure that visitors feel comfortable and can fully enjoy the beauty of the park. In this way, supplemented by a proper visitor-use zoning, the park management can achieve its objectives in both recreation and conservation functions.

Visitor information and interpretation service

To enhance the visitor experience inside the reserves, the park management should provide an information and interpretation service. Interpretation assists the growth of a public awareness of the purpose of the park and its policies. It educates the visitors in natural inter-relationships and it strives to develop a concern for nature protection. The objectives of the visitor interpretation service should be to provide information, entertainment, stimulation and education in a pleasant and fascinating setting in order to win visitor or public support for the type of management being applied. It is thus a management tool.

No park or reserve can survive without the active support of the public (Burrell, 1973). Most of the interpreting will be done inside the protected area, and in the local villages in the reserve's immediate vicinity. Of course, it is important to advertise outside the reserve to attract visitors in the first place. They must know about the reserve, where it is, and what it has to offer. The information service has to cover all aspects of interpretation, from brochures to film-shows (MacKinnon, 1988).

Since the whole support for the reserve and the national reserve system ultimately depends on public goodwill, staff should be helpful, courteous and knowledgeable about the park and its wildlife, pointing out features of special interest. Protected area staff must always set a good example to visitors and must themselves observe park regulations at all times (MacKinnon, 1988).

The visitor experience will be enhanced by provision of maps, information leaflets and well-signposted nature trails. Such trails can be of varying length and should have information boards at special features, such as waterfalls, interesting plant communities. These information boards should give the visitor brief information on the special interest of the site. Visitors need to be told how to behave so as to increase their chance of spotting wildlife, while at the same time minimizing the disturbance of the park features.

According to Mosely et al (1976), the interpretation programme of a master plan should indicate:

- Personnel requirements: specialists on natural and cultural aspects of the area, trained to use interpretation techniques and equipment. He or she also has to be trained in techniques of public relations, about adopting a sympathetic appearance or a pleasant way of communicating with people of all social and educational levels.
- Methods of communication:
  - personal contact: the interpreter speaks directly to visitors, gives examples of positive behaviour and attitude towards the natural environment.
  - indirect contact: books, leaflets on subjects of natural history, information panels, exhibitions and displays in information/interpretation centres, nature trails (self-guided or guided), audio-visual presentation, etc.

Extension Programme

The extension programme is closely related to an information and interpretation programme. The extension programme has actually become an integral part of the management of nature conservation or protected areas. The development of extension programmes is intended to broaden the environmental education function of parks as an effort to obtain public support for the protection and conservation of

nature and the natural environment, and also as preventive effort to minimize violation caused by visitor or by local communities (van Lavieren, 1983).

In relation to "public education", Deshler (1982) points out several approaches that can be used to arrange an extension programme, such as:

- Include a simple and brief statement on hand out material at designated facilities explaining why protection of all resource values and cultural features is important and enlisting the public's cooperation in refraining from destructive practices and in using public sanitary and garbage disposal facilities.
- Include a discussion about problems concerning public use through talks given by protected area personnel, taking place at visitor or information centres, amphitheatres or during camp fire sessions. Slides of damage done by visitors are an excellent visual aid for such talks.
- Develop some means of getting the message to all visitors.
  A mimeographed hand out can be easily and locally prepared and given to visitors by area personnel. A cooperative attitude can generally be instilled in the visitor during such contacts, if a few moments are taken to talk about the area, the reasons for the hand out and getting the visitor's impression of the area.
- Confront any non-conforming situation when it is observed, but where possible, use an educational approach rather than a law enforcement approach. Refrain from displaying authority. Each visitor is a part of general public for whose and enjoyment the protected area was established, at least in most cases. Treat them as such unless circumstances warrant a harder approach.
- If practical, from a weather or animal damage standpoint, post a list of prohibited actions at each campground and picnic area and in heavily used non-developed areas. Always include a statement explaining the reason for the prohibitions.

Methods used to carry out extension programmes
There are many methods that can be used to carry out extension programmes. According to the intensity of use, these methods can be classified into three categories (Deshler, 1982):

- Mass communicating method.
  This method is especially used to generate public awareness and interest, by using mass audio-visual aids such as, radio and television programmes, film, brochures, posters, newspapers, and popular publications.
- Grouped communicating method.
  The awareness and interest that have been generated by the method presented above are supported to change human attitude and behaviour. This method is only effective if it is dedicated to a certain group that already has a similar awareness and interest on nature ecosystems. This method is carried out by discussion, demonstrations, and exhibitions, in special meetings, guided-tours or study-tours to various protected areas, reserves or parks.
- Individual communication method.
  Although extension programmes are directed at the general public (mass or grouped communication), the learning and increasing of knowledge is an individual process. Thus personal or individual communication is important. This individual communication can also be carried out to a group by a group-leader in order to stimulate person to person and person to group educational activities. This method is preferable if there are many groups that require to be serviced by a single extension staff.

Conclusions and recommendations

- Recreational activities are not always immediately compatible with the conservation function of a park. Thus, recreation management should be able to control visitor use and recreation activities while providing the facilities.
- Mitigation programmes in the management of recreation are essential to control damage and to gain public awareness to alter human behaviour and attitude in the desired direction.
- Mitigation programmes should be carried out to encourage use of parks for recreation and to make this experience available and worthwhile to as many as possible without damaging the resource.

- Mitigation programmes should be carried out both in a direct and indirect approach and included in the management of recreation.
- Mitigation programmes require specially selected staff to carry out the programmes properly and to achieve the objectives.

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RELATIONS BETWEEN TOURISM AND NATURE PROTECTION - THE EXAMPLE OF THE SÄCHSISCHE SCHWEIZ IN THE EASTERN PART OF GERMANY

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Introduction of the Sächsische Schweiz

The name "Sächsische Schweiz" (Saxon Switzerland) dates back to the period of romanticism and designates the Saxon part of the Bohemian-Saxon Elbe-sandstone region, which is situated about 45 km southwards from Dresden and which encompasses the Elbe river on both sides. To the south, south-east and east this region borders on Czechoslovakia, to the North on the upper region of the Lusatian Mountains, and to the west on the eastern part of the Ore Mountains.

The Sächsische Schweiz is predominantly shaped by block sandstone interspersed in a few places with granite and basalt. It bears the character of a so-called Pleistocene landscape affected by erosion and includes both colline and submontane, and montane elements. Typical landscape forms are the Elbe valley (about 100 m in depth and 600 m in width at the mountain ridges), flat upland areas (plains) laid down on both sides of this valley, table mountains, rock towers and rock needles as well as the rocky joint systems east of the Elbe river. The highest elevations to the west of the Elbe river are the Große Zschirnstein peak (562 m) and to the east of it the Große Winterberg peak (552 m). The peaks are situated in a ridge of peaks of 350 to 450 m above sea-level. The enormous diversity of land forms in the area greatly effects differences in sites (soil, water regime and terrain climate), which in turn have a strong effect on flora and fauna (Götzinger, 1812; Meiche, 1929; Hunger, 1961; Lemme, 1976; Gutmann and Weber, 1989).

The beauty of this landscape has attracted an ever increasing number of visitors, stimulated by the depictions of the Romantics as well as by a continuing progressive disclosure of the region. In this region various economic branches were established (agriculture, craftsman's trade, industry), of which forestry is still the most important. More than 70% of the total area of the Sächsische Schweiz is managed by foresters. This region can be called a distinctively developed and cultivated area where conservation and protection are necessary for several reasons.

In 1956 the Sächsische Schweiz received the protective status of a landscape protection zone, containing five nature reserves and a system of nature protection areas (covering an area of less than 5 ha). The total area covered is 2,200 ha, i.e., approximately 10% of the forest areas and wastelands of the landscape protection zone, thus comprising a representative sectional area. This area also constitutes the most valuable natural resource of the Sächsische Schweiz, although nature conservationists are not yet satisfied with the landscape protection zone status of the area. During recent decades the nature conservationists tried to provide the area better protection in the form of a national park. This finally succeeded in 1989. Within the national park programme of the former German Democratic Republic Government, a proper programme had been elaborated for the Sächsische Schweiz, which became effective from October 1st, 1990. The rules and regulations for national parks, however, do not apply to the entire area of the Sächsische Schweiz, because not all parts of the area comply with the international criteria for national parks. Therefore so-called national-park regions were selected, the natural features of which are most genuine (Autorenkollektiv, 1984; 1987; 1991; Hertwig, 1985; Hempel and Schiemenz, 1986).

Development, importance, and present situation of tourism in the Sächsische Schweiz

As already pointed out, the unique character and the beautiful landscape of the Sächsische Schweiz aroused the attention of visitors and tourists. The first visitors, admiring this region, had already enthusiastically described it in the 16th century. Since then the numbers of visitors have increased rapidly spurred on by this enthusiasm.

Consequently, the local population gradually adapted itself to the situation and so a service for visitors developed (mountain guides, people engaged in gastronomy, etc.).

During the 19th century a further rise in the number of visitors took place as a result of the increase in infrastructural facilities. The Elbe steamship and the Bohemian railway line started their services ensuring even better opportunities for the inhabitants and guests of Dresden, the Saxon residency, to travel to the Sächsische Schweiz. Numerous spas, holiday-homes and health-resort hotels were constructed. The region itself was further developed for the benefit of its visitors. Just before the outbreak of World War I, pompous plans were elaborated envisaging the construction of new luxurious hotels and special technical infrastructure (such as cableways and lifts providing access to high peaks and observations platforms); all to enhance the Sächsische Schweiz's appeal to visitors. However, due to the War, these plans were never executed.

In the period following World War II the Sächsische Schweiz developed into the most important recreational area of the Dresden district and became, just like the Baltic Sea, the Thuringian Forest and the Harz Mountains, one of the most intensely frequented regions in the German Democratic Republic. As a recreational area, it ranked number one if one takes weekend-holidays in the immediate vicinity of the home into account. On average, 2.5 Million visitors per year visited the area in the late 1980s. Between 60,000 and 70,000 visitors were counted on some peak-days. More than 12,800 accommodations in holiday homes established by the trade union and enterprises, were offered and used by 140,000 holiday-makers annually. This is supplemented by three camping sites, comprising 1200 places attracting 18,000 tourists and recreationists annually, holiday camps for children with approximately 10,000 reservations per year, youth hostels which were used by about 55,000 tourists from home and abroad as well as numerous smaller tourist establishments and privately owned accommodation.

The Sächsische Schweiz is not only very attractive to general recreationists and tourists, but has also the ideal prerequisites for special interest groups, such as mountaineers. Mountaineering had already begun in the 19th century. In a rather short timespan mountaineering gained a large number of supporters. Dresden even developed into Europe's third most important town for mountaineering. The 14 mountaineering regions, contained in this landscape protection zone, offer more than 900 freestanding rock towers with more than 6,000 possibilities for rock climbing a true paradise - so to speak - for mountaineers.

There are also various cultural establishments and historical and cultural monuments that attract large numbers of visitors: eight museums (590,000 visitors annually), the fortress of Königstein (more than 500,000 visitors annually), the Felsenbühne Rathen (an outdoor stage for theatre plays, between the rocks on the hills with 150,000 to 120,000 guests during the five-month season) and several other monuments and events of cultural-historical value.

These figures reflect the state of affairs till the summer of 1989. After the social transformations in the German Democratic Republic with its newly emerging travel opportunities (mainly to foreign western countries) the number of visitors to the Sächsische Schweiz dropped drastically. At present the number of visitors is increasing again, but it will take some time until the number of visitors will once again exceed 2 million visitors per year. Much effort is needed to develop the tourism sector, since the present level of the facilities and services offered by the sector does not meet the standards of the "modern tourists".

Several problems arise from tourism in the Sächsische Schweiz. These problems are related to the local population and to nature conservation. In the next paragraph these problems will be dealt with in greater depth and some solutions will be considered (Lemme, 1976; Autorenkollektiv, 1984, 1987, 1991; Großmann and Rochlitz, 1990; Marketing Beratung Dr. H. Fried & Partner, 1991).

Negative environmental impacts of tourism

When tourism developed into a stage of mass tourism and the tourism industry also followed at the same pace developing into one of the biggest industrial sectors in the world, one began to think of problems caused by tourism and started to look for ways and means to solve them.

The range of problems appears to be very complex and mainly concerns the relationship to nature - the actual main chapter of tourism - and the local population that lives in the area and often earns a livelihood in the tourism business.

The negative impact on the natural environment caused by (mass)tourism gave rise to a general concern about the potential and limitations of tourism to that natural environment. One can think of water pollution, the destruction and impoverishment of the vegetation, the disturbance and displacement of animals, the nuisance caused by noise and air pollution both with respect to the residents and the holiday-makers themselves.

Natural areas that are extremely attractive to tourists and are highly important to tourism are often those areas on which nature conservationists focus their attention. The common interest in these areas often gives rise to conflicts. The interest in the conservation of these areas seems to be in conflict with the exploitation of the same areas. The tourists want to recreate and experience nature, whereas local people and hotel owners need the tourists to be able to support themselves and to make a profit from tourism. All this at the expense of nature. Nature conservationists (especially the so-called conservative nature protectionists), however, aim to maintain the originality and virginity of nature or to reconvert the nature to that unspoiled situation. And, they hope to do this without disturbing factors such as tourism.

If this conflict is to be tackled, a compromise will be the only solution, supported and followed by both parties involved. The process to reach such a compromise is simplified by the fact that tourism itself is interested in and dependent on a healthy landscape, and therefore on the fact that nature conservation targets must be supported. If nature is destroyed, it will lose its attractiveness and a decrease in visitor numbers will result. This is confirmed by a study conducted by the Ludwig-Maximilians-University in Munich, Bavaria, in which an evaluation is made of the impacts of the dying of forests on recreation and tourism in the richly forested mountainous landscape of medium altitudes of Bavaria (Somsák, 1981; Manghabati, 1988; Pröbstl, 1988; Tourismus-Umwelt-Geselschaft, 1988; Autorenkollektiv, 1989; Spandau, 1989; Arbeitsgemeinschaft Tourismus mit Einsicht, 1990; Großmann and Rochlitz, 1990).

Nature conservationists are less interested in the development of tourism, because they regard tourism more as a disturbing factor than a combatant. Probably it will take some time before those involved in the business of tourism will develop a genuine and general interest in nature conservation. In my opinion it depends mainly on the degree to which the landscape is degraded and with this degradation the main attraction of tourism is exposed to danger.

The more threatening a situation is the sooner people are willing to render support. Of course, it can also happen that tourists and hotel owners alike will turn away from the landscape that has become unattractive, looking for new places, so that the nature conservationists and the local population are left alone with their problems of a destroyed environment. However, this can only be the case as long as tourism is able to open up appropriate "virgin" natural areas that have so far not been exploited for tourism. In this way problems are permanently relocated in other regions.

In my opinion tourism developers will only actively start thinking of nature conservation when the development will have reached its limits and when they become aware that protection and maintenance of nature is a necessity. This statement, however, cannot yet be made universally, because nowadays there are plenty of examples indicating the search for alternative concepts of tourism. Also, it has to be stated that such a passive attitude of tourists and people engaged in the tourism sector as described above are not always the case.

Negative environmental impacts of tourism in the Sächsische Schweiz

The Sächsische Schweiz was studied in a joined pilot study of the Institute for Tourism Management and the Institute of Traffic Sociology and Traffic Ecology of the Dresden College of Transport in 1990 (Großmann and Rochlitz, 1990). People of the area and visitors were interviewed, just before the National Park project was implemented. The evaluation of the image factors of the Sächsische Schweiz being of equal importance to the visitors and inhabitants was striking. Both groups (in each case 99% of the

respondents) pleaded that the "landscape" ranked number one in significance, followed by the factor "rocks and mounts" (97% or 98% respectively). The "short distance to Dresden" was similarly appreciated by visitors and inhabitants (55% or 49% respectively). There was also a rather close agreement of both groups on their positive and open-minded attitude towards nature conservation and its measures, including their willingness to accept any necessary restrictions for the benefit of nature. It should be mentioned, however, that this was already a traditional attitude in the Sächsische Schweiz. I like to mention that it seems that preconditions for a suitable concept of tourism development in the Sächsische Schweiz are already in existence.

The main problems related to tourism in the Sächsische Schweiz are:

- traffic with all its consequences (traffic density, exhaust gases, noise, "wild" parking etc.);
- the predominating short-break tourism and its consequences (refuse, noise, low extent of utilization of lodgings for the night, high number of individual visitors);
- occurrence of erosion and the necessary reinforcement of degraded areas;
- damage to the plant cover and impoverishment of the number of species;
- nuisance caused to wildlife and other animals and decreasing retreat areas;
- open sky camping with resulting dangers (danger of forest fire, danger of falling, noise, refuse, spoiling of the surroundings);
- rock climbing without the proper precautions and attention to the existing regulations;
- and recently, dangers caused by sight-seeing flights by airplane and hang-gliders.

Coping with tourism problems and the elaboration of a tourism-concept for the Sächsische Schweiz

In the Sächsische Schweiz one is confronted with the necessity to elaborate a suitable concept of tourism, which is required to exclude or at least to confine the problems mentioned above.
I think that the following steps are necessary in this concept:

1. Basic research is needed to be done into:
   - landscape and nature conservation (recording of the natural assets, proportion of the species and regions that are under protection, restrictions caused by environmental factors, stability of landscape as to those factors);
   - the social and economic environment (industry, trades, agriculture and forestry, infrastructure, gastronomy, hotel branch etc., development tendencies in the region and the importance of tourism therein);
   - tourism (target areas, target groups, motives and demands made by guests, plans of the inhabitants, capacities in quality and quantity, structure of traffic and gastronomy, equipment of the recreational facilities with establishments for sport activities, and the like).

2. The three areas of research (a:b, a:c, b:c) should be compared to determine:
   - the priorities;
   - ranges of conflict;
   - tolerance limits;
   - possibilities for compromises.

3. Study and registration of alternative concepts of tourism, which can be taken into account in the given region.

4. Elaboration of a draft concept for the development of tourism and the management of tourism, followed by a discussion with scientists, managers engaged in the field of tourism, local residents, and local administrations as well as with economists and co-workers of the Nature Conservation Board and also with regional interest groups, visitors, guests and others i.e. with people interested in the field on a broad basis.

5. Review of the concept and final passing of a resolution.

6. Implementation of the concept of tourism with a permanent adaptation to changing circumstances and arising problems (with a priority for nature conservation).

   The last mentioned also comprises an active and broad-scale public work, both supported and effected by tourism and nature conservation. Such work should include:

   - an easily understandable and interesting introduction to the region concerned (natural assets, history, tourism facilities, sights etc.,) e.g., by means of demonstration trails, brochures and other appealing material;
   - a presentation of the goals and work of nature conservation by means of demonstration trails, lectures and similar events;
   - an explanation of the necessary measures taken by nature conservation;
   - the direct and/or indirect request for visitors to behave properly in the natural and socio-cultural environment.

It is important that not only those engaged in conservation act correctly, but all personnel working in the tourism sector as well.

The latter are particularly involved in the process of public work because they have the most intensive contact with visitors and in this way can reach a larger group of persons. As a matter of fact they have to be properly motivated and informed and, if necessary, trained in order to ensure the efficiency of this type of work.

In this respect it is justified to say that the Sächsische Schweiz already has good preconditions. It starts with the various demonstration trails already present, and strict regulations for mountaineering. It is further expressed in the elaboration and implementation of regulations for the proper behaviour of visitors. In the Sächsische Schweiz, at the moment, the publication of proper, and above all, multilingual material such as brochures, slide-shows, audio-visual lectures, video films and the like, is still lacking.

In this paper I could only touch on some aspects in the sphere of conflicts between tourism and nature conservation. The common goal of all those interest groups involved in this issue should be to work together so that tourism will no longer have a negative impact on nature, but rather that it develops into a reliable and active partner of nature conservation.

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THE EFFECTIVENESS OF COMMUNICATION CAMPAIGNS IN CHANGING THE BEHAVIOUR OF VISITORS TO NATURE CONSERVATION AREAS

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Introduction

The conflict between the interests of recreation and nature conservation existed in the past and is still present today. An increasing amount of recreationists want to make use of nature conservation areas in a variety of ways, for example, the emergence of the all terrain bikes. Nevertheless, nature conservationists keep trying to protect nature from all kinds of harmful influences, outdoor recreation being one of them. It is of course possible to build a fence around a nature conservation area to keep recreationists out, with the thought: "let them enjoy nature by video." However, this is not a real solution to the problem. People need outdoor recreation, in one way or the other.

It is impossible and unwise to close all important nature conservation areas. It is important to involve people in nature conservation. They ought to understand the value of it and therefore they need to experience the pleasance of being in a nature conservation area. Together, nature conservationists and involved recreationists are a stronger lobby in the fight against ecologically harmful influences.

People involved in nature conservation and recreation will have to learn to cooperate. The task of the management in nature conservation areas is to guide the behaviour of the visitors in such a way that they will not damage the natural resources. One of the tools for fulfilling this task is communication, which has often been used. In a number of nature conservation areas there are visitor centres with exhibitions and video programmes supported by information boards and signposts strategically placed in the areas. The question is: What is the effect of these sort of communication campaigns on the attitudes and behaviour of recreationists?

The discrepancy between general attitudes and specific behaviour

A well known assumption on the effectiveness of a communication campaign is, that communication about the value of nature leads to a positive attitude towards nature conservation in general and also to proper behaviour in nature conservation areas. The mentality of people needs to be changed. It is expected that in case the mentality is pro-nature, than a pro-nature behaviour will result.

However, research finds little evidence to support the assumption that a general attitude can effectively influence specific behaviour. This is illustrated by the results of a Dutch research project in which the relationships between awareness of environmental problems and three specific types of pro-environmental behaviour (the use of detergents without phosphates, not using the car in leisure time and the purchase of beverages in returnable bottles) were investigated. A correlation was found between awareness of environmental problems and pro-environmental behaviour. But there was no strong relationship. It was found that about 39% of the persons interviewed were well aware of the most important environmental problems. From this group, 29% practised none of the mentioned types of pro-environmental behaviour, whereas only 6% practised all three (Nelissen et al, 1987). Another Dutch research project investigated the relationship between awareness of environmental problems and pro-environmental behaviour (purchase of milk in returnable bottles). It was found that 73% of the people with a high awareness and with knowledge of the environmental consequences of the behaviour did not conduct the pro-environmental alternative (Terwisscha van Scheltinga, 1991).

The discrepancy between a general pro-nature mentality and specific behaviour can be explained using theories from social psychology (see van Meegeren, 1989). In these theories a distinction is made between a general attitude and a specific attitude towards a certain kind of behaviour. A specific attitude results

from an individual evaluation of expected (positive and negative) outcome of the behaviour. When a person expects important positive outcome to prevail over the negative one, a positive attitude will be established (Figure 1).

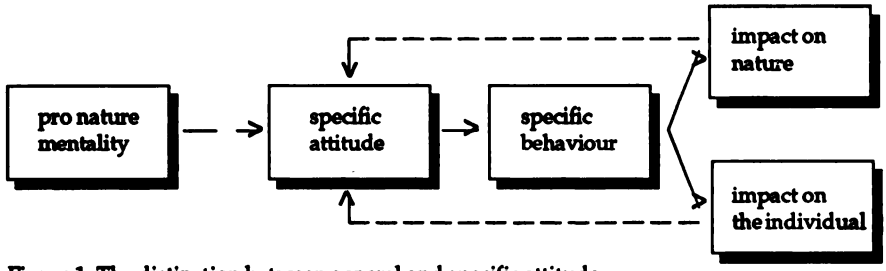


Figure 1. The distinction between general and specific attitude

Determinants of behaviour

There are certain consequences of the behaviour of visitors in a nature conservation area affecting the conservation (policy) of that area. It is important to note that this is not the only outcome of that behaviour. There are also other consequences such as time, effort and pleasure.

The question is: Why do people with a high pro-nature mentality behave in a way that is damaging to the natural environment? There are several possible answers:

1. It is possible that a person just acts like he or she always acts; the behaviour is a custom and the person involved is not thinking of it in terms of outcome.
2. It is possible that a person does make an evaluation of the perceived outcome, but that he or she does not know that the consequences of behaviour is damaging to the natural environment. However, this is not very likely, because we assume that the people involved have a high pro-nature mentality.
3. It is possible that a person does not give much weight to the impact on the natural environment in a evaluation of perceived outcome. This is quite likely because of several reasons. First, nature is seen as a common good; it is not private property, it belongs to everyone. People can benefit from common goods without contributing to its maintenance. In such a situation most people give more weight to personal gain than to collective gains. They think nature is important, but their own comfort and pleasure more so. Second, the consequences of damaging the natural environment are not always directly visible. They may only become noticable much later. And, as research shows, the further away the consequences of a certain behaviour, these consequences are perceived less seriously (Kok 1983). Third, the moral costs for not showing pro-nature behaviour can be denied easily. In many cases visitors can suppress their feelings of guilt by pointing at other visitors ("I am not the only one, it's not only my fault"). They blame the big industrial polluters for ruining the environment, or the local and national authorities.
4. It is possible that a person in an evaluation of perceived outcome does care about what happens to nature and has a positive attitude towards the pro-nature behaviour, but still does not behave as though he or she does because of perceived social norms. In this case the group-pressure hampers pro-nature behaviour.
5. It is possible that a person has a positive attitude towards the pro-nature behaviour and feels socially confident to act like that, but does not do so because of a lack of behaviourial possibilities. The behaviourial possibilities point to the facilities in a nature conservation area.

The question is why do people who have a pro-nature mentality act in a way that is harmful to nature. Several determinants of behaviour have been discussed, already. A simplified model, derived from social psychological theories, presents these determinants of behaviour (Figure 2).

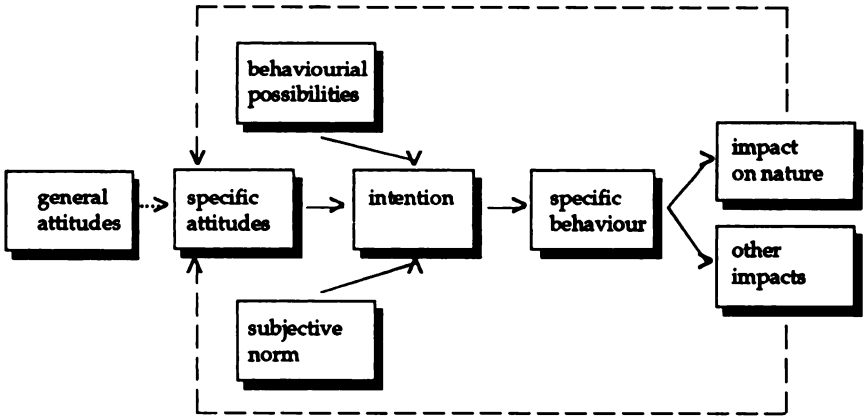


Figure 2. The determinants of behaviour

A model for planning an intervention

This model explains the several factors between a general pro-nature mentality and specific behaviour. The main conclusion is that managers of nature conservation areas who want to change the behaviour of the visitors must have a twofold policy. The first part is to stimulate a general pro-nature mentality. The second part is to change the specific behaviour of specific target groups. Examples of relevant specific behaviour in nature conservation areas in the Netherlands are:

- disposal of litter in a proper way;
- keep to paths when walking/cycling;
- keep dogs on a lead;
- no camp fires allowed;
- no picking of rare flowers;
- horse-riding only on marked trails.

Another conclusion is that if specific behaviour is to be changed, communication campaigns cannot be solely relied upon. Communication helps to enhance the knowledge of the consequences of specific behaviour towards nature, but this knowledge does not necessarily lead to a change of behaviour. It may be necessary for other measures to be taken such as zoning, closing some parts of the nature conservation area, improving facilities, intensifying surveillance and so on. So, instead of only communication campaigns, it may be necessary to combine various measures.

A last conclusion is that it is not easy to change behaviour of visitors and that it is therefore wise to plan an intervention very carefully. For this purpose a model for planning an intervention and for planning communication campaigns in particular has been developed (Table 1).

Table 1. Model for planning an intervention

1.	Set priorities in undesired behaviour.
2.	Analyse which people behave undesirably.
3.	Analyse why people behave undesirably.
4.	Determine how to tackle it.
5.	Clarify the role of communication.
6.	Analyse the target group's communicative predispositions.
7.	Make a plan for the communication campaign.

I will discuss each step of this model.

1. Set priorities in undesired behaviour
Changing the behaviour of visitors is not easy. It needs a careful examination of the situation and a lot of time and effort to execute carefully designed plans. Therefore it is impossible to do everything at the same time. When the manager intervenes in a proper way he has to set priorities. It is better to begin with only a few effective interventions than with many that are ineffective.

The question is how to set priorities in a strategic way. A manager of a nature conservation area has to make a list of all the undesired behaviour of the visitors and determine which behaviour leads to the biggest problems. The most problematic behaviour would have the highest priority. The manager, however, has to take into account the possibilities to influence the undesired behaviour. Behaviours that are relatively easy to change are given priority for the short term.

2. Analyse which people behave undesirably
To be effective it is very important to focus the intervention programme at the right people. It is a waste of effort to try to reach people that are already behaving in the proper way. It even may have contra-productive effects because people might become irritated. They might feel denied in their correct attitude. It can be useful to reach people that already conduct the desired behaviour, but in this case with another message. A message that is additional.

3. Analyse why people behave undesirably
To be able to change behaviour, the manager has to know why people act as they do. Why do people often not act in the correct manner? The manager has to investigate the determinants of the undesired behaviour. He has to seek the answers to the following questions:

- Do the people know what the desired behaviour is?
- Do the people know the harmful consequences of the undesired behaviour?
- Do people know about the consequences? Do they overestimate some of the disadvantages of the desired behaviour?
- how important do people perceive the impact on nature?
- how important do people perceive other impacts?
- what is the people's attitude towards the desired behaviour?
- what are dominant social norms in relation to the desired behaviour?
- are the facilities sufficient to encourage the desired behaviour?

4. Determine how to tackle it
According to the information revealed in the analyses of determinants of the undesired behaviour it is possible to choose the instruments to be used in the change of behaviour.

Suppose that the target group is fully aware of all the consequences of the desired and undesired behaviour. Will they have a positive attitude towards the desired behaviour? If the answer is yes, communication will play a major role in the intervention. If the answer is no, other instruments are necessary. Two kinds of instruments can be used: 1) instruments that give the desired behaviour more positive outcome (a kind of reward for good behaviour) and 2) instruments that give the undesired behaviour more negative outcome (a kind of punishment for bad behaviour) or instruments that make the undesired behaviour impossible (for example building a fence around some part of the nature conservation area). By changing the positive and negative outcome of the behaviour it is possible to change the attitude towards that behaviour.

If there are not enough facilities to encourage the desired behaviour it is important to create these facilities. For example, horse-riders must keep to a special trail. But in order to make a tour they have to use other paths as well. In this case the special horse-riding trails should be extended.

