NATIONAL CONSERVATION STRATEGIES AND BIOLOGICAL DIVERSITY

A report to

International Union for Conservation of Nature

and Natural Resources

Conservation for Development Centre

by

Robert Prescott-Allen

PADATA
627 Aquarius Road
RR2 Victoria, BC
Canada V9B 5B4

IUCN contract no. CDC/C80/RPA

PA63

Revised December 1986

SUMMARY

The World Conservation Strategy (WCS) recommends the preparation of national and subnational conservation strategies (NCSs and SNCSs) to speed the achievement of conservation and sustainable development. Conservation strategies (CSs) have been started in 40 countries. However, the CS effort has been criticized for focussing on only two of the components of conservation (maintenance of ecological processes, and maintenance of harvested resources at sustainable levels), neglecting maintenance of biological diversity (BD).

This report was commissioned by the IUCN Conservation for Development Centre to examine this criticism and recommend ways in which NCSs and SNCSs could provide for maintenance of BD. Preparation of the report involved review of 42 CS documents (10 draft or final government or governmentally endorsed CSs; 7 nongovernmental CSs or equivalent; 17 CS prospectuses; and 8 other documents) and visits to Zambia (1 week), Zimbabwe (½ week), Botswana (½ week), Nepal (1 week), and Malaysia (1 week). The report is in three parts: the first part gives background, defines BD, and outlines the contributions of BD to development. The second part reviews the treatment of BD in NCSs and SNCSs. The third part describes options and approaches to providing for BD in NCSs and SNCSs.

The criticism of the first generation of CSs is justified but does not go far enough. No CS provides a comprehensive description of the socioeconomic contributions of BD to the country concerned. Many do not give even one specific example, dealing only in generalities. The relationship between development and conservation is treated as essentially negative (development damaging conservation; conservation attempting to control development). Whereas several CSs provide adequate assessments of the status and priority conservation needs of ecosystems, species and *in situ* reserves, several others do not; and only one CS considers the status and priority conservation needs of gene pools (genetic resources) or of *ex situ* reserves. No document provides comprehensive treatment of the priority needs of BD conservation.

The CSs are weakest where they should be strongest: in their treatment of obstacles and opportunities, cross-sectoral coordination, and integration of conservation and development. Some of the documents consider the obstacles to conservation in detail. Most do not. Only one (the Zambia NCS) follows its sectoral analysis with an integrated (intersectoral) discussion of the sectoral recommendations and their implications for each other. Integration of conservation and development is treated as a matter of regulating development projects or of adding a conservation officer to a planning agency, rather than of adopting policies and practices that would enable the achievement of development and conservation at the same time. In short, one or more of the four diagnostic features of the WCS--comprehensive treatment of conservation (ecological processes + biological diversity + harvested resources); cross-sectoral approach; identification of action to overcome obstacles to conservation; and integration of conservation and development--is absent from all the CS documents reviewed.

The weaknesses of this first generation of NCSs and SNCSs appear to be due to lack of experience with CSs; lack of communication among people preparing CSs; lack of awareness of the socioeconomic contributions of BD; and lack of data on BD. The people who have produced the first CSs are pioneers. The guidance provided by the WCS and National conservation strategies: a framework for sustainable development has been inadequate. Lack of experience has led to serious underestimates of the scope and complexity of CSs and hence of the time required to prepare them. Greater communication among people preparing CSs would have enabled later strategies to benefit from the experience of earlier ones (including the WCS) and could have resulted in a more rapid and satisfactory adaptation of the WCS to national and subnational conditions. In addition, the preparers of CSs have had difficulties relating BD conservation to development, due to the perception that BD contributes little to development; the indirect nature of certain contributions of BD; underuse of native BD; and a lack of data on BD.

It is recommended that IUCN and its WCS partners (UNEP, WWF, FAO, Unesco): (1) encourage countries preparing NCSs or SNCSs to include the two main features missing from the current generation of CSs--(a) assessment of the socioeconomic contributions of conservation; (b) specific proposals for combining conservation and development, combining measures to maintain BD with other conservation measures, and jointly meeting the conservation requirements of different sectors; (2) produce a handbook on how to initiate, prepare and implement NCSs and SNCSs; (3) widely distribute the handbook; (4) establish a network of people working on CSs, for the quick exchange of experience and ideas; (5) integrate promotion and support of NCSs and SNCSs with the rest of their programmes; (6) reserve the term "conservation strategy" for documents that (a) treat conservation at least as comprehensively as does the WCS, and (b) share a similar cross-sectoral approach to achieving conservation and integrating it with development.

The report then outlines a procedure for assessing the socioeconomic contributions of BD (along with ecological processes and harvested resources); summarizes the main points that should be covered in a review of the status and priority needs of conservation of ecosystem, species and genetic diversity; and describes three ways of achieving intersectoral coordination and integration of conservation and development, with particular reference to maintenance of BD: a rural development substrategy; a programme of BD development and conservation; and a local conservation strategy.

CONTENTS

LIST OF TABLES

1. INTRODUCTION

Background

1.01 The World Conservation Strategy (WCS) recommends that every country should undertake national and/or subnational conservation strategies (NCSs and SNCSs) to achieve the three conservation objectives as expeditiously as possible and to speed the integration of conservation and development. The functions of NCSs and SNCSs are to determine the priority requirements for achieving the three objectives, identify and stimulate the most cost-effective action, focus and coordinate the efforts of governmental and nongovernmental agencies, raise public consciousness, and overcome any apathy or resistance there might be to taking the action needed. Since the WCS was launched in 1980, NCSs and SNCSs have been started in 40 countries (Appendix 1). IUCN's Conservation for Development Centre (CDC) has assisted 20 of them.

1.02 This report is in response to concern that NCSs and SNCSs are focussing on only two of the conservation objectives (maintenance of ecological processes and maintenance of harvested resources at sustainable levels), neglecting maintenance of biological diversity. An evaluation of the CDC's Conservation Strategy Development Project (Bramble 1985) expressed this concern in the following terms:

> The lack of sufficient input from commission members leads in turn to...the undisputed failure to include sufficient emphasis on endangered species, ecosystem and protected area conservation in the NCS work.
>
> Examples of [this failure]...include the fact that the word "wildlife" is hardly mentioned in the Framework* document; and the completed draft NCS for Zambia only mentions wildlife values in terms of meat production and tourism, not biological diversity. Admittedly, IUCN for too long emphasized wildlife and parks to the exclusion of the needs of people. But CDC, in its zeal to present the hard-edged economic benefits of conservation to developing countries, appears to have jumped to the opposite extreme by almost totally excluding wildlife and parks issues.

---

*Note: National conservation strategies: a framework for sustainable development (IUCN CDC 1984).

Terms of reference

1.03 The terms of reference for this report call for a 30-50 page analysis and "user's guide" on the extent to which NCSs and SNCSs provide for maintenance of biological diversity (at three main levels of biotic organization: ecosystem, species, and gene). The report will:

a. Examine the content of existing NCS and SNCS documents with respect to their treatment of biological diversity, paying particular attention to coverage (of the main forms of biological diversity with respect to each of the main sectors concerned), treatment of the relationship between development and biological diversity, intersectoral linkages, and genetic resources.

b. Identify strengths and weaknesses.

c. Consider obstacles to the productive treatment of the subject and ways in which they were (or could be) overcome.

d. Recommend options and approaches to improved treatment of biological diversity by NCSs and SNCSs.

1.04 The report is based on a desk review of NCS and SNCS documents supplied by CDC and a more detailed field study in Zambia, Zimbabwe, Botswana, Nepal, and Malaysia. The documents range from project proposals to completed strategies and are listed in Appendix 2. The purpose of the field study was to seek the opinions and perceptions of the NCS/SNCS participants and others in the countries concerned on items a-d above. The countries were selected by CDC and include three where strategies were completed or at an advanced stage (Zambia, Zimbabwe, and Malaysia) and two where they were just beginning (Botswana and Nepal). In retrospect it would have been more useful to have confined the field study to the first three countries. One person/month was allocated to the field study and one-and-a-half person/months to the desk review and preparation of the report. A sixth country--Fiji--was visited for another purpose (preparation of a project proposal for a Fiji NCS) but also supplied information for the review. Appendix 3 lists the persons interviewed in Africa and Asia, and Appendix 4 the persons in Fiji.

Organization of report

1.05 Part 2 of the report consists of the analysis of the adequacy with which NCSs and SNCSs provide for maintenance of biological diversity (items a-c above). Part 3 consists of a practitioner's guide to providing for biological diversity in NCSs and SNCSs (item d above). Both parts are addressed to individuals currently or potentially involved in the preparation of conservation strategies (Part 2 is particularly relevant to IUCN and WWF because of their substantial commitment to funding and assisting NCS/SNCS work). The remainder of Part 1 is addressed to readers who may not be completely familiar with the WCS or the concept of biological diversity. It defines biological diversity, distinguishes maintenance of biological diversity from the other two conservation objectives, and outlines the contributions of biological diversity to development.

1.06 Throughout this report, the World Conservation Strategy (IUCN 1980) is cited as the WCS. NCS and SNCS documents are cited in abbreviated form (e.g. the Zambia NCS, the Malaysia--Sarawak SNCS, the Nepal NCS prospectus), the full reference being given in Appendix 2. Personal communications are cited with the person's name and the page number of the appropriate appendix (Appendix 3 or 4): e.g. A.C.Mubita A3-1. All other references are cited conventionally (e.g. Bramble 1985).

Definition of biological diversity

1.07 Biological diversity (BD) means the variety of life in all its forms, from cell to biome. For practical purposes of maintenance of BD, it is convenient to distinguish three main levels of BD: ecosystem, species, and gene. The term encompasses all three, and refers to both the number of different ecosystems, species or genes, and their frequency (or relative abundance) in a particular assemblage. Species diversity means the number and frequency of different species in a given area. Ecosystem diversity means the number and frequency of different communities of species (together with their environments) in a given area. Genetic diversity means the number and frequency of different genetic variants within a species. Although BD can include the diversity of harvested resources and of the species and communities that provide ecological services (such as crop pollination and coast and watershed protection), the term is used in this

report as the equivalent of, and in replacement of, the phrase "genetic diversity" as used in the WCS. Ecosystem diversity, species diversity and genetic diversity each provides different benefits (see Table 1 and contributions of BD to development [paragraphs 1.11-1.17]); and each has particular requirements for its maintenance. Hence it is preferable to use the phrase BD when referring to all three levels of diversity.

Maintenance of biological diversity in relation to other components (objectives) of conservation

1.08 The WCS defines three objectives of conservation: (1) maintenance of essential ecological processes and life-support systems; (2) preservation of genetic diversity; (3) sustainable utilization of species and ecosystems. The word "objective" has confused a number of users of the WCS, who have misinterpreted it as a motivating objective (why we conserve)* rather than as a constituent objective (what we must do to achieve conservation), as was intended when the WCS was written. Henceforth, to avoid further confusion, I use the word "component" instead. The wording of the third component of conservation has been criticized (e.g. by Mosley 1986) as implying that it is better to harvest a species than to leave it unharvested (instead of stating, simply, that harvesting should be sustainable). I have therefore rephrased the three components of conservation as follows:

1. Maintenance of ecological processes.
2. Maintenance of biological diversity.
3. Maintenance of harvested resources at sustainable levels.

---

*Note: As a result of this misinterpretation, some NCSs and SNCSs have included additional objectives. For example, the Philippines has added one more ("to hasten social and cultural development in all socio-economic sectors..."); and Canada--Alberta has added three more ("to provide for the recreational, spiritual, aesthetic, and other non-material needs of Albertans"; "to maintain and improve the quality of life in the urban environment"; and "to use and manage our non-renewable resources sustainably in the interests of developing a long-term sustainable economy for Albertans"). All of these objectives are fine (in fact they are true motivating objectives); but lumping them with the three conservation components obscures the essential fact that conservation is not an end in itself but a means of achieving social and economic objectives--from meeting basic human needs to achieving economic growth to safeguarding the rights of other species--such as those of the Philippines and Alberta quoted here.

COMPONENTS OF CONSERVATION / LEVELS OF BIOTIC ORGANIZATION	BENEFITS (GOODS AND SERVICES) WHOSE SUPPLY REQUIRES MAINTENANCE OF		
	ECOLOGICAL PROCESSES	BIOLOGICAL DIVERSITY	HARVESTED RESOURCES
3. GENE POOL (POPULATION)	---	genetic resources for improvement of domesticates (crops & livestock), regeneration of wild stocks, & biotechnology; cultivars & breeds of heritage value*	---
2. SPECIES	insect & other animal pollination of crops; biological pest control	new domesticates (crops & livestock); species used in nonconsumptive recreation (e.g. birdwatching) & tourism; species of heritage value*; plant & animal models for nonconsumptive research	wild resources (e.g. timber, fish, game, medicinal plants) harvested for subsistence, commerce, & recreation; plants & animals harvested for research (e.g. biomedicine)
1. ECOSYSTEM	biochemical cycling & maintenance of geobiochemical equilibria; degradation of organic wastes; nitrogen fixation; soil & water conservation; coast & watershed protection	reference sites for baseline monitoring and other scientific research; ecosystems used in recreation & tourism (e.g. wilderness experience, enjoyment of scenery); ecosystems of cultural value*	farmland & other agro-ecosystems; natural ecosystems that are cropped (e.g. rangeland for livestock production)

Table 1. Goods and services whose supply directly depends on maintenance of ecological processes, maintenance of biological diversity, or maintenance of harvested resources at sustainable levels (horizontal axis) at the indicated level of biotic organization (vertical axis).

*Note: heritage value includes cultural, religious, aesthetic, and symbolic.

1.09 Distinguishing the three components of conservation is necessary because each provides people wth particular benefits and each has special requirements for its achievement. Table 1 displays a selection of goods and services whose continued supply depends on conservation. The three components of conservation (horizontal axis) and the three main levels of biotic organization (vertical axis) form a matrix. This shows that, to assure the continued supply of a given benefit, management agencies must provide for achievement of the appropriate component of conservation at the appropriate level of organization. If a conservation strategy successfully provides for maintenance of ecological processes and maintenance of harvested resources at sustainable levels but fails to provide for maintenance of BD, then a number of valuable benefits will be lost.

1.10 The common denominator of the benefits of BD (listed in the middle vertical column of Table 1) is that the primary means of securing them is by protecting viable samples of representative and unique ecosystems, species and gene pools in a combination of in situ reserves (national parks, biosphere reserves and other protected areas) and ex situ reserves (seedstores, botanical gardens, zoos, etc.). A comprehensive system of in situ reserves is also needed to maintain ecological processes and harvested resources; but management outside reserves is as or more important.

Contributions of biological diversity to development

1.11 BD provides five main kinds of socioeconomic benefit (the level of diversity--ecosystem, species, or gene pool--that provides the benefit is indicated in parentheses):

Research and education (ecosystem, species and genetic diversity)
Cultural heritage (ecosystem, species and genetic diversity)
Nonconsumptive recreation and tourism (ecosystem and species diversity)
New domesticates (species and genetic diversity)
Improvement of established domesticates (genetic diversity)

Research and education (ecosystem, species and genetic diversity)

1.12 Representative examples of each of the main ecosystems in a country are needed as reference sites for baseline monitoring and related scientific research on productivity, regeneration, and adaptation to environmental change. The grassland ecosystems in Tanzania's Serengeti National Park provide a laboratory for research of great significance for range management, exploring the extent to which grazing intensity increases net primary productivity and the protein content and digestibility of grasses (Dyer et al. 1982). Management of development to make it both productive and sustainable requires assessment of its environmental effects, measured against unaltered sites with similar original vegetation, soils and climate. For example, the Zambezi Teak Forest (ZTF) ecosystem, which yields Zambia's most valuable timber, is declining rapidly, due to excessive logging, fire, and shifting cultivation. If present trends continue, the ZTF will effectively disappear in the next 50 years. Attempts at artificial regeneration have so far met with very little success. Understanding natural regeneration is crucial, and is being sought by studying an undisturbed tract of ZTF in Kafue National Park. The value of this tract as a reference site is due to its never having been exploited and to the continued presence of large mammals, notably elephant (large mammals apparently play a major part in regeneration of Zambezi teak by burying seeds, providing manure and destroying competing thicket species) (A.C. Mubita A3-1; G.D. Piearce A3-1; Huckabay 1986; Mwima 1986; Piearce 1985). Continued monitoring of the Kafue tract and of other protected samples of the ZTF will also provide the reference data needed for an assessment of the costs and benefits of any silvicultural system for the ZTF that eventually is developed.

1.13 Species diversity is the raw material of a great many fields of research and education. Sea urchin eggs are used extensively in experimental embryology, studies of cell structure and fertilization, and to test the teratological effects of drugs; medicinal leeches are important in neurophysiology and research on blood clotting; research on the African swallowtail butterfly provided the clues to how Rh disease is transmitted to the unborn child; and discovery of the chemical compound spongouridine in a

Jamaican sponge has resulted in the development of three new antiviral and anticancer drugs (Berquist 1978; Smart 1976; Wells, Pyle & Collins 1983). Myers (1983) gives many other examples. The genetic diversity of fruit flies, maize, and tobacco, make these species the organisms of choice for research on (respectively) speciation, inheritance, and viruses (Carson & Kaneshiro 1976; Coe & Neuffer 1977; Fulton 1979).

Cultural heritage (ecosystem, species and genetic diversity)

1.14 Natural ecosystems have great cultural importance for many people. Mountains are religious places throughout the world: Mount Kenya (Kikuyu, Kenya), Mount Everest (Nepal), and Mount Fuji (Japan) for example. Forests also have great spiritual value: around 2% of the prefecture of Xishuanbannan (China) consists of holy hills where animals are totally protected (Pei 1986); probably the only surviving examples of primary forest in southwestern India are sacred groves--ancient natural sanctuaries where all living creatures are protected by the deity to which the grove is dedicated, and from which removal of even a twig is taboo (Gadgil & Vartak 1981; Vartak & Gadgil 1981). Species also have leading cultural roles. In South and Southeast Asia, trees (notably Ficus bengalensis, Ficus religiosa, and Aegle marmelos), the Asian elephant, monkeys, cobras, and birds figure prominently in tribal religions and have been taken into the pantheons of Hinduism and Buddhism. The trees are sacrosanct and may not be cut down (Agrawal 1981; Chaudhuri & Pal 1981); and political authorities usually have had to invoke the sanction of the animals to win popular support (McNeely & Wachtel 1986). These interspecific loyalties persist. Hornbills have a special place in the hearts of the people of Sarawak, and the rhinoceros hornbill is both the central figure of the Gawai Kenyalang or Hornbill Festival of the Iban people and the official emblem of the state (Malaysia--Sarawak SNCS; Kavanagh 1985). In Papua New Guinea (and elsewhere in the Pacific) the dual contributions of wild animals as resources and as participants in the culture (as ancestors, spirits of the dead, messengers, portents of change, harbingers of good or evil, and characters in myth and legend [Pernetta & Hill 1984]) is expressed in the popular opinion that animals are both "good to eat and

good to think" (Dwyer 1982). The cultural significance of genetic diversity is evident from the large numbers of crop varieties and livestock breeds that different societies have developed. Many of these cultivars and breeds persist precisely because of their continuing cultural value. They include plants and animals with religious and ceremonial significance (such as the festival rices of Nepal, and Mithan cattle in northern Burma and northeastern India), as well as cultivars that are esteemed for their contributions to the traditional diet (such as the coloured rices of Sarawak, the aromatic rices of India, Thailand and Indonesia, native potatoes in the Peruvian Andes, and traditional bean varieties in Spain).

