Biodiversity Planning Support Programme

B P S P



A Review of Experiences and Methods:

INTEGRATING BIODIVERSITY WITH NATIONAL ENVIRONMENTAL ASSESSEMENT PROCESSES

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The UNDP/UNEP/GEF Biodiversity Planning Support Programme (BPSP) had a mandate to provide assistance to national biodiversity planners as they develop and implement their national biodiversity strategies and action plans, or equivalent plans, programmes and policies. The integration of biodiversity into other sectors of the national economy and civil society has been identified as a critical indicator of successful implementation of sustainable development practices and of the objectives of the Convention on Biological Diversity (CBD). Article 6(b) of the CBD states:

Each Contracting Party shall, in accordance with its particular conditions and capabilities:
(b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Exactly how this integration is to be achieved has not been described clearly by the Convention, subsequent Decisions of the Conference of Parties (COP), or by other specialist bodies. The BPSP was therefore established to respond to needs recognized by the Parties to the CBD for strengthening national capacity to prepare and implement National Biodiversity Strategies and Action Plans (NBSAP) in compliance with Article 6 of the Convention.

The present document is one of eight thematic studies designed to provide guidance to biodiversity planners to mainstream biodiversity into sectoral and economic policy development and planning.

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1. Introduction and Summary of Findings

1.1 Background

Impact assessment provides the information needed to balance social, economic and ecological considerations in decision-making for development. By providing information about biodiversity it can facilitate better-informed decision-making and raise general awareness of biodiversity and the threats posed by development. It therefore has an important part to play in the conservation and sustainable use of biodiversity. Article 14 of the Convention on Biodiversity (CBD) calls for the introduction of environmental impact assessment (EIA) - and strategic environmental assessment (SEA)-procedures to ensure that effects on biodiversity are given due consideration in development-planning, whether at the level of individual projects, or for national programmes and policies. In most countries, requirements for EIA and SEA are implemented through planning systems. These differ in the extent to which they require impact assessment, and also with respect to incorporation of biodiversity considerations.

The Biodiversity Planning Support Program of UNEP/UNDP GEF, as described more fully on page 2, provides assistance to national biodiversity planners in developing and implementing biodiversity-related strategies, plans, programmes and policies. Komex Europe ltd was commissioned by UNEP to review the extent to which biodiversity considerations are incorporated in impact assessment procedures throughout the world, with a particular focus on the extent to which EIA and related instruments (including SEA) are applied by countries in accordance with their obligations under the CBD. This report presents the results of this review.

The report drew on literature sources and also on the results of a series of country status reports and case studies produced for the following countries: Afghanistan, Argentina, Cameroon, Colombia, Guyana, India, Kyrgyzstan, Nepal, Niger, Romania, South Africa, Tanzania, UK, Uruguay, and Yemen.

A bibliography of literature relating to the integration of biodiversity with impact assessment can be found on the BPSP website[54] together with the 15 country status reports and case. A workshop was held at Lechwe Lodge, Zambia from the 30th May to the 4th June 2001 to discuss the implications of the country status reports and case studies. A summary of the workshop is also available on the BPSP website[54].

1.2 Structure of the report

This report reviews the role and application of EIA and SEA in relation to biodiversity conservation and development planning. The second chapter provides background information on the importance of biodiversity and global threats from development (Chapter 2, sections 2.1 and 2.2). Chapter 3 summarises current provisions and practices in relation to national biodiversity planning and impact assessment as required by the CBD and evaluates the role of EIA and related instruments in ensuring that biodiversity issues are given full and appropriate consideration.

Chapter 4 discusses the integration of biodiversity concerns with impact assessment, providing background on which levels of biodiversity impact assessment should address (Section 4.2) and providing a checklist of biodiversity elements to consider in EIA (4.3). The following sections outline the main stages in the EIA process and provide guidance on the effective integration of biodiversity concerns into these stages. The country status reports and case studies were reviewed for examples of good and bad practice in the integration of biodiversity concerns with impact assessment procedures. Throughout this chapter, good practice recommendations are provided in bold bullet points, with explanatory text beneath.

Chapter 5 gives special consideration to the integration of biodiversity concerns with strategic environmental assessment (SEA). There is considerably less experience worldwide in the use of SEA than in the use of project-EIA and there is a corresponding lack of practical examples where biodiversity concerns have been explicitly integrated with SEA processes. However SEA has the potential to ensure that biodiversity concerns are taken into account

early in the inception of new developments. In particular, SEA can have an important integrating role, if it is used to ensure that development plans and programmes are evaluated against targets for biodiversity conservation as laid down in national biodiversity strategies and action plans (NBSAPs) or other similar documents.

Chapter 6 summarises the findings of the report and provides recommendations for measures that could be taken to enhance the effectiveness of impact assessment and to help ensure that planning systems contribute to the maintenance and positive enhancement of biodiversity. This chapter also summarises examples of good and bad practice drawn from the 15 national status reports and their accompanying case studies.