5. Clarify the role of communication
The role of communication in an intervention programme consists of one or more of the following tasks:

- prompting the desired behaviour by a short message to draw attention to the behaviour and to remind people what has to be done and what not;
- explaining how the desired behaviour can be executed (in the case of more complex behaviour);
- information about the consequences of the desired behaviour for the natural environment;
- taking away misunderstandings about other consequences;
- information about the whys and wherefores of measures that are taken to influence the behaviour of the visitors (for example information about higher fines for littering and more intensive surveillance);
- trying to promote the desired behaviour as socially desirable behaviour (for example by means of a recommendation from a well known person).

6. Analyse the target group on communicative predispositions
At this stage the manager of the nature conservation area already knows a lot about the target group. However, he needs more information on some aspects of the target group:

- Are the visitors interested in information about the desired behaviour?
- which channels (media or interpersonal networks) can be used to reach the visitors?
- is the management of the nature conservation area a reliable source of information in the eyes of the visitors?

This kind of information helps to adapt the campaign to the communicative predispositions of the target group. And that is very essential for effective communication.

7. Make a plan for the communication campaign
A plan for a communication campaign consists of decisions about the target, the target group, channels of communication, mean topics of the message and some organizational aspects.

Note, that in most cases the visitors will not be very interested in information about the desired behaviour. They come to the nature conservation area to have a good time, to relax. They will not be willing to spend much time reading or listening to someone telling them about their behaviour. When planning the communication campaign, this notion of a fairly uninterested public has to be central. Uninterested people easily ignore information. The mechanisms of selective attention and selective retention are very persistent. To overcome these mechanisms the manager can try to:

- make the message short and clear;
- make the message attractive in its presentation;
- pay much attention to the distribution of the message.

Using this model for planning an intervention costs a lot of time and effort. However it could lead to better results. It is hoped that the results will be satisfying and that the nature in different areas will be conserved.

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ZONING OR INTEGRATING FOREST FUNCTIONS

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Introduction

Forests have always provided us with many essential goods and services. The first humans found their nourishment - such as vital proteins - in the forests, but with the development of agriculture and civilization, in many countries of the world, forests became more appreciated as "wood factories". Nowadays timber production is just one segment in the spectrum of forest functions. Others include: recreation, nature conservation, protection against erosion and flooding. The major role that forests still play in our society cannot be ignored.

Though forests provide us with all these functions they have not always been appreciated. 'People have looked at forests with mixed feelings. The relative weights of these positive and negative feelings have varied as development has taken place' (Gregersen in de Klein, 1990). Forests were not considered very important. Population expansion and the growing concern for wellbeing led to an increased demand for new land for agriculture and urban uses (such as infrastructural and recreational ones). Consequently, forest lands were cleared to serve more "useful" purposes.

The quality and quantity of the forests on earth continue to diminish, while the demands are growing. 'Increasing population, coupled with growing aspirations have already produced greater demands on forests for the various goods and services they produce and these demands will certainly continue to grow. There is also a steady growth in the level of demand placed on forest lands for non-forest uses.' (Stankey and Brown, 1981).

People are beginning to realize that forests are really important. The question frequently asked is what can be done to encounter the growing pressure. Two strategies are possible. The first is to increase the total forest area, e.g. by afforestation of agricultural grounds (a strategy that is practised nowadays in the European Community). The second is to use the existing forest in the best and most efficient way. Proper planning and management are needed to allocate different functions within forest areas that are best suited to these functions and to make sure that the forests will serve these functions optimally, now and in the future.

In this paper the second strategy and especially the planning and management methods of zoning or integrating are dealt with. Two methods to optimize combinations of different functions within a forest area are looked at. The first is the principle of zoning of forest functions (parts of a forest area, the so-called zones, are given a specific function). The second is the principle of integrating forest functions (more functions are realized within the same part of a forest in the same period).

Before we turn to the methods of zoning and integrating, here is a general introduction to the several forest functions and planning processes.

Forest functions

What are the functions that forests (can) have? To give an impression of the different merits of forests, two classifications are given. Marion Clawson (1975) divides forest functions into seven groups:

1. Maintenance of an attractive environment.
2. Provision of opportunity for relatively intensive outdoor recreation.
3. Provision of opportunity for a wilderness experience.

4. Provision of a habitat for wildlife.
5. Watershed functions.
6. General conservation including minimization of soil erosion.
7. Production of wood for various uses.

The Dutch Government (Ministerie van Landbouw en Visserij, 1977) divides the forest functions into four categories:

1. Wood production.
2. Recreation.
3. Nature conservation.
4. Forest as a part of the landscape.

These two classifications do not differ much. It is not very difficult to incorporate the two into a new classification, which is given below. In the classification given below, the production function of non-timber forest products is included in the production function. This function includes industrial as well as local uses. Local uses imply, for instance, people who live in the forest and need the forest directly for their food, housing, etc. These people depend on the products of the forest (Kunstadler, 1978).

1. Production of timber and non-timber forest products for various uses.
2. Recreational and aesthetical functions (e.g. the forest as part of the landscape).
3. Nature conservation (e.g. providing a habitat for wildlife).
4. Environmental functions (e.g. watershed functions, minimization of soil erosion).

The two kinds of recreation mentioned by Clawson (relatively intensive recreation and a wildlife experience) are different in that when demands and impacts on the forest are considered, it will be obvious that the function "recreation" separate needs proper planning and management. The various forms of recreation will not automatically cooperate. And the need for sound planning will only increase if the functions of recreation, nature conservation and wood production (these three functions are considered the most important ones in the case of Netherlands) are to be combined.

The planning process

The demands are increasing and there is a scarcity of land. Given the existing natural resources, sound planning is necessary to serve as many functions as possible.

Land use planning should be used to use the land in the most efficient way. Which activity can best be planned on a certain stretch of land (e.g. agriculture, forestry, urban use) and what functions should the land use type have? (e.g. recreation, production, nature conservation, environmental protection). Camp (1974) states that 'planning independently by functions, such as recreation, timber, range, etc., is not land use planning.' Planning is a way of integrating functions in the most optimal way. Camp (1974) also provides a step by step description of the planning process:

1. Selection of goals.
2. Determination of facts and information needed.
3. Setting up facts and information in a system for storage and quick easy retrieval.
4. Analysis, a step which should result in a set of alternative plans.
5. Selecting a plan and implementing it.

A very important step is that of land evaluation. 'A fundamental understanding of the land, its characteristics and its interrelationships is a necessary first step for sound land use planning. Along with this understanding one must also have accurate, precise and detailed information' (White, 1973). Together with land characteristics (soil, climate, slope, vegetation, etc.) the socio-political and socio-economical environment must also be taken into account.

It is important that the forester is involved in this planning process or else the forest will probably not be given the attention it deserves. When an area is designated as forest land, the question as to which functions the forest is required to fulfil is raised. 'It is helpful to classify forest areas according to their capacity to produce products and services of various kinds' (Clawson, 1974).

Zoning or integrating?

As already mentioned, forests fulfil different functions. Some functions can easily be combined and are even symbiotic, whereas others cannot. If we try to meet society's different demands in the one forest area all at the same time (such as in the Netherlands with recreation, nature conservation and timber production) difficulties will arise. Just think of the combination of intensive recreation and nature conservation, a combination that is causing lots of problems, especially in the western world. As Clawson (1975) notices: 'Too many human feet can in time be as destructive as a bulldozer.' What should we do to combine functions that are not cooperative? And what should be the strategy when we have functions that more or less can be combined?

'Multiple use of forest lands often means the integration of various uses on closely intermingled lands or on the same land at different times' (Clawson,1975). The integration of forest functions implies the allocation of several functions to the same forest area. A forest where wood production is practised can also be used for walking and cycling. Or a forest with special natural values can also permit extensive recreation. There is often no clear definition of what should be regarded as integration of functions and what should not be regarded as integration. But the general belief is that a certain forest area should not be reserved for only one function.

One can distinguish between situations in which two or more functions are more or less realized to the same extent and situations where there is a primary (or dominant) function and one or more secondary functions. For example, timber production is the management objective but recreation is tolerated. Between the two extremes all kinds of combinations are possible (with different priorities given to the various functions).

When two functions are realized at the same time, the realization of the individual functions will probably not be optimal. But the merits from the two can, when planning and management are efficient, be higher than the benefits from only one of the functions realized in the area. 'Trade-offs among the possible uses or outputs of a forest are possible; one use can be increased by decreases in another use or output; but these trade-offs are not necessarily proportional' (Clawson, 1974). The relationship between different functions can be complementary (increase in benefit from one function results in increased benefits from the other), indifferent or competitive (in most cases combining a function with another will result in less benefits from the individual functions; de Klein, 1990). 'The trade-off analysis should result in enabling formulating alternative plans for forest resource allocation' (Stankey and Brown, 1981).

An extra difficulty is the valuation of the different functions. How can we compare the benefits from the recreation function with timber production (the problem of tangible and intangible forest products)?

'When one use is completely incompatible with another, the policy choice is at least simple: choose one, or exclude the other, or perhaps divide the total forest area between the uses, each without the other on its area.' This second suggestion made by Clawson (1975) can be called "zoning". A forest area is divided into parts (zones) and within each zone a function best suited to the area is allocated.

As an example of the zoning principle the largest forest area in the Netherlands, called the Veluwe, is presented. The Veluwe is situated in the centre of the country. Because of the central location and the rather unique character of the Veluwe, it attracts millions of visitors each year, especially people from the big cities in the Netherlands. Apart from day trips, longer visits are also very popular. During the past decades it became necessary to deal with the problems caused by the millions of visitors concentrated within this relatively small area.

Together with the recreational function, the nature conservation and wood production function must be fulfilled by the forest according to the Dutch Government (Ministerie van Landbouw en Visserij, 1977). Hundreds of camp sites and caravan parks, besides other tourist facilities, can be found on the Veluwe. For example, the village of Voorthuizen, situated on the western border of the Veluwe and just one of the many touristic villages within the area, accounts for more than forty camp sites and caravan parks. The population is multiplied fivefold during the summer season. This makes it extremely difficult to serve the three main forest functions (recreation, timber production and nature conservation) at one and the same time. The authorities try to keep the most intensive forms of recreation away from the cores of different forest areas situated on the Veluwe. The centres of these forest areas can (but in practice not always) serve the nature conservation function. Around these centres, zones are situated, where extensive recreation (walking, cycling) and wood production are practised. These zones can be seen as buffers for the high pressure of recreation on the outskirts of the areas.

This example clearly shows that zoning is not only used to plan the three main forest functions in the Dutch situation, but also to allocate different forms and intensities of one function to a certain area. In the case of recreation, intensive and extensive types are situated within different zones. Each type of recreation has a different impact on the forest, which must be taken into account. The objective of zoning in this case becomes a measure to influence the behaviour of recreationists and to concentrate their activities, so the (local) pressure on the forest can be diminished.

Three levels of zoning can be distinguished (Ministerie van Landbouw en Visserij, 1983). At the local level - the micro-level of zoning in the case of the Veluwe - it has proved to be difficult (and perhaps impossible) to reach the desired situation. Pressures, especially imposed by recreational activities, continue to increase. The Dutch Government tries at the macro-level to roughly allocate the different forest functions to different (forest) regions. The plans are worked out into greater detail for these regions (meso-level). At this meso-level the Stichting Kritisch Bosbeheer (a Dutch organization that favours the presence of natural forests) has come up with plans to consider the Veluwe as a whole (National Park the Veluwe) and to develop a zoning plan for the entire area (covering about 40,000-50,000 hectares). Then the centre of the area is to be treated as a natural reserve. Recreation should be concentrated within the outer zones of the area (Goderie, 1986).

Of course in some zones functions can be combined. In the Veluwe, for example, extensive recreation and wood production were realized within one zone at the same time. This situation can be regarded as a combination of zoning and integrating.

The role of the forester

The forester is a manager of forests, but his or her role must not be restricted to this. As already mentioned very important decisions are made in the process of land use planning. Multi-disciplinary planning teams must be created in the land use planning phase. The forester must have a say in these multi-disciplinary planning teams to ensure that forestry is considered an important land use type. 'For the forester, land use planning is organizing the development and use of forest and related land and their resources in a manner that will best meet the needs of the people over time, and to maintain maximum flexibility for a dynamic combination of resource outputs for the future' (Camp, 1974). The forester can try to change the general idea that 'forests tend to be a residual use of rural land' (Healey, 1984).

The task of the forester is not an easy one and has only become more complicated because of the many functions people demand from forests (a differentiation of demands). He or she has to cope with social and natural development. Society often shows rapid and radical changes while natural development needs (a lot of) time (Swellengrebel, 1989). The forester must predict the necessary planning and management measures for the forests. In the process of zoning or integrating this brings about an extra difficulty, i.e. the pressure of the allocated functions on the forests today must not endanger the possibilities for future generations (sustainability).

Using the forests as efficiently as possible with the help of planning methods such as zoning or integrating is a must. Management needs to be flexible and the forester must listen to the voices of the different

interest groups in society. But he or she also has to reckon the merits of the forest that are not clear to everybody (like influencing our living environment in various ways) and inform the public about these. 'Tomorrow's forests almost certainly will be characterized by an increased level of management presence' (Stankey and Brown, 1981).

Conclusions and recommendations

The amount of land covered by forests is still decreasing and given the growing demands from society, pressure on forest lands will continue to increase. In this case efficient use of the forests is of utmost importance. Proper planning and management, taking into account demands and possibilities, is a necessity. The methods of zoning or integrating forest functions can be used as tools to serve this purpose.

The question is what could zoning and integration contribute to sound management and planning. Which of the two should be used in a specific situation? Perhaps one should ask if the two strategies can be separated at all. In the Veluwe, a combination of the two methods is practised. Integrating at macro-level can imply zoning at meso- or micro-level. Thus, is it not be better to speak of zoning AND integrating?

The role of the forester during the process of allocation of forest functions to forests will raise a lot of questions, as discussed above. But an active part in the processes outside "his" or "her" forest - such as in the processes of decision-making - should become normal.

Sound management and planning using methods such as zoning and integrating, and a more active role of the forester will ensure that the case is not lost, at least according to Clawson (1974): 'But I am convinced that imaginative management of large forest areas can go a long way towards meeting each of the various demands upon forests with only modest restraints upon other uses of the whole forest.'

Acknowledgements

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THE FUNCTIONAL DIVISION OF FOREST AREAS IN ROMANIA

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Introduction

Over the years, silviculture has developed continuously and has become more profound and in particular diversified. When forest management became a science and a practice in the days of Hartig (1795), the main problem was meeting the steady demand for wood. The forest was principally regarded as a natural resource for wood.

Forest management primarily aimed at timber production which idea dominated the thinking till the middle of our century. Bader (1945) introduced a few changes in this general belief. Bader aimed at recognizing the varied demands that society places on forests and the role of natural sciences in forest management.

Silvicultural evolution in Romania

Broadly speaking forest management in Romania developed in the way described above. For a long time forest management was dominated by an economic outlook that concentrated on wood production, but the Romanian silvicultural science realized in time that forests need to be multi-functional. In 1954 the first attempts were made to alter the forest management by dividing areas into functional units. The introduction of a multi-functional forest management met with great opposition and faced serious delay for a long period of time. Though at long last it was accepted.

In 1982 Professor Rucareanu promoted a more systematic and diverse approach in forest management, instead of the prevailing narrow production approach. So the idea of complex functional efficiency of forests, was introduced.

In spite of all the progress, forest management - both as a scientific subject and as a practical activity - continued to be dominated by the economic principle. This can be explained by the fact that most of the management methods in Romania were conceived and developed during the period when the interest in wood output was high. The management remained unchanged or was only slightly adjusted to new demands such as the increasing concern about maintaining the natural equilibrium and the quality of life. Today, forest management must be more apt at responding to new requirements from society.

Nowadays silviculture has to fulfil many purposes - like social, ecological and scientific ones - besides that of wood output. The forest management must ensure the ecological equilibrium of nature and aim at improving the living environment of the human population.

These major tasks for the forest management can only be achieved by the functional division of forest areas. This implies that the forest surface has to be delimitated so that various protection and production functions can be fulfilled.

Division into functional groups

In Romania the principle of multi-functional forests and the need for a diversified management has been recognized ever since silviculture began. This multi-functional role of forests was officially recognized by the first Forest Code of 1891 and later by the one of 1910. The next step was achieved in 1935, when the Forest Protection Law was accepted, followed by the Forest Protection Law for National Defence. Thorough documented studies and scientific investigations were made by Mr. Popescu Zeletin between

1952 and 1954 which resulted in an overall agreement and accompanied by the introduction of a proper system of functional division of forests officialized by Law 114/1954.

The forests were divided into two functional groups:

1. forests with special protection functions;
2. forests with both productive and protection functions.

The group of forests with special protection functions includes all forests necessary for the protection of some important economic and socio-cultural objectives, as well as those essential for public health, nature protection and scientific research.

The group of forests with both production and protection functions includes all forests necessary to cover the demand for wood or other material goods, while at the same time fulfilling important protection functions (hydrological, edaphic, climatic, touristic, etc.). We must not forget to emphasize that in the present stage these forests are of great value to nature's ecological equilibrium, ensuring the protection of water, climate, soil and landscape.

In its turn, the first functional group includes the following functional subgroups:

1. Forests with water protection functions.
2. Forests with ground and soil protection functions.
3. Forests with protection functions against climatic and industrial damaging factors.
4. Forests with recreational functions.
5. Forests of scientific interest and for protection of genetic stocks and ecosystems.

It was not necessary to set up functional subgroups for the forests with both production and protection functions. Protection functions are officially attributed to all the forests of the country, except in the second group where the main emphasis was placed on the production functions. It was at that time that criteria to determine the groups, subgroups and functional categories of the forests were defined. This division of forests into functional groups was proclaimed in 1962, together with the new Forest Code. In 1963 the criteria and the stipulations of the division of forest areas were modified, which contributed to the increased number of forests with special protection functions.

The criteria determining the group, subgroups and functional categories, got an official status in 1980, when the technical norms for forest management were worked out. However, the officially adopted criteria did not meet with the wishes of researchers and the increasing demands made by society towards specific forests: many forests with special protection functions were maintained in the second group for no apparent reason. Consequently the administration was not properly differentiated according to the importance of the functions attributed to the forests. Therefore new analyses and scientific research were necessary, finally leading to concrete proposals (Giurgiu, 1982; Giurgiu, 1987), officialized in 1986 and 1988.

The present system is obviously an improvement compared with the previous one. The percentage of forests with special protection functions mounted to over 40% of the total in 1987 and will probably exceed 50% by the end of the second millennium. In future all the forests will be designed to protect the human environment. The further improvement of the criteria can only be achieved on the basis of sound research.

Economic and social functional division of forest areas

Division into economic and social functional forest areas can be worked out by means of national synthesis. To determine the future forest management long-term objectives should be defined. The first research studies in this field divides Romania into four large socio-economical areas. To facilitate the establishment of socio-economical and ecological aims within forest management the following important suggestions have been made:

1. Most of the mountain and hill forests. It has a complex profile characterized by wood output, water protection, soil and ground protection and climatic protection. This area makes the largest contribution to the maintenance of ecological balance in Romanian geographic environment.
2. The forests on the plains where three functions are aimed at: climatic protection, recreation, and timber output. The preservation of forests in this area, otherwise very poorly afforested, becomes the main management objective.
3. The forests around the big cities, as well as other territories of great social interest.
4. The assembly of forest territories which will be included in the system of the future national parks for protection.

In Romania, from an economical and ecological point of view it is not justifiable that the forests in the neighbourhood of the big industrial wood consumers aim at a specific assortment. The forests around the pulp factories specializing in producing pulpwood for this industry, or the forests near the coal fields specializing in producing only pit props has proved to be a mistake. This idea is incompatible with the ecological principle, with that of functional efficiency and last but not least it has negative economic and social effects.

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INFLUENCING ZONE VISITS IN FORESTS BY DESIGN; The case of the small valley of Meijendel

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Introduction

The problem with the multiple-use of forests is the integration of different interests in design and management of forest areas. A forest manager, especially one who is concerned about the conservation and development of natural resources in the area, may experience that the carrying capacity is exceeded at certain times of the year as result of recreation. This may be deduced either by a gradual disappearance of certain forms of wildlife or vegetation, or by the appearance of other, more domesticated, forms. Or the manager may feel that natural values can be developed in the area in a more differentiated and intensified way than is done at present.

Some managers suspect that few people know about the beauties of their resource area. These managers would like to attract more visitors to the area; visitors who would appreciate and enjoy the resource values which are present. The quality of resource values would also be enhanced, e.g. by introducing a new set-up for forest-design (a more natural scheme of cutting and replacing trees), or by introducing other species of trees and forms of wildlife.

Control of recreation behaviour

There are several questions about the control of recreational behaviour that follow from the above considerations.

First there is the general question of the overall carrying capacity:

- Is the total actual demand too high? Is this demand too high because of degradation of the resource, or because of the conflicts between different user-groups, such as walkers and cyclists or horseback-riders? Could it be because the manager wants to redevelop nature values which have disappeared, possibly as a result of excessive recreational demands in the past?

If the answer is negative, meaning that the demand is just right, there is no problem. A negative answer implies that there is room for more visitors. Consequently a manager may want to set up a promotion programme to attract more visitors to the area.

If the answer to the question of the actual demand is yes, then the manager may look for measures to reduce the total demand. This may be effectuated by charging an entrance fee, or by demanding membership of the organization. Even the simple demand of a free entry permit, to be shown at the entrance to an area, for instance, is a means of selecting people who are really interested in the area.

There are, however, other options for conserving natural values on special locations in the area without causing the visitor to experience restriction of freedom (and freedom is, after all, the core motive in recreation; Neulinger, 1978; Bregha, 1980).

The options for controlling visitors without making them conscious of the measures, consists of:

- measures to attract specific target groups directly to a particular part of an area by providing what these groups are looking for, and which do not attract other target groups, or

- measures that lead visitors in general, or specific target groups in particular, to a certain location away from or to another location.

Both these types of measures are operative in the case of so-called zoning of recreation.

Of course, these same two measures may be used for either attractive attributes or leading attributes if the total visitor's demand is far below the carrying capacity. Thereby, either informational and educational techniques, or design techniques, or a combination of both can also be used.

Design techniques in the green structure

This paper concentrates on the options for design, and moreover, within this category not on so-called facilities (artifacts), but rather on the green structure. The matter of promoting visits or modifying behaviour in the area by means of the media, signs or folders is not discussed. This does not mean, of course, that we do not need to know the interpretive reactions of visitors to signs in the environment in a general, semiotic sense, in a comparable way as required by information specialists.

What a manager needs to know about the preferred visitor-attribute-relationship of a zone is:

- What motivates different target groups to visit particular areas compared with other groups (this implies research on characteristics of target groups, their motives and activities, and research on the particular attributes that are characteristic of the locations each target group prefers)?
- To assess the options available to lead visitors to preferred locations, provided that those locations are also acceptable to the management, the next question would be: which design attributes influence the different target groups in their choice of route within the area?

These two questions will be elaborated consecutively. First, some information and data about the visitor's motives and the correlated forest attributes, will be presented. Next, some examples of simple design measures to lead people away from unacceptable spots and toward more acceptable ones will be given. Finally, some remarks will be made about the ethics of behaviour control by researchers and managers in recreation situations and about the role of acceptance of certain measures by the public.

Motives of visitors and the correlated forest attributes

From diverse sources of general psychology (Baron et al, 1980; Boerwinkel, 1986) it may be concluded that a recreational transaction in a specific location in a forest has several psychological components, which are ordered into four transaction layers.

In a direct sense, a visitor seeks experiences, physical sensations, meaning and personal understanding. These exploratory experiences may be derived from the green environment itself and/or from the people and/or from other attributes, such as buildings, statues, etc. For the experience with other people and artifacts, the green environment provides a background, a stage. Nature, in this case, is not a direct source of experience.

Exploratory experiences are psychologically ordered into a second layer of activities. Activities are instrumental for experiences. Walking, for example, is instrumental for the experience of diversity of sights, wildlife elements and other objects, which are structured into aesthetic and meaningful compounds. It is also instrumental for physical exercise, or for an intimate conversation with a partner. Activities have a longer duration than experiences. Sitting for some time on a bench or a playing field may have an instrumental function for the same exploratory experiences, or for different ones (sitting to rest rather than to experience the environment).

A third layer into which instrumental and exploratory activities are ordered is the long-term existence of the visitor. Walking at weekends is done to restore psychological resources, to sort out relationships with partners and other kinsfolk or friends, to expand one's view of the world beyond the sometimes narrow limits of everyday life. One may seek expansion of one's consciousness by cosmic reflection,

which may be provided by nature. Recreational activities are ordered - sometimes consciously, sometimes unconsciously - into a process of existential identity formation and reinforcement, in young people, in adults, and in older people.

A fourth and final layer into which recreational experiences are ordered psychologically, is the **basic cultural attitude** or cultural mentality, which forms the background of the increased importance of forests and other natural areas for public concern. After World War II, both scientists and the public have been increasingly attributing urban and environmental degradation to western cultural, mostly industrial, arrogance (e.g. Toffler, 1981). Therefore, to some people, recreational visitors appear to be encapsulated in a psycho-cultural confrontation with the dilemma of the personal need of recreational experiences in natural areas, - with the risk of contributing to further degradation of nature - and at the same time knowing that abstaining from a visit would be a wiser form of resource "use".

So far for a brief introduction to the complex picture of the psychological basis of the recreational experiences in forests and nature conservation areas. The question how should the problem of measuring these recreational experiences be tackled and correlated with environmental attributes.

In a recent study conducted by the Centre for Recreation Studies of the Wageningen Agricultural University, which is linked to the Department of Forestry, we found - on the basis of factoranalysis - six motive dimensions for visiting the small valley of Meijendel, a dune reserve near The Hague at the west coast of Holland (Kugel et al, 1991).

The case of the small valley of Meijendel

This reserve was formerly managed mainly for sea defence and drinking water catchment and supply. Recently the protection and development of nature has become an important aim of the management, along with recreation. People had access to some parts for recreation purposes, especially the Meijendel Valley that lies in the hart of the area. In its centre is a pancake restaurant, a barn with a stable and a small visitor's centre, and also a horse-jumping arena.

To assess the pressure of visitors on the resource in Meijendel Valley a survey was done among the visitors. One of the questions asked was about the possible motives for going outdoors in leisure time. As a result six factoranalytic dimensions were found during the high season. The percentages of visitors voting for each dimension were calculated using a certain formula, which are presented in Table 1.

Table 1. Motive dimensions for visiting Meijendel Valley in percentage of respondents endorsing a certain motive (after Kugel et al, 1991).

motives for going outdoors in leisure time	%
Enjoyment seekers	70
Rest Seekers	26
Social Relaxation Seekers	16
Nature Involvement Seekers	15
Knowledge of Nature Seekers	15
Entertainment Seekers	0

The table shows that these motive groups are non- exclusive. People may score high on more than one dimension. One and the same person may choose rest at one time, and enjoyment of the environment or involvement in nature at another. These dimensions have been, in the same or different words, corroborated by similar research projects inside and outside the Netherlands (Rossman and Ulehla, 1977; Boerwinkel et al, 1982).

To provide an impression of what these motive dimensions imply psychologically, and what attributes of the environment are involved, the following sketch is drawn. The interpretations are not only based on this research project but also on many other research projects on the subject, carried out by ourselves and by others.

A sketch of types of recreationists and their motive dimensions in the Meijendel study is as follows:

1. The largest target group sought "Enjoyment of landscape and nature":
   - enjoying the special atmosphere of estates and parks;
   - feeling one with nature;
   - enjoying sights;
   - feeling the space around one;
   - absorbing untouched nature;
   - enjoying flowers, fountains and statues.

This general enjoyment of environments, like the Meijendel Valley, does not imply an exclusive confrontation with nature and wildlife but rather the special atmosphere of green areas with some buildings and artifacts, which although may have been made by man in the remote or recent past, radiates an identity and autonomy in a self-assured, rather hospitable, and peaceful, way. The psychological core issue is aesthetics in a broad green-environmental sense (Kaplan and Kaplan, 1989). It means sensing the green environment by total immersion. Nature most definitely contributes to it but more designed areas may also do so very well, provided they have that special character of being alive (as an American urban planner and architect Christoffer Alexander (1979) put it delicately).

The environmental characteristics contributing to the experience are uniqueness, individuality, and reassuring self-assuredness of spaces and objects. These spaces and objects have to be part of a "story" of images which the visitor can "read" while moving along paths and while resting at certain locations. This is definitely a matter of design, not easy to express in elementary aspects, but rather in terms of a whole concept (this is not so much corroborated by research in environmental psychology as in the practice of landscape architecture).

The reference to spaces and objects with identity and individuality, wrapped into a "narrative", a "story", makes this dimension psychologically "other-directed". The visitor is outward oriented, not as much involved in personal needs as in some other motive dimensions.

2. The motive of "Rest-seeking" is a more self-directed dimension. Contributing items in the Meijendel study are:
   - quickly penetrating deep into the area, and
   - seeking rest.

This motive refers to the hectic pace of urban life, from which the visitor seeks to escape as soon and as fast as possible. This motive is a self-centred, narcissistic craving for relief, not - or not yet - enabling the visitor to open him or herself up to the beauty of the environment. As is the case of the enjoyment dimension.

The contributing environmental characteristics are absence of people and noise, which means the opposite of crowdedness and the presence of enough vegetation along a path to shield the visitor from other visitors. Winding paths and dense vegetation of middle height are better suited for this purpose than straight paths and large trees, planted in rows, or open fields, of course.

3. The next dimension has an implication somewhere between self-centredness and total immersion in the environment. "Seeking social relaxation" means:
   - coming to one's self,
   - feeling different, and
   - young and older people romping around making fun on a day - campsite or a playing field.

The motivational picture is one of refilling ones psychological resources, not of just feeling narcissistically sorry for oneself because of the haunting pressures of daily life. The feeling is rather a beginning of a new communication with oneself and one's kin: "leave me and my family alone in this small and cosy green bubble" seems to be the message. The environment, natural or designed, is not - maybe not yet - a communicational partner in itself, which can be enjoyed by immersion. In other research projects a pattern was found of visitors, who occupied playgrounds for several hours, and who made a short walk around their temporary territory and into the forest at a certain time (Kroon, 1979). Maybe that was the time when they got out of their cosy space bubble and opened themselves up to the aesthetics of nature and landscape.

The environmental characteristics contributing to this dimension are enclosures with open spaces covered by grass and sand, with vegetation for the needed protection, on a scale that is large enough to provide space for playing and yet small enough to provide a family with a possibility of territorial defence. The design could provide the spaces and objects for enjoyment around these enclosures, with identity and individuality, and wrapped in an environmental narrative.