Nonconsumptive recreation and tourism (ecosystem and species diversity)

1.15 Nonconsumptive recreational uses of ecosystem and species diversity include enjoying scenery, feeding wildlife, and observing, photographing or contemplating wild plants, animals and habitats. (Recreational hunting and fishing are included with uses of harvested resources.) Ecosystems and species that are spectacular or unique or have other special appeal attract large numbers of local recreational users as well as being valuable tourist resources. In Venezuela, 250,000-500,000 people visit the mangrove forests of Morrocoy National Park every year (Hamilton & Snedaker 1984). State and national parks in the USA attract 700-800 million visitors a year; and national forests receive more than 200 million visitors a year. A major reason for these visits is enjoyment of the variety of landscapes the parks and forests protect: scenic beauty is cited by visitors as the main attraction of national forests; and desire to see a new area is the most frequently given reason for going to national parks (Prescott-Allen & Prescott-Allen 1986; US Forest Service 1981). In North America more people observe, feed or photograph wild animals than hunt or fish. The most revealing finding of surveys of American recreational uses of wildlife is the large number of different species that interest people. Millions of Americans spend time watching not only birds and mammals but also butterflies, spiders, beetles and other arthropods, and amphibians and reptiles (US Fish and Wildlife Service & US Bureau of the Census 1982). There are few data on recreational uses of species diversity by the citizens of devlop-

ing countries; but given its cultural importance such uses are bound to grow. Meanwhile, wildlife tourism is already a major earner of foreign exchange for several developing countries.

New domesticates (species and genetic diversity)

1.16 A notable and long-standing use of wild species diversity is as the source of new domesticates. Domestication of new crop and livestock species is as active a process today as it has ever been. In the USA, the combined farm sales plus import value of wild species domesticated this century is well over US$1 billion a year. Among the wild species domesticated this century are kiwifruit (Actinidia chinensis), red deer (Cervus elaphus), the giant freshwater prawn (Macrobrachium rosenbergii), and many forage and timber species (Prescott-Allen & Prescott-Allen 1986). Any wild species that is or was once used may have potential as a new crop or livestock. Its domestication can make a valuable contribution to rural development in areas that are marginal for conventional crops and livestock. With this in mind, the National Council for Scientific Research in Zambia is working on the domestication of three native species: Phytolacca dodecandra (a potential molluscicide for use against the snails that carry schistosomiasis); Ricinodendron rautanenii (an arid land species whose fruits are used for food and oil and whose wood is valued for carvings); and Uapaca kirkiana (a popular fruit) (M.K. Jain A3-1). Domestication of wild species can also enable countries to increase their economic benefit from the species by improving the product and by raising yields above the levels that could be sustained by the wild stocks alone. Nepal's Department of Medicinal Plants has organized the farming of two native medicinal species, Rauvolfia serpentina and Valeriana wallichii, and is investigating the propagation of several other wild species that are sources of drugs, perfumes and flavours for export, such as Osmanthus odoratus (whose flowers are used for flavouring food) (S.B. Rajbhandary A3-3). The genetic variation within species being domesticated is an important resource. Experience with such new domestications as loblolly pine (Pinus taeda) and highbush blueberry (Vaccinium australe) demonstrates that the most rapid development of a commercially successful domesticate is achieved

when care is taken to identify and combine the best available gene pools from the wild (Prescott-Allen & Prescott-Allen 1986).

Improvement of established domesticates (genetic diversity)

1.17 The genetic variation in domesticated plants and animals and in their wild relatives is the raw material with which breeders increase the yields and improve the quality of crops and livestock. Use of genetic resources has revolutionized agricultural productivity. In the USA, in the 50 years between 1930 and 1980, yields per unit area of sugarcane, wheat, and cotton more than doubled, of sorghum, maize, and potatoes more than quadrupled, and of processing tomatoes quintupled (National Plant Genetic Resources Board 1971; US Department of Agriculture 1981). The average milk yield of cows more than doubled during this period (US Congress, Office of Technology Assessment 1981). Equivalent increases have been achieved in developing countries. Between 1970 and 1984, average yields per unit area of rice in South and Southeast Asia rose by a third, and, in the Philippines and Indonesia, by 50% and 65% respectively (FAO 1981 & 1985a). At least half (60% in the case of maize) of the US increases in crop yields* and most of the Asian increases are attributable to the use of genetic resources, through the development of cultivars (cultivated varieties) with greater resistance to major pests and diseases and greater responsiveness to inputs such as fertilizers (Castleberry, Crum & Krull 1984; Duvick 1986; Swaminathan 1984). Continued yield and quality improvements are mandatory to cope with economic and enviromental changes and the new strains of pest and disease that evolve to overcome existing resistance. The germplasm (genetic material) used by plant and animal breeders comes from three main sources: traditional cultivars and breeds; modern cultivars and breeds; and wild populations. Breeders prefer to work with domesticated germplasm but use of wild genetic resources is already substantial and is spreading to a growing number of crops (Prescott-Allen & Prescott-Allen 1983 & 1986). No country is remotely self-sufficient in domesticated or wild genetic resources. Each depends on a global system of free exchange of germplasm and mutual responsibility for its conservation.

---

*Note: About a quarter of the US increase in milk yield is attributable to genetic resources.

2. TREATMENT OF BIOLOGICAL DIVERSITY IN NATIONAL AND SUBNATIONAL CONSERVATION STRATEGIES

Expectations

2.01 NCSs and SNCSs are national and subnational elaborations and applications of the WCS. Although the term "conservation strategy" does not belong to the sponsors of the WCS, it is now so widely associated with the WCS that to call a document a conservation strategy is to give the impression that it is part of a global series of activities sharing the WCS' approach. The diagnostic features of this approach are (WCS 8.1-6):

a. Comprehensive treatment of conservation (maintenance of ecological processes + maintenance of biological diversity + maintenance of harvested resources at sustainable levels).

b. Cross-sectoral: coverage of all sectors that benefit from or affect conservation; emphasis on enhancing intersectoral cooperation and reducing intersectoral conflict.

c. Identification of the actions needed to achieve each of the components of conservation, of the main obstacles to those actions, and of the measures needed to overcome the obstacles. Includes identification of special opportunities for successful action.

d. Integration of conservation and development.

2.02 In line with this approach, it is reasonable to expect that NCSs and SNCSs would include the following in their treatment of BD:

a. Describe the current socioeconomic contributions of ecosystem diversity (ED), species diversity (SD), and genetic diversity (GD).

b. Examine trends in such contributions, including assumptions concerning the supply of benefits of ED, SD and GD that are implicit in development plans, etc.

c. Assess the conservation status of indigenous ecosystems, species, and gene pools, including the coverage and security of in situ and ex situ reserves.

d. Identify the priority needs for improving the conservation status of the most threatened and the most important (as identified under a. and b.) indigenous ecosystems, species and gene pools, including improving the coverage and security of in situ and ex situ reserves.

e. Identify the main obstacles to meeting those needs and the means to overcome them; and identify special opportunities for meeting those needs, particularly through intersectoral coordination and combining conservation and development.

2.03 The 42 documents reviewed for this report are categorized as follows (Appendixes 1 and 2):

10 draft (category 2) or final (category 3) governmental or governmentally endorsed CSs

Zambia NCS
Zimbabwe NCS
Madagascar NCS
Malaysia--Perlis SNCS
Malaysia--Sarawak SNCS
Thailand Policy Guidelines
Vietnam NCS
Australia NCS
Australia--Victoria SNCS
New Zealand NCS

7 nongovernmental CSs or equivalent substantial nongovernmental responses (category 1.B)

South Africa CS
Malaysia--Kedah SNCS
Malaysia--Melaka SNCS
Malaysia--Negeri Sembilan SNCS
Malaysia--Trengganu SNCS
Philippines NCS
United Kingdom Conservation and Development Programme

24 preliminary documents (category 1.A), of which 17 are project proposals or prospectuses

Guinea-Bissau, Ivory Coast, Senegal, Sierra Leone, Togo, Uganda, Botswana, Seychelles, Bangladesh, Nepal, Pakistan, Canada--Alberta, Belize (x2), Fiji (x2), Jordan

and 7 are assessments or reviews

Zaire, Malawi, Sri Lanka, Indonesia--Irian Jaya, Canada, Spain, Netherlands

1 other document

US Strategy on the Conservation of BD

All documents were reviewed for general coverage of BD. The 17 project proposals or prospectuses were not analyzed further, because they could not be expected to do the job of the strategies they were proposing. The remaining preliminary documents are included in the analysis where relevant.

Coverage

2.04 Conservation strategies should cover BD at all three levels (ecosystem, species and gene) and, at the gene level, should cover domesticated as well as wild populations, Fourteen of the documents do this (Guinea-Bissau, Uganda, Zimbabwe, Nepal, Vietnam, Malaysia--Sarawak, Canada--Alberta, Canada, USA, Belize, Australia, Australia--Victoria, New Zealand, United Kingdom). Others leave out ecosystem diversity (Sierra Leone, Zambia) or genetic diversity (Zaire, South Africa, Pakistan, Indonesia--Irian Jaya, Thailand, Spain); or include genetic diversity but neglect either domesticated genetic resources (Senegal, Malawi, Philippines) or wild genetic resources (Madagascar, Netherlands). A few leave out two of the levels (usually ecosystem and gene) or do not cover BD at all (Ivory Coast, Togo, Botswana, Seychelles, Bangladesh, Jordan). Species diversity is included in almost all of the documents.

2.05 Many of the documents that touch on every aspect (or almost every aspect) of BD do no more than that, treating the subject very sketchily. Table 2 shows the results of analysis of the coverage of the socioeconomic contributions of BD by 16 CS documents (21 documents were analyzed, but Sarawak is treated as representative of the six Malaysian SNCSs, although it is more comprehensive and more detailed). If a contribution is quantified for at least one sector, then the country is entered in capitals (e.g. THAILAND). If there is no quantified account for any sector, but at least one quantified example is given from the country concerned, then the country is entered in upper and lower case underlined (e.g. Vietnam). If examples are given from the country concerned but they are unquantified, then the country is entered in upper and lower case without underlining (e.g. Malawi). If the only example is from some other country, then the country is entered in parentheses [e.g. (United Kingdom)]. (A box with a

cross in it means that the level of biotic organization concerned [ecosystem, species, or gene] does not supply that particular contribution. An empty box means that no country has covered that particular contribution.)

2.06 The following conclusions may be drawn from this table:

a. No CS provides a comprehensive description of the socioeconomic contributions of BD to the country concerned.

b. Only four documents (Zambia, Zimbabwe, Thailand, United Kingdom) provide a quantified account of the contributions of BD to at least one sector. None does for all relevant sectors (agriculture, forestry, fisheries, rural development, health, tourism)--in fact, only tourism is covered.

c. Only four documents (Malaysia--Sarawak, Australia--Victoria, New Zealand, United Kingdom) provide even one example of the contributions of ecosystem diversity, species diversity, and genetic diversity.

d. Seven of the documents do not provide even one specific example of a contribution of BD to the country concerned, being limited to such observations as "genetic resources are important for crop improvement".

2.07 Table 2 also shows that the CS documents are better at covering the socioeconomic contributions of ecological processes and harvested resources. Five CSs give quantified accounts of the contributions of ecological processes to at least one sector; and nine documents do so with respect to harvested resources. The number of documents providing no example of a contribution drops to six for ecological processes and to four for harvested resources. Even so, not a single CS provides a comprehensive--let alone a systematic (sector-by-sector)--presentation of the contributions of ecological processes and harvested resources to the country concerned. Only one CS (Malaysia--Sarawak) gives an example of animal pollination of crops (hence its solitary place in the ECOLOGICAL SERVICES/SPECIES box).

Relationship between development and biological diversity

2.08 Trends in the socioeconomic contributions of BD, ecological processes and harvested resources (including the assumptions of development plans) are considered hardly at all. By contrast there is heavy emphasis on the

SOCIOECONOMIC CONTRIBUTIONS	ECOSYSTEMS	SPECIES	WILD GENE POOLS	DOMESTICATED GENE POOLS
BIOLOGICAL DIVERSITY				
Improvement of established domesticates			(Malaysia-- Sarawak) Australia-- Victoria (United Kingdom)	New Zealand (United Kingdom)
New domesticates		New Zealand (United Kingdom) (Indonesia-- Irian Jaya)	New Zealand	
Nonconsumptive recreation & tourism	THAILAND Australia-- Victoria UNITED KINGDOM	ZAMBIA ZIMBABWE Australia-- Victoria Malawi		
Cultural heritage	Malaysia-- Sarawak New Zealand United Kingdom	Malaysia-- Sarawak New Zealand Malawi		Malaysia-- Sarawak
Research & education	Malaysia-- Sarawak New Zealand	Malaysia-- Sarawak (United Kingdom)		
ECOLOGICAL SERVICES	ZAMBIA ZIMBABWE MADAGASCAR MALAYSIA-- SARAWAK Thailand Vietnam Australia-- Victoria NEW ZEALAND United Kingdom Malawi	Malaysia-- Sarawak		
HARVESTED RESOURCES	Zambia ZIMBABWE Madagascar Australia-- Victoria MALAWI	ZAMBIA ZIMBABWE Madagascar MALAYSIA-- SARAWAK THAILAND VIETNAM AUSTRALIA-- VICTORIA New Zealand PHILIPPINES UNITED KINGDOM MALAWI Indonesia-- Irian Jaya		

Table 2. Coverage of socioeconomic contributions of biological diversity, ecological services and harvested resources by 16 conservation strategy documents (Zambia NCS, Zimbabwe NCS, Madagascar NCS, Malaysia--Sarawak SNCS*, Thailand Policy Guidelines, Vietnam NCS, Australia NCS, Australia--Victoria SNCS, New Zealand NCS, South Africa CS, Philippines NCS, United Kingdom Conservation and Development Programme, Malawi Environmental Effects of Development Report, Indonesia--Irian Jaya CS, Canada Northern CS, Spain CS).

Contributions of biological diversity are divided into five groups (as described in the text): improvement of established domesticates; new domesticates; nonconsumptive recreation and tourism; cultural heritage; research and education.

Key

Country in capitals, e.g. THAILAND	= quantified data supplied for at least one entire sector (e.g. monetary value of wildlife-based tourism)
Country in upper & lower case underlined, e.g. Vietnam	= quantified example given (e.g. monetary value of visits to a particular park) from the country concerned
Country in upper & lower case without underlining, e.g. Malawi	= unquantified example given from the country concerned
Country in parentheses, e.g. (United Kingdom)	= examples are from other countries only
A box with a cross in it, X	= not applicable

* Note: The five other Malaysian SNCSs were also analyzed for their coverage of the socioeconomic contributions of conservation but, to save space, have not been included in the table. Their coverage is less than that of the Sarawak SNCS.

See text for further explanation.

impacts of development on conservation, particularly in the sector-by-sector reviews. The authors of the documents appear to have assumed that the goods and services secured by biological conservation are so widely understood and appreciated that they require little more than a mention in passing. The damage done by development to BD (and to ecological processes and harvested resources) is usually discussed in detail. It is of course essential to describe the main problems affecting conservation; but when conservation's contributions to development are not as clearly or fully described any prejudice that conservation considerations are encumbrances on development is reinforced. The contributions of ecosystems, species and gene pools to each sector should be described as concretely and precisely as possible. Without an adequate presentation of these contributions it is not possible to assess the importance of the problems or to determine the priority actions. The measures proposed to maintain BD (a) may not address those ecosystems, species or gene pools of highest priority for development (or other social objectives); or (b) may not be taken because their relevance to development objectives has not been explained.

The importance of making a better case for biological diversity

2.09 The WCS stresses the educational function of NCSs and SNCSs (WCS 8.10) and calls for "well documented accounts of the extent and manner in which societies...depend on the achievement of each of the three objectives of conservation" (WCS 13.9). The importance of seizing the educational opportunity of a CS is confirmed by a public opinion poll undertaken for the United Kingdom Conservation and Development Pogramme: "...the proportion of people polled who put anxiety about pollution and resource-depletion at the top of their priorities almost doubled (to 25 per cent and 16 per cent respectively) when asked questions about their daily lives as opposed to problems of Britain or the world in general...[providing] evidence that many people's level of concern with the issues is substantially raised when they are provided with the facts in ways which relate them to their daily lives" (Johnson 1983).

2.10 It is part of the job of a CS to convey the information necessary to win support for the actions that the CS recommends. Protection of the last remaining tracts of flatland Mixed Dipterocarp Forest (MDF) in Malaysia exemplifies this need, a need unmet by the Malaysian SNCSs. Flatland MDF is lowland MDF below the hill foot boundary*. Maintenance of viable samples of this ecosystem is the acid test of the effectiveness of Southeast Asian BD conservation in general and conservation strategies in particular. Flatland MDF is floristically and faunistically the richest of Malaysia's terrestrial habitats. Among birds, a significant number of species fail to cross the hill foot boundary "and others are lost progressively with ascending altitude above it. Furthermore, there is evidence...that many of the bird species that are found above the hill-foot junction are only able to maintain their presence there by recruitment from the adjoining flat land... In otherwords, the ecotone [boundary] is even more marked than the actual presence or absence of species would indicate. This has conservation implications insofar as it shows that protected sloping land cannot maintain its faunal diversity in the absence of adjacent protected flat land..." (Malaysia--Sarawak SNCS 4.1.4). Virtually all of the flatland MDF in Malaysia is slated for development (D.R. Wells A3-5). "Since flatland MDF is most attractive to both the timber industry and large-scale agricultural projects (because of its high yield and relative ease of access), the inclusion of these areas into the TPA [totally protected area] system is accorded the lowest priority", land for the TPA system usually being selected after other land-users have rejected it (Malaysia--Sarawak SNCS 4.7.2). Flatland MDF is thus both the richest and the most endangered terrestrial habitat in Malaysia.

2.11 The Malaysia--Sarawak SNCS states that it is "essential that adequate examples of such areas [flatland MDF] are preserved within the TPA system" (4.7.2); but it does not explain why. Instead it observes: "The conservation of lowland and flatland MDF under the TPA system should not be

---

*Note: The hill foot boundary (or hill foot break) is the basal junction of the hill slope with level land. In Malaysia it generally occurs between 60m and 150m above sea level.

seen as non-development but rather as an investment in the range of resource use options it offers for present and future use" (Recommendation 4.7.2). What does this mean? Given the rapid disappearance of flatland MDF, major resource uses that are presumably ruled out for ever are logging and conversion to agriculture. The resource use options are restricted to those that are compatible with maintaining the species and genetic diversity of flatland MDF: use of germplasm for the development and improvement of domesticates; nonconsumptive recreation and tourism; research* and education; and heritage values. These potential uses should be described as persuasively as possible. If they were self-evident or had wide political and popular understanding and support, then flatland MDF would not be as endangered as it is. The Malaysia--Sarawak SNCS is singled out here because it is one of the better CSs in its treatment of BD.

Treatment of conservation status and priority needs

2.12 Table 3 summarizes the results of an analysis of the treatment of BD conservation status and priority needs by 16 CS documents. Assessment of the conservation status of ecosystems is considered adequate if the main representative and unique ecosystem types are identified and their status is briefly reviewed. Six documents do this. The Vietnam NCS identifies the main ecosystems (forest types, etc.) but does not then consider their status (although there is a general account of deforestation). Assessment of the conservation status of species is considered adequate if there is a review of the country's endemic and threatened species, including discussion of the main threats and consideration of the species, groups or areas where problems are most severe or urgent. Six of the documents provide this. Some of the others cover only a few species: the Zambia NCS mentions

---

*Note: Two flatland MDF Forest Reserves of identified value for research are Pasoh and Sungai Menyala in Negeri Sembilan, peninsular Malaysia. Although their primary forest area is very small (only about 670 ha), the two reserves are scientifically important as the sites of IBP and MAB research on the genecology and reproductive biology of tropical trees. Pasoh is particularly valuable as a baseline reference site because of the intensive research done there (Malaysia--Negeri Sembilan SNCS). Incidentally, these are the only paragraphs in all six Malaysian SNCSs--in fact in all CSs examined --where an example is given of what is meant by scientific importance (and even then "baseline reference site" is not explained).