4/5. The next two motive dimensions, "Seeking involvement in nature" and "Seeking knowledge of nature", imply a definite conscious communication with living systems outside the circle of oneself and family. The first dimension refers to a feeling of commitment to nature in a general sense. Contributory items are:
- seeing how the soil, vegetation, animals and people form one large whole,
- studying the connection between plants, animals and their special environment for living,
- feeling the challenge of not-easily passable ground.

This dimension has a definite holistic character. Man is seen as a part of nature, and the visitor feels him- or herself dynamically dependent on nature as a living and life-sustaining system. Environmental characteristics contributing to this dimension are wholesomeness, freshness, conditions that are determined more by management, the climate, or environmental pollution (such as acid rain), than by design.

The other dimension of conscious experience of nature is directed more towards seeking knowledge of details about the way natural elements are mutually and dynamically operating. Contributory items are:

- letting nature guides (people who are supposed to know) tell and show many new and remarkable things about nature,
- exchanging ones knowledge of special birds and flowers with other "knowers", and again (as in the former dimension) studying the connection between plants, animals and their special environment for living.

The core issue in this motive dimension is the knowledge of details about the functioning of nature, which is important to man, in order to be not as unreflective about our cosmic existence as other creatures. Environmental characteristics contributing to this dimension are special birds, insects, plant species, and particulars about their niches and habitats.

6. The motive dimension of "Entertainment seekers" is according to the measurement rule we used, not endorsed by visitors in Meijendel Valley. Contributory items were:
- having great fun in a large group at a campfire or barbecue,
- participating in exciting orienteering tours.

The total absence of this motive-group was not expected beforehand. It is not at all surprising in view of the total lack of facilities to fulfil this motive and the rather restrictive control by management aiming to prevent any activity of this kind.

A question that still remains unanswered is: Do these different target groups actually visit different parts of the Meijendel Valley?

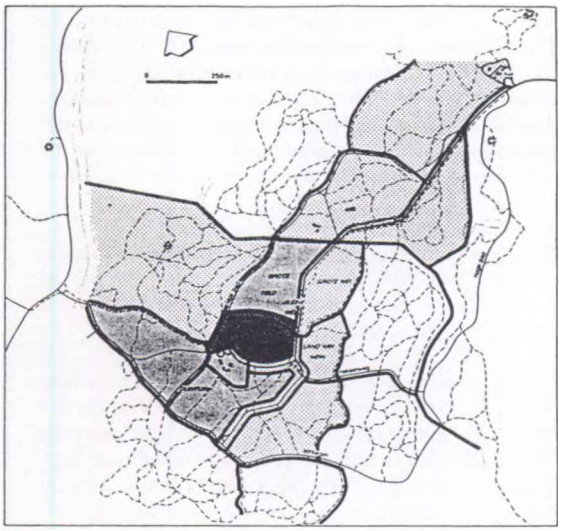


Figure 1. Dispersion pattern of visitors of Meijendel Valley in high season 1990. Numbers represent percentages of visitors that visited a zone

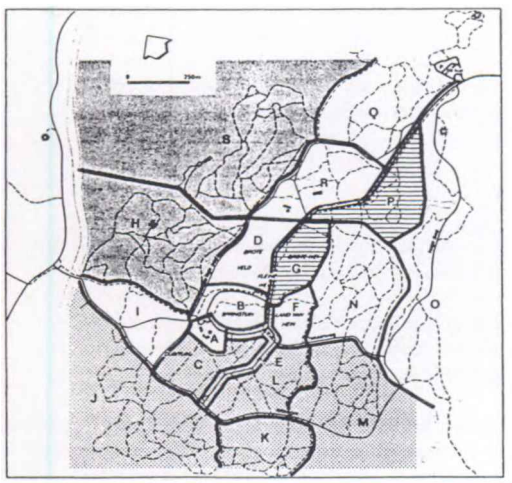


Figure 2. Route patterns based on factoranalysis of visit-scores in Meijendel Valley in high season 1990. Zones with a same type of shading belonged to the same route factor

Figure 1 shows that the most frequently visited part is the pancake restaurant at the centre and its immediate surroundings. Because the largest motive group that of the enjoyers, we may put up the supposition that this targetgroup would be over-represented in the centre of the valley. Visitors who seek rest or involvement in nature would be expected to visit other parts more frequently, further away from the pancake restaurant. From the answer to the question as to where the visitors had walked, we have constructed a spacing map.

In figure 2 three zones in the area are established on the basis of factoranalysis. Every zone has a different shading. The implication of a zone is that if a visitor has passed a certain part (e.g. 'G') he or she is more likely to have passed a part of the same zone (e.g. 'P'), rather than a part of another zone. A zone represents in this way apparently a route that visitors have followed. Consequently, a 'route-zone' discloses the choice of route visitors make, based on their personal motives and the coherence of special elements in the lay-out of parts that belong to the same route-zone. Important design aspects of this coherence are probably the hierarchy of path's (wide path's having sometimes more dominance than narrow ones), the type of vegetation, the availability of views (toward remote spots that are attractive, for the satisfaction of the dominant motive), etc.

The next important question is, whether different target groups could be associated with different route-zones. This turned out to be the case. "Enjoyers" were significantly more often found to have passed route-zone G-P. This is a park-like zone with relatively large open spaces that pass into one another and are separated by large trees and shrubs of intermediate height.

The "Knowledge of nature seekers" and "Rest seekers" passed relatively more through the route-zone H-S. This is a zone with a characteristic low dune vegetation with, over small hills, dispersed bushes, and a special view on a water pond with birds and reeds. The "Involvement with nature seekers" did pass significantly more often through route-zone C-E-J-K-L-M. This is a zone with an image that differs from both the other two zones in several respects. This zone consists of a rather dense vegetation in the form of shrubs and larger trees, with enclosures that were smaller than those of zone G-P, and with no views on special vegetation and wildlife, as compared to zone H-S.

Conclusions drawn from the Meijendel study

The conclusion which may be drawn from this study is that based on particular motives different target groups are attracted by different characteristics of zones in an area. A manager who wants to channel target groups either inside or outside the area, will be assisted by this type of research to attract particular target groups by changing the design and management of zones, and by totally reconstructing zone forms. Of course, this type of reconstruction should be performed along with the reconstruction of special facilities such as parking places, restaurants, picnic benches and tables, paths and roads for walking and cycling, and other activities.

These facilities however are not solely to attract recreational target groups to specific zones. Managers could also use them as instruments for keeping people away from vulnerable parts of an area.

Influencing visitors in their route behaviour

Management problems of keeping people away from a certain part of an area basically arrive at the question of how to lead a visitor from point A to point B, while avoiding location C (Figure 3).

The solution to this type of problem may either focus on presenting an alternative intermediary C' for C, or an alternative starting point A' for A, or an alternative destination B' for B. Some examples on the basis of these schematic representations in real management situations are given below.

The most simple, and wide-spread, illustration of the case of presenting an alternative intermediary C' for C (Figure 3a) is a path leading from one location A to another location B, a path not designed but was

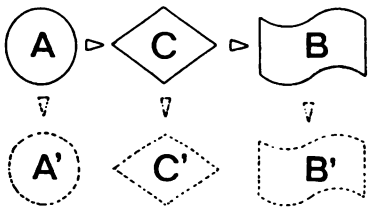


Figure 3. The spacial relationship between a starting location (A), a destination location (B) and an intermediate location (C) with alternatives (A', B', and C') in the case of forest visit zoning

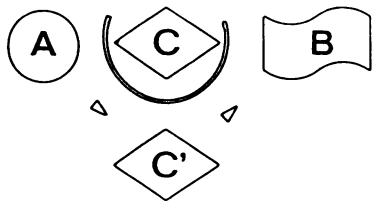


Figure 3a. Bypassing a vulnerable location (C) in a forest area by leading visitors through an alternative intermediate location (C')

a short-cut, made by visitors themselves. For some reason the manager does not want the short-cut to become established and decides that location C has to be reinforced. The visitor has to be forced to take the official route.

The next example in a nature conservation area in the south of the Netherlands is a somewhat grim one (Boonman, 1991). The manager took up the task of protecting a hill which was being eroded by visitors who took a short-cut from a location in the valley up to a visitor's centre at top of the hill. Because the visitors persisted strongly in their unacceptable route choice the manager felt obliged to set-up what he called a "Sigfried Line", named after a military reinforcement in Germany during World War II. Several consecutive lines of wire fences were erected (to protect C) along with signs that warned for the presence of snakes (compare the effect of booby traps). The snakes were really there but of a harmless species.

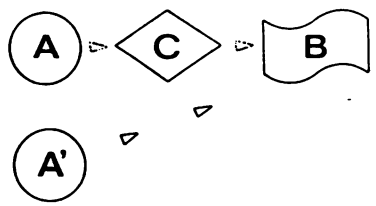


Figure 3b. Bypassing a vulnerable location (C) in a forest area by presenting visitors an alternative starting location (A')

An example of a solution by presenting an alternative starting point A' for A (Figure 3b) is found in the same area (Boonman, 1991) where on crowded days the general tendency to remain in the immediate vicinity of a visitors' centre caused too much pressure on the carrying capacity of the vegetation in that part of the area. A large parking place near the visitor's centre contributed to the attraction to that particular location. Therefore the manager decided to reduce the number of parking places at that location and to construct other parking places at a certain distance from the visitor's centre (presenting an A' for A). Because visitors now approached the centre from different directions they became more evenly distributed over the area. Consequently location C was relieved from some of the visitors' pressure.

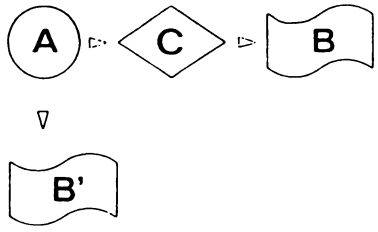


Figure 3c Bypassing a vulnerable location (C) in a forest area by providing an alternative destination location (B') in another direction than

A similar type of solution is now under consideration in a follow-up of the Meijendel study. In this plan, in order to relieve the immediate environment of the pancake restaurant in the centre of Meijendel Valley, the considerable number of approximately 500 parking places will be reduced to about 50. And at the entrance of the area, at a distance of 1,5 mile, where a small number of places is now available, more parking places will be constructed to replace those removed from the centre. It is expected is that more visitors will use this new parking facility. Another expected effect is that visitors who will walk the 1,5 miles to the pancake restaurant will not disperse much around that location because of exhaustion.

There was no clear example in the available literature of a solution of the A-C-B problem of figure 3 by presenting an alternative B' for the destination of an attractive recreation facility B (Figure 3c). This was particularly remarkable in view of the official policy of the Dutch Government that the creation of alternative destinations for recreation in the vicinity of the large cities in the West of the Netherlands - the so-called "Randstad" - should relieve the pressure on the natural resources like "De Veluwe" in the centre of the Netherlands (Buro Maas, 1990). A special reason for caution in this type of solution is the possibility of what is called a "pumping effect" (de Laat, 1981; Buro Maas, 1990). The alternative B' may function not as a substitute but as a reinforcement of the original attractive location B. This effect may be expected especially if it is not quite the same as the original and is placed somewhere in the proximity of B. Even if this alternative is constructed somewhere between the starting location A and the location C to be avoided, there may be the risk of a reinforcement of the pressure on C, because B' may attract additional visitors, due to a still too small distance to the starting location and to the vulnerable location C. Even a stable percentage of this increased number of visitors to alternative B' may increase the pressure on C. And so B' would indirectly pump visitors toward C rather than push them off.

For the Meijendel follow-up study we strongly recommended the provision of a substitute for the centre of Meijendel Valley, to be designed somewhere at the edge of the area in the direction of the city of The Hague, where the largest single group of visitors were living (46% in the high season). We do not know as yet what possible effect of pumping this measure would have.

We also recommended the design of marked walking routes in the follow-up study in Meijendel. Some 20% of the visitors of forests and natural resource areas are inclined to follow such routes, if available (Heytze, 1990). Although starting points (A's) and destination points (B's) coincide most of the time - a walking route is intended to bring a visitor back to a parked car or bicycle - this type of measure is particularly suitable for creating alternatives for starting points (A'), destination points (B's), especially

in their spatial relationship to acceptable connection zones (C's). In the case of walking routes a manager is also able to simultaneously combine the principle of pushing a visitor off an unacceptable course and leading him or her to an acceptable attractive one. The large Enjoyment target group in particular seeks a narrative of environmental pictures, which they presumably will expect to be told by the marked route. A consequence of this leading effect of marked routes is that more drastic measures like the Siegfried Line and other defensive measures for preserving a vulnerable area may not be needed.

This consideration is particularly important in view of the acceptability of sophisticated control measures, especially in the case of management of recreation behaviour.

Ethics of control

There are several aspects of zoning measures by design that concern the ethics of control by both researchers and managers. These aspects will be indicated in the form of statements, as follows:

As far as possible, the control of recreationists should be directed at presenting alternatives to vulnerable locations, rather than prohibition and obstruction of access to those locations.

- This follows from the general motive of freedom that is the core of the recreational experience (Neulinger, 1978);
- This also follows from the general insights of psychological learning theory with respect to the most effective mix of reward (by presenting attractions as positive reinforcements) and punishment (by prohibiting access) (Hamblin, 1969; Gramann and Vander Stoep 1987).

The control of recreationists by design, being for most of the visitors of an unconscious kind, should be performed with the utmost care of the manager, not only to vulnerable nature, but also to the vulnerable man.

- This follows from the fact that a fundamental motive for visiting natural resource areas is caused by industrial man's feeling to be pushed away by his most cultural environment, the city (Rossman and Ulehla, 1977; Kaplan and Kaplan, 1989).
- The consequence is that measures to be taken should be accompanied by information in the media and openness of the manager to public reactions.

These principles, i.e., provision of positive alternatives rather than restrictions, and approaching visitors with due respect when using unconscious control techniques including public information, will enhance the amount of acceptance by visitors of even very restrictive and obstructive measures, when necessary.

- This follows from the general publics concern about nature and the resulting presumed willingness of the public to give nature more room, even if it cannot, on occasion, be enjoyed freely.

Zoning by conscious design is in principle a natural tool for a very unnatural cultural goal. If used as a tool to preserve and develop nature, and to present an image of naturalness in the landscape, it presents a definite cultural paradox.

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Appraisal of forest functions: is a financial yield the only valuation possible for forest functions?

FOREST FUNCTIONS: UNDERVALUED OR OVERESTIMATED?

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Introduction

The title of this paper was chosen because of the difference in the valuation of forest functions by the various interest groups (such as economists, ecologists, foresters, and environmentalists). It generalizes the main question: 'Valuation of forest functions: is a financial yield the only evaluation of forest functions?' (Here, the term "financial yield" is used in the broadest sense possible, i.e., every valuation of forest functions in monetary units is considered to be a financial yield).

Answers to the questions are given by means of descriptions of forest functions and their valuation. These descriptions are very general and are limited because a more complete review would be impossible within the confines of this paper.

Forest functions

Many authors, (for instance Jacobs 1976; Sinden 1978), have stated that forests can fulfil a variety of functions to mankind. But the question that immediately arises, is: What is a forest function? Van Maaren (1984) clearly defines these so-called forest functions as 'the relationship between the forest resource and social demands towards that resource. (...) These functions are in fact human expectations of what should be supplied by the forest.'

A range of forest functions can be distinguished, of which a few examples are presented in Figure 1. They vary from "living environment of indigenous people" (like Indians and Papuans; Kunstadler et al, 1978) to "economic reservoir" (forest can, for instance, be conserved as insurance of future income; USDA, 1987), and from "biological balance" (of many human interventions in forests the side effects on the surrounding ecosystems are not fully known, and the [often fragile] biological balance is disturbed; de Beer and McDermott, 1989) to "landscape unit". An important problem, related to these forest functions, is the recognition that there is overlap between all functions of a specific forest and that perception of functions differ by the different interest groups. A total enumeration of forest functions is (virtually) impossible.

The broad variety that characterizes forest functions is reflected in its classification systems. Various authors have made classifications in forest functions. Among them are divisions into physiological, physical and cultural values (Poore, 1975), into economical importance versus welfare functions (de Leijster, 1977), into production, carrying, information and regulation functions (van der Maarel, 1977), and into production, recreational, ecological and other functions (de Weille et al, 1978). Like forest functions, within each classification system there is overlap between the different categories, and no system is perfect.

There is also the division into tangible and intangible forest functions. Tangible functions are functions which can (directly or indirectly) be valued in (often monetary) units. Intangible functions cannot be valued in these units. Thus, forest functions can be divided into three categories (adapted from von Meijenfeldt, 1980):

1. Tangible functions which are valued by the market.
2. Tangible functions of which, in an indirect way, the value can be calculated.
3. Intangible functions of which a valuation is not (yet) possible.

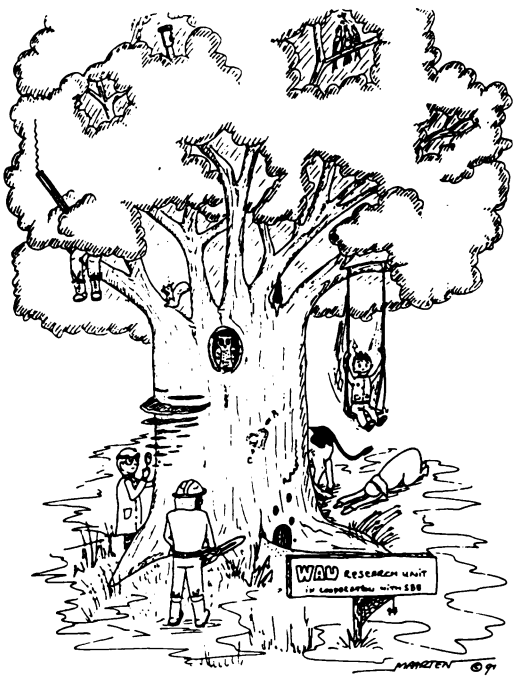


Figure 1. Various functions of a "forests"

Valuation of forest functions

Apart from the problems of overlapping and/or unseen forest functions, defining the present forest functions is relatively easy compared with the valuation of these functions. The question is how can the functions of a certain forest be valued in a satisfactory way, and what kind of units should be used in this valuation? To be able to understand this question, three factors should already be clear. First, one must know what valuation of forest functions is, second, which methods are currently used for this valuation and third, what units are used for the valuation of forest functions.

In general, it can be said that in valuation of forest functions certain forest characteristics are valued by a certain person (Kroon, 1991). For instance in a forest in Papua New Guinea, the amount of timber is highly valued by the forest exploiter, while in the same forest just the amount and variety of edible plants and trees is highly valued by an indigenous Papuan. Note, different interest groups all have different perceptions on the value of forest (functions).

Several attempts have been made to tackle the problem of valuation of forest functions. In this paper, three of these attempts are briefly described. The first is the Cost Benefit Analysis, the second the Multi-Criteria Evaluation, and the third one is Energetics.

Cost Benefit Analysis (CBA) is a method that uses concepts of business economics. It measures the advantages and disadvantages in terms of (social) gain and losses of different effects in one measurement unit (usually the local currency). In CBA different approaches can be taken. For instance, a social and environmental approach is possible. However, it is merely a type of policy analysis and is limited to a description of the effects of decisions on profit, liquidity, and share of the market (Filius, undated).

Multi-Criteria Analysis (MCE) is a totally different approach. Instead of a special measuring unit, the MCE centralizes the objectives and alternatives of forest functions. It is not expressed in specified units like monetary units, but operates with a sort of ranking. The alternative sets of forest functions of a certain forest are defined and each set is valued according to its functions. The result is that to a specific forest, one set of forest functions will be more attractive than another. The value of a specific set can be expressed based on this ranking (Filius, 1988).

An interesting alternative to the two methods mentioned above, is Energetics (the valuation in energy units). Energy is the most crucial limiting factor in economic production or maintenance of environmental quality (Dasgupta and Pearce, 1978). Therefore, in Energetics, a method presented by Odum, the amounts of energy (mostly in kilojoules) a certain function consumes and produces are calculated (Odum and Pigeon, 1972). This method can have rather different results compared to an expression in financial yield. The method represents the actual amount of energy produced by a certain function and the amounts necessary to realize that forest function, instead of an approach to value the function for a certain interest group.

Discussion

The above mentioned methods use a monetary, a ranking and an energy unit. There are hardly any problems with the methods in the first category ("tangible functions of which a value is given") and the third category ("intangible functions") of forest functions. This is because it is either possible or impossible to express them in the units chosen. But problems do arise in the category of "tangible functions of which a value can be calculated". The main problem is how to calculate these values. Many authors have tried to develop various approaches to calculate such values. For instance, the monetary unit to express forest functions can be based on factors ranging from 'the availability and local market prices for purchasable products' (Caldecott, 1988) to 'the numbers, per cent of community involved in processing and manufacture' (de Beer and McDermott, 1989) and from 'the numbers, per cent of community who collect non-timber forest products' (Marsh and Gait, 1988) to 'the per cent of household time budgets spent on these functions' (Connely, 1985).

Considering the diversity of the methods of valuation of forest functions, it is apparent that no unanimous scientific method has yet been developed. At the same time, there seems to be a certain amount of friction between the valuations of forest functions. The different interest groups accuse one another of restricting their valuations to functions pertaining to their own interests by using their own specific methods of valuation and, by doing so, undervaluing the forest as a whole (for instance the ECE Timber Committee versus the environmentalists). The salient point of this dissatisfaction in forest valuation is: The abundance of human factors in the valuation of forests functions. Forest functions are human expectations of what a forest should supply, the valuation of these functions is done by humans and the units the values are expressed in are mainly the units of human society. And the variation of human expectations, interests, and opinions is so extensive that friction is well nigh inevitable.

The difficulties arising from the abundance of human factors in the valuation of forest functions results in four main problem areas, namely:

1. The incapability of incorporating all potential forest functions in one valuation.
2. The impossibility of valuing forest functions to a satisfactory degree to suit all interest groups.
3. The variation in the available methods that can be used.
4. The current valuation in monetary units most used, which cannot be applied to all forest functions.

The impossibility of incorporating all potential forest functions in one valuation, is a problem which will probably never be solved. There is often no precise information available about the various functions of a forest. And can we understand the importance of certain forest functions to future generations? Also, the period of time necessary to develop and exploit a forest is so lengthy (mostly more than 40 years) that it is (virtually) impossible to recognize every aspect of the functions of the particular forest. Besides, ideas and values of people might have changed over time.

The valuation of forest functions to a satisfactory degree (for all interest groups), is at least as difficult as incorporating all potential forest functions within a single valuation. This will probably always remain a point of discussion caused by changes over time. It is necessary to come up with a sounder valuation system of the present forest functions. At least a standardization of used units in forest valuation should be achieved to be able to discuss the points of view between the different interest groups.

A more satisfactory and "democratic" approach of forest valuation requires the participation of interest groups involved. The interest groups, who are often more interested in a certain forest function, should get together and try to understand and accept each others points of view and knowledge of forests. It is very doubtful, however, whether the interest groups have the means and the motivation to do so, especially as it is easier for some of them to use the power they have to influence the valuation of forest functions to their own advantage.

The reason for the variety of methods in valuation of forest functions is because of the difference in potential forest functions, the methods of classifying them, and the methods of valuing them. All this variation makes it very difficult to understand all the possibilities in the valuation of forest functions and to choose the most appropriate one.

The use of monetary units to express the values of forest functions is inappropriate for a satisfactory valuation. It cannot be used to value the intangible functions a forest has, and complex calculations have to be made to try to value functions that are not directly priced by their markets. A better way to value forest functions would be to use a unit that is not influenced by human factors, such as the unit of kilojoule used in energetics. However, monetary units have two important points in their favour, namely the variation of methods in the valuation of forest functions mentioned above, and the convenience of being able to easily integrate the valuation in economics. People tend to use the most familiar ways to value their functions. This last point is of such importance that we will probably continue to use the monetary units for valuation for many years to come.

Concluding remarks

In conclusion, it can be said that generally, forests as a whole are underestimated. Some of its functions are not incorporated in a valuation system, some cannot be valued and some others are valued according to methods that are not agreed upon by some interest groups. This is mainly a result of the many human factors that influence the valuation of forest functions, which can be divided into four problem areas, namely the incapability of incorporating all functions a forest has; the impossibility of valuing forest functions to a satisfactory degree (for all interest groups); the amount of variation in the available methods; and the often used valuation in monetary units. These problem areas will probably always remain because of the socio-economic context of the valuation of forest functions. It will be very difficult to reduce the human factors in the valuation of forest functions.

Although the financial yield is not the only way of valuing forest functions, this unit will probably be that most used in the future, because of the many advantages this unit has in the socio-economic context it is placed in. Furthermore, the division in tangible and intangible forest functions seems to be a good one to work with. Although there are methods in the category of tangible forest functions that are not agreed upon by all interest groups, this classification is the most simple and precise classification possible. It ensures little overlap between the categories and few misunderstandings between the different interest groups.

The valuation of forest functions is so complex that it cannot be done by a single person or interest group. The sound valuation of present forest functions should be done by a team of (all) interest groups. In this way a more objective point of view towards the valuation of forest functions can be reached. In the process of valuation an important task for the forester can be defined. Because of his/her (general) knowledge of the forest ecosystem, (s)he can inform the different interest groups about the forest ecosystem as a whole, direct them to a more sound valuation of forest functions, and thereby to a better use of the forest. To do so, the forester has to become an intermediary between the different interest groups involved: to become a "forest politician" instead of a forest manager.

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APPRAISAL OF FOREST FUNCTIONS WITH SPECIAL REFERENCE TO INDIA

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Introduction and background to the forest functions

Forest ecosystems comprise the total physical environment and all living organisms (including plants, animals and sometimes human beings). Needless to say, forests are economically important, exhaustible, maintainable and renewable living natural resources. At least in theory, their perpetual harvest depends upon proper planning and management. But in many cases, improper land use has resulted in impairment or exhaustion of valuable forest areas with adverse consequences such as complete degradation of lands to a stage of irreversibility (Owen, 1980).

Depending upon the type and intensity of management (to which they are subjected), the forest ecosystems around the world serve a wide range of uses. They contribute substantially in the overall evolution and development of human civilization on our planet Earth. On the one hand, they have provided space for all kinds of man-made infrastructural developments, particularly agriculture and grazing, rural and urban centres, industries and mining, dams and reservoirs, roads, railways and canals, and many others. On the other hand, they have been the source of a variety of produce (timber and non-timber) and services (biological, ecological and environmental), singly or in combination. Even today, the bulk of the world's population is directly dependent upon the forest biomass for their day-to-day basic needs for food, fuelwood, shelter, fodder, timber, fibres, fruits, medicines, etc. Depending on the socio-economic conditions of the people and the needs / demands, importance and values of various attributes of forests have been changing over time and from place to place. The principal role of forests in ensuring environmental stability and maintenance of ecological balance are much more valuable to the society and the total environment as a whole.

Nature of forest functions and their importance to India

The nature of benefits and costs of forest resource management depend on the priorities and objectives of the policies/programmes and vary greatly from country to country, more precisely from forest to forest. In India, the recorded forest area is 75 million ha. But the actual forest cover is 64 million ha and only 37 million ha of forests have got >40% crown density. The per capita forest area is only 0.1 ha, with an average annual wood production of 0.7 m^3 (Table 1).

Table 1. Comparison of forest areas in the world

	total forest area in %	per capita forest area (ha)
India	22.8%	0.1
Developed countries	35.9%	1.6
Developing countries	30.6%	0.6
World	32.8%	1.0

The net annual increment stands at 52 million m^3 from an estimated growing stock 4,196 million m^3. Therefore, India's forest resources are quite low compared with the average figures of most developing and developed countries, and the world as a whole. Functionally, the forests are divided as follows (Table 2):

Table 2. Toatal permanent forest area and status of India.

Protection forests	10 million ha	for ecological stability
Production forests	16 million ha	for producing timber for industries, commerce, railways and defence
Social forests	25 million ha	to meet the demand of firewood, fodder, etc.
National Parks and Wildlife Sanctuaries	13 million ha	for wildlife conservation purposes

From the demand point of view, the position is very discouraging. The country's rural economy leans heavily on forest products and the majority of the people survive within the biomass-based subsistence economy. Of the 52 million m^3 of wood produced every year, 40 million m^3 is used as firewood for domestic energy, 8 million m^3 is used for agricultural implements, bullock carts, housing, etc. and only 4 million m^3 is available for industrial uses. Thus, about 90% of the total wood produced is used as fuelwood by about 80% of the people in India. The latest figures show the following deficits in supplies of firewood, timber and fodder (Table 3):

Table 3. Forest products supply and demand of India.

		Demand	Supply	Deficit
Firewood	(million m^3)	235	40	195
Timber	(" ")	27.6	12	15.6
Green fodder	(million tons)	932	250	682
Dry fodder	(" ")	780	441	339

Nearly 51.7 million tribal people belonging to 250 different communities are dependent on forests for economic, social, cultural and emotional needs. Depending on the forests, they earn on average about 33% of their livelihood from forests. In thirteen States of India, more than 0.6 million families still practice shifting cultivation in an area of 4.4 million ha which is 9,8% of the total forest area. From 1950 to 1980, an area of 0.7 million ha was encroached for agricultural purposes and 4.3 million ha was diverted for non-forestry uses, such as river valley projects, industries and townships and transmission lines and roads. Over and above these demands, the estimated number of domestic cattle grazing in forests is 90 million.

The ownership and management of almost all forests is vested in the State (Forestry Departments). Much of the traditional forest management aims at increasing revenue for the Exchequer by producing timber (Table 4). However the importance of minor forest produce (non-timber forest products) for revenue earning (on commercial basis) has also been recognized and is becoming increasingly influential in present day forest management in India.

Table 4. Forests in India: Revenue and Expenditure (Rs. in million; Source: Government of India, 1987)

Year	Revenue	Expenditure	Remarks (Revenue shares)
1982-83	6964	4649	Share of timber, fuelwood
1983-84	7819	4935	and minor forest products
1984-85	8275	6098	in 1985-86 was 60.7%, 6.4%
1985-86	9156	7135	32.9% respectively.

The above mentioned figures represent only the partial monetization of benefits being realized from the marketed forest products. Various kinds of rights and concessions permit the local people to collect a variety of forest products, especially for food (including nuts, roots and fruits), firewood, fodder and grasses, fibre, medicinal parts, timber for huts/houses, bamboos and canes, leaves, gums, honey, game, and many others. In addition, the problems like illicit cutting, over-grazing, encroachment of forest lands, shifting cultivation, exert great pressure on the country's forests resources. The estimates indicate that the unrecorded production of wood, including firewood is 42% of the total annual wood production in the country (Government of India, 1987a,b). So, the annual revenues shown in Table 1 do not contain the real monetized value of benefits being realized in the country and appear to be highly underestimated. In such areas the actual economic value of the forest resources is certainly much higher than their reported financial values.

In spite of the well laid-out forest policies of 1894 and 1952, the forests have suffered from serious depletion due to relentless pressures arising from the ever-increasing demand for industrial timber, fuelwood, fodder and grazing, etc., over the years. Several amendments have been made to the systems in response to the changes in society and forestry characteristics. The recent national forest policy announced in 1988 (Government of India, 1988), clearly recognizes the domestic requirements of the local people for fuelwood, fodder, non-timber forest products, and small timber as the first charge on forests. This policy stresses that the derivation of direct economic benefits must be subordinated to the principal aim of the forest policy which is to ensure environmental stability and the maintenance of ecological balance. So the forest management is gradually becoming more and more public-welfare oriented. But the acute shortage of biomass due to severe land degradation is seriously undermining the life support system of the country. Nearly 35.9 million ha of forest area and 93.7 million ha of non-forest area is estimated to be degraded land in India. Despite the large-scale dependence of the Indian population on forest products, the expenditures on forestry have remained very low in India's five-year plan. The maximum was 1% of the total public sector outlays in the Seventh Five Year Plan, 1985-90. Between 1950 to 1990, India has afforested 17 million ha by spending Rs 37,098 million (Government of India, 1989).

India strongly believes in conserving its nature and wildlife. There are 67 national parks and 398 wildlife sanctuaries on 3.9% of its land surface.

In the official records, the forestry sector is shown to contribute only a little over 1.0% to the GDP. However, the attempts to calculate the value of the goods and services produced by forests have indicated that it may be more than a quarter of the total GDP of India.

Therefore the demands on forests in India are more of a qualitative nature. Much of the quantitative benefits are utilized by the people of India free of charge or at highly subsidized rates which are generally far below the marketable rates. Depending on the forest types and socio-economic conditions, the proportion of non-marketed benefits is highly diversified and widely dispersed in nature. Also, these benefits have no equatable market price. This creates a problem of accounting the actual value of non-marketable benefits from the Indian forests. If the value of the non-marketed benefits (both qualitative and quantitative) are correctly estimated and added to the total revenue from forests, the real value of forestry in the Indian context could be much more appreciated.

Forest functions: economic appraisal criteria discussed in general with special reference to IRR and NPV and their appraisal

The forests have to be appraised for various reasons. Invariably the investors' and financiers' main interest is to know the return on the capital invested. The forest appraisal involves weighing the benefits against the costs, taking into account the timing of their occurrence in order to establish their relative efficiency. Several methods of forest appraisal are in practice and arguments can be made to justify each method. They are based on a number of objective measurements such as areas, ages, volumes, productivity of stands, types of management, uses and marketability of the products involving a number of assumptions about the rotation period, future costs, prices, etc. The main idea is to estimate the value of the growing stock, and to indicate whether the capital investment is increasing, decreasing or remaining more or less constant.

The two most commonly used criteria for appraisal of forests are the Financial Yield or the Internal Rate of Return (IRR) and the Net Present Value (NPV). A comparative account on these criteria is presented in appendix 1 based on the descriptions and observations made by Price (1989) and Pearse (1990). It is obvious that the IRR and NPV do not provide the same selection among investments. Instead of comparing the present values of benefits and costs discounted at some pre-determined interest rate, the interest rate of the IRR is determined by equating the present values of benefits with present values of costs.

Projects with large initial investments or long occupation of a site are not favoured by the IRR. When budget is a constraint, the IRR prefers the projects with a shorter repayment period than NPV per dollar invested for rapid build up of funds creating maximum scope for future intensive forest management.

The application of the IRR criterion to many projects presents serious problems and can give misleading results. It is suitable only for projects that involve an initial investment and later returns. The calculation of the IRR becomes exceedingly complicated and sometimes indeterminate for projects with positive and negative returns scattered through time, i.e. the multiple root problem. Another defect with the IRR is the problem of the inappropriate discount rate. Moreover, the IRR is a misleading criterion for comparison of alternatives. Most importantly, the IRR criterion does not take explicit account of the opportunity cost of capital and, therefore, cannot indicate the desirability of investments from the viewpoint of society as a whole.

Lastly, to quote Price (1989): 'IRR is only the solution of an equation and leaving mere equations to determine the weight to place on future events is a grave abrogation of human responsibilities.' Therefore, his advice is not to judge a forest investment by its IRR.

Forest appraisal in the Indian context

The estimation and prediction of the volume of trees is considered central to all rational planning connected with Indian traditional forestry. Nearly 78% of the forests in the country are covered under the working plans for effective, systematic and scientific management purposes to generate site-specific goods and services. The main objective relates to the concept of the normal forest for a constant volume of timber every year in perpetuity, i.e. the sustained yield criteria. Therefore, the forest is divided into annual felling areas or coupes with pre-determined rotations. The yield regulation is carried out by the area control method and/or the volume control method, sometimes by applying upper girth limits and/or restricting the number of trees to be felled. In many cases the price of standing trees is fixed without any reference to the growing costs of the crop or the market price of the produce. The rates are such that the Forest Department can never hope to make a surplus on investments. The methods adopted for revenue and expenditures do not account for their economic implications which may be significant. Perhaps, the wider economic significance of forest management in India has not been realized (FAO, 1989).

The application of forest economics has remained negligible in the management of India's forest resources. Economics as a subject was included in the curriculum of forestry training in the early 1970s. The projectized approach (pre-project appraisals and subsequent evaluations, indicating various profitable criteria) is of recent origin. It started with an idea of attracting financial support from international donor agencies such as the World Bank, USAID, SIDA, CIDA, EEC. However this is now widely used for the foreign-aided social forestry projects (outside the preview of the traditional forestry with the idea to augment the local supply of fuelwood, fodder, poles, small timber, etc. to reduce pressure on natural forests and to create local employment opportunities). These programmes have spread over the entire country and have formed the main activities of the government's forest departments, attracting the major share of the financial provisions of forestry. In the process, attention towards traditional forestry has gradually declined. The share of social forestry in various States of India varies between 50 and 75% of the total investments on forestry programmes every year. The foreign-aided social forestry projects amounted to nearly Rs 16,000 million during the period 1980-1990.

Unfortunately, the social forestry projects are also based on the financial criterion involving the IRR and the contribution of non-market benefits. Social and environmental values have not been considered in detail while carrying out the pre-project appraisals. Moreover, since 1980 certain States have completed two consecutive phases of social forestry projects. Looking at the diversified nature of forest functions in India (especially the socio-economic role of forests) it does not seem appropriate to use the IRR criterion for the appraisal of forests. These projects still predominantly give priority to the final timber crop rather than the intermediate non-market benefits/products. They have created poles and timber of considerable commercial value and the output harvested has been largely sold to urban and commercial markets. Considering this, the ex-post evaluations involving a detailed social cost-benefit analysis in respect of the completed projects may provide better evaluation of forest functions in India, especially to establish the real values of implementing social forestry projects.

Discussion and conclusion

Forests are part of a society's total endowment of productive resources. Their contribution to social welfare is governed by the efficiency with which they are allocated and used. They provide infinite opportunities in silviculture and forest management that can yield a mixture of benefits. Worldwide, the forests contribute hundreds of billions of dollars annually to major industrial concerns for most man-made industrial raw materials (Oldfield, 1989). The magnitude of the non-market and non-priced forest values is also of enormous significance to the society as a whole, but it is seldom acknowledged. As a result, the true economic value of the forests is usually underestimated and indirect extermination of valuable forests continues. Therefore, before deciding on the immediate and long-term objectives of financial management, it is necessary to take into account factors such as the direction and extent of timber production; monetary, physical and socio-economic resource availability; demand for ready money, expectation rate, future market trends, government policy, as well as many others.

It is necessary to examine the credentials of profit maximization in forestry programmes, particularly in the developing countries where non-timber materials are locally much more important in promoting community goodwill that ultimately enhances profits. Society has multiple objectives and multiple products, although not all reflected in profits, they should be incorporated in decision-making processes. The true value of the forests should be evaluated more appropriately in terms of the net benefits they provide to society, countries, regions, and mankind as a whole. This is important because the economic interests of individual entrepreneurs, landowners or workers often diverge from that of society. The purpose should be to generate the maximum net value to society. We must take unbiased account of the full range of social benefits, whether they are priced or not.

In view of the foregoing paragraphs, it is apparent that forest economists have to play a greater role and take more responsibility towards societal, ecological and environmental objectives. Therefore, they should try to adopt a more rational and realistic approach while evaluating the forest functions in different parts of the world. The following four points need special attention in this regard.

1. There is a need to understand, appreciate, feel, recognize and list the important kinds of forest functions in different countries/regions. These should be classified into quantitative (national and local) and qualitative functions.
2. There is a need to carefully evaluate and compare the marketable and non-marketable functions to grasp the real impact of forestry on society and the environment, not only to a single nation, but to humanity as a whole.
3. The changing role of today's forestry programmes/projects, particularly in the social/communal forestry in developing countries needs to be evaluated in a more realistic manner.
4. Our thinking may be global but there is a need to look at the micro-level in an integrated manner to enhance our understanding of the values of all goods and services from the forests. This is because the value of non-commercial products vary enormously with location and type of forestry.

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RECREATION, TOURISM AND NATURE CONSERVATION; the Dolomiti, Italy in historical perspective

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Introduction

Although Italy is still esteemed for many of its natural and artistic possessions, we have to remark that in this century many resources have been ruined because of the rapid growth in industrial development. Many choices have been made ignorant of their repercussions on natural resources and only recently have we begun to understand their impact on the complex environmental-social balance. Having reached the present high standard of living the appreciation of non or hardly measurable intangible products such as the quality of life, environmental quality and the necessity to let nature express itself is gradually emerging.

To many, nature changed from a dangerous and invincible subject to a defenceless one that needs to be protected. The many problems are known to most citizens. In cities there are big sanitary problems connected with air and water pollution. In rural areas environmental damage dominates, ranging from excess of ecosystem simplification to the complete absence of life as a result of new agronomic methods.

Natural borders in mountain areas often preserve small ecosystems, whereas human socio-economic systems often decline under these circumstances. Living conditions are hard and marginal, with the result that many inhabitants live in poverty, or that inhabitants suddenly become rich thanks to tourism (Susmel, 1971). There is a need to defend the territory and its economics is born and a demand for the recognition of their resources. Regional land coordination plans evaluate these resources and show that the contribution of the trees and forests is big, although difficult to access in monetary terms.

The green presence is well accepted in the city as well as in the country and accordingly the intangible values are more and more appreciated and valued. In the mountains the recreational function often dominates, especially where a good forest management has kept the forests in a perfect shape, like uneven aged forests with a selective felling system, or where natural borders preserve endemics unintentionally.

These forests form the base for national park establishment though the establishment of these parks caused some social problems. In Italy, parks are established primarily to manage territories and only secondarily to protect nature (Merlo, 1990). Are mountain area inhabitants still concerned about the current protection of resources? Unfortunately bad behaviour towards protection originating in the lowlands (hedonism: use and throw away) have a negative influence on the mountain people's way of thinking. So it is necessary to restore their cultural values and their inherited rights (Viola, 1990). Furthermore, we have to educate the tourists about how not to harm the ecosystem and to ease the pressure by directing tourists towards other places of interest; places with origins in European civilization and the natural environment (Dolcetta, 1990).

National Park the Dolomiti d'Ampezzo

Normally it takes years to establish a national park, but this was not the case for the Dolomiti d'Ampezzo (around Cortina). Only a few months were needed to establish it. Why? Because this present park is situated in an area which has always been managed as a park in a uniform way, thanks to "Regole" (which means "rules") and the "Magnifios Cominita d'Ampezzo" (Richebuono, 1986).

In the Boite valley covering a surface area of about 15,000 ha situated between 1,000 and 3,200 m altitude - with a vegetation dominated by *Fagus sylvatica, Picea excelsa, Larix decidua, Pinus cembra* and *Pinus mugo* - a kind of rural republic was created by people with a common concern to manage and collectively utilize

the land properties. This organization was maintained for centuries, because the mountain environment with all its difficulties required a collective management of resources, of woods and pastoral lands (Merlo, 1990).

Let us take a closer look at the changing-process of the people-land relationship in a historical perspective and according to the different forest functions and their valuation.

History of the people-land relationship

The Ampezzian population dates back to prehistoric times. Around the year 3,000 B.C. they were nomads and settled down as farmers around the year 1,000 B.C. With the Roman colonization, the local tongue called "Ladino" (and not "Latin"), and the common management of private properties developed.

When the Longobards came and they remarked upon the concept of land division, pastures of the valley became a collective and unshared property of the tribe. At that time the pastures were essential to the livelihood of the local population and so they created family groups who made the "Regole", confirming that they were the owners of the pastures and the valley. Each spring, at the beginning of the Regole's year, all the heads of the family groups met, and still do, to elect new deputies and overseers to define new proceedings.

The rules have been written down after 1288, the so-called "Laudi", one for each "Regola". A common characteristic was the duty for everybody in the valley to accept the appointments and in this way all the people took responsibility and occupied themselves with general and common concerns. The "Laudi", that is the written rule, was altered over the years. New laudi were introduced to testify new groups, as inhabitants of the valley, the Commune d' Ampezzo.

In the course of time dominated by Romans and Longobards and later by Venetians and Austrians, the Ampezzian community obtained autonomy and confirmed their constitution. The community developed and bought new lands, and the Regole approved the ownership of the land, pastures and woods. In fact they paid for new pastures and gave an indemnity to those who left the community. The first Regole were created to manage the highlands, land above 1500 meters altitude, for sheep rearing.

After 1450 "Regole Basse" (low rules) became necessary to manage bottom valley grazing lands for milk cows. These were Regole independent of commons. While wars were going on all around the Ampezzan population, they always kept their traditions and reached their objectives without arms, but with their perseverance and money (coming from animals and woods) which paid for the trials in Venice or Innsbruck. Being collectively owned, the woods were also managed as common property, individuals were not allowed to cut the woods. It was decided that the family heads should manage the woods together. The "Comunune" cut and divided the timber (also for coffins) among the families and sold the surplus.

At the end of the 18th century the Austrians decided to resolve land property problems. Since timber production was considered more important than cattle rearing, they thought the right of property should follow the principal of utilization. So the land ownership, following timber property, was given to the "Commune" and was not managed by local families at that time. In 1917 the area changed from Austrian to Italian leadership. The rights of the Commune, returned to the people of Ampezzo and the rights of the Regole and thus the land ownership in the valley was re-established (Richebuono, 1986).

The present situation

After World War II agricultural and forestry activities lost importance and tourism took over. The changes can be seen when looking at the low value of pastoral land and the high value of building land. The demand is considerable, but the availability of such land is lacking. Consequently nowadays there is only an elite tourism in Cortina.

With the increasing number of visitors air pollution has increased and also social-environmental degradation is faced. Many young residents are not able to find a house and have to emigrate, while tourist facilities require new streets, skiing tracks and accommodation (Illing, 1991).

Fortunately the Regole are still alive and after the shock of the first money flow the people of Ampezzo are now searching for limitations for tourism development and they try to avoid land utilization entirely aimed at tourism.

Conclusions and questions still to be answered

No more skiing tracks and houses for non-residents must be built. Forests are growing on the old pastures, and while they should be respected they continue to be sacrificed.

A national park has been created in this valley. But for whom and why? Is it to recover the deep sense of the community-land relationship which moved the residents until now or to increase a tourist population that superficially pretends to enjoy changes in this valley?

Two different cultures present two different psychological evaluations of this land. What they have in common is that both confirm the global value of it.

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GENETIC STOCK: THE SAFEGUARDING OF THE GENETIC DIVERSITY OF FOREST ECOSYSTEMS

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Introduction

Besides many other functions, forests function as a reservoir of genes. They must (all) be represented in the limited forest areas of our world. The consequences of using forests as a genetic stock on other forest functions need to be faced, and a conflict situation can arise. In this paper the (technical) requirements for the use of forests as a genetic stock will be touched upon. Other forest functions however may not be forgotten.

Even when the arguments supporting the use and conservation of forests as a genetic stock are very sound and logical in the opinion of one interest group, to another these arguments may be of less importance. In order to anticipate the different interests of people and especially decision-makers who decide upon the forests, several interests in gene conservation will be discussed. The problems of who should and can conserve forests and who benefits from the results, are dealt with.

Forests as a genetic stock in its context

The current concern for and awareness of the need for conservation of genetic diversity stems from the alarming rates by which (tropical) forests of the world are being depleted and destroyed. Biologists, ecologists, and foresters have raised their voices and at the moment (certain) politicians within the Dutch Government, for instance, have taken over their concern (Regeringsstandpunt tropisch regenwoud, 1991). Myers (1984) has stated that every day 100 species disappear from the earth as a result of deforestation and other anthropogenic causes. Extinction of this magnitude constitutes a crisis worse than any other in earth's geologic history because this is occurring in a very brief span of time (Ledig, 1988).

The growing awareness of the need to protect gene resources was also inspired by the alarm raised by agriculturalists, who warned about genetic erosion which undermines the potential of adaptability of species (Keiding, 1977). Genetic erosion of annual crops is caused by replacing the old genetically diverse land races with newly uniform highly bred cultivars. The paradox is that the success of the cultivars, originating from a broad diversity, will destroy this same genetic diversity (Hawkes, 1977).

The problems concerning genetic diversity can be considered on the level of the genes, e.g. diversity, quality, availability, etc. But the problems can also be linked or made part of a larger discussion; the discussion about how to protect the world's forest resources from an ecological point of view.

Relevance of genetic resources

A rather general statement has been made by Frankel (1977) about the need to conserve genetic diversity:

> "genetic conservation is the concern for a continuing evolutionary potential, as a condition for adaptation to environmental change" (Frankel, 1977 in Keiding, 1977).

Not only environmental conditions change, but societal conditions, in the form of needs and priorities of people, change as well. The advantages for society to be derived from (the conservation of the) genetic resources will be discussed. Different reasons for the conservation of genetic diversity can be discerned, e.g. economic, ecological, aesthetical, and ethical reasons (Prescott-Allen, 1983; Ledig, 1988).

Economic reasons. In economic terms, to increase the quality and quantity of production, the benefit of genetic stock has to be looked for in tree improvement. However, in silviculture the application of genetics is relatively recent: intensive improvement began just after World War II (Prescott-Allen, 1983). Even though the application of genetics has only been introduced recently and breeding programmes in forestry take a long time to accomplish, the results are already impressive. For instance, *Pinus patula* in Zimbabwe achieved volume increases of 17% in five years and 37% in eight years compared with the standard yields of unimproved varieties. In agriculture, however, even higher yields, purely subscribed to breeding programmes, have been achieved, i.e., from 10% to 70%.

At the moment forestry is still a kind of exploitive industry. However, because of the continuing diminishing of the forest area and the predicted climatic changes, improved and newly adapted tree species for a higher yield under different conditions can become more important.

Ecological reasons. The life-support services provided free by ecosystems are important to us all, and genetic diversity is crucial to ecosystem function. Genetic diversity within species is also crucial to ecosystem functioning. Loss of genetic diversity eliminates the possibility of evolutionary modification, which is necessary for populations to adapt to changing environments. Removing a few species may have no noticeable effect on ecosystem functioning. However there is little knowledge about such an impact, and intuition leads us to expect that many more species will become extinct when enough components of the ecosystem have been removed. To prevent a chain-reaction in the extinction of species, the genetic stock of the world has to be protected.

Aesthetical reasons. Probably, aesthetical reasons are major motivations for conserving genetic diversity. Though, we often mask this motivation by other rationalizations. How much more interesting would a diverse world be compared to a homogeneous one that is reduced to a few, widespread, weedy species.

Ethical reasons. Many people feel an ethical obligation to protect genetic diversity. One way to express this feeling is by the question: "How dare we have the arrogance to destroy other species by our own uncontrolled breeding, and by rampant consumerism?"

Requirements for genetic conservation

After discussing the need for conservation of the genetic resources, we must consider how to put the ideas into practice. There are two ways of conserving genetic resources: in situ (in nature reserves) and ex situ (in zoos and genebanks). Both ways have advantages and disadvantages a few of which will be mentioned here.

First, there is a difference in accessibility between in situ and ex situ genetic resources. Nature reserves are often far from the grower's nurseries, the people who use the gene material. But with in situ genetic resources not only will the genetic diversity be preserved, the ecosystems will also be sustained.

Second, there is a difference in safeguarding the genetic stock. In situ genetic resources will be vulnerable to periodic disturbances by poachers, firewood collectors and livestock, to outright destruction by development, or to pressure of population growth. Ex situ genetic resources although easier to be controlled, they are subject to human error.

Third, there is a difference in scale or coverage. In situ genetic resources will cover considerable tracks of land, ex situ genetic resources can be sustained on smaller areas of land. Still, many more differences can be listed in economic, political, biological, social terms, etc.

To preserve genetic diversity, there are various alternatives but resources (capital and certainly land) are limited. Choices have to be made between the alternatives, but should be based on a motivated choice to obtain an optimal alternative, which can be a combination of in situ and ex situ genetic resources.

During the discussions, we need to ascertain just what is to be conserved. Evolution is an ongoing process and we cannot preserve the total variety of species which currently exists. A distinction can be made between preserving gene material and whole ecosystems, for instance.

Genetic conservation in relation to other forest functions and the different interests of the diverse groups in forest use

Our forests have become a growing concern, because there are many different needs and demands in society, which often have higher priority than conserving the world's genetic stock (and the world's forests). In the discussion about conservation of genetic diversity, reality has to be faced. Forests have other functions to fulfil, as well, which can be of different value to the various interest groups.

Who has, or where can we find the genetic diversity to be conserved and who has to pay for it? It is said that genetic diversity is not evenly distributed around the globe. Genetic diversity increases from temperate climates to tropical ones. This is due to the former glacial periods and due to present climatic differences. The view that on the whole most genetic resources are found in developing countries can be taken for granted (although many different species exist in developed countries too). If this view leads to the conclusion that developing countries have to pay most for the conservation of the genetic stock, we are going in the wrong direction. The Indonesian minister of environment, Dr. Emil Salim, has put it this way: "In a sense, we in the South are conserving our genetic resources for the North to exploit and enjoy." (Prescott-Allen, 1983).

A similar question can be raised about the different interests people or groups have in preserving (tropical) forests. For instance, the developed (and rich) countries call for preservation of the tropical forests (why not consider their own temperate forests too), and point to the function of a reservoir of genetic diversity of these forests (see the policy of the Dutch Government, Regeringsstandpunt Tropisch Regenwoud, 1991). But developing countries have different needs and for them conservation of the genetic stock is, at the moment, not so very important or relevant. How do foresters and genetic stock conservationists deal with these different needs and the different (power) positions of the parties involved in the discussion about conservation of the forest ecosystems?

Points for discussion

A lot questions have been raised; still a lot of questions remain. The main questions to be considered are:

- How can relevant and important arguments be put forward for as many people as possible, especially the ones who decide upon the forests, of use forests for the conservation of genetic diversity ?
- Which arguments can be put forward to safeguard the function of a gene reservoir of a forest in relation to other forest functions?
- How can an integrated (or inter-disciplinary) solution to the problem of genetic erosion and the tremendous pace in which extinction of species progresses be arrived at?

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MANAGEMENT AND CONSERVATION OF THE GENETIC DIVERSITY OF COSTA RICA'S TROPICAL FORESTS

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Introduction

Costa Rica is a country in Central America located between Nicaragua and Panama. In 1950, 72% of its surface was covered by forests. In 1973 the forested area had decreased to 49% and in 1978 to 34%. In 1990, it was estimated that only 26% of Costa Rica is covered by natural forests and that the deforestation rate is near 50,000 ha per year (Bonilla and Meza, 1990; figure 1).

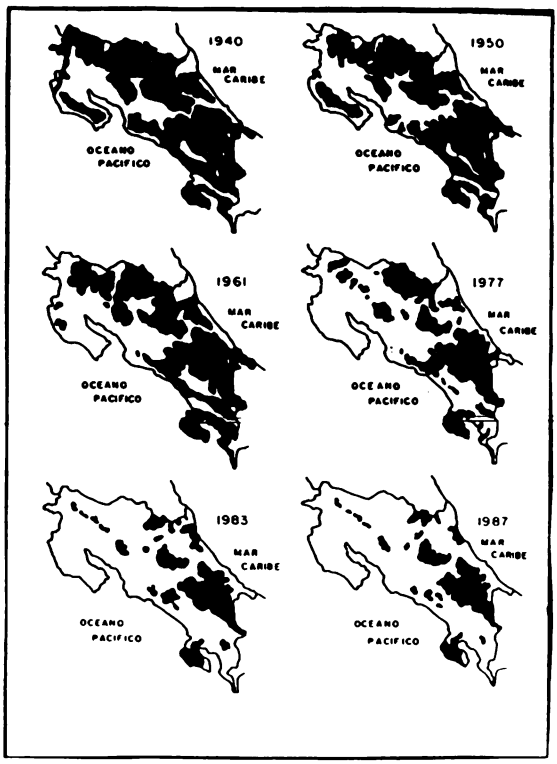


Figure 1. Forests destruction in Costa Rica (Source: Agriculture Planification Office (DPSA); DGF. Costa Rica).

One of the main causes of this forest reduction is the fact that the country depends (traditionally and/or historically) on a few export products, especially beef, banana, coffee and sugar cane. Additionally, the high population growth rate (2.6% per year in 1989) has caused urbanization and an increased consumption of local agricultural products. In the past, the government stimulated cattle raising by providing financial aid. It was of no interest to the government whether the land on which the cattle was going to be kept, was covered by natural forests or not. In the period between 1950 and 1970, incentives for cattle raising were provided and the area of grazing lands rapidly expanded. Historically, beef production and export never represented more than 8.6% of the total export value of the country, but it occupied 54% of the land used for agriculture at that time. Today, cattle raising is done on about 32% of the country's surface (Anonymous, 1988; figure 2).

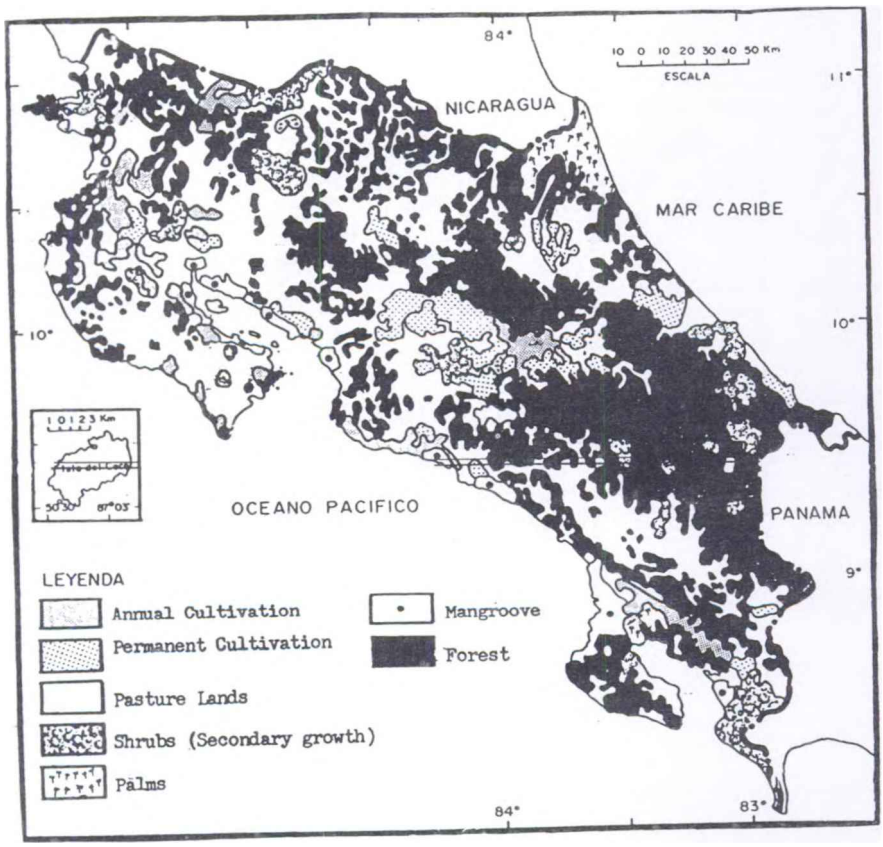


Figure 2. Use of lands in Costa Rica (Source: National Geographic Institute, 1985).

The destruction of the forests have caused many negative effects. Many people are aware of the problems and already even more efforts are directed towards environmental education. Furthermore the government now provides incentives to reforest. The reforestation is done with the use of commercial tree species (to make it attractive to timber companies). The rate of reforestation is growing annually.

The species used for reforestation are mainly of exotic origin, like *Eucalyptus spp, Gmelina arborea, Tectona grandis, Cupressus lusitanica,* and *Pinus spp.* There are however three native species used, which are *Bombacopsis quinatum, Alnus acuminata* and *Cordia alliodora.*

The consequences of the extinction of species in Costa Rica

Genetic research is a newly practised science in Costa Rica, both in natural forests and plantations. Genetic research will lead to genetic improvement programmes. Examples are: research on father trees, "plus" trees, seed stands, seed orchards, "in vitro" plant tissue culture, stake reproduction, etc. However, because of a lack of economical resources and governmental support, this field of research has not advanced much. Moreover, many plantations do not attain the quality and efficiency expected, partly due to questionable seed sources and lack of good silvicultural management.

Most of the politicians, investors, researchers and people involved in forest activities are concerned about the management of genetic material of plantations. There are however only few people motivated to work with/do research on the genetic diversity of the Costa Rican natural forests.

Costa Rica has a great diversity of animal and plant species, as a result of its great variety in climate and geography. Due to its location between North and South America, migration of species went from the north to the south and vice versa. Some of these species established themselves in Central America. Consequently, a mixture of species from both continents can be found in one small area. New species have evolved as a result of the adaptation of animals and plants to their new environment.

In Costa Rica, according to Holdridge's life zone classification system, 12 different types of zones can be distinguished, classified according to precipitation and temperature conditions (Figure 3). The flora and fauna composition varies from zone to zone. From figure 3 it can be concluded that because of the humidity conditions, in the biggest part of the country the predominant natural vegetation should be forest. The different environmental conditions have generated a great variety of vegetation types and consequently, a great variety of animal species (Table 1). Of the plant species described, 14.5% of the angiosperms, 36.4% of the ferns and 39.4% of the orchids can only be found in Costa Rica. Of the fauna (fishes not included), 4.6% of the species are endemic (Anonymous, 1988).

Table 1. Estimated number of animal and plant species in Costa Rica Source: Burger, 1980).

Group	Total number of species	Number of endemic species
Flora		
Angiosperms	9000	1300
Orchids	1200	325
Ferns	825	300
Fauna		
Birds	848	7
Mammals	205	8
Reptiles	216	19
Amphibious	160	32
Fish	1630	?