COUNTRY	ECOSYSTEMS		SPECIES		GENE POOLS		COVERAGE & SECURITY OF RESERVES IN SITU		EX SITU	
	STATUS	NEEDS	STATUS	NEEDS	STATUS	NEEDS	STATUS	NEEDS	STATUS	NEEDS
Zambia	no	limited	limited	yes	no	no	no	yes in part	no	no
Zimbabwe	no	no	no	no	no	no	no	no	no	no
Madagascar	no	no	no	no	no	limited	no	no	no	no
Malaysia--Sarawak	yes	yes	yes	yes	no	limited	yes	yes	no	no
Thailand	yes	yes	yes	yes	no	no	yes	yes	no	no
Viet Nam	only in general terms	yes but sketchy	yes	yes but sketchy	no	no	yes	yes	no	no
Australia	no	no	no	no	no	no	no	no	no	no
Australia--Victoria	no	yes	only in general terms	yes	no	yes	only in general terms	yes	only in general terms	yes
New Zealand	yes	yes	yes	yes but sketchy	no	no	yes	only in general terms	no	no
South Africa	yes	no	yes	no	no	no	yes	yes but sketchy	no	no
Philippines	no	only in general terms	no	only in general terms	no	very sketchy	very sketchy	only in general terms	no	no
United Kingdom	yes	yes	yes but sketchy	only in general terms	no	no	yes	yes	no	no
Malawi	no	no	some	some	no	no	yes	yes	no	no
Indonesia--Irian Jaya	yes	yes	yes	yes	no	no	yes	yes	no	no
Canada	no	no	no	no	no	no	no	no	no	no
Spain	no	no	no	no	no	no	no	no	no	no

Table 3. Extent to which 16 conservation strategy documents assess the conservation status of indigenous ecosystems, species and gene pools and the coverage and security of in situ and ex situ reserves (STATUS columns) and identify the priority needs for improving conservation status, coverage and security (NEEDS columns).

Key

no = not done
yes = adequately or well done

See text for further explanation.

only elephants, rhinoceros, and mungongo nut. Assessment of the conservation status of gene pools is considered adequate if the state of knowledge of genetic erosion of crops and livestock (depletions and losses of cultivars and breeds and of native wild relatives of domesticates) is summarized. No document does this. Assessment of the coverage and security of in situ reserves should show the extent to which these ecosystems, species and wild gene pools are represented in the country's system of reserves and the security of their protection (in terms of the adequacy of size and distribution of the reserves and their security from external pressures, such as poaching, hydrological changes, declassification, etc.). Eight of the documents do this. Assessment of the coverage and security of ex situ reserves should identify the main ex situ conservation facilities (seedstores, zoos, botanical gardens, etc.), consider the extent to which the country's germplasm reserves meet national needs and international responsibilities, and discuss the role of zoos and botanical gardens in providing support and rescue services for the country's in situ reserves. None of the documents does this.

2.13 Identification of the priority needs for improving the conservation status of ecosystems, species and gene pools and the coverage and security of in situ and ex situ reserves is self-explanatory. It is one of the main functions of a CS--so it is disconcerting to find that five of the documents do this hardly or not at all; and that no document provides across-the-board treatment of the priority needs of BD conservation.

Genetic resources

2.14 As shown in Tables 2 and 3, the conservation of genetic diversity (in contrast to that of ecosystem and species diversity) is almost completely neglected by the CSs examined. The WCS pays particular attention to the need to "preserve as many varieties as possible of domesticated and other economic or useful plants, animals and microorganisms and their wild relatives", both ex situ and in situ (WCS 6.4-7 & 17.1-5). But apart from mentions in the Madagascar, Malaysia--Sarawak and Philippines strategies, this reommendation is ignored in all documents except the Australia--Victoria SNCS.

2.15 The WCS followed the Action Pan of the UN Conference on the Human Environment (United Nations 1973) in combining the conservation concerns of all living resource sectors (agriculture, forestry, fisheries, wildlife, tourism, health, rural development) in a common approach. The resource maintenance needs of these sectors overlap, as do the requirements for conservation of ecosystem diversity, species diversity, and genetic diversity. Accordingly, the effectiveness of conservation efforts can be greatly enhanced by combining them whenever appropriate. Conservation of the wild genetic resources required for improving agricultural, silvicultural and aquacultural production is economically the most significant area in which the interests of agriculture, forestry and fisheries merge with each other and with other sectors, including nature conservation. Consequently, treatment of genetic resources is a good test of the extent to which the cross-sectoral approach to conservation promoted by the Stockholm Conference and the WCS has been adopted. The evidence of the first generation of NCSs and SNCSs is: hardly at all.

Treatment of obstacles and opportunities

2.16 The general lack of a systematic (sector-by-sector) presentation of the contributions of the three components of conservation to development, and of an adequate assessment of the status and priority needs for conservation of ecosystems, species and gene pools, makes it very difficult to identify the main obstacles and opportunities and the best ways of responding to them. Specific proposals for combining conservation and development, for combining measures to maintain BD with measures to maintain ecological processes and harvested resources, and for jointly meeting the conservation requirements of different sectors, are rare.

2.17 Some of the documents consider the obstacles to conservation in detail--notably Zambia, Australia--Victoria, New Zealand, and United Kingdom. The best of these is the Zambia NCS, because it is the only strategy to follow its sectoral analysis with an integrated (intersectoral) discussion of what should be done. The sectoral reviews of the Australia--Victoria SNCS are well organized (description of main issues; policy objectives; long term directions; immediate actions); but the action recommendations are no-

where brought together to see where there are conflicts and compatibilities and what should be done about them*. The New Zealand NCS achieves a certain amount of integration in the section on legislation and organization, but it is not evident that the proposed actions are the most appropriate response to conservation/development problems (largely due to somewhat general treatment of conservation contributions, status and needs). The United Kingdom document deals at length with many obstacles to conservation, and although some of the linkages among the chapters are identified, they are not explored. There are frequent references to the WCS but scant consideration of its main recommendations--e.g. concerning the priority requirements for achieving conservation, functions of a CS, or the need for ecosystem evaluations.

2.18 The other documents provide little analysis of obstacles and opportunities. The Zimbabwe NCS describes conservation problems only in general terms. The Madagascar NCS, Thailand Policy Guidelines, and Vietnam NCS mention a number of obstacles but do not treat them in depth. The Madagascar NCS document could itself have helped to overcome two of the obstacles it lists--difficulties in getting the message across; and risk of appearing to perpetuate the opposition of conservation and development--if it had included a thorough treatment of the benefits of conservation and specific consideration of ways of combining conservation and development. The Thailand Policy Guidelines note such obstacles as encroachment on reserves, poaching, and lack of enforcement of legislation, and emphasize the need for enforcement and education. Little attention is paid to ways of redirecting development or of combining the interests of different sectors. The Vietnam NCS proposes a National Board for Environmental Coordination to promote intersectoral coordination and implementation of the NCS. This recommendation is supported by a useful table showing intersectoral linkages, which could have formed the basis of an analysis of the effect of cross-sectoral problems on conservation and development. Without such an analysis, and without careful definition of the role and functions of the

---

*Note: The Australia--Victoria SNCS follows the WCS in calling for anticipatory environmental policies and a cross-sectoral conservation policy but does not show the need for them or illustrate how they would work--e.g. by identifying conflicts and compatibilities among the sectoral recommendations, and suggesting how such policies might deal with them.

Board, it is not clear that the Board would be the most effective way of getting coordination where it is most needed*. For example, coordination of planning is assigned to the existing State Committee for Planning "and more specifically" to the National Board for Environmental Coordination--but the NCS does not discuss which body should do what.

Intersectoral linkages

2.19 A surprising feature of all NCSs and SNCSs is their highly sectoral nature. The Vietnam NCS is the only strategy that tries explicitly to show intersectoral linkages. Although they generally conclude with proposals for cross-sectoral measures and institutions, and despite their emphasis on the necessity of a cross-sectoral approach, most of the documents restrict discussion of BD to a section on wildlife and protected areas--which in turn is treated as a sector apart from other sectors (such as agriculture or forestry). Two consequences of this are:

a. The actual and potential contributions of BD to other sectors (notably agriculture, forestry, fisheries and aquaculture, rural development, health, tourism) are not made clear or are overlooked altogether.

b. The relationships among sectors--whether and how their development objectives and conservation needs conflict or are compatible--are not described. Hence the need for cross-sectoral action is not demonstrated effectively, and there is insufficient basis for determining what cross-sectoral measures should have priority.

The sector-by-sector review that is the body of most NCSs and SNCSs is an indispensable part of a strategy, because most users of the strategy will be concerned primarily with their own sector. However, it can and should be designed to increase the user's awareness of (1) the contributions of conservation to the sector's objectives; (2) interactions with other sectors.

---

*Note: Several other CSs also propose the establishment of coordinating and/or planning bodies without supporting the proposal with analysis of the country's institutional needs.

2.20 Sectoralism occurs within sectors as well as among them. Several strategies discuss agricultural conservation, for example, almost entirely in terms of the ecological processes that conserve soil and water. The contributions of BD are not mentioned. This is partly because the representatives of the agricultural sector most involved in the strategy have come from the soil conservation side, with insufficient involvement of other divisions such as plant and animal breeding. It is also because, even when all divisions of the sector are involved, their representatives have not been trained to consider the actual and potential contributions of BD to their objectives. Thus a representative of the plant breeding division will not necessarily consider the need to conserve wild plant gene pools for their potential contribution to crop improvement; and someone concerned with developing new farmland will not necessarily be aware of the need to reserve viable samples of the ecosystems concerned as reference sites.

Conclusion

2.21 The concern expressed by Bramble (1985) (paragraph 1.02) is justified. None of the CS documents reviewed covers the socioeconomic contributions, status and priority needs of BD conservation comprehensively. But the problem is greater than Bramble's criticism implies. The documents that provide adequate coverage of ecosystem and species diversity neglect genetic diversity and also neglect the issues and measures that are the hallmark of the WCS approach: intersectoral cooperation and integration of conservation and development. An extreme example of this neglect is the Indonesia--Irian Jaya document, which is called "a strategy for rational resource utilization" but is nothing of the sort (it is a conventional descriptive plan for the protection of species and ecosystems). Several of the other documents are so lacking in detailed analysis or in justification and explanation of recommendations as to be essentially framework documents or sets of policy principles, not full CSs as envisaged by the WCS: Zimbabwe, Madagascar, Australia, South Africa, Philippines, Canada, Spain.

2.22 None of the documents includes an assessment of the socioeconomic contributions of the three components of conservation. Perhaps this is due

to the fact the neither the WCS nor National conservation strategies: a framework for sustainable development (IUCN CDC 1984)--hereinafter referred to as NCS framework--calls for one. But the WCS does make it clear that CSs should cover the status and needs of each of the three components of conservation; and both documents emphasize the importance of identifying priorities, dealing with obstacles to meeting these priorities, cross-sectoral matters, and integration of conservation and development. Yet several of the CS documents cover status and needs superficially, incompletely, or both; and many fall down completely when it comes to synthesis, cross-sectoral coordination, etc.--the very features that distinguish a strategy from a conventional plan or programme. Integration of conservation and development is treated rather trivially (almost as if the phrase were just a slogan), as a matter of regulating development projects or of adding a conservation officer to a planning agency, rather than of adopting policies and practices that would enable the achievement of development and conservation at the same time.

2.23 The ideal first generation CS would have been a document with the best features of the Zambia NCS, Malaysia--Sarawak SNCS, Vietnam NCS, and Australia--Victoria SNCS, together with an assessment of the socio-economic contributions of BD. The strength of the Zambia NCS is its treatment of obstacles to conservation and how to overcome them: notably its proposals concerning the need for an integrated extension service, local involvement in wildlife projects, increasing the economic return from wildlife and combining it with conservation (trading policy on ivory, changes to National Parks and Wildlife Act), use of land capability assessment to avoid conflicts between wildlife conservation and other living resource sectors, and identification of the Luangwa Integrated Resource Development Project as a pilot of the strategy's principles. Its weakness is its very limited treatment of the benefits, status and priority needs of BD conservation. The strength of the Malaysia--Sarawak SNCS is its excellent coverage of status and needs of ecosystem and species conservation. Its weakness is its lack of attention to planning, use allocation, sectoral coordination, and integration of conservation and development. The nearest that it gets to considering these issues is in paragraphs on BD conservation and rural development (2.6.13; 2.9.3-2.9.8; 2.11.2-2.11.4; 4.2.1-

4.2.7; 4.4.8; 4.9.1-4.9.3; 5.3.27-5.3.28; 6.2.2.-6.2.10)--a great advance on the other Malaysian SNCSs, but the discussion is not pulled together. The strength of the Vietnam NCS is the start it makes in identifying intersectoral linkages; a weakness is that it does not examine these linkages. (The strengths and weaknesses of the Australia--Victoria SNCS are mentioned in paragraph 2.17.)

Obstacles to providing for biological diversity

2.24 The main obstacles to providing comprehensively for BD in CSs appear to have been:

a. Lack of experience with CSs.

b. Lack of communication among stategists.

c. Lack of awareness of the socioeconomic contributions of BD.

d. Lack of data on BD.

Lack of experience with CSs

2.25 The people who have produced the first NCSs and SNCSs are pioneers--the first conservation strategists. Their only guidance has been the WCS, NCS framework, and experience with natural resource management plans and conservation action plans. The recommendations on preparing CSs in section 8 of the WCS were soon realized to be inadequate; and NCS framework was prepared to bridge the gap between the WCS and people faced with the practical problems of undertaking an NCS. However, NCS framework concentrates on the process of preparing a CS, providing little additional guidance on the content of a CS. On matters of content the first generation CSs have tended to follow either natural resource management plans (plans for each of the main living resource sectors that although combined in one report are not otherwise integrated--the Thailand and Malawi documents are examples) or conservation action plans (plans for the formation of a network of protected areas and for the other technical actions to conserve ecosystem and species diversity--the Malaysia SNCSs are examples). Neither type of plan is a suitable model, because CSs are

intended to go beyond such plans to show: the priority technical actions (= "requirements" of the WCS); the measures required to assure the success of such actions; how the interests of different sectors can be combined; trade-offs between one sector and another and among priority actions; and so on. In addition, the process of preparing a CS, including the information it assembles on conservation benefits and needs, should be designed to facilitate the recommended actions by building public and political support for them.

2.26 Lack of experience has led to serious underestimates of the scope and complexity of CSs and hence of the time required to prepare them. The Zambia NCS was completed in seven months. As the IUCN CDC advisor to the Zambia NCS has acknowledged, this is far too short a time: "lack of time and resources has meant that many opportunities for more detailed analysis have been missed--and these would have resulted in a more effective Strategy..." (Bass 1986). Much of the available data needed to build a convincing case for maintenance of BD is time consuming to obtain, especially in developing countries. Lack of time was one reason why there is a little information on BD in the Zambia NCS (S.M.J. Bass A3-1) and why conservation of wild and domesticated gene pools is not covered in the Malaysian SNCSs (M. Kavanagh A3-4) (for another reason, see paragraph 2.28). Experience has shown that it takes two years to prepare a CS. People who have tried to do a CS in less time have overlooked the facts that a lot of information has to be assembled, much of which is scattered and reported only in the gray literature (files and other unpublished papers) and is time consuming to retrieve; synthesis and integration, and consideration of priorities and trade-offs, also demand a good deal of time for reflection and discussion; and time is required to reach agreement among the various sectors and interest groups involved.

Lack of communication among strategists

2.27 It so happens that it took two years to prepare the WCS; and the lessons learned in preparing the WCS might have been helpful to people preparing NCSs and SNCSs. However, there was no transfer of experience from me, as the individual responsible for preparing the WCS, to CDC

(none was sought). This is no longer necessary because the experience of the past six years with NCSs and SNCSs is more directly relevant; but it might have been helpful for the first generation CSs. In addition, there appears to have been little communication among the persons involved in preparing the various NCSs and SNCSs. Some of the people visited for this report (S.M.J. Bass A3-1; J.A. Pile A3-2; G. Child A3-2; M. Kavanagh A3-4; L. Chan A3-4) remarked on the value of being able to discuss both the approach and the details of their strategies with someone having a different perspective but similar experience and concerns. This suggests to me that IUCN, WWF and the UN partners in the WCS should specifically provide for informal review missions, so that (if they wished) the preparers of an NCS or SNCS could be visited by a one- or two- person team from some other CS to review the draft document, discuss options, and provide alternative points of view. At the same time, CS teams should allow time for consultation with colleagues in other countries.

2.28 Australia sought and received outside advice during the preparation of its NCS. Alberta in turn has benefitted from the Australia--Victoria SNCS. WWF Malaysia asked for technical and financial assistance from IUCN and WWF International (in 1982), but was turned down on the grounds of lack of government involvement in the SNCSs (K. Scriven & M. Kavanagh A3-4). Had assistance been given, the scope of the Malaysian SNCSs might have been widened and the strategic components now missing from them could have been included. There may have been other exchanges (or attempted exchanges) of substantive advice between one CS team and another, but there is no evidence of this in the documents. On the contrary, there is evidence of misinterpretation of the WCS that could have been avoided had the strategists concerned been less isolated. The United Kingdom Conservation and Development Programme, for example, asserts that the "systematic approach to conservation" advocated by the WCS is more appropriate for developing countries than for developed countries (p284)--an assertion belied by the problems the UK document describes.

Lack of awareness of the socioeconomic contributions of BD

2.29 Preparers of CS documents seem to have been unaware of the importance of one or more of ecosystem, species or genetic diversity, or of the relevance of their conservation for social and economic goals. Problems of relating BD conservation to development include: the perception that BD contributes little to development; the indirect nature of certain contributions of BD; and underuse of native BD.

2.30 The perception that BD contributes little to development. This remains a significant obstacle to adequate treatment of the subject in NCSs and SNCSs. The fact of the matter is that the conservation contributions that generally carry most weight with senior government officials and other influential individuals are those made by ecological processes and harvested resources. Countries living with the stark and costly realities of massive soil erosion and cycles of flood and drought can relate easily to the benefits of soil protection and water control; and countries short of food, fuel and foreign exchange readily understand the commercial and subsistence contributions of harvested resources. Except for the money earned from tourism, the economic benefits of maintaining BD, although they can be substantial, require explanation and interpretation. This is an important consideration during the preliminary phase of a strategy, when its preparation is being negotiated. But it should not be a factor during the main phase, once the decision to go ahead with the strategy has been made and the text is being prepared. An NCS or SNCS provides an unrivalled opportunity for educating all sectors of society about how they benefit from BD and what it takes to secure those benefits. A strategy provides the forum for whatever explanation and interpretation is needed.

2.31 The indirect nature of certain contributions of BD. Most of the genetic resources used in any given country come from somewhere else. It follows that most of the benefit from conserving native gene pools (both domesticated and wild) will be obtained by countries other than the one conserving them. The development benefit to the country doing the conserving is indirect, derived from its participation in the global system of germplasm maintenance and exchange. Brazil's wild Manihot raises cassava

yields in Africa, and in exchange the African forage species, Neonotonia wightii, increases Brazil's cattle production. Tunisia's wild Medicago species improve pastures in Australia, while eucalypts from Australia raise Tunisia's timber yields. Wild Saccharum from Southeast Asia provides South America with vigorous, disease-resistant sugarcane, and South American Hevea and Theobroma species provide genetic resources for Southeast Asia's rubber and cocoa industries (Prescott-Allen & Prescott-Allen 1983). It is important to communicate this interdependence, otherwise it is easy for a government to feel that the costs of conserving native gene pools outweigh the benefits.

2.32 Similarly, conservation of ecosystems, species and gene pools of national value (as reference sites, tourist attractions or genetic resources) may impose costs on local communities by limiting access to resources. Again it is important that people be made aware of the larger picture. However, this will seldom be enough, particularly when loss of the resource causes economic hardship. In such cases it is vital to provide compensatory development benefits (for example, a share in receipts from tourism, or assistance in the development of a rural industry). The options should be explored with the community itself, since it will know best what compensation it prefers.

2.33 Underuse of BD. Extolling the contributions of BD can take on an air of unreality in many developing countries, where little use is made of native BD. Due to a lack of awareness, capital, scientific and technical expertise and entrepreneurial skills, tourism based on nonconsumptive enjoyment of wildlife and scenery is poorly developed, and there is little or no use of native species and gene pools for the development and improvement of crops and livestock. The potential is often great but is as yet unrealized. Fiji, for example, relies on sun, sea, sand and dutyfree shopping to attract and entertain tourists, neglecting the exceptional attractions of its plant and animal diversity. Silviculture in Zimbabwe and Madagascar and pasture improvement in Botswana are based on exotic species, ignoring native species on the assumption that they are uniformly slow growing or otherwise poorly adapted for intensive use (although rural users of the resources often prefer certain native species; and provenance

trials might reveal differences in growth rate among different populations and individuals of these species that would be worth exploiting). Aquaculture in Zambia is being developed with native species but with essentially no attempt at testing the merits of different species and populations, despite substantial interspecific and intraspecific variation (E. Cayron A3-1). Under the circumstances, claims about the value of BD quickly lose credibility. It is important that strategies identify not only conservation needs but also realistic development potentials, showing how the economic benefit from maintaining species and genetic diversity could be increased.

2.34 Lack of data on BD. Lack of data is a major obstacle to conservation and sustainable development and is one of the priority concerns of many NCSs and SNCSs. The Zambian NCS, for example, lists as many as eight types of basic inventory data as being urgently required (land capability data; land use data; identification of areas of worst soil erosion; identification of areas of worst deforestation and overgrazing; inventory of the ecological conditions of protected areas; inventory of areas of high ecological value but not yet protected; inventory of fish stocks; inventory of water resources in areas suffering water supply problems). In Botswana, data are inadequate on range composition and productivity and on animal migration patterns (H.J. Cooke A3-3; R. Kwarepe A3-2). In Nepal the effects of irrigation and hydropower proposals on aquatic plants and animals cannot be assessed because there is no inventory of the major river systems (K.G. Rajbanshi A3-3). There is also a lack of data on the biological composition of aquatic habitats in Sarawak and there is no comprehensive list of the state's aquatic fauna and flora (Malaysia--Sarawak SNCS). This lack of data applies to ecological processes and harvested resources, as well as to BD.

2.35 As noted in paragraph 2.26, many of the data that are available are scattered and difficult to retrieve. They are in reports, files, books, papers, and foreign research establishments. Many foreign researchers still fail to submit all reports to host governments and institutions. Even when bibliographies have been prepared on some of the topics to be covered, the documents still have to be found and the data extracted from them. As one IUCN reviewer of a draft of this report observed, these problems can

be overcome by making data collection a higher priority in the CS process and allocating sufficient time and resources to it. But the problem of outright lack of data remains real, and soon becomes evident whenever an attempt is made to produce a CS using the WCS approach. The same IUCN reviewer commented: "consultants working on NCSs frequently lack biological background and so consider data on BD to be lacking when they don't know where to look"; and "...most of the data [mentioned as lacking in paragraph 2.34] are only indirectly related to BD. In fact there is [sic] plenty of data on BD in Zambia but nobody looked for it". These remarks indicate a lack of understanding of the information needs of an effective CS, and of the difficulty of meeting them in a developing country.

2.36 In Southern Africa (Botswana, Zambia, Zimbabwe) the available data (e.g. on vegetation and floristics) are good enough for paper assessments of how well represented the main biotic regions are in national parks and nature reserves (e.g. Huntley 1978; Lamprey 1975). But they are not adequate for assessing the current "real world" (as opposed to theoretical) coverage and security of the reserves, and hence whether or not they are indeed maintaining the ecosystems and species they are supposed to. The Zambezi Teak Forest (ZTF) is an endangered ecosystem, regarded as the top conservation priority by the Zambia Forest Department (Piearce 1986). Recognized by Lamprey (1975) as a subtype of the dry deciduous forest biome, its protection status was regarded by him, and by Huntley (1978), as secure, being protected in Chobe NP (Botswana), Sioma Ngwezi NP and Liuwa Plain NP (Zambia), Wankie NP (Zimbabwe), and Bicuari NP and Mupa NP (Angola). However, the ZTF is now being destroyed throughout the region. There are people living in Liuwa Plain NP (they were there before the NP was established and it is politically impossible to remove them) (H. Chabwela A3-1); and 3,000 people are living in Sioma Ngwezi NP (Wood 1986). Zambia's Department of National Parks and Wildlife has not assessed the representativeness of national parks (it would like to), and so does not know what in practice the NPs are protecting (H. Chabwela & F. Lungu A3-1). According to Prof. G.W. Howard, Professor of Zoology at the University of Zambia (and presumably a biologist): "In most cases the real nature and extent of the wildlife resources...are not adequately known... basic data are not available to provide the basis of decision

about utilization...there is a pressing need for a series of inventories, censuses and assessments to be made of all the wildlife areas and resources..." Aerial surveys are desperately needed to assess the animal populations of Zambia's natural areas, as are more detailed ground surveys of animal and plant populations (G.W. Howard A3-1).

2.37 The other data reported as lacking by the Zambia NCS are needed to work out practical ways of combining BD maintenance with relief of the most pressing environment-development problems (such as heavy overgrazing and excessive clearing of woodland) and projects to achieve near term to medium term economic development. Without such data, a CS's consideration of ways of coordinating sectors and integrating conservation and development is likely to be theoretical and superficial.

Recommendations to IUCN and its WCS partners (UNEP, WWF, FAO, Unesco)

2.38 The main problems with the current generation of CS documents (paragraphs 2.16-2.28) go beyond their treatment of BD and so are not addressed in Part 3. The following recommendations propose actions by IUCN and its WCS partners to deal with these problems, and help NCSs and SNCSs realize the potential for achieving conservation and sustainable development envisaged by the WCS.

2.39 The two main features missing from the current generation of CSs are (a) assessment of the socioeconomic contributions of the three components of conservation (and in several cases of the status of ecosystems, species and gene pools, and the priority needs for their conservation); and (b) specific proposals for combining conservation and development, for combining measures to maintain BD with measures to maintain ecological processes and harvested resources, and for jointly meeting the conservation requirements of different sectors. IUCN and its WCS partners should encourage countries whose strategy documents are at an early enough stage to be modified to include these features. They should encourage those countries whose strategy documents have been completed, or are close to completion, to provide these two features as priority undertakings of the implementation of their CS. The results of the assessment could be

used in the further development of the CS. Formulation of specific proposals for integrating conservation and development, etc., could be achieved through preparation of a more detailed local or regional CS, covering an area that is a high priority for BD conservation (selected on the basis of assessment of status and needs).

2.40 A handbook should be produced on how to initiate, prepare and implement NCSs and SNCSs. The handbook should draw directly on the substantial body of experience that has been accumulated in 40 countries since the WCS was launched, including information provided at the Ottawa WCS Conference. It would be designed for use by current and future developers of CSs. At the Ottawa WCS Conference it was proposed that the handbook be issued as a supplement to National conservation strategies: a framework for sustainable development (NCS framework). I now believe that this would cause confusion and that instead the handbook should replace NCS framework. The guidance given by the handbook on a number of aspects is likely to depart from (if not contradict) NCS framework. For example, the latter's description of the purpose of an NCS (2.1) differs significantly from that of the WCS (8.1-2), lacking the emphasis on achieving conservation. NCS framework's advice on collection of information (2.5.1) would not produce the kind of information on ecological processes, BD, and harvested resources that would persuade decision makers of their importance or justify the actions a CS should recommend. Its advice on analysis of conservation and development interactions (2.5.2) mentions only "threats" and "problems", neglecting both the contributions of conservation to development and the ways in which development can enhance the achievement of conservation.

2.41 The handbook should be widely distributed. Several people commented at the Ottawa WCS Conference that they had not been aware of the existence of NCS framework. The handbook, like the WCS, should be treated as a promotional item and actively distributed (not just made available on request). The cost of doing this should be included in the budget.

2.42 The Ottawa WCS Conference recommended that IUCN should establish an informal network of people working on CSs for the quick exchange of experience and ideas. This would help reduce the isolation of NCS and SNCS teams, enable later strategies to build on the experience of earlier ones, and generate a wider range of ideas (an evolution of the WCS that would not have to wait for formal revision of the WCS document). Networks that are not self-maintaining do not work, so IUCN should not be held responsible for development of the WCS network. However, it could and should facilitate it by maintaining an up-to-date list of CSs in progress with names and addresses (and telephone and telex numbers) of contact points for each.

2.43 Promotion and support of NCSs and SNCSs should be integrated with the rest of the programmes of IUCN, UNEP, WWF, FAO, and Unesco. As far as possible, promotion and support of CSs should be concentrated in those countries where WWF and IUCN are spending most of their money and effort. By the same token, WWF and IUCN should channel most of their investment in species and habitat conservation into those countries that are demonstrating their commitment to conservation and sustainable development by undertaking NCSs or SNCSs. The same applies mutatis mutandis to the UN agencies. If this were done, then the two approaches to conservation--one conventional, focussing on field level support for species and ecosystem protection or for individual resource sectors (agriculture, forestry, fisheries); the other strategic--would reinforce each other. At present, they are not coordinated (a very poor advertisement for the principles of the WCS). Obviously there needs to be flexibility: opportunities for new CSs and for advancing conservation and sustainable development in other ways should be seized whenever they arise. But the principle of integration should be established, by committing a substantial percentage of programme budgets to supporting countries undertaking NCSs or SNCSs.

2.44 IUCN and its WCS partners should promote a wider understanding of conservation as defined in the WCS and of the strategic approach to achieving conservation and sustainable development by reserving the term "conservation strategy" for documents that (a) treat conservation at least as comprehensively as the WCS does, and (b) share a similar cross-sectoral approach to achieving conservation and integrating it with development.

3. OPTIONS AND APPROACHES TO PROVIDING FOR BIOLOGICAL DIVERSITY IN NATIONAL AND SUBNATIONAL CONSERVATION STRATEGIES

3.01 Please note: throughout this part the words "nation" and "country" mean any geographical area that is the subject of a conservation strategy (CS).

3.02 The following paragraphs outline a procedure for assessing the socio-economic contributions of BD; summarize the main points that should be covered in a review of the status and priority needs for conservation of ecosystem, species and genetic diversity; and describe some options and approaches to achieving intersectoral coordination and integration of conservation and development, with particular reference to maintenance of BD.

3.03 Other options and approaches are sure to be developed as more CSs become operational. As noted in paragraph 2.27, it is important that people working on NCSs and SNCSs allow time in their CS process to consult with selected colleagues elsewhere. They should consult at least twice: (a) when they are designing Phase 2 (Appendix 1 gives phase definitions); (b) during Phase 2, when the draft CS document is reviewed. This will enable them to benefit from the experience of other strategists at the times when they can make most use of outside advice. From Phases 1 through 3 strategists should participate in the WCS network, exchanging information and ideas, teaching as well learning. They should start forming the network themselves, and not wait for IUCN to do it (see paragraph 2.42).

3.04 Unless stated otherwise, the actions recommended here should be undertaken as part of Phase 2. It is assumed that Phase 2 will take two years. However, assessment of the socioeconomic contributions of conservation and a review of status and needs could be undertaken as part of Phase 1 to initiate a CS.

A procedure for identifying the socioeconomic contributions of BD

3.05 CSs should provide a clear account of the socioeconomic contributions of ecosystem diversity, species diversity and genetic diversity to the nation and to particular sectors and interest groups. This should be part of an assessment of the socioeconomic contributions of BD, ecological processes, and harvested resources. The purpose of this assessment is (a) to convince political leaders, local communities, and other concerned parties, of the importance of conservation (including maintenance of BD) and its relevance to development and other national and local concerns; (b) to assist analysis of intersectoral and conservation-development conflicts and compatibilities; (c) to help decide priorities for action proposals by the CS; and (d) to generate support for such action proposals. The contributions of BD that should be covered are described in paragraphs 1.11-1.17 and summarized in Table 1.

3.06 How detailed the assessment should be, and how precise the measurement of particular socioeconomic contributions, will depend on the availability of data (many will have to be obtained through special studies) and the size of assessment effort that the CS project is able to support. An efficient way of organizing the collection of data for the assessment is to divide it into 5-7 activities (two of the activities are optional):

a. External living resource base (optional--see paragraph 3.08).
b. Commercial (internal) living resource base and its support systems (BD support systems include new domesticates and genetic resources for the improvement of established domesticates; ecological [process] support systems include critical habitats, pollinators, and pest enemies).
c. Subsistence (internal) living resource base and its support systems (optional--see paragraph 3.16).
d. Ecological processes (how they benefit the country in ways other than supporting the living resource base--e.g. value of watershed protection to water and power supply.
e. Contributions of BD and harvested resources to recreation and tourism.
f. Contributions of BD and harvested resources to research and education.
g. Contributions of BD and harvested resources to cultural heritage.

Items b-g are in descending order of ease of measurement. (Contributions to cultural heritage cannot be quantified but can be stated precisely.) The following procedure for identifying (and where appropriate measuring) the socioeconomic contributions of conservation covers items b-c and e-g (d not included here because of the report's focus on BD).

The living resource base and its support systems

3.07 A country's living resource base (LRB) is the sum total (combined annual value) of domestically produced (internal LRB) and imported (external LRB) wild and domesticated plants, animals and other organisms that are consumed or exported as consumable resources by that country.

3.08 Analysis of the external LRB should be an essential part of the CSs of the super-importers of living resources (the eight countries importing more than US$10 billion/year of agricultural, fishery and forest products*): USA, FRGermany, Japan, UK, USSR, Italy, France, and the Netherlands. The Netherlands document shows that such an analysis can be very revealing about the relationships between the economies of developed countries and the ecosystems of developing countries. Analysis of the external LRB should also be considered for the CSs of the major importers of living resources (countries importing US$1-9 billion/year of agricultural, fishery and forest products**); but is optional, given their lesser impact on ecosystems overseas.

3.09 For most countries priority should be given to analysis of the internal LRB. This consists of a commercial division (items produced for the market, which establishes their monetary value) and a subsistence division (items produced for own [or family, or community] consumption, whose monetary value must be imputed).

Notes: *Annual average 1979-1983 (FAO 1985-8b).

**Algeria, Egypt, Libya, Morocco, Nigeria, South Africa; Canada, Cuba, Mexico, Brazil, Venezuela; China, Hong Kong, India, Indonesia, Iran, Iraq, Israel, Rep. Korea, Kuwait, Malaysia, Saudi Arabia, Singapore; Austria, Belgium & Luxembourg, Czechoslovakia, Denmark, Finland, German DR, Greece, Hungary, Ireland, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, Yugoslavia; Australia (FAO 1985b).

3.10 Table 4 presents a classification of resource species that will help organize the analysis. Harvesting of wild resources is divided by taxonomic group and principal harvest method into four sectors: fishing, hunting, gathering, logging. Culture of domesticated resources is divided by taxonomic group and form of culture into five sectors: aquaculture, livestock raising, crop growing, silviculture, industrial culture.

The commerical living resource base and its support systems

3.11 The analysis should determine (a) the size of the LRB (average annual value); (b) the size of each sector; (c) whether each sector is growing, stable or declining relative to other sectors and to the economy as a whole; and (d) the species composition of each sector, identifying the major species (the species that together account for 90% of the annual value of each sector's production). This provides the context for analysis of the LRB's support systems: (e) BD; and (f) ecological processes.

3.12 The contributions of species diversity to the commercial LRB can be shown by determining trends in the species composition of each sector. This will reveal whether, and at what rate, the sectors are drawing on species diversity for new resources, including new domesticates. The contributions of genetic diversity to the domesticated resource sectors can be shown by determining (a) the rate of introduction of new cultivars/breeds; (b) the rate of turnover (= time taken for complete replacement) of the cultivars/breeds supplying 90% of production of the major* species in each domesticated resource sector (the wild resource sectors are not included because there is no breeding activity to make use of genetic diversity); (c) for those species with a moderate to high turnover rate (see Appendix 6 for definitions and example), analyze the current (or most recent) major* cultivars/breeds to identify the main sources (geographic

---

*Note: A major species is one of the group of species accounting for 90% of the annual production value of a resource sector. A major cultivar or breed is one of the group of cultivars/breeds accounting for 90% of the annual production (value or quantity) of a major species.

KINGDOM*:	PROKARYOTES	P R O T I S T S		A N I M A L S		P L A N T S		F U N G I	
RESOURCE GROUP:	BACTERIA, BLUE-GREEN ALGAE, SPIROCHETES	EUKARYOTIC MICRO-ALGAE, PROTOZOANS, SLIME MOLDS, ETC.	EUKARYOTIC MACRO-ALGAE	FISHES & AQUATIC INVERTE-BRATES	MAMMALS, BIRDS, REPTILES, AMPHIBIANS & LAND INVERTE-BRATES	VASCULAR PLANTS (EXCEPT TIMBER TREES) & BRYOPHYTES	TIMBER TREES (TREES CUT FOR WOOD, PULP & FUEL)	EDIBLE MUSHROOMS & TRUFFLES	OTHER CONJUGATION FUNGI, SAC FUNGI, CLUB FUNGI, YEASTS
WILD SPECIES PRE-DOMESTICATES			FISHING		HUNTING (INCLUDING TRAPPING)	GATHERING (INCLUDING TAPPING)	LOGGING	GATHERING	
INCIPIENT DOMESTICATES DOMESTICATES	INDUSTRIAL CULTURE		AQUACULTURE		AGRICULTURE & HORTICULTURE LIVESTOCK RAISING / CROP GROWING		SILVICULTURE	HORTICULTURE CROP GROWING	INDUSTRIAL CULTURE

Table 4. A classification of wild and domesticated resource species by taxonomic resource group, harvest sector (wild species) and culture sector (domesticated species). There are four harvest sectors (fishing, hunting, gathering, logging) and five culture sectors (aquaculture, livestock raising, crop growing, silviculture, industrial culture). The arrow down the left of the table acknowledges that domestication is a process and that wild and domesticated resource species intergrade (pre-domesticates and incipient domesticates being intermediate).

*Five kingdom classification (Monera, Protista, Animalia, Plantae, Fungi): Whittaker (1969) modified by Margulis (1971)

origins and whether domesticated or wild) of (1) disease and pest resistance, (2) other yield characteristics (e.g. increased yield potential, hybrid vigour), (3) quality characteristics (e.g. higher alkaloid percentage); (d) estimate the value of these characteristics, as follows--(1) disease and pest resistance (either the value of that proportion of the crop that would usually be lost without it; or the cost of the cheapest practical alternative method of control [if any]), (2) other yield characteristics (the value of the increased yield obtained), (3) quality characteristics (the increase in price that the quality realizes).