Because of the reasons mentioned above, many habitats of animals and plants have been disturbed or destroyed. Illegal hunting, pollution of rivers with chemicals, introduction of exotic animal and plant species, are some of the factors that have contributed to the reduction of the wild fauna (Anonymous, 1988).

In Costa Rica and probably also in other countries, plant and animal extinction, or "only" reduction of their populations, have not been a concern to the people for long, because they were not aware of the extinction, and/or were not affected directly by it. There are three very important consequences, however, that may affect people in the long or even in the short term.

The first consequence of extinction of species, significant to society as a whole, is the loss of raw material for all kinds of goods, such as medicine, food, tannines. Likewise, watershed protection, production of valuable wood, etc. Examples of these species are: *Copaifera camibar* (Fam. *Caesalpinaceae*), an endemic species, valuable as timber and for the production of the medicinally used "camibar oil"; *Myroxylon balsamun* (Fam. *Fabaceae*) is one of the few trees, from which the wood can be used to build musical instruments; *Caryodaphnopsis burguerri* (Fam. *Lauraceae*) is the only member of the family with opposite leaves. Additionally, it produces a good quality wood; *Lecythis ampla* (Fam. *Lecythidaceae*) is very important for wildlife because its fruits are edible; *Brosimun alicastrum* (Fam. *Moraceae*) is also important for wildlife; *Guaiacuni sanchani* (Fam. *Zygophyllaceae*) is one of the hardest woods in the world. It has a specific weight of 1.17 to 1.32; *Peltogyne purpurea* (Fam. *Caesalpinaceae*) is used in handicrafts because of its purple colour; Dalbergia retusa (Fam. Fabaceae) is also used in handicrafts; *Syderoxylon capiri supsp. tempisque* (Fam. *Sapotceae*) is important for wildlife; *Minquartia guianensis* (Fam. *Olacaceae*) has a specific weight of 0.91 and is very resistant against rot. It can stay submerged for over a hundred years. There are many of these valuable species with all kinds of uses (Jiménez, 1991).

The second consequence of extinction of species is based on the functioning of ecosystems. Where interrelationships exist between organisms, extinction of one of the species involved will lead to the extinction of the other species.

The third consequence, which may be the most important, is the loss of genetic variability, necessary for the evolution of species and the adaptability to new environments. It is believed that the number of individuals of a breeding population must be considered as an evolutionary factor. When because of changes in the environment the population decreases and when at that time an intra-crossed genotype has been produced (which has not been in contact with other races), the species will have a hard time to adapt to other circumstances. It is possible that this population, which does not present race mixing, will not survive and is going to be replaced as time passes.

While external crossing is the normal reproductive procedure, reproduction without new genetic contribution (this is the continuous crossing between related individuals) results in a reduction of both vegetative strength and fertility of the species (Hocker Jr. 1984). In addition, it is stated that the extinction of species is stimulated by excessive use (continuous exploitation), plundering, sparse regeneration, endemism and characteristic aspects of the species (Jiménez, 1991). In this paper, these species, in danger of extinction, will be called "problem species".

The strategy used in Costa Rica for the conservation of genetic material of "problem species", is not efficient. The strategy is based on the protection of these species in natural reserves, where most of the individuals of the same species grow far from each other which makes crossing difficult. For conserving and maintaining the variability and amount of genetic material of "problem species", it is necessary that man reproduces and/or manages those species with the help of appropriate planning. An educational and conscience programme is also needed.

In Costa Rica, the growing of native tree species for economic purposes is limited, due to both a lack of research and the introduction of exotic species, as mentioned before. Introduced species grow faster and are genetically improved. This makes it difficult to find people willing to grow or manage native "problem species" for conservation purposes.

A few institutions have started to investigate these species. For example, in 1985 the OTS (Organization for Tropical Studies) began to reproduce and generate information on native species of the Sarapiqui zone. The Forest Engineering Department of the ITCR (Instituto Technologico de Costa Rica), has also been researching germination of "high elevations native species" and silvicultural management of "San Carlos native species" (the latter under the auspices of GTZ).

There is an important project in progress in Costa Rica, known only to a few people, which tries to integrate various important objectives. These objectives include the conservation of native species (some in danger of extinction, so, "problem species"), the restoration of life zones (ecological zone) which are endangered in the world (Tropical Dry Forest or Deciduous Forest), and the restoration of uninhabited areas in the forest. Furthermore, the project is generating and collecting silvicultural information to make it (in the future) possible for the government to reforest using those native species which should produce the best results. In this way reforestation with native tree species can be stimulated.

The "Restoration of Forest Masses"-project

The project is called "Restoration of Forest Masses" and is designed and planned by Maria de los Angeles Molina, a forestry engineer from the National Park Service. The project is financed by Sweden (Swedish Agency for Research Cooperation with Developing Countries, SAREC). It is a part of the management of the Guanacaste Conservation Area (GCA), a nature reserve with a land surface of about 100,000 ha. The project started in March 1989 and focuses on two principal objectives:

1. Restoration of degraded environments.
2. Silvicultural research on the most valuable timber producing species (Molina, 1991).

The first objective tries to accelerate and enrich the natural process of restoration on different sectors of the Dry Forest in the GCA. The biggest part of the forests of Costa Rica has been eliminated by constant logging and burning to create cattle grazing lands. The idea is to accelerate the process of forest restoration by planting selected trees on the pastures. These tree species in most cases cannot be found in these forests or, if they exist, are only scarcely represented, due to the continuous exploitation. Priority is given to species whose seeds are dispersed by animals. These trees are a food source for different populations of animals (Molina, 1991). Also, trees and shrubs which have economical value and which are an integral part of the forest structure, are planted to act as a seed source for these specific species in the future.

The second objective is a silvicultural one. It will generate information that has not yet been documented well. Different institutions and persons interested in reforestation with native species can make use of it. This information covers basic aspects, from phenology and seed management, to the behaviour of the different species on the experimental plantations. What is aimed at is to incorporate some of these species in the government's list of authorized species to be used for reforestation.

The methodology of the project is as follows:

1. The tree species used (1989-1991) are:

Simarouba glauca	*Anacardiaceae*
Licania arborea	*Chrysobalanaceae*
Andira inermis	*Papillionaceae*
Swetenia macrophylla	*Meliaceae*
Acosmium panamensis	*Papillionaceae*
Cedrela odorata	*Meliaceae*
Pithecellobium saman	*Mimosaceae*
Dalbergia retusa	*Papillionaceae*
Tabebuia impetiginosa	*Bignoniaceae*
Tabebuia ochracea	*Bignoniaceae*

Lonchocarpus ssp.	*Papillionaceae*
Albizzia guachapele	*Mimosaceae*
Enterolobium cyclocarpum	*Mimosaceae*
Dyphisa robinoides	*Papillionaceae*
Hymenea courbaril	*Caesalpinaceae*
Guaiacum sanctum	*Zygophyllaceae*
Cordia gerascanthus	*Boraginaceae*
Gliricidia sepium	*Papillionaceae*
Swartzia cubensis	*Caesalpinaceae*
Manilkara chicle	*Sapotaceae*
Brosimun alicastrum	*Moraceae*
Sterculia apetala	*Sterculiaceae*
Bombacopsis quinatum	*Bombacaceae*
Tabebuia rosea	*Bignoniaceae*
Astronium graveolens	*Anacardiaceae*
Syderoxylon capiri ssp. tempisque	*Sapotaceae*

2. Seed trees selection:
The seed is obtained from trees in the Guanacaste zone. Most of these trees are found in pastures and are badly shaped, because the best individuals have already been exploited (Molina, 1991).

3. Seed collection:
Seeds were collected, even though very little was known about phenology. So at present, there are some programmes aimed at the study of phenology and in addition the planning of how to collect the seeds.

4. Reproduction in tree nurseries:
The seeds are planted without a pre-germinating treatment, except for *Enterolobium cyglocarpum* and *Hymenea courbaril*. The hard shell of the seeds of these trees, necessitates treatment. This is done by rasping the cover, followed by boiling of the seeds. Then the seeds are planted directly in a bag and not first in a seed bed.

5. Arboretum:
An "arboretum" was established at the same time the project in the GCA started. On an area of one hectare, native tree species were planted in order to observe their development. The tree species that show the best results are *Swetenia macrophylla, Tabebuia rosea* and *Dalbergia retusa*.

6. Plantation:
In the first year of the project, in 1989, the researchers started planting the species on so-called "mixed plots", consisting of 3 blocks with 3 species each, thus, 9 species on each "mixed plot" in total. At present, two methods are used.

For the "restoration" objective, a design of "enrichment plots" is used. These are circular plots where a tree is planted at the centre and the other trees are planted around it at a distance of approximately 5 metres from each other. The radius of the circle varies and the species distribution is at random. These circular plots do not receive any kind of maintenance. About 400 ha is planted following this design (Molina, 1991).

For the "silvicultural" objective, the Horizontes Experimental Station developed two kinds of plantation designs. In the first, eleven different tree species were planted using three different planting systems (bag, naked root, pseudo stakes). The distance between the trees is three meters. The species originally used were planted following the naked root system but did not function well and have been replaced with other species.

The second design is located on another area of the experimentation station. The principal purpose of this design is to investigate which combination of species will have the best results on growth and development. The space between the trees is three meters. Measurements on the trees are made every

six months. The only maintenance the trees receive is weeding. No fertilization takes place. The area planted according to these two designs is about 40 hectares.

Influence of the project

There are other projects that have also been carried through at the station. Besides the management of an abandoned nursery of Bombacopis quinatum, permanent plots have been established in the natural forests of the Guanacaste zone (natural secondary growth forests), where all kinds of data are collected, on a variety of parameters (e.g., structure, composition, phenology, etc.).

The project has an important influence on the towns near the Guanacaste Conservation Area. Environmental education is given at primary schools, high-schools, universities and institutions, informing them about the project and the importance of the project for the Guanacaste zone.

Furthermore, the project managers, because they have knowledge of the native species of the area, are able to advise institutions or persons interested in using these species. Besides, big hydro-electric and irrigation projects which are present in the Guanacaste area and needing to restore the damaged lands near the projects, can consult the project for advice on how to restore the lands in the best possible way.

Conclusions and recommendations

After examining the problems that Costa Rica faces, it can be said that "Restoration of Forest Masses" can be one of the solutions. To inform people (including politicians, investors, technicians) about the great variety of genetic resources that Costa Rica has and also that this can contribute to a sustained development is certainly a great step forward. This sustained development can be achieved by an optimal use of the available resources, while more research is done. The available native species permitted and recommended for reforestation according to the list of species open up a real possibility to create, restore and maintain the habitat of many animals. A large amount of these tree species produce valuable timber or have other uses.

It is important to understand that many of the projects described (concerning native species, "problem" species, management of genetic stock in natural forests, etc.), cannot be executed without the financial support of developed countries. Costa Rica is a developing country without sufficient financial resources to elaborate these kind of projects, particularly if there are no economical benefits to be obtained on the short term.

Additionally, the lack of stimulation from the government towards these initiatives, is discouraging to Costa Rican researchers, leaving the planning and executing of these kinds of projects to foreigners.

In Costa Rica, an incentive system for research projects on native species and "problem" species that are important to society and natural ecosystems has to be created. In this way, local researchers will get the chance to do research in this field of study. Meanwhile, projects like "Restoration of Forest Masses" have to be developed for other natural reserves too, to contribute to the restoration of "problem" species and increase the silvicultural knowledge available on these species. In the future, when Costa Rica has the economical ability to embark on other reforestation projects, then these species may be used; not only for the production of timber, but also for the benefit of society in other ways. The safeguarding of genetic stock is one of these benefits, in order to guarantee the sustainability of the natural resources for future generations.

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Effects of genetic erosion at the example of silver fir (*Abies alba* Mill.) in Central Europe

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Introduction

Genetic erosion is often assumed to be a problem only in countries with tropical rainforests, where many species have become extinct these past years. In this paper we would like to show that genetic erosion also exists in the forests of the countries of Central Europe, and that the loss of genes has become a problem for species and whole ecosystems.

In comparison with the tropics in Central Europe there are only a small number of plant species to be found, and even these are threatened by air pollution and climatic changes. It is important to conserve every one of these species, because each of them is an indispensable part of the forest ecosystem. As evolution continues, it is necessary that every species has its own specific variability of genes. Selection can take place and the survival of the species can be safeguarded only if there is an adequate gene reservoir.

The silver fir (*Abies alba* Mill.) has been chosen as an example of the effects of genetic erosion in Central Europe. We would like to show what happened to the species in the last glacial epoch and its present problems as a result of genetic erosion. Furthermore, the role of the silver fir in the mountain forests of the Alps, and the role of forest genetics to solve existing problems, are presented.

Case study: silver fir (*Abies alba* Mill.)

The silver fir is the only natural species of the genus "fir" in Central Europe. The map in Figure 1 shows the habitat of the silver fir (Dengler, 1980).

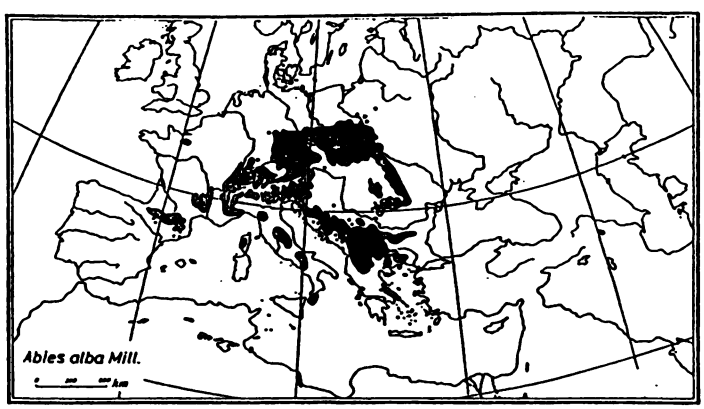


Figure 1. Natural range silver fir (*Abies alba* Mill.; Source: Dengler, 1980).

The silver fir is a mountainous tree and an indispensable part of the alpine mixed forest. The nutrient requirements of the tree are moderate but the moisture requirements are high. Because of the silver fir's shade endurance and mighty root system, the tree is an important stabilizer of forest soils. Therefore the silver fir is important for the forest ecology and structure of the forest stand. Moreover, the silver fir is of economical importance, especially in selection forests.

In the last hundred years, specific decline symptoms have been noticeable. "Silver-fir dieback" strikes single trees as well as whole forest stands, in waves of variable long intervals (Dengler, 1980).

Symptoms are noticed in the crown and the roots of the trees. The best visible are symptoms of decline of the crown; needles change in colour and fall off. Consequently, a characteristic thin crown results. Regression of increment in the high crown contributes to/results in the typical "stork's nest". One of the most important symptoms is the "pathological wet heart". This is an irregular, reddish-brown coloured part of the trunk's basis with an unpleasant smell. The fine roots also suffer exhibiting reduced formation, for example.

In the past, many factors have been assumed to be the cause of the silver fir dieback, such as changing climate, insects and soil conditions. Nowadays it is seen as a complex decline syndrome, which means that different stress factors act in combination. However, there is no answer yet to the question of its real background and underlying causes (Larsen, 1986).

Larsen (1986;391) states: 'By comparing ecology and geographic variation of the species with the distribution and variation by provenances in the dieback, two main conclusions are drawn:

1. The geographic distribution of dieback is closely related to that part of the natural range where the species is characterized by almost no variation between provenances and a small ecological adaptability. (Central and western part of the natural range: Czechoslovakia, Germany, Switzerland, Northern-Italy, Austria, France. Figure 2).
3. In contrast no signs of dieback are reported from regions where silver fir shows a pronounced variation between seed sources and a high adaptability even when planted far outside the natural range. (Calabria, Italy; Southern-Yugoslavia; Bulgaria. Figure 2).

This leads to the hypothesis that the decline of silver fir is basically caused by insufficient genetic variation which causes lack of adaptability.'

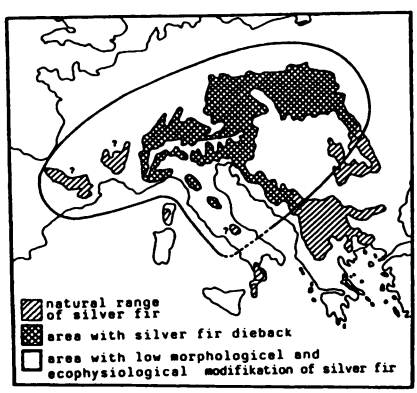


Figure 2. Geographical relationship between the distribution of decline and provenance variation in silver fir (Source: Larsen, 1986).

'The reason for this reduced variation and adaptability is explained by a severe pressure of directional selection in addition to the possibilities of genetic drift as response to extreme climatic conditions (short growing seasons, frost, winter drought), in the refugial population during the last glacial period before migrating back into Central Europe. In order to apply this theory to the concept of the decline syndrome, the reduced genetic variation and adaptability is put forward as the main predisposing factor exerting a permanent stress on silver fir, thereby predisposing it to other factors (indicants) such as frost, drought, pollution, and other abiotic and biotic stresses.' (Larsen, 1986;391).

General aspects of genetic erosion

The example of the silver fir enables us to deal with the problems of genetic erosion in a more general manner. Forced by the heterogenous environment, selection and adaption of species will always evolve in ecosystems. To make a certain state of conformism possible in a heterogenous environment, the species or population has to be able to adapt. The basis of the ability to adapt is the genetic variation or diversity.

This diversity can manifest itself on an individual or population level. Therefore, genetic diversity of the individual is the main decisive factor governing adaption to the temporal variation of the environment, while genetic diversity of a population can adapt to the spatial variation of the environment. Thus, any disrupting impact on the genetic variation of a species leads to a lower ability to survive (Larsen, 1989).

This can occur due to natural causes, as in the case of the silver fir. But often the direct and indirect impact of human influence, which has markedly increased during the last centuries, and even more so in the last few decades, are more important. Research on beech (*Fagus sylvatica* L.) has shown, that environmental stress (air pollution, acid rain, etc.) affects the genetic structure and variation, which leads to loss of genetic variation (Stimm and Wolf, 1991).

Lack of genetic variation is also an important predisposing factor to abiotic and biotic stresses like pollution, drought, frost, diseases, as the example of silver fir revealed (Larsen, 1986). Especially in connection with predicted climatic changes, the lack of genetic variation can have important negative consequences for the stability of forest ecosystems (Stimm and Wolf, 1991). Because of the complexity and the mutual relationships within an ecosystem, an entire forest can become unstable by the inflexibility of only one species. For example, silver fir plays an important role in alpine mixed stands, together with Norway spruce (*Picea abies* Karst.) and beech (*Fagus sylvatica* L.). These stands have a vital function in protection against erosion (Mayer,1979). The decline of silver fir, therefore, leads to a growing danger for the wellbeing of the environment and consequently human population.

There are also economical effects. Because of its shade tolerance, silver fir is an indispensable part of a selection forest. As explained before, a lower genetic variation is a predisposing factor to other stress factors. So any "normal" stress can get a fatal effect through genetic erosion.

Measures for the conservation of forest gene resources

Since the beginning of this century, conservation of endangered (sub)species or phenotypes have been carried out by forest tree breeding programmes (Kleinschmit and Dimpfelmeier, 1990). The "forest decline" of the last twenty years, however, have led to these programmes being inadequate to cope with the problems. Therefore in 1986, the German Federal Government established a task force to work out a draft proposal for the conservation of forest gene resources in the Federal Republic of Germany (Muhs, 1989).

A short summary of the draft proposal is given below, to show the government's policy.

'The purpose of conserving forest gene resources, is the conservation of genetic variation to fulfil the principle of sustained integrity of genetic information of species. The well known principle of sustained yield has been extended in that way, that the genetic information available, should be stored in the population or species to be conserved. This must be achieved as much as possible, in order to give the

species a chance to survive "in situ", making it able to adapt to the changing environments. Or to make the species able to survive, to grow up and to adapt "ex situ" at suitable places. It is obvious that the genetic variation of a population or species cannot be preserved completely. The problem is that by now, we do not know how much genetic variation is necessary to fulfil the principle described above. Adapted populations are important and are favoured if there is a choice between well adapted and less adapted populations, although the ability to adapt may be more important than the adaptation to a certain niche. As long as it is not possible to clearly measure the adaptability, we have to look for parameters which actually give us evidence for sufficient genetic variation, for instance the genic multiplicity checked by allozymes.'

'In a given case the purpose for the conservation of the basic material has to be defined clearly. Four main purposes can be listed as follows:

- to keep populations adaptable;
- to help single trees or groups of trees to survive;
- to secure a continuous availability of populations, selected trees and clones, which serve as basic material;
- to store reproductive material such as seed to overcome supply shortages in forestry.' (Muhs, 1989;193).

This draft proposal transformed action by a four year programme, began in 1989 and ends in 1992 (Muhs, 1989).

Conclusion

Genetic variation as basis for genetic adaptability is not only vital to the survival of populations, but also to the forest ecosystems as a whole. A loss of genetic variation would have significant negative effects on the stability of these ecosystems. To safeguard a forest as being a source of genetic material, is therefore the most important function of that forest.

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NON-TIMBER FOREST PRODUCTS: weighing the benefits against the costs

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Introduction

Non-timber forest products are a very heterogeneous group including all the animals, plants and materials a forest produces, besides timber, which are used by man. Millions of people exploit the other products in one way or another for their daily subsistence; products such as fruits, nuts, seeds, mushrooms, herbs, rattan canes, game and fish. Besides this group there is a group of non-timber forest products that are produced naturally by plants and emerge from injured tissues, such as exudates, viscous liquid compounds, which is mainly used for industrial use. These include resins, gums and latexes. Extracts comprise another group of products for industrial use that include essential oils, tannins and dyes, which are obtainable only with the aid of chemical solvents or steam distillation. To give you an idea of their wide application is impossible. The list is unending.

The original Brazilian word "extractivismo" will be used in this paper, meaning the harvesting and similar activities of non-timber forest products.

What all these products have in common is that it is hard to quantify them in terms of volume and economical value. This might also explain why they are often referred to as minor forest products. A term which has a denigrating character, and denying the huge impact they make on the lives of millions of people all over the world. They are collected in such variety and quantities, that in terms of economic value they might even outweigh that of timber.

Forest management options

The question raised here is whether more attention should be paid to this group of non-timber forest products in forest management.

Forest management could mean making an impact on natural forest stands or artificial husbandry. An example of the former is the coppice technique in *Quercus spp.* forests in the Netherlands to produce shafts for tools, a technique applied until recently. An example of the latter can be seen at the age-old village-forest-gardens; the Malayan kebun, the Indonesian kampung, the West Indian jardin créole, and the dooryard gardens of Central America. With their multi-storeyed structure and high diversity of cultivated plant species evoking the configuration of tropical forest ecosystems, these village-forest-gardens fulfil most of the fundamental needs of local populations (Michon, 1983).

One way or another it will mean manipulating natural forest stands or domesticating wild species. Extractivismo in situ is already a manipulation. To what extent can you do this unpunished? If the population densities are low the impact on the forest structure will be. The Pygmies in Central Africa, the Dayaks in Borneo or the Tremembé Indians in Brazil roam over large forest areas collecting non-timber forest products hardly altering the forest structure and composition.

When the population densities increase, the impact will be greater. The old civilization of Maya of Central America already managed their forest ecosystems. The Maya protected and probably managed their forests as sources of many plant and animal products. Botanists exploring the region many years ago noted the abundance of useful trees at the Mayan ruins and suggested that the old Maya had something

to do with this abundance. The Maya probably not only protected their forests but planted them for their future use (Gómez-Pompa, 1991). The question is "How did they do it?" and does this open new avenues for forest management directed principally at non-timber forest products instead of timber.

So, choices will have to be made. The management and control of the extractivismo should be laid in the hands of the local population to assure that the extractivismo is not going to be indiscriminative, which has occured with mining practices. Therefore, active participation of the local population will be a necessity. The responsibility should also be in the hands of the local population. Extractivismo could be determined by the condition of the product, its ripeness, size, appearance and occurrence. The extractivismo-period and the quantity of the produce should also be determined. The forest service could have the overall control and should determine the ecological effects of the extractivismo.

Balancing pros and cons

To what extent do these non-timber forest products play a role in the economies of countries and what is their potential?

As mentioned above their importance should not be underestimated. For instance in West Africa one estimates that 75% of the protein sources consumed consists of the meat of wild animals, the so-called bushmeat (Asibey, 1974). For Côte d'Ivoire alone the annual bushmeat consumption has been estimated to be over 50,000 tons. All this meat finds its way to markets, even in the capital. Martin (1989) states that at the end of the 1970s the Nigerian bushmeat market was estimated to range between 150 and 3600 million Naira (1 Naira = 1,0 US$). These estimates indicate that several percent of the Gross National Product are spent on bushmeat. Although 95% of the interviewed Nigerians confirmed that they eat bushmeat regularly or once in a while, you will not find it in any statistics.

This confirms the lack of an organised market authority, so often no economic value is attached to these forest products. On the other hand, since the first half of this century, those products for industrial use that have found their way to official markets are often ousted from it by mineral or synthetic substitutes since the first half of this century. This is due to the nature of the forest products. The regular supply and the constant quality required are some of the problems which have to be solved by the forester who pays attention to the extractivismo of non-timber forest products in his management plans. The local market might offer better opportunities for a certain market rather than the competitive international market.

This can be demonstrated for the tannins, but is also valid for most other non-timber forest products for industrial use. Since its introduction in 1878 the chromium mineral tanning process quickly gained ground (Thomson, 1985) and has gradually reduced the world consumption of vegetable tannins (see table 1). Nevertheless, the vegetable tannin possesses some specific properties which the substitutes do not possess. This ensures that although limited, there will always be an international market for it.

Table 1. World consumption of vegetable tannin-extract *Schinopsis spp.* [quebracho], *Acacia spp.* [mimosa], *Castanea sativa* [chestnut]) 1950-1988 (Source: Tanning Extract Producers Federation, 2 Gayton Road, Harrow, U.K.).

year	total consumption (.000 ton)	species consumption					
		quebracho		mimosa		chestnut	
	(t)	(t)	(%)	(t)	(%)	(t)	(%)
1950	440.8	224.2	50.9	140.3	31.8	76.2	17.3
1960	380.8	167.4	44.0	140.4	36.9	72.9	19.1
1970	288.3	108.5	37.6	128.9	44.7	51.0	17.7
1980	241.2	101.9	42.2	106.8	44.3	32.5	13.5
1984	204.5	77.7	38.0	94.4	46.2	32.4	15.8
1988	179.6	66.9	37.2	82.3	45.8	30.4	16.9

The ever increasing interest of consumers in the temperate regions for natural products is clarified by the example of the copaíba tree species (*Copaifera multijuga*) which produces an essential oil. The British Body Shop cosmetics chain store wants to use the copaíba-oil, tapped from the stem and roots of this tree, in their cosmetic products. The Brazilians were astonished by the order placed in 1989 of 65 million tons of copaíba-oil. This was more than the annual tapped production of the entire rain forest. Several other products would have this potential, but as the Brazilian researcher Saragoussi wisely remarks, no such thing as a copyright of the rain forest exists (Holtwijk, 1989). The questions to be raised are as follows: "Will these products be ousted from the market like those we have seen at the first half of this century?" and "What should be done to avoid the same trend."

Research to find new applications, for example, by modifying the raw material, for the non-timber forest product is an option which is underexposed. The local processing instead of the export of the raw materials could also boost the added economic value of these forest products.

In the temperate regions of the world the knowledge and the application of non-timber forest products has dwindled more then anywhere else. This has led to the estrangement of the population from the natural environment but could be revised with the ongoing interest for more nature related products. New markets open up and this in turn opens up renewed perspectives for these products.

Forest management in the temperate regions could adjust accordingly and rediscover the importance of some of its indigenous non-timber forest products. Alder, *Alnus glutinosa*, provides three different dyes; buttercup, *Ranunculus spp.*, gives an excellent latex used in tennisballs and tires; hemp, *Cannabis sativa*, since ancient times used for manufacturing ropes for navigation; Canada turpentine, *Abies balsamea*, an oil-containing resin; these are just a few of the products which are still applied in small quantities, but might conquer new markets (Smits, 1989). A more creative forest management policy should trickle into the minds of foresters.

Population dynamics of the forest stand

To what extent can the extractivismo take place without harming the environment?

Thirgood (1986) has demonstrated that ruthless extractivismo can lead to the serious degradation of the forest stand. In the Mediterranean area the forest ecosystem has degraded to a mere shrub like vegetation where badly formed trees dominate. Indiscriminate logging next to extractivismo of fuelwood, cork (*Quercus suber*) and tannin (*Quercus spp.*) in combination with frequent occurring forest fires have led to the alteration of the whole environment.

The concept of minimum viable populations (Gilpin and Soulé, 1986) frequently stressed by conservation biologists will also be vital in an ecological sound forest management directed towards extractivismo. In tropical rain forests some tree species occur only at a frequency of 1 to 2 trees per ha. The required forest area to maintain a minimum viable population of the species has to be determined. Webb has demonstrated this in the tropical rain forest of Queensland, Australia and indicated that the minimum forest area should be 400 ha. This is the minimum required area to preserve one tree species without taking into account the possibility of extractivismo.

Ghana has designated one-fifth of its rain forest zone, although very split up, as forest reserve. Some 17 of the 200 forest reserves found in this zone are even smaller than 400 ha (Hall and Swaine, 1981). So the designation of extensive forest areas for extractivismo will be essential and should be incorporated in the forest policy. It is also of importance to determine whether extractivismo is allowed over the entire area or that certain areas are restricted or even entirely closed to these kinds of activities.

Zoning or integrating timber production and extractivismo

Silvicultural systems directed towards timber production applying treatments to eliminate undesired tree species and climber cutting could have a counter-productive effect on the potential of extractivismo in future. Examples of such silvicultural systems are found all over the tropics, such as, the Malayan

Uniform System in Malaysia, the Selection System in Ghana or the CELOS System in Surinam (Schmidt, 1991). Are timber production and extractivismo to be integrated in forest areas or is each one to have its own zone? Essential questions for the forest management.

A large-scale pilot project in a forest reserve in Côte d'Ivoire has shown that a silvicultural system aimed at timber production could provide substantial revenues to the forest service from the sale of non-timber forest products. The sale of stems of the small- and medium-sized trees *Funtumia latifolia* and *Discoglypremna caloneura* for match sticks and the wood of *Garcinia kola* for tooth sticks alone provided a revenue of US$ 45,440 within a period of 18 months (Aidara, 1990).

In temperate regions, forests are compared to species-poor tropical forests, sometimes dominated by just one species due to reforestation. The zoning or integrating concept might give way to new forest management in which more species diversity could be aimed at. The principles applied could be natural regeneration over a longer time span or enrichment of forest stands in the near future. The functioning of the original forest ecosystems should be known to avoid excessively high costs for possible manipulations in the forest composition.