3.13 The above analysis will almost certainly demonstrate (a) that genetic resources are indispensable; (b) that most of them come from some other country; (c) that the turnover of genetic resources is rapid; (d) that use of new genetic resources is increasing--requiring the lines of supply from other countries to be kept open and a great diversity of genetic resources to be maintained. Point (b) is important to get across because it can help to show that the country is a substantial beneficiary of the BD conservation efforts of other countries. Maintenance of indigenous BD--much of which will benefit other countries--is the quid pro quo. The above points may be elaborated and reinforced by identifying major breeding needs, including characteristics yet to be obtained. For example, maize breeders in Zimbabwe are trying to achieve drought avoidance (drought tolerance is much more difficult to achieve because every drought is different) by developing hybrids that mature in 90 days (present hybrids mature in 110 days). However, the only sources of very early maturing material (Europe and the northern cornbelt of the USA) are unsuitable because they are daylength sensitive (R.C. Olver A3-2).

3.14 The actual and potential importance of indigenous genetic resources should also be assessed. This entails identifying indigenous cultivars and breeds that have been or could be used in breeding programmes. For example, in Nepal local landraces of maize are being used as sources of earliness and cold tolerance (earliness is useful for double cropping: e.g., rice + maize; maize + maize); and local landraces of wheat are used as sources of dormancy (exotic cultivars tend to sprout in heavy rains) (G.R. Rajbhandary A3-4). Assessment of indigenous genetic resources also

entails identifying native wild species with economically important characteristics that have been or could be transferred to related crop or livestock species. Characteristics that have been transferred to commercial cultivars/breeds can be evaluated using the procedure outlined at the end of paragraph 3.12 (characteristics that have not yet been transferred to commercial cultivars/breeds should simply be identified, since their evaluation is too speculative to be worthwhile).

3.15 Assessment of the main ecological support systems of the wild resource sectors of the commercial LRB requires identifying the critical habitats (habitats on which a species depends for feeding, breeding, sheltering, and migrating) of the species that collectively supply 90% of the production value of each sector. Assessment of the main ecological support systems of the domesticated resource sectors includes: (a) determining the proportion of agricultural and horticultural production that comes from particular agroecological classes of land (to show e.g. the importance of prime farmland for crop production); (b) estimating the contributions to livestock production of different rangeland ecosystems; (c) identifying and evaluating the contributions of domesticated and wild pollinators to crop and silvicultural production; (d) identifying and evaluating the contributions of native and introduced enemies of pests to crop and silvicultural production. The value of wild pollinators and of native and introduced enemies of pests may be estimated on the basis of the cost of providing the service by some other means. The value of the habitats used to sustain colonies of domesticated bees when the crops they pollinate are not in flower may be estimated on the basis of charges to crop growers (for the pollination services provided) plus the value of the honey produced from that habitat.

The subsistence living resource base and its support systems

3.16 In some developed countries the subsistence economy is too small to justify separate treatment; but in most countries it is very important, especially for indigenous peoples and other ethnic minorities and for rural and single-industry communities. Subsistence resources are grown or harvested for personal consumption or consumption by the grower's or

harvester's immediate family or community (depending on the system of exchange involved). Distribution of the resource from harvester to consumer seldom involves money--establishment and maintenance of the relationship between harvester and consumer being the medium of exchange. Hence the value of the subsistence resource base is entirely missed by studies devoted exclusively to commercial resources.

3.17 Subsistence resources have two kinds of value: cultural value, for which there is no monetary equivalent; and utility value (value of the product or service that the resource provides), for which a monetary equivalent can be estimated. The cultural value of a subsistence resource (for example, its role in strengthening community and individual identity and supporting kinship and exchange systems) should be described accurately but there is no point in trying to assign a dollar value to it. Estimating the utility value of subsistence resources requires the following information:

a. Quantity of each species harvested in a year (edible weight in the case of species harvested for food).

b. Goods obtained from each species (food, fuel, medicine, etc.).

c. Cost of buying locally the same quantity of substitute goods of equal utility (e.g., in the case of food, of equal nutritional and culinary value).

d. Species required to supply 90% of the total annual quantity of each category of goods.

e. Critical habitats of these species.

Harvest surveys (and equivalent for crop and livestock production) are required to obtain this information. Studies of a selection of culturally and ecologically representative subsistence communities may be used to estimate the size and composition of the country's subsistence living resource base.

Recreation and tourism

3.18 Assessing the contributions of BD and harvested resources to recreation and tourism involves two quite different questions:

a. What is the recreational value of BD and harvested resources to the individual participants (photographers, birdwatchers, hunters, anglers, etc.)?

b. What proportion of the value of tourism to the nation or locality (in terms of its contribution to income, employment, and/or Gross Domestic Product) is attributable to (1) BD; (2) harvested resources?

Special surveys will be needed to determine the relative importance of different ecosystems and species to consumptive recreational users (anglers and hunters) and nonconsumptive recreational users (birdwatchers, etc.).

Research and education

3.19 BD and harvested resources provide six kinds of contribution to research and education:

a. Supplies for research and education (harvested resources).

b. Income from research contracts and grants.

c. Sites for education (fieldwork).

d. Baseline reference sites.

e. Advances in biological knowledge.

f. Synthesis of drugs and other chemicals, and manufacture of other products, modelled on a plant, animal or other organism.

Biological supplies for research and education are commercially harvested resources, and for consistency their evaluation should be included in the assessment of the commercial living resource base (their monetary value is usually small). Income from contracts and grants is also likely to be relatively small, as well as unrepresentative of the scientific value of the BD involved. It may not be worth the effort to determine unless the data

are readily available. The contributions of BD in providing sites for education, baseline reference sites, and advances in biological knowledge are unsuitable for quantification; instead, good examples of each should be given. It would be useful to list those resource and environmental management issues whose resolution requires (or would benefit from) study of representative ecosystems; and then to indicate which ecosystems have been studied for this purpose (and with what result). One way of evaluating the contribution of species as models for drugs and other products would be on a royalty basis, calculated as a percentage of the annual sales value of the product (the chosen percentage being whatever is regarded as standard for patent owners in the industry concerned). The sales data needed for the calculation are generally confidential, but industry analysts are potential sources of reliable estimates.

Cultural heritage

3.20 Table 5 summarizes the relationship between cultural attitudes to BD and the ecosystems, species, and gene pools concerned. An assessment that is intended simply to show the importance of BD need attempt to identify only those taxa that are valued positively. If the assessment is intended also to guide conservation management (as it should), it should be extended to those species that are valued negatively. Many conflicts and compatibilities--between protection and use, and among different interest groups--might be revealed by recording and analyzing the attitudes and practices of various interest groups concerning BD, using the format of Table 5.

Presenting the results of the assessment

3.21 It is suggested that the results of the assessment be presented at the beginning of the CS document. This opening chapter should demonstrate the contributions of conservation to development (and to other national and local objectives) more clearly and forcefully than is possible with a general description or one that is dependent on examples from other countries. If the country has an operational economic development plan (or is preparing one), the assessment's findings should be used to show how

ATTITUDE TO ECOSYSTEM/ SPECIES/GENE POOL:	POSITIVE		NEUTRAL	NEGATIVE	
	NONCONSUMPTIVE	CONSUMPTIVE		AVOID	DESTROY
Effect on ecosystem/ species/gene pool:	Positive	Positive or Negative (depending on effectiveness of conservation)	Neutral or Negative (if habitat destruction a problem)	Neutral or Negative (if habitat destruction a problem)	Negative

Table 5. Relationship between cultural values and biological diversity. See text for explanation.

maintenance of ecological processes, BD, and harvested resources will contribute to achievement of the plan's objectives, policies and undertakings (identifying those policy proposals that depend on the achievement of one or more components of conservation). For example, maintenance of indigenous ecosystem, species and genetic diversity is necessary for achievement of at least five of the policy areas of Nepal's current Five-Year Development Plan: "massive afforestation and forest conservation programs; conservation of watershed areas in the villages, hill settlements and agricultural areas; forest farms to supply domestic needs of forest products, provide raw materials for forest-based industry and produce industrial forest products; food production programs to ensure self-sufficiency of food grains in the hill areas within ten years; [and]...measures that diversify agricultural crops and increase rural income" (Amatya & Naysmith 1986). The details of the assessment should be included in the appropriate sectoral chapters, even if this involves some repetition. People in each sector will naturally concentrate on what concerns them most: it is essential that editorial parsimony does not cause them to miss the contributions of BD (and of ecological processes and harvested resources) to their sector.

Reviewing the status and priority needs for conservation of BD

3.22 The CS should review the status and trends of maintenance of BD in the country concerned. A strategic procedure for maintaining BD is illustrated in Table 6. Action directed specifically at maintaining BD is undertaken at three levels, within a general framework of planning, allocating and managing land and water uses. The aim of level 1 (actions at the ecosystem level) is to maintain:

a. As much ecosystem diversity as possible, by protecting--
   i. representative ecosystems (ecosystems representing each of the main biogeoclimatic zones of the country);
   ii. unique ecosystems.
b. As much species diversity as possible, by achieving (a) above and by protecting--
   iii. species-rich ecosystems;
   iv. centres of endemism.

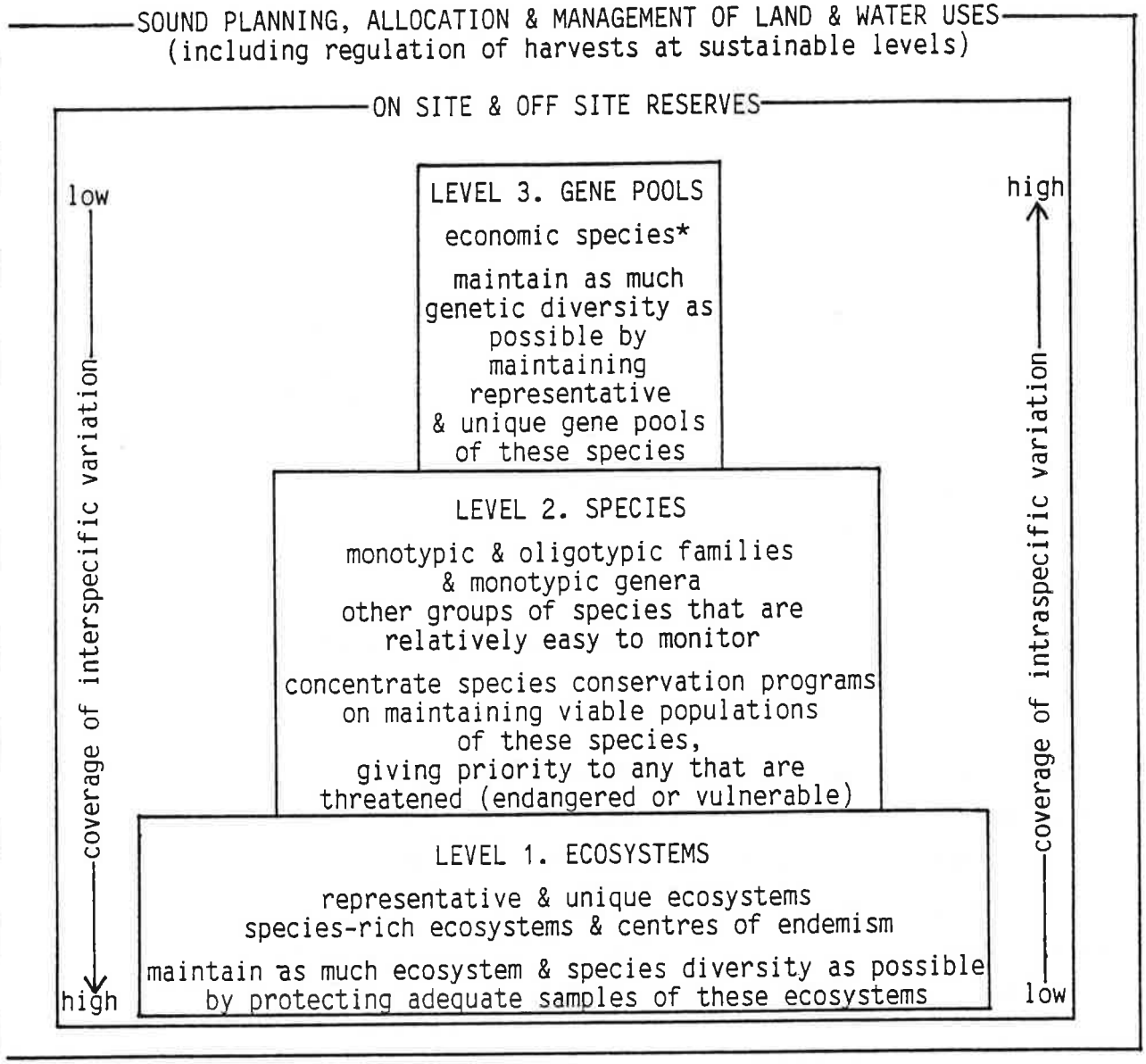

Table 6. A strategic procedure for maintenance of biological diversity.

*Note: economic species are defined here as (a) established & incipient domesticates (crops & livestock); (b) wild relatives of domesticates; (c) wild resource species.

3.23 This level provides for conservation of ecosystem diversity and for conservation of most of a country's species diversity. Since the distribution of species diversity does not coincide exactly with the distribution of ecosystem diversity, however, some species may be missed. Level 2 (actions at the species level) aims to provide a safety net for the more important of these species. It is generally impractical (particularly in the species-rich taxonomy-poor countries of the tropics) to monitor the status of and make special provision for all species. Therefore, level 2 actions concentrate on maintaining species in the following groups, giving priority to those species that are threatened (endangered or vulnerable):

a. The genetically most distinct species (and hence those species whose extinction would result in the greatest genetic loss)--
   i. monotypic and oligotypic families and monotypic genera (this assumes a reasonable correspondence between taxonomic distance and genetic distance).

b. Other important species that are relatively easy to monitor--
   ii. culturally important species;
   iii. endemic genera and species.

Economic species are not included here because they will be covered in greater detail by level 3 actions.

3.24 The aim of level 3 (actions at the gene level) is to maintain as much as possible of the gene diversity of economic species. Even if levels 1 and 2 were achieved, much gene diversity would be lost. The "ideal"--to maintain all genetic variants of all existing species--is logistically, economically and biologically unattainable. So priority at this level is given to the three groups of economic species whose genetic variation, if conserved, is most likely to be used:

   iv. established and incipient domesticates (domesticated plants and animals).
   v. wild relatives of domesticates.
   vi. wild resource species (wild species used for food, fuel, fibre, medicine, ornament, etc.).

Level 3 actions conserve traditional and advanced cultivars and breeds and special genetic stocks of established and incipient domesticates; and the

major genetic variants of wild relatives of domesticates and wild resource species.

3.25 The main instruments for achieving these actions are:

Level 1: national parks, reserves and other protected areas.

Level 2: national parks, reserves and other protected areas; zoos and botanical gardens.

Level 3: seedstores, in vitro collections, field genebanks, etc.; national parks, reserves and other protected areas; management of the harvest of wild resource species to avoid negative selection among and within populations.

3.26 On site reserves (national parks, reserves and other protected areas) are the primary means of maintaining ecosystem diversity, species diversity, and the diversity of wild gene pools. Off site reserves (zoos, botanical gardens, seedstores, field genebanks and other germplasm collections) are the primary means of maintaining the diversity of domesticated gene pools, of providing breeders and researchers with ready access to domesticated and wild gene pools, and of maintaining species that are critically endangered in the wild. The two types of reserve (on site and off site) are complementary; and both are necessary to maintain, and make available for use (in breeding, research, recreation, etc.), a country's BD. They are most effective when operated within a framework of sound planning, allocation and management of land and water uses (as depicted in Table 6).

3.27 The strategy should analyze the adequacy of maintenance of BD in terms of the actions and instruments listed above. Among the questions to be asked are: how complete is the coverage of reserves (does the country's network of on site reserves cover all representative ecosystems, unique ecosystems, species-rich ecosystems, etc.)? Is this coverage effective or is it limited by deficiencies of design and management of the protected areas or by competition from incompatible uses (such as poaching)? What are the most important ecosystems and species that cannot be conserved by the network of reserves alone, and what kinds of development are compatible with their conservation? What is the status of native wild and domesticated

genetic resources? What provision is there for ensuring the supply of the genetic resources needed for agriculture, forestry, aquaculture and rural industries through (a) long term off site maintenance of domesticated germplasm, particularly traditional and other local cultivars; (b) on site maintenance of wild gene pools?

A natural resource data bank

3.28 The data assembled for the CS on the socioeconomic contributions of conservation and the status of ecosystems, species and gene pools are also needed for economic development plans, resource development proposals, land use planning, environmental impact assessments, and other planning and management purposes besides the CS. It is sensible to make the most of the effort to collect the data by storing it on computer in a form that allows for efficient access, analysis and updating. It is strongly recommended that the establishment of a natural resource data bank be included as a standard part of NCS and SNCS preparation. The first task of the data bank would be to assemble the data required for the strategy. Thereafter it would be a permanent asset, serving national needs for natural resource data. A framework for a natural resource data bank is given in Appendix 5. This is proposed as a means of organizing available data. It is not recommended that countries go to the expense and labour of generating as comprehensive an array of data as the framework implies.

Options and approaches to achieving intersectoral coordination and integration of conservation and development

3.29 Because of the intense competition for scarce resources (of land, money, trained personnel) it is essential that all measures and actions to achieve conservation and sustainable development are as cost-effective as possible. Consequently, a key section of every strategy will be its consideration of ways of combining conservation and development, combining measures to maintain BD, ecological processes and harvested resources, and combining the conservation requirements of different sectors. The more comprehensive and specific are the assessment of the socioeconomic contributions of conservation, the sectoral reviews, and the analysis of the

status of ecosystems, species and gene pools, and priority needs for their conservation--the easier it will be to identify (a) conflicts that can be avoided relatively easily (with readily acceptable changes of policy or programmes); (b) conflicts that are unavoidable (and require decisions on priorities); and (c) opportunities for cooperation.

3.30 There are a number of options and approaches to combining maintenance of BD with the other conservation components and with economic development. Three are described here:

a. A rural development substrategy.

b. A programme of BD development and conservation.

c. A local conservation strategy.

A rural development substrategy

3.31 A rural development substrategy could serve as the means of providing for maintenance of BD in a programme of economic development. Many rural communities, particularly in regions that are marginal for high-energy agriculture, use large numbers of native species for food, medicine, fuel and raw materials. These species and their habitats need to be maintained for the economic and cultural survival of the people concerned. The necessary conservation measures could be designed to maintain other populations and species that share these habitats, and also habitats that are linked to them.

3.32 The 40,000 San and Khoe of Botswana once lived entirely by hunting wild animals and gathering wild plants. Although they are becoming sedentary (due to occupation of their land and their attraction to permanent sources of water provided by boreholes), hunting and gathering are still very important. Without wild food most San and Khoe would starve, and hunting and gathering continue to play a central role in their social lives. The population is increasing rapidly, and shortly all of them will be living at boreholes. Such concentrations of food collectors soon overharvest the surrounding area. As farming becomes more commercialized, the services of Khoe and San as stock herders become less valuable. Many farmers try to

remove them from their land, particularly if the San or Khoe own any livestock. The San and Khoe now find themselves facing the following problems: (a) heavy dependence on wild food; (b) declining availability of wild food, due to unsustainable harvesting pressure around boreholes, loss of land, and competition from agriculture (livestock production); (c) few and declining prospects of employment; (d) no formal education; (e) growing population, exacerbating problems (b) and (c) (A.C. Campbell A3-3).

3.33 Abandonment of hunting and gathering is not a realistic option. Collecting is a most practical way of obtaining food in an environment as rigorous as the Kalahari's. In addition, experience with food collecting societies elsewhere (e.g. the North American Arctic) demonstrates that the social and psychological importance of hunting and gathering persist long after the food collecting society has adopted many of the ways of the larger society around them. Going back to an earlier era without boreholes or pressure from pastoralists is not an option either. What is needed is a rural development strategy to develop a mixed rural economy with the following elements.

a. Hunting and gathering at sustainable levels. This requires--

knowledge of the basic needs of the communities (what are the main species harvested and how many of each are consumed per person) obtained through harvest studies designed and conducted with the full participation of the hunters and gatherers themselves;

understanding of San and Khoe attitudes to the plants and animals they harvest;

knowledge of the vital parameters of the harvested species;

a management system to meet the basic needs of the communities while maintaining viable populations of the harvested species, to be designed on the basis of the above studies, with the full participation of the communities concerned;

relief of pressure on areas around boreholes, possibly by providing an off-road vehicle for food collecting expeditions (eventually this should be supported by sales of plant and animal products--see [c] below).

b. Development and introduction of a sustainable agriculture (gardening and livestock raising). This requires--

investigation of appropriate crops, livestock and practices;

domestication (if feasible) of the most valued wild species and of wild species with potential as sources of income (see [c]. below);

adaptation of other acceptable crops to local conditions;

integrated extension services to provide training and advice (single sector [e.g. agriculture] extension has too narrow a focus).

c. Development of sources of income, such as--

wild plant and animal products (food, biochemicals, arts, crafts);

domesticated plant and animal products (same as wild);

wildlife-based tourism;

government employment (e.g. as managers and guards of nature reserves and genebank areas).

3.34 Maintenance of viable populations of harvested plants and animals can be combined with maintenance of the species and gene pools that will be used to develop sustainable, locally-adapted agriculture and sources of income. These activities can be integrated with _in situ_ conservation of wildlife and wild genetic resources: the Kalahari is a major region for hartebeest (_Alcelaphus buselaphus_), springbok (_Antidorcas marsupialis_), blue wildebeest (_Connochaetes taurinus_), and gemsbok (_Oryx gazella_) (Campbell 1983); and is a centre for the wild relatives of watermelon (_Citrullus lanatus_) and melons and cucumber (_Cucumis_ spp.). Domestication and product development of native wild species would provide the San and Khoe, and the nation of Botswana, with an increased return from the BD of the Kalahari and an added incentive to conserve it. All of the development and conservation measures indicated here could be combined in a rural development substrategy of the Botswana NCS.

3.35 Some of the work on domestication and product development has been started. Grapple (_Harpagophytum procumbens_) tubers are collected from the wild and exported to Europe where they are used in homeopathic medi-

cine (treatment of arthritis). The trade potential has been estimated at US$117,000 a year, but the harvest is reported already to be excessive (Veenendaal 1984; E.M. Veenendaal A3-3). Recent investigations have indicated possibilities for marketing the fruit of six wild species (Citrullus lanatus, Grewia bicolor, G. flava, G. retinervis, Sclerocarya caffra, and Vangueria infausta) (Campbell no date). Thusano Lefatsheng (a local organization providing agricultural assistance to rural communities) has combined with the Ben Gurion University of Negev (Israel) to investigate the domestication of three fruit species (Harpephyllum caffrum, Ricinodendron rautanenii, and Sclerocarya caffra) (F. Horenburg A3-3)*.

3.36 A rural development substrategy with a strong BD maintenance component could be as important as the protected area system for conservation of BD. More than 90% of the land area of most countries is outside reserves. At best, therefore, reserves can maintain only a sample of BD. Viable and diverse populations of species whose habitats are substantial or dispersed (for example, large mammals and migratory birds) cannot be maintained by a system of protected areas alone. In principle, the measures required to maintain BD outside reserves are compatible with those required to maintain the diversity of species and habitats used by many rural communities. Consequently, economic development that is sensitive to the cultural needs of these communities could provide opportunities for maintaining BD outside reserves while developing the land for other purposes as well.

3.37 The Malaysia--Sarawak SNCS gives examples of this potential. Riparian forest is the main source of wild fruits and nuts (and of other plant products that are significant for food and/or income) for rural communities in Sarawak. Catchment forests protect the water supply of inland villages, many of which rely on gravity-fed pipelines for their drinking water

---

*Note: Marama bean (Tylosema esculentum) is another important wild food plant (the tubers and beans are eaten) whose domestication is being studied (Campbell no date). Wild stands of this species "are being exterminated in may areas" due to excessive harvesting for village consumption or for sale, extension of cattle ranching into the Kalahari where the livestock eagerly devour the plant, and ploughing of the habitat for crops (National Academy of Sciences 1979).

(Malaysia--Sarawak SNCS). Forests are the mainstay of the one million wild bearded pig (Sus barbatus) and thousands of rusa deer (Cervus unicolor) estimated to contribute 36,000 tonnes of meat a year to rural diets in Sarawak. The annual imputed value of this meat is from US$89 million (on the basis of local trade prices) to US$138 million (on the basis of the cost of replacement meat from domesticated animals [generally regarded as the truer measure]). Bearded pig, which provide 94% of wild meat (and about 60% of the average annual supply of animal protein), are sensitive to logging because their breeding cycles and movements are determined by forest fruiting patterns: reproductive success is strongly linked to fruit production in patches of forest where oil-rich oaks and dipterocarps are relatively abundant (Caldecott & Nyaoi 1985). The pigs travel widely, so protection of these forest patches would benefit rural people throughout a large area. The Malaysia--Sarawak SNCS suggests that such patches--together with riparian and catchment forests--could form the unlogged cores of island rotation systems for managing logging concessions. The villagers attach great importance to these forests--there is increasing resentment among them over forest destruction and its effects on water and food supply (P. Chai A3-4)--which they would like to have designated as communal forests (for which they need maps and training to make applications [Sarawak SNCS 4.4.8]). Thus there is scope for a strategy that would combine (a) providing continued supplies of food, water and other goods for rural communities; (b) maintaining the resource base (ecological processes, BD, harvested resources) of these supplies; (c) commercial logging and other large-scale development; (d) maintaining BD in general (for example, the communal forests could serve as genebanks for the maintenance of wild fruit populations, in addition to assuring the supply of wild fruits to the village).

3.38 Dambos in Zambia and kopjes in Zimbabwe are other examples of pockets of neighbourhood diversity--habitats that are particularly important both for BD conservation and for the supply of village resources--that could act as the BD focus of a rural development substrategy. Dambos are seasonally waterlogged drainage lines. The patches of evergreen gallery forest (mushitus) associated with dambos have a highly diverse flora and distinctive fauna (especially of birds and mammals). They are small (a few

hectares) and could be destroyed by repeated burning within 50 years. They are crucial for water supply in areas with high concentrations of people relying on natural waters (such as in the Copperbelt and the chitemene region of the Northern Province of Zambia), which is where they are most threatened. Programmes of social forestry (to establish alternative sources of wood for construction and fuel) and of community control of burning are needed (E.N. Chidumayo A3-1).

3.39 Kopjes are hills (usually granite castle hills). In Zimbabwe's communal areas, kopjes support what remains of natural woodland, supplying villages with small animals, medicinal plants, fruit, and wood. More than half the wood used for construction and fuel by all households surveyed by du Toit et al (1984) was harvested from kopjes. An inventory of kopje species annotated with economic use data is required, followed by the development of sustainable use plans and a public awareness effort to promote their adoption. Each village has an elected development committee, which could provide the necessary leadership. Urgent needs include: emergency restoration of cover, establishment of community woodlots, village regulation of tree cutting (by the development committee or by setting up a local conservation committee), and integrated extension to show villagers alternative practices and how to do them (research is needed to determine sustainable levels of such alternatives) (R.F. du Toit A3-2).

3.40 In each of these cases (Sarawak, Zambia, Zimbabwe), the measures required to maintain economic benefits of great value to the local people coincide with those required to maintain BD. Similarly, BD maintenance is combined with ecological process maintenance (in the case of Zambia's dambos), maintenance of harvested resources (in the case of Zimbabwe's kopjes), and both (in the case of riparian and other forests in Sarawak). An integrated extension service (with officers with practical experience of many other aspects of rural development besides farming) is needed to promote such measures.

A programme of BD development and conservation

3.41 The most convincing argument for maintaining BD is demonstration that there is a direct economic return from doing so. The two main problems with this are: (a) native BD is a neglected resource--as noted in paragraph 2.33, most countries make too little direct use of their own BD, overlooking BD as a recreational and tourist attraction, importing species for silviculture and aquaculture without investigating the potential of native species, and failing to develop rural industries based on local resources; (b) as noted in paragraph 2.32, in those cases where money is made from BD, local communities that bear most of the costs of conservation do not get a commensurate share of the benefits.

3.42 Development projects are needed that (a) make use of native BD; (b) are linked to *in situ* reserves to maintain the resources being developed as well as other BD; (c) provide a direct and immediate (as well as long term) economic return to the local communities affected by the *in situ* reserves. The projects could include:

1. Development and marketing of foodstuffs, medicines, arts, crafts, and other products from native plants and animals, together with strengthening or establishment of local management to ensure that harvesting is sustainable (if the products come from the wild).

2. Domestication of wild resource species (to increase the sustainable yield and improve quality).

3. Development of tourism--with a share of the revenue, as well as employment, going to the local community--in a manner compatible with the social and cultural values of the community and conservation of BD.

3.43 Nepal provides some examples of what can be done. The Mahaguthi Shop (Kathmandu) was established in 1984 by a local charity, the Nepal Charkha Pracharak Gandhi Smarak Mahaguthi, with the support of Oxfam (UK). Its aims are: to help stimulate the development of handicrafts production (particularly traditional crafts) by poor and disadvantaged groups in Nepal, to enable them to earn money; to provide an effective retail outlet for these groups, as well as advice on product development and design;

and to contribute to the support of the Tulsi Meher Mahila Ashram, a refuge and training centre for destitute women and their children. Profits from the shop are distributed among the contributing producers and the Ashram. Well over a thousand people now benefit directly from the activities of the shop. Two of the groups using the shop to market products made from native plants are:

a. Bhakatpur Decorative Paper Products (BDPP) and Bhakatpur Crafts Printers (BCP). Handmade fine paper from lokta (Daphne spp) is a traditional Nepalese cottage industry. BDPP and BCP were set up with the assistance of UNICEF as part of a project to increase rural income and employment from Daphne collection and paper making, while maintaining the Daphne forests and avoiding competition with the supply of community fuelwood needs. Since the "Community Development through Production of Greetings Cards Project" began in 1980/81 the number of families engaged in paper making has risen from 100 to 316 (1983/84) and the average family income has more than doubled (growing from Rupees 2,345 to Rupees 5,699). In addition, 190 persons are involved in lokta collection and transportation; and 75 persons are employed in printing (Acharya 1984).

b. Dolakha Allo Weavers. Sherpa groups in remote villages in Dolakha District process the fibres of allo (Girardinia diversifolia), a giant nettle. Traditionally allo was used to make extremely durable cloths, sacks and fishing nets, but it has been almost completely displaced by cotton, jute and synthetics, and trade in allo is in steep decline. The Swiss-funded "Integrated Hill Development Project" is supporting the development of new allo products (such as carpets). The Panchayat Development Training Institute in Nepal, and the UK Tropical Development and Research Institute (ODA), are also involved in developing a new cottage industry based on allo, through research to make the processing of allo fibre less arduous and time-consuming and to increase the number of products made from it.

3.44 Nepal is developing a useful export trade in medicinal and other biochemical plants, taking advantage of its diversity of native species and its proximity to India, a major consumer of plant medicines. The export value of medicinal plants was estimated in 1985 to be about US$6.5 million (Rupees 100 million) a year, 90% of sales being to India for Ayurvedic medicine (S.B. Rajbhandary A3-3). Several of the more important medicinal exports are collected from the wild (e.g. Dioscorea deltoidea, Ephedra gerardiana, Orchis latifolia, Picrorhiza kurroa, and Rheum emodi). How-

ever, overcollecting is becoming a problem: it takes 4-5 days to collect Dioscorea deltoidea, when once it was only one day away from Kathmandu; and wild stands of Rauvolfia serpentina have virtually disappeared (S.B. Rajbhandary A3-3). The Department of Medicinal Plants encourages farmers to grow medicinal plants, operating pilot herb farms, studying the biochemical properties of the native flora, and investigating the propagation and culture of species with good potential. The criteria for selection of species are (a) that they can be used locally, and (b) that they can be sold for export (Nepal's domestic market being too small to bear the research and development costs). Cultivation of belladonna (Atropa belladona) (not native to Nepal) began in 1981 when the Department of Medicinal Plants persuaded a farmer to grow a quarter hectare. Now 300 farmers are growing belladonna, each earning an average of Rupees 20,000 (US$1,309) per hectare net (and some earning up to Rupees 40,000/ha net). Cultivation was initially for local consumption, but a large surplus is now exported; and the economy of Panoti, where the crop is grown, has been transformed. As mentioned in paragraph 1.16, two native species that are now being farmed are Rauvolfia serpentina and Valeriana wallichii. However, there can be a number of obstacles to developing new biochemical crops, notably competition from synthetics. It takes three years to get a crop of Rauvolfia; by the time the first crop was ready, competing synthetics had cut the price from 50 to 20 rupees. Nepal is trying to obtain long term price guarantees (S.B. Rajbhandary A3-3).

3.45 Monitoring and regulation of the collection of wild medicinal plants is poor. Truckloads of orchids (notably Flickingeria macraei) are exported to India for use in Ayurvedic medicine (as many as half a million plants in one consignment) (Bailes 1985). Since India banned export of wild-collected orchids, exporters have moved into Nepal to collect orchids* and to launder exports of orchids collected in India. According to a reliable but confidential source, orchids are collected from the wild and planted in gardens--

---

*Note: These include ornamental as well as medicinal orchids. Nepal's native ornamental orchids have economic potential both as tourist attractions (in situ and ex situ displays) and as the starting material for commercial propagation and export (Bailes 1985).

and then claimed to be cultivated. The floristically richest region of Nepal, with much the greater proportion of the orchid flora, is between 900 and 3,650 metres (Bailes 1985). This region (temperate and subalpine zones) is also the source of the most important medicinal plants (Singh et al. 1980). It is the least protected (National Parks are largely at higher and lower elevations), and is under the greatest human pressure, since most people live there. It is especially in the "middle zone" (1,000-2,200m) where conversion of forest to agriculture, cutting of trees for fodder and fuel, and prevention of regeneration by grazing animals are most severe (Hawkins & Napier no date). For these reasons, the "middle zone" is the priority region for silvicultural research and development (establishment of community woodlots; selection and propagation of species; establishment of seed orchards). Conservation of tracts of native forest in community-managed reserves seems to be recognized as the only practical means of maintaining the species and genetic diversity of wild ornamental and biochemical (including medicinal) plants (S.B. Rajbhandary A3-3) and of maintaining stands that are good sources of seed of native tree species being domesticated for fodder, fuel, fruit and timber* (T. Hawkins & I. Napier A3-3; A.M.J. Robbins A3-3). National Parks and ex situ seed and in vitro collections would provide essential back-up. Projects to enable communities to increase the sustainable yield of commodities and income from native species provide an invaluable opportunity to establish these reserves.

A local conservation strategy

3.46 Rural development and the linking of BD development and maintenance can be combined with other sustainable development and conservation activities in a local CS. Restricting the geographical scope of a CS allows for greater public participation in its formulation and implementation and

---

*Note: Native tree species have a prominent part in Nepalese silviculture--probably because the focus of the programme is on the basic needs of local communities, rather than on industrial forestry. Communities have been surveyed concerning their needs and preferences. The survey results, together with knowledge of propagation and availability of seed, have determined the choice of priority species for research and development (Hawkins & Napier no date; T. Hawkins & I. Napier A3-3).

for more detailed application and demonstration of the approach and principles of the NCS or SNCS. A local CS can provide the means of working out the day-to-day practicalities of integrating conservation and development--of achieving development and conservation at the same time, in one process.

3.47 A local CS should cover one or a few administrative units, or a natural region of the country (such as a river basin or a biome). The Kelabit Highlands in northeast Sarawak could be an example of the former. It is important for BD conservation (site of the proposed Pulong Tau National Park; high diversity of local rice cultivars, which the people want to maintain; rich oak woodland for pigs). The people are well organized, have a strong sense of community, and are very forward looking. Recognized conservation needs include a combination of communal forest establishment, protection of critical habitats of wildlife, and protection of the water supply (Kelabit people are experts at irrigation and produce enormous rice surpluses, so the incentive to protect the water supply is strong) (J. Caldecott A3-4).

3.48 The Zambezi Teak Forest (ZTF), referred to in paragraphs 1.12 and 2.36, would be a good choice for a local CS based on a natural region. It is a distinctive centre of floristic endemism; and the dambos and floodplains draining the Kalahari sands on which the ZTF occurs support rich concentrations of large mammals (e.g. eland, sitatunga, roan antelope, sable antelope, puku, lechwe, tsessebe, oribi) (Huntley 1978)*. The ZTF grows the region's most valuable timbers and so is heavily logged (Zambezi teak is one of Zambia's few remaining sources of foreign exchange [S.F. Kufakwandi A3-1]). It is best developed on relatively fertile sands that are favoured for clearing and cultivation (Wood 1986). An international

---

*Note: Liuwa, in the ZTF, is considered by H. Chabwela (A3-1) to be the richest wetland in Zambia and one of the best areas for mammals, especially lechwe and wildebeest. It was not included in the WWF/IUCN wetlands programme because of its remoteness from Lusaka. G.W. Howard (A3-1) recommends that Liuwa Plain NP be redesigned to accomodate the migration of the 50,000+ wildebeest of Liuwa.

conference on the ZTF recommended: reducing the allowable annual cut; more complete use of timber cut; restricting use of Zambezi teak and other high value species to high value products (e.g. parquet flooring rather than furniture stock); increasing the royalty (stumpage) rate for Zambezi teak and other high value species; establishing stands of fast growing species and developing small local industries based on secondary species, to provide alternative employment and relieve pressure on the high value species; increased research on ZTF silviculture, ecology and protection (Piearce 1986). Mubita (1986) proposed the establishment of gene resource conservation stands in eight ZTF forests. A National ZTF Project has been drafted that could form the core of the CS. Eventually it would combine economic development (improving the efficiency of Zambia's sawmills and increasing timber exports as part of Zambia's "economic crusade"), provision of local social and economic needs through rural development, conservation of ecosystem and species diversity, environmental protection, conservation of timber and other gene pools, and development of new crops and products (Forest Department 1985; Piearce 1985 & 1986).

Indicators of progress

3.49 The test of a CS's effectiveness is the state of conservation in the field--its success in achieving real improvements in the status of the three components of conservation. NCSs and SNCSs should identify indicators of progress with respect to each component. With respect to BD, these include:

a. Ecosystem diversity: proportion of representative ecosystems (ecosystems representative of each of the main biogeoclimatic zones of the country or region concerned) and unique ecosystems given secure long-term protection in parks or reserves.

b. Species diversity: recovery rates of endangered species; proportion of monotypic families and genera, endemic genera and species and culturally important species given secure long-term protection in parks or reserves.

c. Genetic diversity: extent to which traditional and modern cultivars and breeds and special genetic stocks of established and incipient domesticates are given secure long-term protection (in seedstores, in vitro collections, field gene-

banks, etc.); extent to which the major genetic variants of wild relatives of domesticates and wild resource species are given secure long-term protection primarily in parks or reserves (genebanks areas) but also in zoos, botanical gardens, seedstores, etc.).

APPENDIX 1. STATUS OF NATIONAL AND SUBNATIONAL CONSERVATION STRATEGIES

NCS = National Conservation Strategy
SNCS = Subnational Conservation Strategy

Phase 1. Initiation:	A.	Assessment, review, NCS/SNCS project proposal, prospectus, framework document.
	B.	NGO NCS/SNCS or equivalent substantial nongovernmental response.
Phase 2. Preparation.		Preparation of NCS/SNCS document by government or with full governmental commitment and participation.
Phase 3. Implementation.		NCS/SNCS policy proposals adopted and action proposals being implemented.