Challenges for the future

Forest policy ranked by priorities is developed as a means of achieving objectives. As it has been argued before the non-timber forest products play an essential role in the lives of millions of people all over the world. It can improve the wellbeing of the population in the tropics, but also strengthens the estrangement with nature in the temperate regions. Priority given to these products can contribute to the conservation of biological diversity. The assessment of the value of non-timber forest products can convince policy makers that the contribution to the economy is not a factor to be neglected. The challenge to the foresters will be how to incorporate these objectives in forest management.

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Duikers in Parc National de Taï, Côte d'Ivoire

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Introduction

The deforestation process is a crucial problem which all African countries are faced with. Annually about 4 million ha of forest is destroyed or severely downgraded on the African continent. This destruction is mainly caused by land reclamation for agricultural activities, bush-fires, over-grazing, the gathering of firewood and the mostly uncontrolled exploitation of forest (Asibey, 1974).

Hundreds of hectares of forest are lost each year in Côte d'Ivoire. This seriously affects forest resources such as animals and vegetation. Therefore the preservation of forest lands through the creation of protected and guarded areas, such as national parks where the ecosystem is still in its natural state, is of utmost importance.

The present Parc National de Taï (from now on referred to as PN Taï) was created as early as 1926, to preserve its unique faunal and floristic elements; initially as a flora and fauna reserve, but in 1973 upgraded to the status of national park. In 1978, together with its buffer zone, the park was enlisted as world heritage site within the Man and Biosphere Programme of UNESCO.

The study of duikers (*Cephalophus spp.*) as a non-timber forest product, has been initiated in PN Taï. Duikers form traditionally one of the main sources of bushmeat on the Ivorian markets.

The aim of this study is to find ways to save the duiker species which have their habitat in the Taï forest. This is done by studying their biology and ecology. The conservation of various species of duikers is urgent since the annual bushmeat consumption is increasing and the massive destruction of their habitat is spreading.

Côte d'Ivoire's general description

Côte d'Ivoire is a West African country of 322,000 km² and borders on its southern edge along the Gulf of Guinea. The population numbers about 12 million. The rainfall pattern differentiates the vegetation into a rain forest zone, extending up to 200 km inland from the coastline and a savanna zone further inland, with a decreased rainfall. This is characterized by a continental dry wind, the so-called Harmattan, originating from the Sahara desert during the dry season and a maritime humid monsoon in which south-west winds prevail during the rainy season. In the central part of the country a mosaic of forest savanna cuts deep into the rain forest zone and is known as the Baoulé Gap.

Parc National de Taï

The study site is situated in the south-western part of Côte d'Ivoire (Figure 1). PN Taï is one of the 8 national parks of Côte d'Ivoire and encompasses an area of 350,000 ha. PN Taï is located in the rain forest zone. From north to south the moist semi-deciduous forest-type gives way to the wet evergreen forest-type. Precious timber species like mahogany (*Khaya* and *Entandophragma spp.*) and makoré (*Tieghemella heckelii*) are to be found in the forest. The fauna is very rich with many endemic species (Galat and Galat-Luong, 1980) such as the pygmy hippopotamus (*Choeropsis liberiensis*), forest elephants (*Loxodonta africana cyclotis*), bongos (*Tragelaphus euryceros*), duikers (*Cephalophus spp.*), bush-pigs (*Hylochoerus spp.*), crocodiles (*Crocodilus spp.*) and many rare species of monkey and bird.

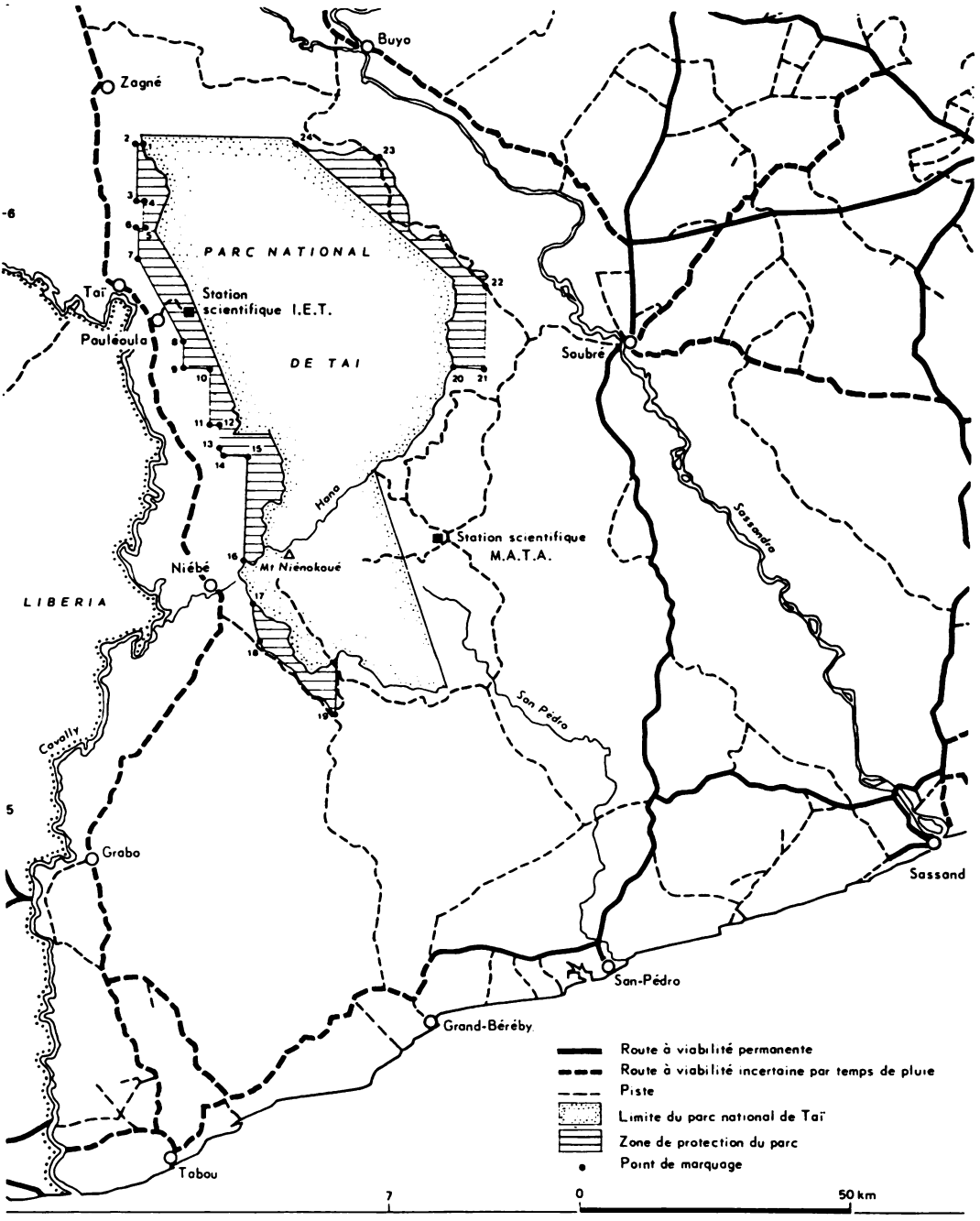


Figure 1. Parc National de Taï (Source: Jean-Louis Guillaumet et al, 1984).

The park area consists of a core area surrounded by a buffer zone (Figure 1). The core area consisting of primary forest is to remain untouched. Only research activities with a low impact on the environment are allowed in this area. The buffer zone, to the contrary, is formed by secondary forest where logging activities have taken place in the past. Certain activities are possible, but on a limited scale. It has been determined that in this area non-timber forest products may be harvested in a controlled way, i.e. harvesting of firewood and construction wood, hunting and other forms of extractivismo, fish breeding and tourism. All aimed as a source of money for the local communities.

Assessment of the duiker species

Method of determining duiker densities

This was done by interviewing villagers and researchers of other disciplines who work in the area, besides direct observation. An enquiry is essential because any serious policy of conservation and utilization of forest resources should be preceded by detailed enquiries (Wilson and Wilson, 1991). Local knowledge should never be underestimated. Direct observation in the forest was done in the daytime and overnight during a six month period which lasted from July to December 1991. The research sites were the Gouleako village and the station of the Institut d'Ecologie Tropicale (IET) at the edge of the buffer zone and the PN Taï. Indirect signs of duikers, more particularly their droppings, has also been monitored. All these data enable a more precise idea on the density of duiker populations to be obtained.

Results

Seven different species of duikers have been identified in PN Taï (Roth and Merz, 1986). In decreasing order of abundance they were:

1. *Cephalophus maxwelli*
   The colouring of their body is variable: grey-brown to blue-grey (Haltenorth and Diller, 1985). It is the most widespread species in the park. It may be ubiquitous in all habitats (Davies, 1987).
2. *Cephalophus dorsalis*
   Its colouring varies from brownish-yellow to brownish-red with a distinct black dorsal stripe from nose to tail. Preferred habitat is primary forest (Davies, 1987) and farm land.
3. *Cephalophus ogilbye*
   One can easily mistake it for *Cephalophus dorsalis* because of its distinct black dorsal stripe from shoulder to tail. It is further characterized by its legs without black spots. It depends on the primary forest.
4. *Cephalophus niger*
   It is distinguishable from the other species by its black colour. This species is to be found in the secondary forest.
5. *Cephalophus zebra*
   The colour of the body is reddish-brown with 12 to 15 black transverse stripes. We observed it only once over a time span of six months in the park. It is endemic to Sierra Leone, Liberia and Côte d'Ivoire. It favours the primary forest.
6. *Cephalophus jentinki*
   The head and neck are black, shoulders white while the back and rump have a grizzled "salt and pepper" appearance (Wilson, 1987). It is very rare and very little is known about this highly endangered species. It is endemic to Liberia and PN Taï in Côte d'Ivoire.
7. *Cephalophus sylvicultor*
   Its colour is blackish-brown with a distinct yellow rump patch. It is a species which is to be found in the forest and savanna (Wilson, 1987).

Preference of duiker habitat: primary versus secondary forest

A study site in the PN Taï with its primary forest has been compared with a mosaic of secondary forest near the Gouleako village. So far the study has come up with the following:

The forest destruction around the village because of agricultural activities, has provoked a change in composition and diversity of faunal elements. Certain species which need primary forest for their living have disappeared due to the change in habitat. However, the local farming system in which the land lays fallow for a period of 5 to 6 years, which results in the formation of an impenetrable forest, secures an admirable natural protection for some duiker species (Wilson, 1987). The protection is so efficient that the local hunters use a technique that consists of attracting duikers out of their hiding-place by imitating their cry (Wilkie and Taylor, 1990). Within the park borders duikers are seen wandering freely, because there is little pressure from hunting. They have large foraging areas. Some species are restricted to the primary forest habitat, but many can also be found in the secondary forest.

Some steps to be taken to preserve the duiker populations and which will also benefit the local population

In the villages Gouleako and Pauléoula, 80% of the human population depend on farming activities for their living (Davies, 1987). They cultivate cash and food crops simultaneously. The methods of cultivation are itinerant, that means they fell trees, then they burn them and after the harvest they move to another area. For sound management purposes, the local population should actively manage the forest to improve the regeneration of animal and vegetal elements on which they depend. For this reason we have to undertake certain actions in cooperation with these populations:

- exert control over hunting by the villagers themselves;
- propagate the domestication of duikers.

A breeding project is in its preliminary stages. At present we have an idea of the duikers' natural population densities, their preferred habitat and nourishment (Newing, 1991). Soon the reproduction cycle will be known and the type of parasites that occur. A similar programme in Ghana with the cane rat (*Thryonomys swinderianus*) and giant rat has already proved to be successful (Davies, 1987). The economical profitable breeding of duikers by the population would reduce the hunting pressure and allow the protection of those species which are at present at the brink of extinction. A socio-economical study among the local population is to start to find out whether the local population is really interested in such a project. In case the breeding programme would prove to be successful and hunting regulations are enforced, the problem of ongoing poaching should be tackled in cooperation with the local population.

Revelations concerning the marketing of bushmeat

According to the results of an inquiry done in 1979 but not published before 1984, the annual Ivorian bushmeat consumption was estimated at 70,000 tons, 12,320 tons of which in the urban centres. All this bushmeat is transacted illegally on the market, because of the prevailing hunting regulations. As a result the state loses a lot of income since the trade is not taxed. I think that the state should legalize the bushmeat trade and develop special programmes. This will not only be profitable for the government, but also benefit those who depend on the fauna for making their living. The outcome of the legalization will result in regulating the trade and hunting pressure in a rationalistic way.

Conclusion

In view of the progressive diminution of unique faunal and floristic resources of a forest such as the one of Taï, a good management and conservation plan is what is needed. The local population should continue to have access to all kinds of forest products, but at the same time excessive exploitation must be avoided. The main target for the future is to ensure the ongoing development of the area to improve the living conditions of the local population and at the same time avoiding the total destruction of the vegetation. Sustainable forest and farm management aimed at the local population will have to be a prerequisite.

I think that the buffer zone should be used to satisfy some subsistence needs of the local population, but under the control of the administration (in this case the Service des Eaux et Forêts). The secondary forest of the buffer zone, created by timber exploitation in the past, should be used for the realization of certain pilot schemes, like the duiker breeding project.

The interviews with villagers including poachers revealed that benefits from future so-called eco-tourism should be channelled to the villages, in order to preserve the unique fauna and to control the hunting pressure. One should explain the management of touristic infrastructure to the villagers. The introduction of other protein sources, like pisciculture, should also be looked for. In future the agents of Eaux et Forêts should keep in touch and monitor the opinion and criticism of the villagers of the management of the fauna. I think this will lead to the active participation of the local population and elaborate the faunastic management programme and benefit its use.

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Nature reserves: Exlusion of people because of forest protection

NATURE RESERVES: EXCLUSION OF PEOPLE BECAUSE OF PROTECTION

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Introduction

The establishment of a national park or national reserve in certain areas of the so-called "developing countries", has a major impact on the way of life of the inhabitants of these areas. Indeed, this could lead to the restriction or even prohibition of the use of all kinds of products out of these areas, by the people or organizations who manage the parks or reserves. Obviously, this could lead to conflicts between the parties involved, who all have more or less different interests.

All kinds of interests groups are involved in the establishment and management of national parks and reserves, such as national and local governments, their financiers (which can be international organizations, such as, WWF and UNESCO), western governments and development organizations, multinationals, park management and local inhabitants (the users). They all have a certain influence on the process of planning and decision-making. Normally, national and regional governments make the rules and take the decisions. But in many cases these governments try to meet the wishes of western governments, organizations or multinationals, often to gain favour which may lead to the financial or industrial aid they need to develop the country or the region. Consequently, the needs of their own people are often forgotten.

Conflicts will be even greater when an ever increasing population has to depend on decreasing natural resources, which they have to exploit to make a "reasonable" living. This becomes a paradoxical situation. Nature conservationists and local people oppose each other in a certain area, because their perspectives and interests clash (conservation versus use), although both parties want to conserve nature as it is, or even to improve it (again conservation but now versus sustainability for the future).

Local people versus nature conservationists

There is a conflict between the conservation of nature and the utilization of it. The big difference between the problems with nature protection in the industrialised countries and those in developing countries, is that in the developing countries any affect (exploitation, conservation or whatever) has a direct effect on the way of life, or maybe even on the very existence of the local inhabitants. It is obvious that local people are the most directly involved, where natural resources are concerned. They use the area to obtain all kinds of goods and services, like firewood, timber and non-timber forest products. They need the area for hunting, because this is often the only means of obtaining meat. Furthermore, they need land to grow food and to raise cattle.

Most organizations that want to protect nature by means of a national park or national reserve are from other countries; countries that already have played a major role in the financing of all kinds of development projects in the past. The problem is that these organizations are not always aware of the needs of the local people, which may be because of ignorance, misinformation, lack of knowledge or various other reasons.

It is easy to see that the local people may be suspicious or are misinformed about the motives and interests of international organizations and the like. Often, both sides have to change their attitude towards the other parties involved.

Reasons and causes of the conflicts with national parks in developing countries

An overview of the arguments used in the conflict by both the conservationists and the local people, is presented. To begin with, the causes of the problems according to the nature conservationists, are enumerated (Hough, 1988).

Agriculture inside the park
The local people are often not aware of the advantages of a national park or reserve located in their area. The population density in many cases is (very) high, sometimes caused by migration, which can force the people to encroach on the park or reserve. This can result in damaging effects on the vegetation. It is also possible that the local people have (old) claims on the area in which the park is located. This can result in the continuation of shifting cultivation or other damaging practices within the boundaries of the national park or reserve.

Poaching
Hunting is forbidden in a national park or reserve. Often, inside the park or reserve there is a higher density of (rare) animals than outside the park. This can attract poachers from all over the area.

Collecting
All kinds of products are used by locals. Wood, honey, nuts, fish, etc. If the utilization of the area is done too intensively, it will damage the park's structure and health.

Grazing
Locals, often use national parks to graze their cattle. If the vegetation is already in a poor state, the negative effects can be immense.

The problems of the local people are, of course, closely related to those of the nature conservationists.

Agriculture inside the park
In many cases the people do not have alternatives. If the only land left suitable for agriculture is situated inside a park or reserve, people will enter a park to make a living, whatever restrictions there may be to prevent this happening.

Poaching
There are two kinds of poaching. Poaching because for commercial reasons and poaching for the provision of food. This last kind of poaching may be necessary for survival.

Collecting
National parks are often designated as such because they are as an "oasis in the desert". This means that in a certain area, the national park and reserves can function as the only source of all kinds of non-timber forest products.

Grazing
Often the park or reserve is the only place in the surroundings with sufficient and healthy grazing lands. It is obvious that local people would want to use it to obtain food for their livestock.

Of course, this list is far from complete. The problems mentioned above are certainly not all valid at the same time and same place. They can differ from case to case.

The cause of the problems does not constitute to the entire conflict. The conflict is also caused by large differences in the socio-cultural backgrounds of the conservationists, who "grew up" in a world with totally different values, ideas, education, than the local people who live in the area of the national park or reserve. The creation of a park is often based on concepts from western culture.

In many cases, these concepts do not correspond with the concepts of the people in developing countries. For these people, the use of the land is the only way to survive; no more; no less. The protection of nature by preservation is seen by the locals as a luxury that they cannot afford, and more importantly, understand (Ariës, 1988).

Furthermore people who work for international environmental organizations often have a broader (worldwide) view of the situation (which certainly is not always an advantage, because they sometimes overlook the local situation), while the locals only have to deal with their own "small", (but to them the most important), vicinity.

This can result in:

1. The local people not trusting the environmentalists. Because of the perceived distance between the local people and the (foreign) environmental organizations and their representatives, the locals do not trust these (foreign) organizations (Hough, 1988). They consider the efforts to create a national park or reserve as a unwanted interference in their livelihood, especially because it is initiated from "above" (that is to say, the government). Besides, they are often not aware of the existence of a problem. They see it as the problem of the conservationists, not theirs.

2. Problems with communication. The locals and the park management (often foreign organizations like WWF) are not able to communicate properly because they use different words for the same thing. The realization of a park or reserve and the management of it, has a major impact on the local social system and political structure. When this new system is mixed with the old, the results are unknown, to say the least. Probably misunderstandings will occur.

A system of land use that meets the needs of both the local people and the conservationists, has to be based on eliminating these two very important points. This does not mean that problems will not occur any more, only that the chance of success will increase.

A different approach

It will be plain that a lot has to be changed if positive results are aimed at. One of that changes could be the creation of bufferzones (Oldfield, 1988). However, it is certainly not the ultimate solution for all the existing problems. The "bufferzone idea" should be considered as a means of nature protection in which the local people has an important say in the planning and implementation of all kinds of measures to do with the national park or reserve and, more specifically, the bufferzone.

A bufferzone is often described as an area where the protection of nature is combined with the land use in that area. It is also called a "joint use zone", which perhaps is a better name for it. (Saharia, 1982). The bufferzone is predominantly the area where the local people have an important task in the management and use of the natural resources. This is in sharp contrast with the more conventional type of parks and reserves, where different functions and types of use are strictly separated. (Garratt, 1982).

Organizations that are involved in the planning and management of a national park or reserve, hope that failures that occurred in the past will be avoided with the introduction of this fairly new type of "area protection". The key words that are used in this type of protection are participation by the local people, responsibility and economical advantages for the local people, use of local ruling structures when implementing certain measures, etc. (UNDP-FAO, 1978). However, before bufferzones can be a success a lot of work has to be done and may problems have to be solved.

Problems with the functioning of bufferzones

Borders

In most parks and reserves, there are problems in the border zones of the areas. Even when there are guards to "protect" the area, they cannot do their work properly, if the borders between the fully protected area, bufferzone and "normal" area, are not well marked. The existence of a gradient from intensive to extensive use of the bufferzone will make it even more difficult to recognize the borderline (Botterweg/Udo, verbal information, 1990).

Surveillance
Recognition of borders is one thing, surveillance is another. Often there are not enough people to control the park rules. Moreover there is often a lack of a well developed infrastructure, which makes it impossible to reach and control the entire area (Doumenge, 1990; Hecketsweiler, 1990).

A management plan
A sound and clear management plan is indispensable. (Hecketsweiler, 1990; Doumenge, 1990). It is not unusual that both the local people and the wardens do not exactly know what is prohibited and what is not inside the national park and the bufferzone.

Mistrust and problems with communications
The socio-cultural gap between people from foreign organizations and the local people has already been mentioned. There is also a gap between people from urban areas (who often act as wardens) and the local population. These gaps can lead to misunderstandings. The local people are usually not eager to cooperate, which can lead to opposition and resistance against regulations and measures imposed from "above". Local participation is absolutely necessary from the beginning of a project to avoid the misunderstandings. Participation can be more easily obtained if traditional local structures (such as, the chiefs and the counsel of the village eldest) are used.

Economical advantages
If the local people are not aware of the economical advantages of the park and if they do not feel the need for conservation, problems will arise. The local people have to be compensated for the loss of land they formerly used, in one way or the other (Doumenge, 1990). This should be done with mutual respect. If nothing is given in return for the loss of land, the people will take it themselves and who can blame them for that?

Population density
The population density is high in many places for a variety of reasons. Consequently the allocation of land, especially when there are also refugees from other places in the area becomes difficult (Vooren, 1988; De Graaf, verbal information, 1990). Who is entitled to use the land?

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NATIONAL PARK MANAGEMENT AND THE IMPACT ON LOCAL PEOPLE; a case study of the Bali Barat National Park

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Introduction

Indonesia is the worlds largest archipelago, situated between the continents of Asia and Australia. It consists of 13,677 islands over a length of 5152 kilometres from East to West and 1770 kilometres from North to South. Indonesia has a surface area of 190.4 million hectares. At this moment, the population numbers about 182.7 million. By the year 2000, this will probably be more than 205 million (MacKinnon et al, 1986).

The distribution of people over the islands of Indonesia is not proportional. Some of the islands have a high population density, like Java and Bali for instance, while other islands, like Sumatra, Kalimantan, Sulawesi and Irian Jaya, have a much lower population density. So, the exploitation of forest land by people has not always reached the same level. In Java and Bali, forests have been over-exploited to meet the needs for fodder, for land to grow food crops and for fuelwood. The forests have also been converted for other kinds of land use.

Because of its land use and economic activities Java can be considered as the main island. It has the highest population density; 63% of the total population of Indonesia live here on 7% of the country's surface. In the remoter parts of Java island, forests have not yet been over-exploited. Still, this forest land is being used for the commercial supply of raw materials for the pulp, plywood and paper industry. Recently, non-timber forest products like rattan, have also become important. Shifting cultivation and diminishing of forest land, because of land conversion, is still prevalent (Fandeli, 1989).

Although there are a lot problems with the Indonesian forests, the forests still cover 74% of the country. Indonesian forests are classified into groups according to the functions of the forests (Table 1).

To assure a balance between wood production and forest conservation, the Indonesian Government has implemented several rules and laws. These rules and laws are adapted to suit the place, time and situation. The Indonesian Government, determines which type of nature reserve will be established where, in order to preserve harmony with nature. The national park is a type of nature reserve that has dual objectives (total protection as well as limited utilization).

Table 1. Indonesian forest lands (Source: Fandeli, 1989).

Forest	Area (million hectares)	Percentage of total forest
1. Protection forest	30.3	21.1
2. Production forest	64.4	44.7
3. Production forest which can be converted into other kinds of land use	30.4	21.2
4. Conservation forest	18.7	13.0
Total	143.8	100.00

In 1980, the first national park was established in Indonesia. At the moment there are 24 national parks, scattered all over Indonesia, totalling about 7 million ha. Another 40 national parks have been planned by the government (Anonymous, 1990a).

A national park management conception

A national park is a protected area, the management of which is based on a combination of protection, preservation and utilization within a single management unit. It is different from other conservation areas, such as, nature preservation forests, tourism forests or protection forests, because the management goals of these forests are mainly aimed at preservation and protection or just at the conservation of aesthetic values.

In Indonesia, a national park must meet the following standards (Atmawijaya, 1983):

- The park must have a land surface of at least 10,000 hectares.
- The park must have specific and unique qualities with regards to vegetation, wildlife, and ecosystems, but also in originality and condition of the area.
- The park must not face difficulties caused by exploitation and/or settlement.
- The park should be managed by a competent and responsible department.
- The area is open to the public under special conditions and restrictions. The opportunity for development of nature tourism is provided.

The management of the park is based on three basic objectives, which are (Hadiseputro, 1991):

1. protection of life support systems;
2. preservation of the biodiversity of plant and animal species, together with the environment the species live in;
3. sustained utilization of all natural resources and their ecosystems.

Achieving these three objectives is a national task. Success depends on the institutions involved and the participation of local communities, hence coordination is necessary both on central and local governmental level. But it also needs cooperation of scientists and management.

The direct aim of national park management is to obtain or maintain the appropriate conditions for flora and fauna and/or the ecosystem they live in, as described in the conservation plan, especially drawn up for a certain area (Sudrajat and Sriyono, 1988). The plan can include manipulation of plant and animal populations or protection from modification and outer park factors.

To achieve the management goals, efforts have been made to pursue an optimal direction in park management by the establishment of a zoning system. Through this zoning system, all measures can be carried out specifically for a particular zone. It is hoped that in this way management will be effective and efficient.

The types of zone which currently exist are:

1. "Core zone". In this zone, the ecosystem is fully protected. It may only be used for the purposes of research and education. Any human interference that would effect the area permanently is not allowed.
2. "Utilization zone". This zone is mainly used for nature oriented recreation purposes and to accommodate tourists.
3. "Other zones". These zones may be designated as wilderness and/or rehabilitation areas, whatever the needs and conditions may be. It can be a buffer zone, visitor centre zone, management facilities zone, traditional use zone, historical zone, etc.(Anonymous, 1990b; Hadiseputro, 1990).

National park development can protect the area from any human disturbances. This will only be successful, if the local people participate in the conservation of the resource. Participation should be stimulated wherever possible, particularly in managing the area. This management includes all interrelated

elements of participation, while regulations and law enforcement will be handled by both central and local government (Hadiseputro, 1990).

Despite the existence of a national park policy and strategy, the national parks are not yet functioning optimally. This is due to several problems. The main problems originate from the pressure exerted by the local people who live next to the park. The problems vary from park encroachment, illegal settlement, illegal hunting to harvesting of forest products. Such practices (may) have a negative influence on the park's ecosystem which could reduce the value and functioning of the park itself.

The living conditions of local people and their activities in the Bali Barat National Park

Forests, including those in national parks, are usually located adjacent to urban or rural areas with high population densities, whose numbers are still growing rapidly. The people in these areas often have a low level of education, in addition to a very low income. There is an excessive need for land. The occupied land is in many cases unsuitable for agriculture, owing to a combination of steep slopes, low soil fertility and large soil degradation. This is also the case in the Bali Barat National Park (BBNP).

In the Bali Barat National Park (77,727 hectares), there are 5 villages which have close interrelations with the national park. The villages of Gilimanuk, Blimbingsari, Melayu and Pejarakan are situated in the vicinity of the national park. Sumber Klampok is an enclave inside the BBNP area. It is only 3,980 hectares in size. In 1989/1990, the total amount of the inhabitants of the five villages was 24,059. The number is composed of 12,029 male and 12,030 female inhabitants. Most villagers are farmers/gardeners and civil servants. In addition trading, labour work, fishing, small industry work and animal husbandry are practised (Hadisumitro, 1990). Most of the village people took education only till elementary school or are uneducated. They have a low income. The educated inhabitants usually do not originateb from the area, but are new comers, like the BBNP civil servants (Subagiadi, 1985).

The lack of land, skills and knowledge and the poor environmental conditions, minimize the opportunities for people to fulfil their daily needs. Still, these people depend heavily upon natural resources. Therefore, the combination of lack of skills, lack of appropriate technology, complemented by an insufficient interpretation and low awareness of proper environmental utilization, leads to environmental damage. The inhabitants of the villages carry out illegal and destructive activities inside the park, which may cause severe damage to the park and surroundings. Land slides, erosion, floods, fires and degradation of biodiversity can be the result. If nothing is done these activities can threaten the people's existence as well as the park's ecosystem.

In addition, the management of the national park tends to focus on internal activities such as development of management facilities, recreation management and habitat management. The situation and conditions outside the park seem to have less priority, although this should be an element of the national park's development. Accordingly, in certain areas conflicts arise, which later may create permanent social and environmental problems in and outside the park (Hadiseputro, 1991).

The problems that occur in the park are of various origin. They include poaching, agriculture activities inside the park, grazing, cutting fuelwood (rencek), etc.

Poaching in the BBNP area is not done by local people alone. A classification into two groups can be made:

1. Traditional poaching by local people, to obtain meat for themselves or for commercial purposes.
2. Modern poaching by urban citizens, most of the time as a hobby but occasional with commercial aims.

The main species poached are "Rusa" (*Cervus timorensis*), a deer, "Kijang" (*Montiacus muntjak*), a small antelope, "Kancil" (*Tragulus javanicus*), mouse deer, "Babi Hutan" (*Sus scrova*), wild boar, "Ayam Hutan" (*Gallus gallus*), jungle fowl and "Curik Bali" (*Leucopsar rotschildii*), a White Starling with black wings. The current population of the "Curik Bali" is less than 20 (van Ballen and Soetawidjaya, 1990).

Sometimes, urban citizens even shoot animals from their cars while driving on the roads outside the national park. Another problem is the traditional poaching for commercial purposes. This kind of poaching has increased not only because of population growth and the accompanying increased demand for meat, but also because of the increased demand from the urban people, who buy from the local people.

Usually the shooting of an animal, especially the "Curik Bali" (*Leucopsar rotschildii*), is done for pleasure by urban citizens as a kind of status symbol. It shows the lack of environmental awareness of people, even those who are usually well educated and of a higher social strata.