Phase 1 includes a great variety of different activities, but all are intended to achieve comprehensive implementation of the World Conservation Strategy at the national or subnational (province, state) level. Usually, this will require a Phase 2 activity; and Phase 1.A activities are undertaken to show the need for a full (governmental) NCS/SNCS document. Phase 1.B activities are undertaken as demonstration projects or when a positive response by government seems unlikely.

All Phase 2 documents listed below are NCSs unless otherwise specified. The list is based on information from the IUCN Conservation for Development Centre and other sources. Conservation strategies evolve rapidly: some countries may be missing from this list; and some entries may already be out of date.

Australia:	NCS	Phase 3
	South Australia SNCS	Phase 2 started
	Victoria SNCS	Phase 2 draft completed, final document being prepared.
	Western Australia SNCS	Phase 2 started
Bangladesh		Phase 1.A
Belize		Phase 1.A
Botswana		Phase 2 started
Canada:	NCS	Phase 1.A
	Alberta SNCS	Phase 2 started
	British Columbia SNCS	Phase 1.A
	Ontario	Phase 1.A
	Quebec	Phase 1.A
Czechoslovakia:	Frysavka SNCS	Phase 1.B
Fiji		Phase 1.A

France		Phase 1.A
Germany, Fed. Rep.		Phase 1.A
Guinee Bissau		Phase 1.A
Indonesia		Phase 1.A
Italy		Phase 1.B
Ivory Coast		Phase 1.A
Jordan		Phase 1.A
Madagascar		Phase 2 completed
Malawi		Phase 1.A
Malaysia:	Kedah SNCS	Phase 1.B
	Melaka SNCS	Phase 1.B
	Negeri Sembilan SNCS	Phase 1.B
	Perlis SNCS	Phase 2 (government adoption of a Phase 1.B document)
	Sarawak SNCS	Phase 2 completed
	Trengganu SNCS	Phase 1.B
Nepal		Phase 2 started
Netherlands		Phase 1.A
New Zealand		Phase 2 at an advanced stage, preparation of final document deferred
Norway		Phase 1.A
Oman		Phase 1.A
Pakistan		Phase 1.A
Philippines		Phase 1.B
St Lucia		Phase 1.A
Senegal		Phase 1.A
Seychelles		Phase 1.A
Sierra Leone		Phase 1.A
South Africa		Phase 1.B
Spain		Phase 1.A
Sri Lanka		Phase 2 at an advanced stage
Switzerland		Phase 2 started
Thailand		Phase 2 prototype NCS completed
Togo		Phase 1.A
Uganda		Phase 2 suspended
United Kingdom		Phase 1.B

United States	other*
Vietnam	Phase 3
Zaire	Phase 1.A
Zambia	Phase 3
Zimbabwe	Phase 2 draft completed, final document being prepared
International	Inuit Regional CS (Greenland and Arctic Canada and Alaska), Phase 1.A

Total countries:	40 (not including USA)
Total Phase 3, countries:	3
NCSs:	3
SNCSs:	0
Total Phase 2, countries:	12 (incl. Australia, also phase 3)
NCSs:	10
SNCSs:	6 (3 countries)
Total Phase 1.A countries:	22 (incl. Canada, also phase 2)
Total Phase 1.B countries:	6 (incl. Malaysia, also phase 2)
Total other countries:	1 (USA)
Total international:	1

*the USA has a strategy for conserving biological diversity outside the USA

PADATA, AUGUST 1986

APPENDIX 2. DOCUMENTS EXAMINED

The documents examined for this report are listed below by geographical region and categorized as follows:

2/3 document. Draft or final governmental or governmentally endorsed NCS/SNCS.

1.B document. NGO NCS/SNCS or equivalent substantial nongovernmental response.

1.A document. Assessment, review, NCS/SNCS project proposal, prospectus, framework document.

Other document. A document not in any of the above categories.

Of the 42 documents reviewed, 24 are 1.A, 7 are 1.B, 10 are 2/3, and 1 is other.

A total of 32 countries are covered. The regional totals are (in order of listing in this appendix):

West Africa	6
East Africa	1
Southern Africa	5
Indian Ocean	2
Western South Asia	4
Eastern South Asia	5
North America	2
Middle and Central America	1
Oceania	1
Australia and New Zealand	2
Southern Europe	1
Northern Europe	1
Western Asia	1

West Africa

1.A documents

Guinea-Bissau: Portas, P. & J.P. de Oliveira Costa. 1985. Vers l'elaboration d'une strategie nationale de conservation des ressources naturelles. Rapport de mission 25 mars - 2 avril 1985. IUCN CDC, Gland.

Ivory Coast: Halle, M. & G. Sournia. 1983. Vers une strategie nationale ivoirienne de la conservation. Rapport d'une mission UICN en Cote d'Ivoire 19-30 juin 1983. IUCN CDC, Gland.

Senegal: UICN. 1984. Vers une strategie nationale senegalaise de conservation. Rapport de mission 4-19 juillet 1983. IUCN CDC, Gland.

Sierra Leone: Rennie, J.K. & B. Wohlwend. 1985. Sierra Leone. Proposal for a national conservation strategy. Report of a mission 18 February - 10 March 1985. IUCN CDC, Gland.

Togo: Portas, P. & G. Sournia. 1985. La conservation des ressources naturelles au service du developpement socio-economique durable du Togo. Rapport de mission 18-27 mars 1985. IUCN CDC, Gland.

Zaire: Filion, F. 1984. Toward a national conservation strategy: observations on the role of wildlife utilization in Zaire. Report submitted to the International Union for Conservation of Nature and Natural Resources (Gland, Switzerland) on the GTZ/IUCN/CWS mission in Zaire during October 1983 (IUCN Project 9049).

East Africa

1.A document

Uganda: IUCN. 1983. Proposal for a national conservation strategy for Uganda. Report of the IUCN mission 3-20 July 1983. IUCN CDC, Gland.

Southern Africa

2/3 documents

Zambia: Government of the Republic of Zambia. 1985. The National Conservation Strategy for Zambia. Government of the Republic of Zambia and IUCN, Lusaka and Gland.

Zimbabwe: Anon. 1985. A national conservation strategy. Zimbabwe. A working document. Fifth draft. Ministry of Natural Resources and Tourism and Natural Resources Board, Harare.

1.B document

South Africa: Conservation Committee, The Wildlife Society of South Africa. 1980. A policy and strategy for environmental conservation in South Africa. The Wildlife Society of South Africa, Durban.

1.A documents

Botswana: IUCN. 1984. Botswana conservation strategy. Advisory note based on IUCN mission to Botswana 14-19 October 1984. IUCN CDC, Gland.

Malawi: Brunt, M.A., A.J.B. Mitchell & R.C. Zimmermann. 1983. Environmental effects of development. Malawi. Phase II report. FAO, Rome.

Indian Ocean

2/3 document

Madagascar: Ministere de la Production Animale (Elevage et Peche) et des Eaux et Forets. 1984. Repoblika Demokratika Malagasy. Document de projet relatif a la strategie malgache pour la conservation et le developpement durable. IUCN CDC, Gland.

1.A document

Seychelles: IUCN. 1985. Outline for the preparation of a national environment strategy for the Republic of Seychelles. Report of an IUCN visit to Seychelles 12-23 November 1984. IUCN CDC, Gland.

Western South Asia

1.A documents

Bangladesh: IUCN. 1985. Project description. A national conservation strategy for Bangladesh. IUCN CDC, Gland.

Nepal: His Majesty's Government of Nepal. 1983. National conservation strategy for Nepal. A prospectus. IUCN, Gland.

Pakistan: Halle, M. & B. Johnson. 1984. A national conservation strategy for Pakistan: first steps. Report of the IUCN mission 27 November -9 December 1983. IUCN CDC, Gland.

Sri Lanka: Indraratna, A.D.V. de S. 1984. National conservation strategy. Development issues. Division of Planning and Research, University Grants Commission.

Eastern South Asia

2/3 documents

Malaysia--Perlis: Mah, Y.L., L. Chan, Earl of Cranbrook & D.R. Wells. 1984. Proposals for a conservation strategy for Perlis. A paper submitted to the State Government of Perlis. WWF-Malaysia, Kuala Lumpur.

Malaysia--Sarawak: Strategi Pemeliharaan Sumber Semulajadi Malaysia. 1985. Cadangan-cadangan bagi strategi pemeliharaan bagi Negeri Sarawak (A conservation strategy for the State of Sarawak, Malaysia) (draft). WWF-Malaysia, Kuala Lumpur.

Thailand: IUCN (in collaboration with UNEP). 1979. Conservation for Thailand--policy guidelines (2 vols). IUCN, Morges.

Vietnam: Committee for Rational Utilization of Natural Resources and Environmental Protection. 1985. Vietnam National Conservation Strategy (draft). IUCN and WWF-India, New Delhi.

1.B documents

Malaysia--Kedah: Chan, L., Y.L. Mah, Earl of Cranbrook & D.R. Wells. 1984. Proposals for a conservation strategy for Kedah. A paper submitted to the State Government of Kedah. WWF-Malaysia, Kuala Lumpur.

Malaysia--Melaka: Mah, Y.L., L. Chan, Earl of Cranbrook, D.R. Wells & J.I. Furtado. 1983. Proposals for a conservation strategy for Melaka. A paper submitted to the State Government of Melaka. WWF-Malaysia, Kuala Lumpur.

Malaysia--Negeri Sembilan: Chan, L., Y.L. Mah, Earl of Cranbrook, D.R. Wells & J.I. Furtado. No date. An outline for a conservation strategy for Negeri Sembilan. A report submitted to the State Government of Negeri Sembilan. WWF-Malaysia, Kuala Lumpur.

Malaysia--Trengganu: Mah, Y.L., L. Chan, arl of Cranbrook, D.R. Wells & J.I. Furtado. 1983. Proposals for a conservation strategy for Trengganu. A paper submitted to the State Government of Trengganu. WWF-Malaysia, Kuala Lumpur.

Philippines: The Haribon Society. 1983. Philippine national conservation strategy. A strategy for sustainable development. The Haribon Society, Manila.

1.A document

Indonesia--Irian Jaya: Petocz, R.G. 1984. Conservation and development in Irian Jaya. A strategy for rational resource utilization. WWF/IUCN Conservation for Development Programme in Indonesia and Directorate General of Forest Protection and Nature Conservation, Bogor.

North America

1.A documents

Canada: Task Force on Northern Conservation. 1984. Report of the Task Force on Northern Conservation. Department of Indian Affairs and Nortern Development, Ottawa.

Canada--Alberta: Public Advisory Committees to the Environment Council of Alberta. 1984. Prospectus for an Alberta conservation strategy. Environment Council of Alberta, Edmonton.

Other document

USA: An Interagency Task Force. 1985. US strategy on the conservation of biological diversity. An Interagency Task Force report to Congress. US Agency for International Development, Washington.

Middle and Central America

1.A documents

Belize: IUCN. 1983. Conservation for sustainable development. Towards a national conservation strategy (draft). IUCN, Gland.

IUCN. 1985. Belize: national conservation strategy. Phase II. Project proposal. IUCN CDC, Gland.

Oceania

1.A documents

Fiji: Chew, W.-L. 1981. Conservation for Fiji. Framework for a national strategy. A report on the preparatory phase of the development of a national conservation strategy for Fiji. IUCN Commission on Environmental Planning, Gland.

Prescott-Allen, R. 1986. Sustaining Fiji's development. Project proposal for a national conservation strategy for Fiji (draft). IUCN CDC, Gland.

Australia and New Zealand

2/3 documents

Australia: Department of Home Affairs and Environment. 1983. A National Conservation Strategy for Australia. Living resource conservation for sustainable development. Proposed by a conference held in Canberra June 1983. Australian Government Publishing Service, Canberra.

Australia--Victoria: Ministry for Plannng and Environment. 1984. Draft state conservation strategy for Victoria. Overview statement for public comment. Ministry for Planning and Environment, East Melbourne.

New Zealand: Nature Conservation Council Technical Sub-Committee. 1981. Integrating conservation and development. A proposal for a New Zealand conservation strategy. Nature Conservation Council, Wellington.

Southern Europe

1.A document

Spain: ICONA. No date. Estrategia espanola para la conservacion de la naturaleza. Ministerio de Agricultura Secreteria General Tecnica, Servicio de Publicaciones Agrarias, Madrid.

Northern Europe

1.A document

Netherlands: Netherlands National Committee for IUCN/Steering Group World Conservation Strategy. 1986. The Netherlands and the world ecology: towards a national conservation strategy in and by the Netherlands, 1986-1990. Amsterdam.

1.B document

United Kingdom: World Wildlife Fund UK, Nature Conservancy Council, Countryside Commission, Countryside Commission for Scotland, The Royal Scoiety of Arts and Council for Environmental Conservation. 1983. The conservation and development programme for the UK. A response to the World Conservation Strategy (2 vols, including: Johnson, B. An overview--resourceful Britain). Kogan Page, London.

Western Asia

1.A document

Jordan: IUCN. 1985. The Hashemite Kingdom of Jordan. National environment strategy. Project proposal. IUCN CDC, Gland.

APPENDIX 3. PERSONS INTERVIEWED IN AFRICA AND ASIA

Zambia (20-26 October 1985)

IUCN Conservation for Development Centre, c/o P.O. Box 30475, Lusaka
Mr. S.M.J. Bass, Regional Project Officer

National Parks and Wildlife Service, Private Bag 1, Chilanga
Dr. H. Chabwela, Deputy Director
Mr. F. Lungu, Departmental Development Officer

Department of Fisheries, P.O. Box 100, Chilanga
Dr. S. Subramaniam, Chief Fisheries Research Officer
Ms. E. Cayron. Aquaculturist,
FAO/UNDP/GRZ Fish Culture Development in Zambia Project

Forest Department, P.O. Box 70228, Ndola
Mr. A.S. Banda, Chief Extension Officer
Mr. B.K. Kawina, Chief Management Officer (now Chief Forest Products Research Officer, Kitwe)
Mr. S. Kashweka, Training Officer

Division of Forest Research, P.O. Box 22099, Kitwe
Dr. G.G. Piearce, Chief Forest Research Officer
Mr. A.C. Mubita, Geneticist

Beekeeping Division, Forest Department, P/Bag Mwekera, Kitwe
Mr. G.M. Zulu, Chief Beekeeping Officer, Mwekera

Natural Resources Department, P.O. Box 50042, Lusaka
Dr. E.N. Chidumayo, Conservator of Natural Resources

Department of Agriculture, P.O. Box 7, Chilanga
Dr. B.K. Patel, Chief Agricultural Research Officer,
Mt. Makulu Agriculture Research Station

Zambia Forestry and Forest Industries Corporation Ltd, P.O. Box 71566, Ndola
Mr. S.F. Kufakwandi, Manager - Plantation Management

National Council for Scientific Research, P.O. Box 21210, Kitwe
Dr. M.K. Jain, Prinicipal Scientific Officer,
Tree Improvement Research Centre

National Food and Nutrition Commission, P.O. Box 32699, Lusaka
Mr. John O'Dea, Nutritionist, Nutritional Policy and Planning Unit

University of Zambia, P.O. Box 32379, Lusaka
Prof. G.W. Howard, Chairman, Kafue Basin Research Project
Mr. P.S.M. Phiri, Lecturer in Botany, Biology Department

Wildlife Conservation Society of Zambia, P.O. Box 30255, Lusaka
Mr. R. Lumbe, Director

Zambian Ornithological Society, P.O. Box 33944, Lusaka
Miss N. Ashley

Save the Rhino Trust Ltd, P.O. Box 38169, Woodlands, Lusaka
Mr. M.J. Faddy, Chairman, Operations Committee

Zimbabwe (28-30 October 1985)

IUCN Conservation for Development Centre, P.O. Box 745, Harare
Mr. J.A. Pile, Regent

Department of National Parks and Wildlife Management, P.O. Box 8365, Causeway, Harare
Dr. G. Child, Director
Dr. D. Cumming, Chief Ecologist, Branch of Terrestrial Ecology

Department of Research & Specialist Services (Ministry of Agriculture), P.O. Box 8100, Causeway, Harare
Mr. R.C. Olver, Head, Crop Breeding Institute
Mr. T. Muller, Curator, National Herbarium and Botanic Garden

Agricultural and Rural Development Authority, P.O. Box 8439, Causeway, Harare
Dr. L. Mhlanga, General Manager

Forestry Commission, P.O. Box HG595, Highlands, Harare
Mr. L.J. Mullin, Divisional Manager Research,
Forest Research Centre

University of Zimbabwe, P.O. Box MP167, Mount Pleasant, Harare
Dr. B.E. Marshall, Department of Biological Sciences
Dr. C.H.D. Magadza, Director,
University Lake Kariba Research Station

Zimbabwe National Conservation Trust, P.O. Box 8575, Causeway, Harare
Mr. J.A. Pile, Director

IUCN SSC African Elephant and Rhino Specialist Group, P.O. Box 8437, Causeway, Harare
Mr. R.F. du Toit, Scientific/Executive Officer

Botswana (31 October - 1 November 1985)

IUCN, c/o UNDP, P.O. Box 54, Gaborone
Mr. S.H. Butterfield, Senior Advisor

Department of Wildlife and National Parks, Ministry of Commerce and Industry, P.O. Box 131, Gaborone
Mr. M.L. Nchunga, Acting Director

Department of Field Services, Ministry of Agriculture, Private Bag 003, Gaborone
Mr. R. Kwarepe, Range Ecologist, Division of Land Utilization
Mr. V. Tlhalerwe, Assistant Range Ecologist, Division of Land Utilization

National Museum and Art Gallery, Private Bag 00114, Gaborone
Mr. A.C. Campbell, Director

University of Botswana, Private Bag 0022, Gaborone
Dr. H.J. Cooke, Professor of Environmental Science
Dr. R. Hartland-Rowe, Professor of Biology
Mr. E.M. Veenendaal, Environment Development Linkages Project, National Institute of Development Research and Documentation

Kalahari Conservation Society, P.O. Box 859, Gaborone
Ms. E. Warr, Executive Officer

Thusano Lefatsheng (Terre Aide Botswana), P.O. Box 1966, Gaborone
Mme F. Horenburg, Manager

Nepal (5-9 November 1985)

IUCN, Suite 1409, Bluestar Building, GPO Box 3923, Tripureswar, Kathmandu
Dr. J.K. Naysmith, Senior Advisor
Mr. D.B. Amatya, Consultant

Department of National Parks and Wildlife Conservation, Babar Mahal, Kathmandu
Dr. S. Dhungel, Ecologist

Department of Medicinal Plants, Ministry of Forests and Soil Conservation, Thapathali, Kathmandu
Dr. S.B. Rajbhandary, Deputy Director General

Department of Medicinal Plants, Godawari, Lalitpur
Dr. P.R. Shakya, Botanical Survey and Herbarium, Godawari

Department of Forest, Babar Mahal, Kathmandu
Mr. T. Hawkins, Silviculturalist, Forestry Research Project (ODA/HMG Nepal), Forest Survey and Research Office
Mr. I. Napier, Research Officer, Forestry Research Project (ODA/HMG Nepal), Forest Survey and Research Office
Mr. A.M.J. Robbins, Silviculturalist, National Tree Seed Project (ODA/EEC/HMG Nepal), Community Forestry and Afforestation Division

Department of Agriculture, Post Box 1135, Kathmandu
Dr. G. R. Rajbhandary, Chief Agriculture Botanist, Agriculture Botany Division
Mr. H.B. Malla, Agriculture Botany Division
Mr. I.N. Bhatta, Vegetable Development Division
Mr. M. Ghimire, Vegetable Development Division
Mr. B.D. Pathak, Vegetable Development Divison

Department of Agriculture, Harihar Bhavan, Lalitpur
Mr. K.G. Rajbanshi, Chief Fisheries Development Officer, Fisheries Development Division

Malaysia (10-16 November 1985)

World Wildlife Fund Malaysia, P.O. Box 10769, 50724, Kuala Lumpur
YB Tan Sri Datuk Hamzah Sendut, Chairman
Mr. K. Scriven, Secretary and Executive Director
Dr. M. Kavanagh, Project Director, Strategi Pemeliharaan Sumber Semulajadi Malaysia
Ms. L. Chan, Senior Project Officer, Strategi Pemeliharaan Sumber Semulajadi Malaysia

World Wildlife Fund Malaysia, Kuching, Sarawak
Dr. E. Bennett, Project Officer
Dr. J. Caldecott, Project Officer

Dewat Undangan Negeri (Sarawak State Legislature), Petra Jaya, Kuching, Sarawak
YB Dr. J.J. Masing, State Assemblyman

Unit Perancangan Negeri (State Planning Unit), Petra Jaya, Kuching, Sarawak
Encik Mohd Jamil Mukmin, Director
Encik J. Langub, Principal Assistant Secretary

Forest Department, 93000 Kuching, Sarawak
Dr. Paul Chai, National Parks and Wildlife Officer, National Parks and Wildlife Office
Miss Rena George, Forest Officer i/c, Botanical Research Centre, Semengoh

Muzium Sarawak, 93566 Kuching, Sarawak
Mr. P. Kedit, Ethnologist

Forest Research Institute Malaysia, Kepong, Selangor (P.O. Box 201, 52109 Kuala Lumpur)
Dr. Salleh Mohd Nor, Director-General

Malaysian Agricultural Research and Development Institute, Serdang, Selangor (P.O. Box 12301, GPO, 50774 Kuala Lumpur)
Dr. A. Wahab bin Ngah, Director, Fruit Research Division
Dr. A. Razak bin Shaari, Fruit Research Division

Universiti Kebangsaan Malaysia, Bangi, Selangor
Prof. Mohd Nordin Hj. Hasan, Professor of Zoology and Director, Bureau of Research and Consultancy
Prof. B.S. Jalani, Deputy Vice Chancellor and Professor of Genetics
Dr. A.H. Zakri, Deputy Dean, Faculty of Life Sciences

Universiti Malaya, 59100 Kuala Lumpur
Dr. D.R. Wells, Associate Professor, Zoology Department

APPENDIX 4. PERSONS INTERVIEWED IN FIJI

Ministry of Housing and Urban Affairs, Government Buildings, Suva
- Hon. E.J. Beddoes, Minister for Housing and Urban Affairs
- Mr. P.K. Nacuva, Acting Permanent Secretary for Housing and Urban Affairs; Director of Town and Country Planning
- Mr. C.S. Verma, Principal Assistant Secretary
- Mr. M.S. Hannif, Senior Town Planner, Department of Town and Country Planning

Ministry of Economic Development, Planning and Tourism, P.O. Box 2118, Government Buildings, Suva
- Mr. J. Samy, Permanent Secretary for Economic Development, Planning and Tourism
- Mr. M.L. Nayyar, Director of Economic Planning
- Mr. N.H. Delailomaloma, Director of Tourism
- Dr. S.C. Thakur, Principal Planning Officer, Central Planning Office

Ministry of Fijian Affairs, 61 Carnarvon Street, Suva
- Mr. J.D.V. Cavalevu, Permanent Secretary for Fijian Affairs

Ministry of Finance, Government Buildings, Suva
- Mr. Karim Buksh, Senior Administrative Officer, Budget Division

Ministry of Foreign Affairs, Government Buildings, Suva
- Dr. J.B. Senilagakali, Roving Ambassador

Ministry of Forests, P.O. Box 2218, Government Buildings, Suva
- Mr. K.T. Yabaki, Conservator of Forests
- Ms. A. Ravuvu, Environment Education Officer

Ministry of Lands, Energy and Mineral Resources, Goverment Buildings, Suva
- Mr. B. Dutt, Permanent Secretary for Lands, Energy and Mineral Resources
- Mr. B. Lal, Director of Lands and Surveyor General
- Mrs. S. Siwatibau, Director of Energy
- Mr. A. Rahiman, Director of Mineral Development
- Mr. M. Jaffar, Chairman, Mangrove Management Committee, Department of Lands
- Mr. J. Lum, Department of Mineral Resources

Ministry of Primary Industries, P.O. Box 358, Suva
- Mr. R.H. Yarrow, Permanent Secretary for Primary Industries
- Mr. N. Patel, Director of Agriculture and Chairman Land Conservation Board
- Dr. A.D. Lewis, Principal Fisheries Officer, Fisheries Division
- Mr. K. Swamy, Fisheries Officer, Fisheries Division

Native Lands Trust Board, P.O. Box 116, Suva
- Mr. N.T. Drauna, Deputy General Manager and Chief Estates Officer

National Trust for Fiji, P.O. Box 2089, Government Buildings, Suva
Mr. R. Mercer, Chairman
Mr. B. Singh, Conservation Officer

University of the South Pacific, P.O. Box 1168, Suva
Mr. J. Brodie, Institute of Natural Resources

United Nations Development Programme, National Bank of Fiji Building, Suva
Mr. R. Mountain, Deputy Resident Representative
Mrs. O. Dewes, Project Officer

Australian High Commission, Dominion House, Suva
Mr. G.J. Munro, Counsellor (Development Assistance)

British Development Division in the Pacific (Overseas Development Administration), Private Mail Bag, Suva
Mr. R. Beales, Fisheries Adviser

British High Commission, Victoria House, 47 Gladstone Road, Suva
Dr. R.A. Pullen, Deputy High Commissioner

New Zealand High Commission, P.O. Box 1378, Suva
Mr. A. Matheson, Deputy High Commissioner and Counsellor

United States Agency for International Development, Regional Development Office, American Embassy, P.O. Box 218, Suva
Mr. R. Nishihara, Agriculture Rural Development Officer

APPENDIX 5. FRAMEWORK FOR A NATURAL RESOURCE DATA BANK

This framework is proposed as a means of organizing available data on natural resources. It is not proposed that countries generate as comprehensive an array of data as the framework implies.

Objectives

1. To serve decision makers, planners and resource users in the nation by providing ready access to data on natural resources that otherwise might be difficult or impossible to obtain.

2. To identify priority gaps in natural resource data and to fill them.

3. To identify natural resources with potential for development and to provide data to assist that development.

4. To identify natural resources in need of conservation and to provide data to assist that conservation.

Data to be included

1. ECOSYSTEM DATA

   a. Biogeoclimatic classification: vegetation, landforms, soils, climate, plant and/or animal indicators (representatives) of particular ecosystem types. (Classification and survey will lead to identification of representative and unique ecosystems.)

   b. Critical/vulnerable watersheds.

   c. Current uses of ecosystems; use potential; productivity data; capability assessment.

   d. Ecological status of protected areas.

2. SPECIES DATA

   a. Economic species:

      i. Established and incipient plant and animal domesticates.
      ii. Wild relatives of plant and animal domesticates.
      iii. Wild resource species (wild species used for food, fuel, wood and other fibre [including construction], medicines and other biochemicals [e.g. tanning and dyeing agents], arts and crafts, recreation and tourism, nonconsumptive uses, etc.).

      Distribution (including occurrence in National Parks and reserves), ecology, reproductive biology, traditional uses, commercial uses (actual), potential uses, conservation status. Also, for selected species, inventory and census data.

b. Exceptional species:

i. Endemic species.
ii. Monotypic genera.
iii. Threatened species (not otherwise included under a or b above).
Distribution (including occurrence in National Parks and reserves), ecology, reproductive biology, conservation status. Also, for selected species, inventory and census data.

3. GENE DATA

a. Established plant and animal domesticates:

i. Traditional cultivars and breeds.
ii. Modern cultivars and breeds.
Distribution, status, trends, morpho-agronomic descriptors, germplasm storage and regeneration data, chromosome numbers and genome formula, genetic variation data.

b. Incipient domesticates (plants and animals undergoing domestication experiments, trials, development).
Distribution (including occurrence in National Parks and reserves), domestication data (status of domestication, uses, propagation methods), ecology, reproductive biology, germplasm storage and regeneration data, chromosome numbers and genome formula, genetic variation data, conservation status.

c. Wild relatives of domesticates.
Related domesticate and crossing relationship (including data on barriers to gene transfer and means of overcoming them), distribution (including occurrence in National Parks and reserves), ecology, reproductive biology, germplasm storage and regeneration data, chromosome numbers and genome formula, genetic variation data, useful characteristics, conservation status.

APPENDIX 6. CULTIVAR (CV) TURNOVER RATE DETERMINED BY AVERAGE AGE OF CVS

Identify cvs accounting for 90% of the crop. Multiply the age (years since release) of each cv by the percentage of the crop area that the cv occupies. Add the resulting figures for all the cvs. Divide by the total percentage they account for. The result is the average age of cvs of that crop. Example: wheat in North Dakota 1982.

Cv	Age (years)	% of acreage planted (all types of wheat)	Age x %
Len	3	18.0	54.0
Vic	3	12.1	36.3
Butte	5	10.1	50.5
Olaf	9	9.6	86.4
Coteau	4	7.8	31.2
Ward	10	7.7	77.0
Waldron	13	6.7	87.1
Rugby	9	5.0	45.0
Solar	4	4.2	16.8
Crosby	9	3.3	29.7
Cando	7	2.0	14.0
Era	12	1.9	22.8
Walera	2	1.4	2.8
Roughrider	7	1.2	8.4
		91.0	562.0

Ave. age (562.0 ÷ 91.0): 6.2

Date source: North Dakota Crop and Livestock Reporting Service. 1983. North Dakota wheat varieties 1982. Agricultural Statistics 51. Department of Agricultural Economics, North Dakota State University of Agriculture and Applied Science. Fargo.

Annual crops:

High turnover 1-9 years; moderately high turnover 10-19 years; moderately low turnover 20-39 years; low turnover 40-79 years; conservative 80 years plus.

Perennial crops:

High turnover 1-19 years; moderate turnover 20-39 years; Low turnover 40-79 years; conservative 80 years plus.

REFERENCES

Acharya, P.P. 1984. The economic benefits of Daphne harvesting and paper-making. In: Anon. (1984).

Agrawal, S.R. 1981. Trees, flower and fruits in Indian folk songs, folk proverbs and folk tales. In: Jain (1981).

Amatya, D.B., & J.K. Naysmith. 1986. A report concerning the preparation of a national conservation strategy for Nepal. National Conservation Strategy for Nepal. Kathmandu.

Anon. 1984. Lokta (Daphne) and craft paper-making in Nepal. A series of papers presented at the HMGN Department of Forest and UNICEF Lokta (Daphne) Forestry Policy and Planning Workshop-Seminar, 21 December 1984. Kathmandu, Nepal.

Bailes, C.P. 1985. Orchids in Nepal. The conservation and development of a natural resource. Royal Botanic Gardens. Kew.

Bass, S.M.J. 1986. An analysis of experience gained in preparing the Zambia NCS. Paper prepared for Workshop 1: National and Sub-national Conservation Strategies. World Conservation Strategy Conference, Ottawa, Canada, 31 May - 5 June 1986.

Berquist, P.R. 1978. Sponge chemistry--a review. Colloques Internationaux du CNRS 291: 383-392.

Bramble, B. 1985. Evaluation of project 3044. Conservation strategy development. WWF. Gland.

Caldecott, J., & A. Nyaoi. 1984. Hunting in Sarawak. A report prepared for the Adhoc Sub-Committee on Mammals and Birds of the Sarawak State Legislative Assembly Special Select Committee on Flora and Fauna. National Parks and Wildlife Office, Sarawak Forest Department. Kuching.

Carson, H.L., & K.Y. Kaneshiro. 1976. Drosophila of Hawaii: systematics and ecological genetics. Annual Review of Ecology and Systematics 7: 311-45.

Castleberry, R.M., C.W. Crum & C.F. Krull. 1984. Genetic yield improvement of US maize cultivars under varying fertility and climatic environments. Crop Science 24: 33-36.

Chaudhuri, R.H.N., & D.C. Pal. 1981. Plants in folk religion and mythology. In: Jain (1981).

Coe, E.H., & M.G. Neuffer. 1977. The genetics of corn. In: Sprague (1977).

Durbin, R.D. (ed.). 1979. Nicotiana: procedures for experimental use. Technical Bulletin 1586. US Department of Agriculture. Washington. DC.

Du Toit, R.F., B.M. Campbell, R.A. Haney & D. Dore. 1984. Wood usage and street planting in Zimbabwe's communal lands: a baseline survey of knowledge, attitudes and practices. Report produced for the Forestry Commission of Zimbabwe and the World Bank. Resources Studies. Harare.

Duvick, D.N. 1986. Plant breeding: past achievements and expectations for the future. Economic Botany 40: 289-297.

Dwyer, P.D. 1982. Prey switching: a case study from New Guinea. Journal of Animal Ecology 51: 529-542.

Dyer, M.I., J.K. Detling, D.C. Coleman & D.W. Hilbert. 1982. The role of herbivores in grasslands. In: Estes, Tyrl & Brunken (1982).

Estes, J.R., R.J. Tyrl & J.N. Brunken (eds). 1982. Grasses and grasslands: systematics and ecology. University of Oklahoma Press. Norman.

FAO. 1981. 1980 FAO production yearbook. FAO Statistics Series 34. Rome.

FAO. 1985a. 1984 FAO production yearbook. FAO Statistics Series 38. Rome.

FAO. 1985b. 1984 FAO trade yearbook.FAO Statistics Series 38. Rome.

Forest Department. 1985. The Zambia Teak Forests project. Draft plan. Photocopy. Republic of Zambia, Ministry of Lands and Natural Resources, Forest Department, Division of Forest Research. Kitwe.

Fulton, R.W. 1979. Nicotianas as experimental virus hosts. In: Durbin (1979).

Gadgil, M., & V.D. Vartak. 1981. Sacred groves of Maharashtra: an inventory. In: Jain (1981).

Hamilton, L.S., & S.C. Snedaker (eds). 1984. Handbook for mangrove area management. East-West Center. Honolulu.

Hawkins, T., & I. Napier. No date. Silvicultural research priorities in the middle hills of Nepal: a proposal for discussion. Department of Forest. Kathmandu.

Huckabay, J.D. 1986. The geography of Zambezi teak. In: Piearce (1986).

Huntley, B.J. 1978. Ecosystem conservation in Southern Africa. In: Werger & Van Bruggen (1978).

Hutterer, K.L., A.T. Rambo & G. Lovelace (eds). 1985. Cultural values and human ecology in Southeast Asia. Papers on South and Southeast Asia 27. University of Michigan Center for South and Southeast Asian Studies. Ann Arbor.

IUCN. 1980. World conservation strategy. Living resource conservation for sustainable development. IUCN, UNEP & WWF. Gland & Nairobi.

IUCN CDC. 1984. National conservation strategies: a framework for sustainable development. IUCN. Gland.

Jain, S.K. (ed.). 1981. Glimpses of India ethnobotany. Oxford & IBH Publishing Co. New Delhi.

Jeanrenaud, J.P. 1984. Daphne (Lokta), some silvicultural considerations. In: Anon. (1984).

Johnson, B. 1983. The conservation and development programme for the UK. A response to the World Conservation Strategy. An overview--resourceful Britain. Kogan Page. London.

Kavanagh, M. 1985. Planning considerations for a system of national parks and wildlife sanctuaries in Sarawak. Sarawak Gazette 61: 15-29.

Lamprey, H.F. 1975. The distribution of protected areas in relation to the needs of biotic community conservation in Eastern Africa. IUCN. Morges.

Margulis, L. 1971. Whittaker's five kingdoms of organisms: minor revisions suggested by considerations of the origin of mitosis. Evolution 25: 242-245.

McNeely, J.A., & P.S. Wachtel. Power, politics, religion, nature, and animals: how the coalition has worked in Southeast Asia. IUCN & WWF. Gland.

Mosley, G. 1986. Australian case study: strategies for the future. Plenary paper presented to the World Conservation Strategy Conference, Ottawa, Canada, 31 May - 5 June 1986.

Mubita, A.C. 1986. Prospects for genetic improvement of Zambian Teak Forests timber trees. In: Piearce (1986).

Mwima, H.K. 1986. Analysis of Ngoma Forest in Kafue National Park--a research proposal. In: Piearce (1986).

Myers, N. 1983. A wealth of wild species: a storehouse for human welfare. Westview Press. Boulder.

National Plant Genetic Resources Board. 1979. Plant genetic resources: conservation and use. US Department of Agriculture. Washington, DC.

Pei, S.-J. 1985. Some effects of the Dai people's cultural beliefs and practices upon the plant environment of Xishuangbanna, Yunnan Province, southwest China. In: Hutterer, Rambo & Lovelace (1985).

Pernetta, J.C., & L. Hill. 1984. Traditional use and conservation of resources in the Pacific basin. Ambio 13: 359-364.

Piearce, G.D. 1985. The Zambezi Teak forests. A case study of the decline and rehabilitation of a tropical forest ecosystem. Prepared for the Twelfth Commonwealth Forestry Conference, Victoria, BC, Canada, September 1985. Division of Forest Research. Kitwe.

Piearce, G.D. (ed.). 1986. The Zambezi Teak Forests. Proceedings of the First International Conference on the Teak Forests of Southern Africa, Livingstone, Zambia, March 1984. Forest Department. Ndola, Zambia.

Prescott-Allen, C., & R. Prescott-Allen. 1986. The first resource. Wild species in the North American economy. Yale University Press. New Haven & London.

Prescott-Allen, R., & C. Prescott-Allen. 1983. Genes from the wild. Using wild genetic resources for food and raw materials. Earthscan. London & Washington, DC.

Singh, M.P., S.B. Malla, S.B. Rajbhandari & A. Manandhar. 1980. Medicinal plants of Nepal--retrospects and prospects. Economic Botany 33: 185-198.

Smart, P. 1976. The illustrated encyclopedia of the butterfly world. Salamander Books. London.

Sprague, G.F. (ed.). 1977. Corn and corn improvement. Monograph 18. American Society of Agronomy. Madison.

Swaminathan, M.S. 1984. Rice. Scientific American, January 1984: 81-93.

US Congress, Office of Technology Assessment. 1981. Impacts of applied genetics: micro-organisms, plants, and animals. Congress of the United States. Washington, DC.

US Department of Agriculture. 1981. Agricultural statistics 1981. Washington, D.C.

US Fish and Wildlife Service & US Bureau of the Census. 1982. 1980 National survey of fishing, hunting, and wildlife-associated recreation. US Department of the Interior & US Department of Commerce. Washington, DC.

US Forest Service. 1981. An assessment of the forest and range land situation in the United States. Forest Resource Report 22. US Department of Agriculture. Washington, DC.

Vartak, V.D., & M. Gadgil. 1981. Studies on sacred groves along the Western Ghats from Maharashtra to Goa: role of beliefs and folklores. In: Jain (1981).

Wells, S.M., R.M. Pyle & N.M. Collins. 1983. The IUCN invertebrate red data book. IUCN. Gland.

Werger, M.J.A. & A.C. Van Bruggen (eds). 1978. Biogeography and ecology of Southern Africa. W.Junk. The Hague.

Whittaker, R.H. 1969. New concepts of kingdoms of organisms. Science 163: 150-160.

Wood, A.P. 1986. Man's impact upon the mukusi forests of Zambia, with special reference to Sesheke District. In: Piearce (1986).