Agriculture, the grazing of animals and the cutting of fuelwood takes place inside the park, because the local people need the land for themselves and their cattle (Subagiadi, 1985). They need to defend this way of living, because they do not have an alternative one. They do not have the technology for intensive agriculture neither do they have tools and the (fertile) land. They encroach on the national park area, because they find the land and products they need, here. Again this behaviour is supported by a lack of knowledge about the damage they are causing.

Other problems with the BBNP are caused by the unclear status of the area, the lack of coordination between departments and agencies, lack of professional skills by national park officials and civil servants and the negative influence of nature tourism utilization.

Some solutions for the existing problems

Prosperity improvement

The first action to minimize forest damage, is to improve prosperity of the local people. They will have to change their traditional system of agriculture and husbandry and their way of life to a modern system. The people in the village of Sumber Klampok, the enclave inside the BBNP, will have to move to another location outside the national park area. These measures are difficult to execute. Cooperation and coordination between national park management and other departments and agencies (such as, local government, the department of social affairs, the agricultural department, etc.) is strongly needed (McCauly, 1991).

Proper Extension

Most of the communities do not know how important it is to conserve the natural ecosystem. People living in the surroundings of the forests are not aware of the existence and the usefulness of the national park. They have been using the forest to maintain their livelihood for a long period of time and according to tradition. In some areas, the national park is disturbed by new comers, who want to make a living near or in the national park.

Proper and continuous extension and information services should be provided to all groups involved. These groups are: local people, new comers who need a livelihood, visitors and other users of the park. The services should guide these groups to understand the usefulness of the park for local as well as national needs. This effort will hopefully prevent the destruction of the area and stimulate the willingness to protect the park, especially among the local people (Hasan, 1991).

Bufferzone utilization

A bufferzone provides opportunities for local people to earn a living. At the same time, it constitutes a natural boundary which prevents encroachment and disturbances within the national park's boundaries. National parks that borders agricultural estates or settlements (or concession) can be used as bufferzones.

Socio-economic conditions and the cultural pattern of local communities have to be considered in bufferzone development. It is expected that the bufferzone development programme can anticipate the needs of the community and that the local people will participate. The programme also needs continuation to make it an indispensable part of the people's life and attitude towards the conservation

of the park. All people in the local communities should be provided with the necessary information, direction and guidance, so that they are aware of the functions, advantages and restrictions of the bufferzone.

The success of all the efforts mentioned above depends on the organization and management of the national park. Therefore improvement of the professional skills of the officials and civil servants is absolutely necessary (Hadisumitro, 1990).

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ESTABLISHMENT OF NATIONAL PARKS AND NATIONAL RESERVES IN GUATEMALA: The main problems and possible solutions

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Introduction

As a developing country, Guatemala has serious problems managing its natural resources, especially its forest resources. Just as in other developing countries, it has not been easy to establish national parks and reserves in Guatemala. At this moment there are a number of problems which have contributed to the destruction of forests. An overview of the problems with forest management in Guatemala is presented in this paper.

Because of its excellent geographic location, Guatemala has a great diversity of animal and plant species and many of these species can only be found in Guatemala. Guatemala has the biggest forested area of Central America. This forest is an important "lung" for the American continent; perhaps for the entire world.

In many places remains and ruins of ancient cultures can be found. The most important of these places is Tikal, occupied by the Mayan people thousands of years ago. Tikal is located in the middle of a large forest in the "Peten" department (biggest department of the country).

At the moment in some places, all these kinds of natural values are being destroyed and altered. This is caused by misuse and inappropriate management of these natural resources. A few measures to prevent the destruction have been taken, but they have not been effective. One of these measures is the designation of national parks and reserves by the government, national and/or international organizations. In many cases however, this designation is only in theory. In practice, these national parks and reserves do not fulfil the functions for which they were meant to fulfil; let alone meet the needs of the local people. So, in Guatemala, like in other developing countries, the responsible organizations do not have a sound programme for the establishment and management of national parks and nature reserves.

In this paper, the objectives that are considered are as follows:

1. Analysis of some specific problems of the establishment and management of national parks and nature reserves in Guatemala.
2. Determining some of the many reasons for the conflicts between the inhabitants of a nature reserve and the conservationists.
3. Finding some possible solutions for the problems described above.

General introduction to Guatemala

Guatemala is the most northern situated of the Central American nations, bordering El Salvador, Honduras and Mexico.
The land area measures 108,889 km² (Querra Borges, 1982). In 1991, the population numbered 8.37 million people, 65% of which being of native origin. Most of the native people live in rural areas. About 55% of the population is illiterate (Azurdia Bravo, 1991).

For most people who live in rural areas, farming is their livilihood. Although the land is often sloped, the farmers use it more and more to grow vegetables. They cut down the trees around their farms to extend their farming activities, consequently they reduce the forested area (Azurdia Bravo, 1991).

There are two forms of land ownership in Guatemala: The large land owners (most of the land is divided between these large owners) and peasants who only have a small piece of land. Most of the native people

belong to this second group of land owners, who use their land to grow just enough food to survive, without making use of any sophisticated tools or techniques (Querra Borges, 1982).

The forested area is being incorrectly exploited. It is managed without a good and efficient management plan. The annual production of the forest can be categorized as follows (Azurdia Bravo, 1991):

50% timber
32% fuelwood
15% pulpwood
3% other uses

Establishment of national parks and reserves in Guatemala

The government of Guatemala has been concerned about the continuing destruction of the forest resources of the country for a long time. Consequently, they have introduced laws to protect the forest. In the past few years, many areas have been designated as national parks or national reserves. These areas can be found all over the country and take up a lot of space. The problem is that the people who manage the national parks or nature reserves, do not have a suitable management plan in which the measures taken to protect the area are in balance with the needs of the people who live in the area. The local inhabitants have continued to use the protected areas for agricultural practices or for extraction of various kinds of products from the forest (Godoy, 1991).

Some causes of the poor functioning of national parks and reserves

1. Many protected areas are established in places with a high population density. The local inhabitants need this same area to grow crops necessary to sustain their way of life. When no consideration is given to the needs of the people within the management plan, the goals will not be reached.

2. There is a lack of forestry education. Most of the local people are just not aware of the importance of the resources of the forests. Moreover, they are not really interested and act indifferently to the measures taken to protect the area. This makes it very difficult to involve the people in the environmental problems in their area (Martínez Del Rosal, 1978).

3. When a protected area is established, the opinion of the local people living in the area, is ignored. The conservationists do not study the needs of the local inhabitants, and therefore, they often are unaware of the attitude of the local people towards their plans of establishing a protected area (Anonymous, 1991). How can people be expected to cooperate if they do not know what is going on and why? Conflicts between local people and conservationists very easily arise in this way.

4. Even if there is a good management plan available, there is often little or no financial support from the authorities responsible for implementing the plan properly. Also, the necessary scientific research on some of the important aspects of the area cannot be executed (Anonymous, 1991). If there is not enough money to pay wardens, it will be impossible to keep the area in a good condition and to protect it against illegal wood cutting, collection of firewood or other products from the forest.

Some important points for the planning and establishment of national parks and reserves

1. A good management plan should contain general as well as more specific aspects pertaining to the management of an area. It must include the major detected problems and their possible solutions. An

inventory of the most used and most important forest products, needs to be included in the plan. Special attention must be given to an educational programme for the local people, which should explain the optimal use of the forest, without the need to damage it (Anonymous, 1989).

2. Forestry education should be taught in rural schools at all levels, where possible. Emphasis must be placed on the importance of the natural resources in the vicinity, and on the conservation and the management of these resources. When a national park or reserve is to be established in the area, awareness about their environment can reduce possible future conflicts between the local inhabitants and the conservationists.

3. The local people should participate in the planning and establishment of a protected area. Their opinions, approaches and ideas must be taken into consideration by the planners (Anonymous, 1989).

4. If there is a danger of over-exploitation of the forest or any of the forests products, a solution must be found to reduce it; by agroforestry, for instance.

5. The establishment of a national park should go together with the creation of new jobs, so that the socio-economical level of the local people could increase. Organizations involved with planning and establishment of the protected area should consider employing the local people (Anonymous, 1990).

The paragraphs written above, must be understood as a contribution to the possible solutions of the problems with planning and establishment of national parks and reserves. Solutions should focus on reducing the considerable impact of a protected area on the life of the rural people.

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ESTONIA - A DEVELOPING COUNTRY WITH A LONG TRADITION OF NATURE PROTECTION; The case of Lahemaa National Park

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Introduction

After more than half a century, Estonia's independence has now been officially recognized both in the East and in the West, and a democratic republic can be reestablished under new conditions. Unlike many African and Asian countries, Estonia is not a developing country in the real sense of the word. Economically however, Estonia can be considered to be a developing country. It still claims to be a member of the European society and the country is proud of its long traditions such as, nature protection. The Vilsandi bird sanctuary, established in 1910, was the first controlled nature reserve in the Baltic sea area (Kumari, 1973).

Not many Estonian students have been abroad and the libraries do not have much foreign scientific literature (journals, papers, books). So maybe our views are a little narrower when discussing the problems of the Third World. But the situation in Estonia is so characteristic that we think it may be interesting to describe the problems that Estonia's single national park, called "Lahemaa", has to face. Reforming an entire society inevitably means new legislation for land and other property, but also new legislation in the field of environment and nature protection.

A short introduction to Lahemaa National Park

Lahemaa National Park was founded just before the centennial celebration of Yellowstone National Park (in the United States of America), on June 1st, 1971. It is situated at the northern coast of Estonia, 50 km east of Tallinn (our capital city), and covers an area of 64,911 ha. The typical Estonian landscape is variable and largely unchanged. It includes: forested areas (mostly pine stands), raised bogs, alvars (plant associations on very thin soils on a limestone basement), stony coasts and sandy beaches. Lahemaa National Park has a rich variety of wildlife, including bears and wolves, and many birds. Flocks of hundreds of thousands of migrating geese leave an unforgettable impression.

The aims of the Lahemaa National Park fit rather well in the international nature conservation concept, and are as follows (Anonymous, 1981):

1. To preserve, protect and popularize nature and the cultural heritage.
2. To organize scientific research.
3. To increase the public awareness of ecological and environmental problems.
4. To provide recreation in those parts of the park which are meant for that purpose.

To achieve the right balance between conservation and use of the park, there are several important aspects to consider. Unlike many Scandinavian national parks, Lahemaa is not an uninhabited wilderness. Man has been living here for more than 4,000 years, and this is why there are cultural landscapes and semi-natural associations adjacent to virtually untouched areas. The coast dwellers have been seafarers and fishermen since immemorial time. All this has to be taken into account when a zoning plan for the area is to be formulated.

In the park, we can distinguish between: 1) natural or wilderness areas and 2) cultural (cultivated) landscapes. The former (70% of total area), is predominantly a sparsely populated, forested area, that has primarily maintained its natural state. Human activity is not prevalent or to such a small extent that it will not cause lasting negative effects upon nature. However, some remote country dwellings can be found inside the park area. Natural areas include reserves and territories with general and special management regimes. There are 5 reserves with a very strict management regime (8% of the total area), where only scientific studies are allowed.

The main emphasis in this natural area is placed on educating the public about nature. The major educational activity of the park management is the organization of educational excursions along nature study paths under the leadership of a guide.

The cultural landscapes or areas include fields, areas used for forest management and recreational areas. One of the management goals is the preservation of the remains of former land use types and of semi-natural associations. Also of importance, is the protection and display of the rich Lahemaa monuments of archaeological, ethnographical and architectural value. Two prominent mansions have been restored and a forestry museum is located in one of them.

Human activities inside the Lahemaa National Park

Recreational activities in the Park can be classified as follows:

1. Long-haul vacations in the historically established recreation centres, in rest homes or summer cottages with recreation facilities in the vicinity.
2. Long-haul vacations dispersed outside these centres, in rest homes, summer cottages and houses, especially in the coastal villages.
3. Visits to the park by tourists interested in cultural and nature aspect, organized as well as unorganized.
4. Nature-educational activities in summer study camps.
5. Unorganized short-time recreation by motorists, gatherers of berries and other products, weekend spenders from surrounding towns and cities.

All visitors are expected to buy a permit which allows them unlimited visit to the park for one year. Although the permit is quite cheap, the park has not sold more than a thousand permits a year.

There are two small towns and 65 villages within the park's boundaries. The average population density is 16 persons/km² (the Estonian average is 32 persons/km²). Over 4,,,000 people live in the rural areas of the park. The town of Loksa has a population of 4,320, representing 27 different nationalities, of which 28% have Estonian nationality. Of the working population in this town, 65% are active in industry (there is a shipyard in the town) and 30% are employed in services. In the town of Vosu, more than half of the working population is employed in recreational services.

The Estonian Forestry Research Institute's management plan for the park consists of a functional zoning system. It specifies the rules for the different management regimes. At this moment, 2230 and 230 people respectively can be accommodated in the resorts of Vosu and Loksa. There are plans to increase this to accommodate 3000 and 650 people respectively. In the planned situation, together with local inhabitants and short-time tourists this will cause a density of about 2-3 people per hectare of forest. Due to the concentration of people around recreational centres, surface damage can be noticed in frail heath pine stands. If the long-haul vacationists are dispersed according to the existing lodging facilities, then the environment will not be damaged.

The forest management methods in the recreational zone include thinnings, sanitary cuttings and drainage (when necessary for improving recreational purposes). Clear-cuts are prohibited in the entire park.

Several principles of nature conservation demand a protection zone around the Lahemaa National Park. A zone which includes existing and future protection and recreation areas. One of the aims is to disperse recreational activities to suitable sites. Another aim is to protect the national park from industrial and agricultural pollution. The belt of large forests and sparsely populated rural areas meet these needs. In the zoning scheme, all the areas of different regimes are scattered and located throughout the park. It makes a rather colourful mosaic.

The life of the local population

At present, the most actual process is the privatization of lands and other kinds of property. Over the entire country, tens of thousands of farmers have reclaimed the lands they owned before Soviet occupation and thousands have started private farming. Next year, when the term to reclaim the nationalized properties is expired, it is possible that local governments will divide part of the present state farm lands (kolkhozes) among other local inhabitants and even among necomers. But certain conditions and restrictions will be set for the farmers of Lahemaa.

The new land law has not yet been accepted by the Parliament. Several questions concerning the ownership, selling, renting, etc., of land have not yet been answered.

There are about 30 private farms within the park's boundaries and many applicantions to start a farm. It is generally believed that private farmers will take better care of land and nature, than the great socialistic collective farms did; where carelessness and ad hoc decisions were the rule. However, there is a danger that the over-intensification of land use by farmers, caused by perspectives of quick improvement of life standards, may cause degradation of farmland and pollution of water when, for instance, the number of cattle increases before a manure handling system is developed.

Most new farmers think of starting with arable farming rather than animal breeding, because the first gives more freedom. The hope that ecological (organic, bio-dynamic) agriculture would spread especially in this region seems rather utopic, since food prices are extremely high, whereas state shops are still empty. Though there are a few ecological farmers in Lahemaa, the more expensive agricultural methods cannot flourish until people get enough food at reasonable prices.

The park administration hesitate to give a clear and positive answer to the question, whether the local inhabitants will benefit from living in a national park. Restrictions on certain activities sometimes need to compensated, but with the general shortage of money, not much can be offered. However, according to the park administration, concrete measured loss (eaten crops or other damage caused by animals, etc.) should be compensated.

There are still several ways of making money in the park. Expanding tourism, especially from countries in western Europe, has encouraged the idea of "farm tourism". Visitors can be lodged in a typical old Estonian farmhouse where traditional Estonian food is on the menu. At the moment, most of these ideas have not yet been realized. Motels and cafes are still the most common tourist facilities to be found in the area.

Business activities that do not comply with the objectives of the park, are not allowed. It is noticeable however, that most of the local people do lack the motivation to set up a business. And when a newcomer wants to organize activities, he is usually obstructed by the locals.

Conflicts between local people and visitors can arise from the existing food problems. The (rich) visitors can buy the limited available goods from the shops, which can result in higher prices for farm produce (like milk).

The stationing of the Soviet Army has had a considerable influence on the development of the park. The coast was strictly guarded, fishing was prohibited for the villagers, no boats were allowed to leave offshore. As Estonians are calm by nature, no unpleasant conflicts arose between the border guards and local inhabitants. The hated barbed wire, removed from the coastline only two years ago, prevented the building of houses and summer cottages too near the coast. The disturbance of seabirds however is increasing as more people go boating and fishing.

The armed forces which were stationed south of the Lahemaa National Park have caused severe damage to nature. Being uncontrolled masters of 33,000 ha of picturesque landscapes, (once called the Switzerland of Estonia, from which the local people were evacuated in the fifties), the Soviet Army continues, or even accelerates, clear-cutting of forested land and bombing the bogs. As we expect once again to become the

administrators of this land soon, a large part of this area will probably be joined with Lahemaa National Park. As a matter of fact, on October 30th, 1991, Pohja-Korvemaa State Landscape Protection Area was founded, covering 11,283 ha of the most valuable parts of the former firing area.

Problems with the park management

About half of the complaints registered by the park administration are to do with people who have driven their cars outside the paved roads, which is prohibited. The rest of the conflicts deals with the violation of rules concerning the collecting of berries etc., or simply the penetration into the reserve. It must be mentioned that picking berries is not merely a recreational activity. It constitutes a sizeable contribution to the scarce food supply of the local people. Some misunderstandings have occurred with old villagers, whose traditional collecting areas appear to be within the nature reserves. It is hard to force them to give up these berry sites.

The task of a national park inspector is largely the protection of the forest, although other work, such as, the felling of trees is also included. The kind of park ranger which can be found in the United States has not (yet) been introduced here. Training courses will to be provided for the inspectors, because quite a few of them are unaware of the exact contents of the rules and restrictions in the area.

Poaching is a big problem that the park administration and nature protectionists have to face. No poachers have been caught recently, although signals of their activities have been received at times. Army officers can also be accused. The shooting of animals in the park should only be done by professional hunters for culling purposes (for instance moose tends to eat most of the young pines). The status of a national park apparently keeps many potential poachers from poaching. It also influences the public opinion that up to now has been comparatively tolerant towards poachers in our country. Estonian peasants poached for centuries in the forests which German landlords claimed to be theirs. For traditional poachers, hunting is first and foremost a way of obtaining food (Eilart, 1976).

To some people, however, hunting is more like a hobby. Socialism in Estonia has produced a class of people who are above the law (communist party bosses, state enterprise directors and government leaders of all levels). They are unwilling to give up their unofficial but generally recognized privileges. Their illegal hunting encourages other poachers to continue. We very much hope that rising democracy in our country will make all people equal in the eyes of the law.

Estonia's challenges for the future

We are now expected to show the world what we are able to develop in Estonia. The beautiful side of our society has already been shown to foreigners. The Lahemaa National Park was presented as being representative of the entire country; as candy on a tray. Problems were long kept in the background. Now, expected freedom and democracy are challenging everybody, and we must be careful to make the right choice to bring welfare not only to the local people, area, nation or state, but to the earth's ecosystem and the planet as a whole.

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Self-sufficiency of wood production in Europe: A more efficient wood production system in western countries as an alternative to the import of tropical wood.

THE CONSEQUENCES OF A HIGHER DEGREE OF SELF-SUFFICIENCY OF WOOD PRODUCTION IN EUROPE

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Introduction

Many European countries have policies to increase the self-sufficiency of wood production. This can be accomplished by using materials other than wood, for example, plastic, steel or concrete. Wood, however, is a renewable resource, which compared to other materials only uses little energy and produces less environmental problems. Recycling of waste paper and used timber is an alternative for saving on the use of wood. Other ways to reach a higher degree of self-sufficiency of the use of wood, include: the better preservation of wood, a higher efficiency in the processing of wood products by using wood residues and by developing new industrial processes producing high-quality wood-products.

A higher degree of self-sufficiency in Europe can also be achieved by a higher production of wood. This policy can be achieved by various measures, which can be broadly distinguished into two categories. The first category consists of extending the amount of land occupied with trees, for example along roads and canals, and of course by planting trees on former agricultural land. The second one consists of producing more wood in the existing forest. Silvicultural measures can also be taken, such as, using faster growing (exotic) trees, earlier and heavier thinning in young stands and by organizational, infra-structural and institutional measures (Hummel, 1989). Consequently, the emphasis is placed on the production function, which probably has a negative impact on other functions, such as, recreation and nature conservation in the case of the European forests.

Probably the most important reason for considering to raise the self-sufficiency of wood production is that of the negative environmental consequences of the export of tropical wood in these countries (von Meijenfeldt, 1985). Cutting trees is one of the main causes of deforestation, erosion and desertification. One should bear in mind that revenue from the export of wood is very important to some developing countries. If exports fail several serious (financial) problems will result in these countries.

The issue mentioned above is rather complex, therefore an initiative analysis will be drawn in this paper, aided by the next theme:

> self-sufficiency of wood production in Europe: a more efficient wood production system in western countries as an alternative for the import of tropical wood. The consequences for forest and people both in western and tropical countries.

A closer look will be taken at the environmental problems related to the development process. Furthermore, the price, supply and demand of wood will be focused upon, followed by the conclusions and the unanswered questions.

Development, deforestation and sustainability

Development is often seen as being similar to a higher gross national product (GNP). But development is not the same as the growth of the GNP (Todaro, 1989). Raising the gross national product by cutting trees often results in the destruction of the forest consequently the living area and the culture of people living in the forest. For native people this does not mean development but a loss of almost everything that

is valuable to them. Women, who almost always are responsible for the collection of fuelwood and non-timber forest products, are the first who bear the negative consequences of the diminishing forest. That is why it is important to make a distinction between the different groups involved in the export of tropical wood. Concessionaries and traders, often companies from abroad, take the lion's share of the profit. Politicians, government employees, and businessmen often also share in the profits, while the rural people who have always lived in the area that is clear cut, often get nothing. When speaking about development, it should be clear who benefits and who takes the negative consequences.

Many tropical countries feel the need to raise their Gross National Income and their export earnings. This is because of their need for economic growth, to earn foreign exchange so that (western) goods and technology can be imported and their foreign debts can be repaid. One way of earning foreign exchange is by the export of wood. The total amount of money involved in the world trade in tropical hardwood is considerable, from 1980 to 1984 this was 7-9 billion US dollars per year (FAO, 1983). According to Westoby (1978) the first priority for forestry should be to support the traditional rural sector in which forestry activities should be executed by the rural people themselves. The second priority should be the forest based industries focus on the satisfaction of basic needs. Only when these priorities are adequately met should it be possible for the forest industry to concentrate on export.

Clearance of the forest for agriculture is the main cause of deforestation (von Meijenfeldt, 1985). This clearance must be understood within the complexity of underdevelopment and development (Otto, 1987). People are more or less forced to cut forests because of the lack of employment in the (forest) industry, and of the trade barriers by western countries, etc. Deforestation is not by definition a problem. It only becomes a problem because the consequences of deforestation are often negative. Deforestation can easily lead to the depletion of the soil, erosion and degradation, i.e., to non-sustainable land use. Sustainable land use is a necessity, because of the need for food and forest products and also of the lack of employment in the industry, for this generation and for the increasing number of people in the future. Sustainable forest management can be a means of fulfilling the short term needs of people and hence, a necessary factor for long term sustainable land use.

Less then only 1% of the traded tropical wood is exploited from forests under sustainable management. Sustainable management of tropical forests is not easy to accomplish. Large scale felling of trees provides a lot of environmental problems, and it is doubtful whether concessionaries are willing to invest their money in sustainable forest management. Their aim is to get money out of the forest. It will take at least two decades for a good return on investments, which is often far too long for a private company. Small scale forest management with the participation of the rural people who have the right of ownership of the forest and who will gain the profits, is perhaps a better alternative to stop deforestation and to achieve sustainable land use.

Price, supply and demand of wood

The total foreign income in tropical countries is dependent on the amount of wood they export, the price they get for their wood and the total costs. A relatively large part of the costs goes to the transport of the timber. For roundwood it can be up to 40% of the price. Often this transport is carried out by companies in the importing country, consequently a large share of the revenue stays in or returns to western countries. For example, 80% of the export of wood from Indonesia to Japan is transported by ships under a Japanese flag, while only 20% under a Indonesian flag. Taxes that have to be payed for importing wood consumes another part of the costs. For logs, there is little or no tax to be payed. The more the original log is processed, however, the higher the tariff. Tropical countries find it more attractive to transport and process the wood, because of the employment offered, and the higher the added value, the higher the profit. The reason that tariffs for processed wood are high is because western countries want to protect their employment and their profit (Bussink et al., 1982) involved with the transport and the processing.

The price of wood depends on several factors; supply and demand are important ones. The world market for supply and demand of wood is however complicated. Wood is an heterogeneous product, the market is not clear and there are several monopolistic tendencies, which is a negative aspect for consumers as well as producers. Another important problem is that the market price does not reflect the actual costs

involved for compensation of the felling of trees. This is due to the fact that several functions of the forest, such as the influence on the climate and the prevention of erosion are hard to express in terms of money. Also the costs of reforestation, or better still, of the sustainable management of forests, are not added to the price of wood. Westoby (1989): 'Their price continued to be related not to the costs of renewing or replacing them (he means trees, EV), but only to the costs of getting them to the market.'

In Europe, forests have disappeared because other land use activities on the former forest lands were considered to be more important. Only recently has there been an awareness of the importance of forests among scientists, politicians and western public in general. This awareness is not only limited to the concern about the importance of European forests (acid rain), but also, or perhaps even more, to the concern about the diminishing of tropical forests. But, which forest must be saved and for whom? In Europe we have destroyed our own forests. How can we tell people in the tropics not to touch theirs? A first step for many European countries would be to raise the self-sufficiency of wood, which some politicians seem to be aware of. Nowadays, the production of wood is now taken more seriously, perhaps because of the fact that scarcity in the future is becoming more significant. And moreover because of the long time between planting a young tree and the yield of this tree, it is felt that it is time to take action to increase the supply of wood from the forests in Europe. The average production in Europe is about 2.5 $m^3/ha/yr$. According to Hummel (1989) it falls far short of what could be achieved, even when environmental and social constraints are taken into account. In some countries an average production, already reached 4 $m^3/ha/yr$ or even more. Improved forest management and afforestation in recent decades have brought about increases in timber production throughout Europe and this trend will continue under existing policies (Hummel, 1989).

One of the forces behind the destruction of tropical forests is the commercial felling of trees for the export of wood. A part of this export is for the European market. In the Netherlands the demand for tropical wood began to rise especially after the early 1960s. This wood is mainly used for is the construction of windows, window frames and doors. Softwood was used prior to this time and is still the best alternative for these purposes. Consequently to increase the production of wood from Dutch forests as an alternative to tropical wood, it is necessary to emphasize the production of softwood (von Meijenfeldt, 1985).

Besides Europe other countries also import tropical wood. Japan imports a substantial proportion of the total traded tropical wood. Next to high quality wood products, tropical wood is used for other products, even for eating sticks and pulp. The demand for imported wood is rapidly growing in industrialising countries such as South Korea and Taiwan, and even in developing countries where there is hardly any forest left, as in Thailand, for instance. Because of the growth of the amount of people and because of the rise of welfare in several tropical countries it is expected that the world demand will increase in the near future. If the demand exceeds the supply, the prices of wood will rise accordingly. It would then become more lucrative to cut wood, legally or illegally. Consequently, deforestation as a result of commercial felling will increase, especially if there is no government control. Government control is often difficult as the infrastructure of the government in tropical countries is often weak, and corruption by government employees, most of whom only get a small salary, is not unusual.

Conclusions and unanswered problems

The demand, supply and price of wood in the future are not known. Predictions have been made in several studies. For example, six different scenarios were presented by Kallio et al (1987). A better analysis of the future demand, supply and prices should be made so that a better estimation of the consequences of a higher supply of wood exploited from European forests can be obtained. If a higher level of self-sufficiency is to be primarily achieved by decreasing the pressure on tropical forests, it might be more efficient to spend money directly on sustainable forest management in the tropics. Because of the expected rise in the demand of tropical wood outside Europe, and because of other causes of deforestation, a single activity, like a more efficient wood production system in Europe, to decrease the pressure on tropical forests might have only little impact. Therefore, the following question needs further analysis:

Is increasing the self-sufficiency of wood production an efficient activity to slow down deforestation? Or is it necessary to consider the broader context, in which solutions to environmental problems begin with development and sustainable land use?

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CHILE - FORESTRY IN A DEVELOPING COUNTRY

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Introduction

There has been a general tendency in the so-called Third World countries to destroy their forest resources. During the colonial period much land was cleared for agriculture. This practice still exists today.

At present, poverty is one of the main causes of environmental degradation. People living under these conditions heavily depend on their natural environment. Overuse of the natural resources caused by inappropriate techniques with little concern for conservation is a common feature.

There are large forest areas in the developing countries which have the potential to be managed as production forests for exploitation of their valuable species. The proper exploitation of these forests will improve the production capacity and yields in these countries, seen from an economic, social and ecological points of view. One can call this sustainable development.

This paper describes the present situation in Chile, an example of forestry in a developing country. Some of the concepts, however, have a much broader application.

The present situation in Chile

Chile is a long and narrow country on the western coast of South America, south of Peru and west of Argentina. Although the forests are temperate the problems are similar to those of other developing countries.

Since the colonial period, Chile has almost lost 20 million hectares of forest (an area similar to that of the former Federal Republic of Germany), because of fires and conversion for agricultural uses. Most of the remaining forests, many of which are located in inaccessible zones, have been exploited for their valuable species. The amount of wood actually extracted from this vast area for fuel and timber products, however, was small. Most of the material was burned in situ or just left to rot.

Valuable species are still being exploited illegally from private and publicly owned forests, including the national parks. Moreover, there is the problem of the increasing demand for firewood, much of which does not enter the market economy.

As an illustration, the estimated drain of forest products from the native forest in Chile (plantations not included) in 1989 is shown below.

Industrial use	0.8 million m^3
Firewood	5.0 million m^3
Chips	1.2 million m^3
Total	7.0 million m^3

Actions for the future

A fundamental action is the reforestation of denuded forest lands. In Chile, approximately 1.4 million ha have been planted with *Pinus radiata* (Monterrey Pine) and to a lesser extent *Eucalyptus spp.* It is estimated that there is another 5 million ha of forest land without cover that can be reforested. An important forestry

issue in Chile, probably the most controversial, is what should be done with the remaining native forest. It is estimated that of the total area of natural forest, approximately 5.5 million ha, is potential production forest. This area has been classified as follows:

Commercial Forests	0.8 million ha
Degraded Forests	4.4 million ha
Second Growth Forests	0.3 million ha
Total	5.5 million ha

In the commercial forest area, silvicultural management can be carried out to produce industrial roundwood and chips with profitable results. Silvicultural measures should also be undertaken in the degraded forests, to improve the stands. The qualitative poor, defective trees should be removed and the material converted into chips, which can make the operation profitable in view of the current strong market. In the younger, second growth stands, thinnings should be carried out to improve future growth and composition.

Sustainable forestry development

In recent years there has been considerable political pressure from a worldwide conservationist movement. A major concern of this movement is whether or not natural forests should be used for timber production and, if so, how it should be done. In this regard, two important concepts have to be considered: preservation and conservation.

- Preservation means that the forest resources should not be used. Instead they should be allowed to remain in their natural, pristine condition.
- Conservation means that the resources should be utilized to the maximum sustainable level without altering the ecosystem or, at least, modifying the ecosystem within acceptable limits. An important facet of this concept is to assure the productivity and continuity of the resources for future generations.

It must be understood that both concepts are important and have their own place in the world. It is necessary to preserve certain areas and ecosystems in their virgin condition for several reasons: scenic beauty, as a pool of genetic resources, for research and education, for their effect on the climate, recreation, tourism, etc.

The second concept, conservation, is intimately linked with population. The continuing population growth creates an increasing pressure on the environment to provide goods and services. To meet the demands and to maintain or improve environmental conditions, the concept of conservation must be applied.

Sustainable development is a concept which has become popular in the last decade. It implies:

- The economic growth of a country.
- A better distribution of the fruits of economic growth to permit the population to acquire the goods and services required.
- Conservation of the natural resources of the country.

These prospects may seem utopic to developing countries, but it is necessary to make a beginning, even if it is a beginning on a small scale. Developing countries should start with a basic premise: All land has a social function, including agricultural and forest lands.

In the southern central part of Chile (Regions IX and X) there are approximately 30,000 small land owners with properties of less than 30 ha. Many of these owners are subsistence farmers who utilize the native forest for fuelwood or burn it to convert it to agricultural land. Much of this land is hilly with steep slopes.

After yielding two or three harvests the land becomes severely eroded. A similar situation occurs in tropical forest areas. Colonization, either spontaneous or government programmed, often results in felling of forests, burning and conversion of land for agricultural uses. After a brief period the land becomes eroded, or the soil loses its structure and fertility. Often, the result is increased poverty, loss of forest and degradation of the soil. In brief, the conversion of forest lands - with soils not suitable for agriculture - is a problem which is reaching calamitous proportions. This scenario is not restricted to tropical forest areas only. It has occurred, similarly, in other developing countries in temperate and arid regions.

An important problem in developing countries is the fragmentation of land into small holdings with soils not suitable for intensive agriculture. The population has a subsistence existence and are overwhelmingly dependent on their local natural environment, often over-exploiting it. This not only results in forest destruction but is also followed by desertification.

Prohibition of forestry activities, permitting appropriate extraction, in native forests is not a solution. To change the agricultural habits and traditions of the populations living in these areas, to a forest use and conservation mentality, would be a better option. This can be done by providing the local people technical assistance, subsidy programmes and assistance to establish forest cooperatives (for instance to establish a small-sawmill cooperation). This would have the additional benefit of providing employment and improving the economic well-being of the local inhabitants, as well as conserving the forest resources.

Private companies who utilize the native forests in the developing countries, should operate under a legal system that controls their actions so that the resource is protected and maintained. At the same time, the use of local labour should be encouraged so that employment opportunities are created.

The appropriate use of the forest can also be important in generating foreign exchange for the country. This point is very important, since most of the developing countries are burdened with large foreign debts. It is necessary to eliminate the practice of converting the forests into money to repay the national debt. Instead, the forests should be managed wisely to secure a sustained production and to maintain them for environmental protection.

At the same time, we should not be guilty of oversimplifying the problem. We must take into consideration all the ecological, economic and social variables. The most sensible course is to use the forest resource wisely for rural development. If one wants to conserve the natural forest it is necessary to manage it and thus give it an economic value.

Conclusions

The boycott of wood products from tropical forests and the effort to make European countries self-sufficient in wood production do not seem to be the best way to stop deforestation in tropical countries. The best way to change from deforestation to sustainable forest development is to investigate ways of managing tropical forests, to institute appropriate management and extraction methods, giving the forest an economic value and thus an incentive for their conservation. Technical cooperation and financial assistance for this purpose from the more developed countries would be a wise investment.

In conclusion, to assure their sustainable production and the conservation of their ecosystems, tropical countries should utilize their forests for production, under appropriate silvicultural systems. This will have the added benefit of fostering development in rural areas, improving the standard of living and reducing emigration of the population to urban centres.

A great deal of research on the best ways to manage and utilize tropical forest ecosystems, in addition to the political will of the government of the country and education and participation of its population is required.

DEVELOPMENT: THE ONLY WAY TO STOP DEFORESTATION

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Introduction

The idea to stop or significantly slow down deforestation in the tropics by enhancing the self-sufficiency of wood in the developed countries is challenged in this paper. This idea assumes that tropical forests are plundered by rich countries to satisfy their high demand of wood. Deforestation is mainly caused by small-scale farming and, to lesser extent by large-scale pasture and logging for timber. They account for 60%, 20% and 20% respectively of the deforestation in the tropics (Myers, 1991). This means that 40% is deforested by large-scale 'actions', while 60% can be understood as the total deforestation on small plots. The real reasons for deforestation, on small- and large-scale, can be traced to the socio-economic and the socio-political underdevelopment of Third World countries.

Basic principles of development

Development can be understood as a socio-economical and a socio-political problem. Socio-economic because the matter entails the allocation of resources (income) among a population. Socio-political because of the way an income is obtained.

A poor socio-political development explains the basis of deforestation. Most of the deforestation in the tropics is caused by small-scale farming, which can be interpreted as subsistence farming. This means that people satisfy their elementary needs by producing the food themselves rather than by buying it. The latter implies a financial income. People are forced to deforest and to cultivate the land to survive. Because tropical forests cover a vast area, the value of the forest and its functions seem very low to governments and even so to the poor people. It seems impossible for these poor people to exploit the forest to sell the wood . Therefore deforestation is tolerated or even stimulated by governments, with the advantage of (or in order to maintain) political stability.

Under a dictatorship, poor people do not have the power to demand guaranteed minimum wages, social infra-structure, etc. Democratization can set an economical development in motion. Providing an income decreases the people's dependency on the need for producing their own food. Opportunities for the evolution of specialized economic branches come into existence. People can concentrate their activities on specific activities, such as agriculture, small scale industry, forestry, etc.

To put a halt to large-scale deforestation actions for pasture and for timber harvesting should be taken. Large-scale pasture for export does not seem really profitable in some parts of the tropics (e.g. Brazil; Katzman and Cale, 1990). It is practised by a small powerful class which is (over-)compensating low meat selling prices and other loss making factors by defending the existence of high subsidies, low wages, low land prices, etc. Although the revenues from this serve only a very small part of the population, they can contribute to the development of the country, provided that the revenues find their way to where it belongs. The rich class represents a potential capital which can provide primary investments, once democratization is initiated.

Creating higher prices or improving the timber market constitutes only half the measures to force forestry towards a form of sustainable land use. What is also needed to stop deforestation is an awareness of the scarcity of forest land. Deforestation will not stop until a buyer has to pay a price for wood that is related to its scarcity. With present prices, the buyer is not aware of the scarcity of wood. Therefore exploitation companies should have to pay an appropriate tax or price calculated according to the use of the forest (extracting timber and non-timber forest products). This assumes the existence of property rights. Consequently, the question arises as to how these rights can be granted and what the position of indigenous people and communities will be. How can the indigenous population become an integral part of the technologically developed society? Or to be more specific, which role can they play in "modern" forestry?

Implications for tropical countries

From the explanation already given, it is clear that deforestation is not caused by the high demand of wood in rich countries alone, but mainly as a result of the under development of the Third World countries. Only 20% of the deforestation is caused by logging for timber, but can be regionally important as in South-East Asia, for instance (Myers, 1991). Although in this case deforestation is linked with the felling of timber, the real cause can be traced to the lack of control over the felling activities. Local people are powerless and cannot control the felling activities directly or indirectly.

Furthermore, several reasons indicate that self-sufficiency of wood in the rich countries has only little impact on the tropical wood-exporting countries. In the first place, the wood from current afforestation in developed countries cannot be harvested before the years 2000-2010. In Belgium for example, the minimum age for the fastest growing trees (poplar) for sawnwood is 15 years. Oak demands at least 80 years of growth before a small quantity of high-quality wood can be sawn from such trees. Normally oak should be cut at the age of 150 to 300 years. The first harvested wood will be used as industrial wood where it will be converted to packing materials and mass-products such as paper, fibreboard, particleboard, etc. This is because of the small proportions of the slow growing tree species with high-quality wood and because of the low intrinsic wood quality of the fast growing tree species. The prospect is that only low-quality wood will be produced from the current afforestation in Europe in the near future. While at the same time only high-quality tropical wood species are imported by the rich countries The assumption can be made that a country like Japan and the European countries will remain dependent on tropical high-quality wood resources from the tropical forests for the time being. For these reasons no changes in the existing or future estimated demand for tropical wood can be expected in the near future.

Secondly, high-quality tropical wood has properties that temperate or boreal wood species have not. In addition, there are more diverse tree species with so far unknown technical properties to be found in the tropics compared with temperate and boreal regions.

Implications for the rich EEC countries

Afforestation in the EEC seems to be favourable because of the high import bill for wood. One of the most obvious advantages of afforestation in the EEC is a decrease in the production of agricultural surpluses. To balance the agricultural production in the EEC, the afforestation area is estimated at 10 to 15 million ha (Strehler, 1990; Hall et al, 1991). After a short period the agricultural surpluses of the EEC will be withdrawn from the market. This can be understood as a pure waste of money and human efforts which always has negative economic consequences.

The production of these surpluses is maintained by subsidies which seem to be enormous. Farmers, whose organizations are often powerful and who do not consider afforestation as an alternative to their agricultural activities, demand that these subsidies be maintained.

A situation that has already been described concerning the Brazilian large-scale pasturers seems to be comparable here. The only difference is the magnitude of the subsidies demanded. In the EEC, these subsidies may just, or partly, compensate for the actual low market prices, and can be seen as an expensive social payment. Therefore the socio-economical aspects of the policy favouring afforestation in the EEC should be questioned. For example: is afforestation of the land of farmers who retire, together with a land policy to improve the rentability of both forestry and agriculture, a step towards a solution for the problems facing the policy of afforestation?

Afforestation in the rich countries may become necessary. The internal demand for wood in the developed countries will increase. Wood or wood products can be used as alternative building material for the construction of houses, but also as a replacement for fossil fuel (methanol). As non-wood products become scarcer and/or more expensive, the situation will become more favourable for the use of wood. As wood becomes more abundant on the market, it will become cheaper and the use of wood can increase.

Conclusions and remarks

The idea of a high wood demand of the rich countries as the cause of deforestation is not correct. The main cause can be found in socio-economical and socio-political reasons. If poor people get more power, their income also will become more righteous. Consequently their dependency on self cultivation of land and deforestation will decrease. Therefore one can state that: development is the only way to stop deforestation.

Because the demand for tropical wood by developed countries is expected to remain unchanged, the Third World countries will have the opportunity to obtain an income, which - if used wisely - could improve the development of these Third World countries. What is more, one can assume that a process of development will be accompanied by an increased demand for wood.

In some tropical regions, afforestation does not have to be restricted to rich countries. High deforestation rates result or will result in a shortage of (fuel)wood.

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THE CONSEQUENCES OF A HIGHER DEGREE OF SELF-SUFFICIENCY OF WOOD PRODUCTION IN EUROPE, A VIEW FROM MALAYSIA

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Introduction

The drastic increase in population leads to an increased demand for natural resources. Wood is not an exception. The greater the demand, the higher the price, although the market trends remain unpredictable (Todaro, 1989).

The tropical countries have generally been blamed for causing a global environmental deterioration. This blame is based on the over-exploitation of the forests in tropical countries. It should be remembered though, that the occurrence of acid rain in western countries has partly destroyed the forest in these countries. Acid rain is the result of excessive overindustrialization in urban areas. Western countries have cautioned the tropical countries not to cut too many trees in the name of the protection of the natural environment, although they too should be blamed for the destruction of the forests in our part of the world.

The European countries are looking forward to making use of other wood substitutes such as plastics, steel or concrete in the hope that they will not have to rely on supplies from tropical countries. Measures have been taken to plant trees along roadsides and canals, and to some extent, afforestation on former agricultural land has already been carried out. These activities can lead to a higher degree of self-sufficiency of wood production in Europe.

Implications

Whether Europe can be totally self-sufficient in wood production is questionable. The positive effect of a greater self-sufficiency is that Europe will not have to rely on tropical countries for the supply of raw materials, in which this case tropical countries will apparently lose their major income from the export of tropical wood. But this is unlikely to happen as there are a few other factors that will determine the impact on the tropical countries.

Westoby (1978) states that there are three priorities to be dealt with when forestry activities are planned and managed in developing countries. The first priority should be given to activities that support the rural people who carry out forestry activities. The second priority is that forest based industrial activities should be directed at local consumption and only the third priority should be given to activities directed at the export of wood. Currently, Malaysia exports only high quality wood products such as sawnwood, plywood, woodchips, and furniture. But this is not the case for the local market. The local consumers know that they are buying lower quality products. It is my opinion, that if the European countries are self-sufficient in producing their own hardwood, or if they can find substitutes for the dark coloured, high quality hardwood, then the local consumers would be only too happy and willing to pay for the high-priced, high quality local products.

The demands

We cannot deny that there is an insufficient supply of good quality products within Malaysia, itself. Although Malaysia at present exports good quality products, it is not an exaggeration to say that our local consumers would be perfectly happy and willing to pay a higher price for these good quality products for their own consumption. For example, plywood of high grade and superior quality is being exported and all that is left for the local market is wood that is rejected for the export market. Local consumers also need good quality products, however, and are willing to pay a higher price.

The growth of population within the ASEAN region results in a higher demand for wood. The growth of housing estates is tremendous. Private enterprises plant trees such as rubber and oil palm not only for agricultural products but also for wood substitutes. If the European countries become self-sufficient in forest products, the tropical countries will have to find new markets for the export of their products. The ASEAN region is a growing market. The Middle East countries are also known to be potential buyers. As a result of the recent Gulf War, Kuwait and Iraq have to rebuild their countries to compensate for the losses during the tragedy. This should certainly create a high demand in wood consumption.

Industries and other sources of income

When European countries become more self-sufficient in wood production, tropical countries have to alter their market-oriented products. The wood producing countries should have more industries that use raw material from the forest instead of exporting raw materials such as logs and saw wood. The technological know-how of the Japanese is needed to set up further processing mills in the tropical region.

Malaysia does not solely rely on the export of wood products as the main foreign exchange earner. There are also other resources such as petroleum and natural gas. The country is now concentrating on tourism as the number one income source for the country in the near future.

Conclusions and recommendations

Since the European countries are so concerned about the diminishing tropical forests (Hummel, 1989), I would suggest that they should invest their money in our forests. They can have concession areas and have their own forest management strategy towards sustained yield management, bearing in mind that conservation of the forest should be the top priority. The return of the investment of European countries may take a long time, but if these countries are sincere enough to want to maintain or upgrade the quality of the environment for the betterment of life, what are two or three decades?

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THE CONSEQUENCES OF A HIGHER DEGREE OF SELF-SUFFICIENCY OF WOOD PRODUCTION IN EUROPE; A case study of the situation in the former West-Germany

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Introduction

Because of wasteful exploitation, 40% of the tropical rainforests are already irretrievably lost and clear-cutting continues at a rate of more then 11 million ha/year (Council on Environmental Quality, 1980; another source even has estimated it to be 20 million ha/year; Anonymous, 1991). The tropical Asian countries have the highest forest destruction rate. They also have the highest export rate (they export mainly to Japan). Of the tropical logs imported by the former West-Germany, about 65% came from South and South-East Asia (Anonymous, 1989). Africa used to be the main exporting continent to Germany. Now, having lost about 85% of its former primary rainforests, and despite its disastrous economic situation, Africa still exports more than 30% of its logs untreated. In South America 10 to 30% of the growing stock of the rainforests are exploitable (at the present state of technology). South America does not play an important role in the exporting of tropical logs, but that may change in the future (Council on Environmental Quality, 1980).

At the same time (talking about the last 30 to 40 years of tropical forest destruction) the EEC faces problems of an astonishing surplus of food production in the twelve member-states. Consequently it has become necessary to lay fallow about one third of the agricultural lands until the year 2000 (Council on Environmental Quality, 1980). This means in concrete numbers that more than 44 million ha in the EEC has to be laid fallow of which no less than 4 million ha is situated in the former Federal Republic of Germany (FRG; Kroth, 1987).

Only recently have people begun to combine the problems in order to find the proper solutions. Questions that arise are: Is increasing the wood production in Europe by using the fallow land the right way to stop clear-cutting and destruction of the tropical forests? Are there economic connections, and what are they?

I will try to point out the present situation of the German timber trade, within the limits of this paper followed by the developments between Germany and the EEC. A closer look will be taken at possible trends in the timber trade of the less developed countries. Comparing both results will hopefully lead to the formulation of an acceptable result concerning the possibilities and the consequences of afforestation in the EEC.

Note, that in all available literature there is no mention at all of a connection between the afforestation of fallow agricultural land and the intention to stop deforestation in tropical rainforests. It would seem that up to now, nobody has published a study on this topic. Furthermore, it is very difficult to compare the different statistic numbers in the various studies and even among the responsible institutions such as FAO and ECE there appears to be a great deal of speculation about the future of the global timber trade. As the reader hopefully will understand, this is why this paper does not offer any definite results, but only a reconnaissance of the problem.

The timber balance of Germany

The timber balance in 1989 of the former West-Germany shows a consumption of about 70 million m^3 (measured as equivalent of raw timber), facing a volume felled of about 32 million m^3 (Anonymous, 1991). This would imply that the FRG annually imports more than 50% of their timber consumption and for this reason the FRG might have a particular interest in increasing their self-sufficiency of wood production. But actually that is a precipitate conclusion, because for instance the timber balance also includes recycling paper, which one can hardly count if one is interested in a comparison between the felled volume

and the raw timber consumption. If the most important quantities of import and export are considered, the result is a surplus of imported timber of about 30% with a pessimistic trend for the future (Kroth and Plochmann, 1984; Kroth, 1987). To estimate the requirement of the timber industry for the near future, it would seem necessary to analyse the timber balance more precisely.

Pulpwood, with imports totalling 11.3 million m^3 (1985), is by far the most important commodity of the timber import and hence, probably the most lucrative one. In the paper and cardboard sector, the FRG imported 5,5 million m^3 of timber a year (Kroth, 1984; Anonymous, 1989). To meet timber demands, slender softwood (so-called industrial timber) from Scandinavia and Canada was chiefly imported. It is foreseeable, that there will be a growing trend to import this kind of timber from the expanding number of tropical forest plantations, for instance, from Eucalyptus plantations in Central-Africa.

To achieve complete self-sufficiency in the sectors mentioned above, (which will have no impact on the deforestation of tropical rainforest whatsoever), 17 million m^3 of industrial timber would be required, which is more than half the annual cutting in former West-Germany. Besides, it would not be profitable because of the immense costs incurred for tending and harvesting the plantations in the FRG (compared to the costs in Third World countries). The only profitable trade for the German forest economy at present, is the market for logs of deciduous trees. The annual cutting is expected to slightly decrease within the next few years (3.7 to 3.2 million m^3) while at the same time, the consumption will increase by about 2% (FAO, 1986). Since the unification of the two Germany's in 1990, this trend will become more noticeable.

To meet the present net-import of broadleaved timber plus the expected extra demand of imported broadleaved timber, not more than 10% of the fallow agricultural land (400,000 ha) will be used for afforestation (taking into account an average annual increment of 2 m^3/ha; Kroth, 1987). This fact, together with a growing future interest in bio-energy (wood briquettes, see projects in Sweden and Finland) as well as an increasing domestic timber industry (Hummel, 1989), will justify a future policy of increased afforestations. I personally think that the tendency described will not be welcomed by all interested parties, because of the unknown impacts of the government policy and of the agricultural policy (in particular the worsening of the financial situation of farmers).

The consequences of afforestations in Germany on tropical rainforests

Will there be a noticeable relief for the benefit of the rainforests because of the anticipated afforestations in Europe?

In 1987, the FRG imported 1.9 million m^3 of tropical timber (mainly hardwood used for carpentry), which represents (only) 3% of the total consumption (Anonymous, 1989). In the very same year the EEC imported 11.3 million m^3 of tropical timber, being the second biggest importer after Japan (Council on Environmental Quality, 1980; FAO, 1986; Anonymous, 1989). Theoretically, tropical hardwoods can be replaced almost entirely with indigenous (European) timber. In case of a complete renunciation of tropical timber, a further 1 to 1.5 million ha of fallow land for afforestation will be needed. That is one fourth of the land available (see above). It can be understood, therefore, that tropical timber can be replaced from the industrial point of view as well as from the agricultural-silvicultural point of view. However, the production of proper diameter classes may take some 60 - 150 years and by then the last accessible primary rainforests will probably have been cut down.

The growing shortage of tropical timber is bound to increase the demand for European and North American timber (simply to substitute the tropical hardwood). Consequently, the forest area in these regions will also need to be increased. Moreover, the degree of self-sufficiency might increase too. Even with the help of optimistic acceptances it seems unrealistic that deforestation of the underdeveloped countries will stop if European, North American or even Russian timber substitutions were successful: it would simply be too expensive. Besides, countries of the northern hemisphere would not be able to produce the required quantities of timber. Therefore the deforestation of the tropical rainforests will not only continue, but intensify, because of the rapidly increasing population in many tropical countries. The result would be ,an increasing demand for more land and a higher consumption of fuelwood. Furthermore, an expanding industry will need new quantities of timber.

It can be said that a more intensive wood-production in Europe does not necessarily imply an accompanying increase in self-sufficiency. The increment might just compensate the rising demand. A higher production of timber means a growing timber industry, the growth of the gross national product and maybe a higher degree of self-sufficiency. But it definitely does not mean a slowing-down of deforestation in the tropical rainforests.

Conclusions

It is not a matter of either increasing the self-sufficiency in wood-production in Europe or development aid and sustainable land use forms in the respective countries. It is a matter of both. Apart from obtaining more self-sufficiency in wood production, the industrial countries should increase their efforts to save the remaining tropical forests. In my opinion, a boycott of traded, tropical logs, which are not from forests under sustainable management, is yet to come. It might be a hard deal for the economy of the respective underdeveloped countries as well as for the undersupplied industrial countries, but at the moment it would seem to be the best way to underline the vital nature of the issue of the survival of the tropical forests.

The following questions remain unanswered: What will happen to the timber supply in Europe, should there be an immediate effective boycott of tropical logs? What will be the future capacity of tropical plantations with regards to pulp production in Europe?

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Final statement

Conclusions

1. At present, man is a main destroyer of nature, due to an attitude that does not recognize the mutual coexistence of man and nature.

2. Foresters have little influence on policy and decision making, because of an undervaluation of the importance of forests for society in the decisions taken concerning land allocation and forest resource utilization.

3. Although forests should remain the basic object of forestry education, the education is often felt to be incomplete, with a too narrow focus on forests only.

4. The forester of today is too little aware and concerned about the society outside his/her forest, that has direct influence and interests in the forest.

5. There is a lack of public understanding of forestry, due to a public environmental education system, in which forestry is not yet included.

Specific conclusion on land allocation

6. Priorities in land allocation are often not given to forestry, due to the fact that non-foresters decide upon the allocation of land for specific purposes.

Specific conclusion on forest resource utilization

7. There is still a lack of an appropriate (financial) valuation system for forests and forest functions.

Recommendations

8. If foresters want to take more responsibility for the world's forests, the role of the forester has to change. Foresters should:

- come out of the forests and step into society;
- actively take part in decision making processes concerning land allocation and forest resource utilization on all levels;
- increase public awareness about the growing concern about the world forest resources by improving extension and education on the importance of forests for society;
- promote other functions of forests besides the wood production function;
- translate his/her expert knowledge regarding forests into workable advice on which public action can be based;
- find an optimal balance between people's interests, with a special reference to the local interests, and fragility of nature;
- objectively recognize priorities of society, either to the advantage of forests or to the advantage of other land uses;
- realize that he or she has not only to deal with trees, but also with people.

9. The forestry educational system has to change and should:

- integrate knowledge of other disciplines, especially sociology, into the forestry discipline;
- allow an increased influence of the forestry students on the build up and contents of their education;
- offer forestry students a global orientation, by giving opportunities for exchange of ideas and opportunities for research, nationally as well as internationally;
- make efforts to reduce the gap between theories and reality.

10. Regional, national as well as international cooperation between policy-makers and foresters has to be improved to solve problems concerning forests on a global level.

11. The basic element of long term solutions to environmental, and more specifically, forestry problems in the world is a mental revolution, which means a change in attitude from consumerism towards an active responsibility for ones environment.

12. More efforts should be made to construct environmental based regulations and laws in order to support the implementation of land use and forest policies.

13. Communication between foresters, decision-makers and society should be improved by developing the forester's communicative skills.

Epilogue

FROM GROWING CONCERN TOWARDS ACTION: WHO IS FIRST?

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At the sunset of the XIXth International Forestry Students Symposium it is an honour for me to address you and add some ideas to all the issues you did review last week: what is next?

Today, I joined you in your efforts to develop the final conclusions and recommendations. The enjoyment of the blessings of a symposium, such as, the growing feeling of solidarity, the exchange of opinions and the breeding of ideas should culminate in fetching phrases. Phrases which would achieve ... Indeed, what could they achieve?

I have been present at several congresses, symposia and workshops, among which three World Forestry Congresses: at Buenos Aires, Jakarta and Mexico-City. Each of those ended with final declarations. Yet, what were the results? Big words and fair words, expressed solemnly and confirmed by all the participants. But who remembers all these words after a few weeks have passed? In spite of all the congresses that have taken place over the past 20 years, deforestation and desertification processes did not stop at all. On the contrary, they have been proceeding at an alarming, even accelerating ...

You, in your turn, have also drafted a final statement: again a new range of fine words has emerged. Was it once more a statement without personal commitment? Frankly speaking, when I cast a glance at your final statement, my confidence in your words is greater than in those of the congresses I mentioned before. This is simply for the very reason that you did pinpoint your personal commitment.

Our hopes for a better future rest with you. Your commitment to all forestry matters that still go wrong will contribute to the skills and abilities that you readily seek to develop. In the struggle for survival of forests and mankind, all these assets are needed if you are to stand your ground. I feel I could make a contribution to this commitment by adding a few remarks.

The first point that should have your undivided attention is the growing concern of the shrinking forest area and its degradation, which is happening at an unprecedented rate so far. How should you commit yourself to such an issue? How can growing concern be transformed into an act of commitment? It may help to realize that problems also appear on a certain scale. The largest scale of deforestation and forest degradation tends to occur not in the northern but in the southern regions, notably the tropics. Nevertheless, the shrinking of the forest area is a global problem on a global scale; indeed a problem of international economic relations.

We from the North are still removing cheap raw materials from the South and converting them into products we trade for profit on the world market. Yet how can forestry professionals bring this immense problem within the confines of a practicable framework? Within North-South relations, the South should be enabled to develop a pattern of land allocation in which sound, ecologically based land use can take place. Enabled, that is to say, by a change of attitude in the North. I do not mean a kind of tutelage of the wealthy North, instead, the sharing of its wealth with our poorer partners in the South. In other words, this change should take place not at the expense of, but for the benefit of developing the rich natural resources in the South.

Stepping down from this tremendously complex international level to the regional one, the same problem of the vanishing forests appears. Provided solutions will be found for the troubles in international economic relations. On the regional level, professional foresters are more in touch with the actual situation. Attention can be paid to the driving forces: the masses of poor populations looking for their subsistence. Usually they have no other opportunity than to slash and burn the forest again, and after its depletion move to the next forest. Here the scope of land use can be shifted by means of social forestry strategies, at a local level effectuated by agroforestry or silvi-pastoral approaches.

You should be aware, however, that we in the North, or at least in Europe, have to face similar questions of land use. The EEC questions agricultural land we no longer need for reasons of overproduction. This calls for important changes in rural areas, changes that should have at least included a socio-economic component, for these are the main problems that farmers encounter when their former agricultural land is afforested.

The second point that I would like you to consider emerges from the following questions. Are you conscious of the tension between the sciences and the policies that govern everyday practice? Or do you only feel bound by the chains of existing laws and regulations, which apparently are, in most cases, outdated? How would your newly gained professional forestry expertise be allowed to touch upon the roots of evil that affect the resources of forests and forest components? Of course, your chances will be different in accordance with the different sites and conditions in your home country.

Some of the fruits of this symposium are laid down in the recommendations. One of these is highly important for your forthcoming professional lives: it is the question about the extent to which your (university) forestry curriculum has provided you with the know-how and skills to deal with decision-making. As agents of change in the field of forestry, are you critically aware of the outdated existing laws and regulations, the institutions, and the paradigms or myths that lie at the root of these matters? Have you gained any insight into how policies with respect to land use, forests and trees should be formed and formulated? And do you know how rigid policies can be reformed and reformulated in the near future, for instance by adapting them to the changing conditions in your home country? This does not mean that each of you should develop into a forest policy expert. Nevertheless it is my opinion that each of you should at least use your studiousness and your opportunities to learn in order to adopt some sensitivity to policy questions. In my view, the "structural contents" of this XIXth International Forestry Students Symposium will allow you to proceed in this way, each according to your own personal responsibility and ability. The "structural contents" offers a range of items for deliberation in the light of policy matters. The world is in dire need of your newly gained expertise, but please use it in an effective way. Do not wait for changes in the curricula, but put it forward yourself with all your energy!

In the meantime you have broken with the tarnished image of foresters as being solely capable of planting and harvesting trees. Keep committing yourself to act in a different, more or less revolutionary way. Try to improve the world, starting with yourself; prevent fine statements and not effect from ruling the world.

I have gained the impression that you were all training up yourselves during the past seven days, each of some 16 hours workload. You were privileged to get such an opportunity. Nevertheless you are all still young, so you are hardly in a position yet to put your experiences into practice and to pursue modern scientific knowledge in everyday's life. However, it is my opinion that you will not easily forget the so-called "Wageningen approach" you became acquainted with during this symposium. And I am sure that it stands a good chance of bearing its fruits sooner or later.

In conclusion, dear friends from everywhere in the world, I hope you will have a safe journey home, carrying with you the symposium message to pass it on to your colleagues over there. May it be for the benefit of forests and forestry and, last but not least, for the wellbeing of the society you are part of.

God bless you all.

I declare the XIXth International Forestry Students Symposium closed.

List of participants

Urban forests: The significance of these forests and the importance of the cooperation between city planners and foresters

Harald Aalde - "A small case study on the forest areas surrounding Oslo" - Department of Forestry, Agricultural University of Norway. As, Norway
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