1.3 Layout of the Report

Within this guide, best practice guidance or principles are presented as bullet points, thus:

- Ensure an adequate negotiating process representing all stakeholders

We have tried wherever possible to complement the guidance by referring to real life examples from case studies or from the literature, and by providing methodologies or tools when they were available. Key points mentioned in the text are drawn out and summarised in side boxes, framed as with the box on the following page (Box 1). Extensive tabular information is provided in several tables.

Footnotes throughout the text refer to the numbered list of references and web addresses given in the Endnotes at the end of the report.

1.4 Summary of Findings

The study produced some recommendations for the integration of biodiversity concerns with existing impact assessment procedures as well as identifying some actions that could be taken to ensure that impact assessment procedures are integrated with national biodiversity and development planning processes.

Experience in the use of SEA is relatively limited, particularly in terms of biodiversity planning. Additional work is required to produce effective guidance in this area.

As tools for promoting sustainable development with respect to biodiversity, EIA and SEA can:

* help to ensure the CBD's objectives are integrated with decision-making processes for development projects, plans and policies;
* provide up to date and reliable information about biodiversity in areas where little survey work has been carried out;
* ensure biodiversity is considered in consent procedures for new developments
* help to raise awareness of biodiversity;
* enable adverse environmental, economic and social impacts to be anticipated, avoided and/or mitigated for;
* provide structured methods for public participation with respect to uses of biodiversity and its cultural, religious and economic value;
* enhance understanding of human impacts on biodiversity;
* provide opportunities for enhancement of biodiversity;
* promote use of appropriate technology for analysis of impacts on biodiversity.

EIA and SEA can't always:

* deliver the best outcome for biodiversity (ensure the 'right' decision is made)
* safeguard biodiversity for unregulated development
* regulate activity after development consent has been granted (follow-up procedures are required)

Sustainable development requires biodiversity considerations to be fully integrated with all processes for land-use planning and the regulation of existing land-uses and activities.

2 Biodiversity and Environmental Impact Assessement

2.1 Defining biodiversity

Impact assessment practitioners need to decide which aspects of biodiversity they will measure and what standards will be used to evaluate any changes. Lack of consensus about exactly what constitutes biodiversity results in inefficient allocation of scarce resources and in impact assessments that fail to address important biodiversity issues.

For the purposes of this report, the definition included in the Convention on Biodiversity is used (Box 1). Other definitions in regular use are summarised in Table 1.1.

Box 1 The Convention on Biodiversity (CBD) definition

Article 2 of the CBD (Use of Terms) defines biodiversity as:

'*The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*.'

The requirements of the CBD all hinge on this definition and demand an ability to identify, describe, map, and understand variation at the gene-, species- and ecosystem-levels in the field. Exactly how this variability should be measured and evaluated for impact assessment is open to interpretation; but what the CBD makes absolutely clear is that effects on biological variation, however defined, *must* be taken into account when we make decisions about the acceptability or advisability of new developments. The requirements of the CBD and the various potential roles of impact assessment in implementing its objectives are reviewed in Section 3 of this report.

For 'biodiversity' to be more than just a buzzword, it must be translated into measurable attributes. Various approaches to measurement have been used, depending on how biodiversity is defined and interpreted. Ongoing debate about definitions of biodiversity emphasises the need to be absolutely clear about how the term is being applied in impact assessment.

'Biodiversity' (originally referred to in full as 'biological diversity') describes variation at different levels of biological organisation, from genes to whole ecosystems. In its broadest sense, 'biodiversity' is used as a synonym for the 'variety of life'[59,46,20,39]. However, there are many dimensions in which this variety, diversity or heterogeneity can be measured[41,15]. The term 'biological diversity' as first defined, included two related concepts: genetic diversity (a measure of variability within species) and ecological diversity (the number of species in a community of organisms)[40]. More recently, definitions have also incorporated structural and functional dimensions and relationships, emphasising the role of diversity in maintaining the integrity and productivity of biological systems[41,11,49]. Noss[41], for example, recognised distinct but interdependent components of biodiversity and suggested that biodiversity should be viewed in terms of composition, structure and function for different levels of biological organisation, as indicated in Figure 1 and Box 2.

Box 2 Components and levels of biodiversity (after Noss, 1990[41])

Biodiversity has three components:

* composition: what there is and how abundant it is;
* structure: how the units are organised or arranged in time and space;
* function: the roles different units play in maintaining processes and dynamics.

These three components are each represented at four different levels:

* genes;
* species, populations;
* communities, habitats, ecosystems; and
* landscapes.

Noss's 'levels' of biodiversity mix purely biological definitions (genes, species, populations, communities) with ecological concepts that also take account or relationships between biotic and abiotic factors (habitats, ecosystems and landscapes). Using a definition of biodiversity that includes functions, processes and a wide array of abiotic and biotic factors can result in a loss of focus and a tendency for biodiversity assessments to aim to include "everything"[47]. However, for purposes of impact prediction, it is impossible to avoid addressing the complex interactions between abiotic and biotic features of the environment, as these drive the responses of ecosystems to external development pressures.

Figure 1 Biodiversity relationships (based on Noss[41] and Byron[5])

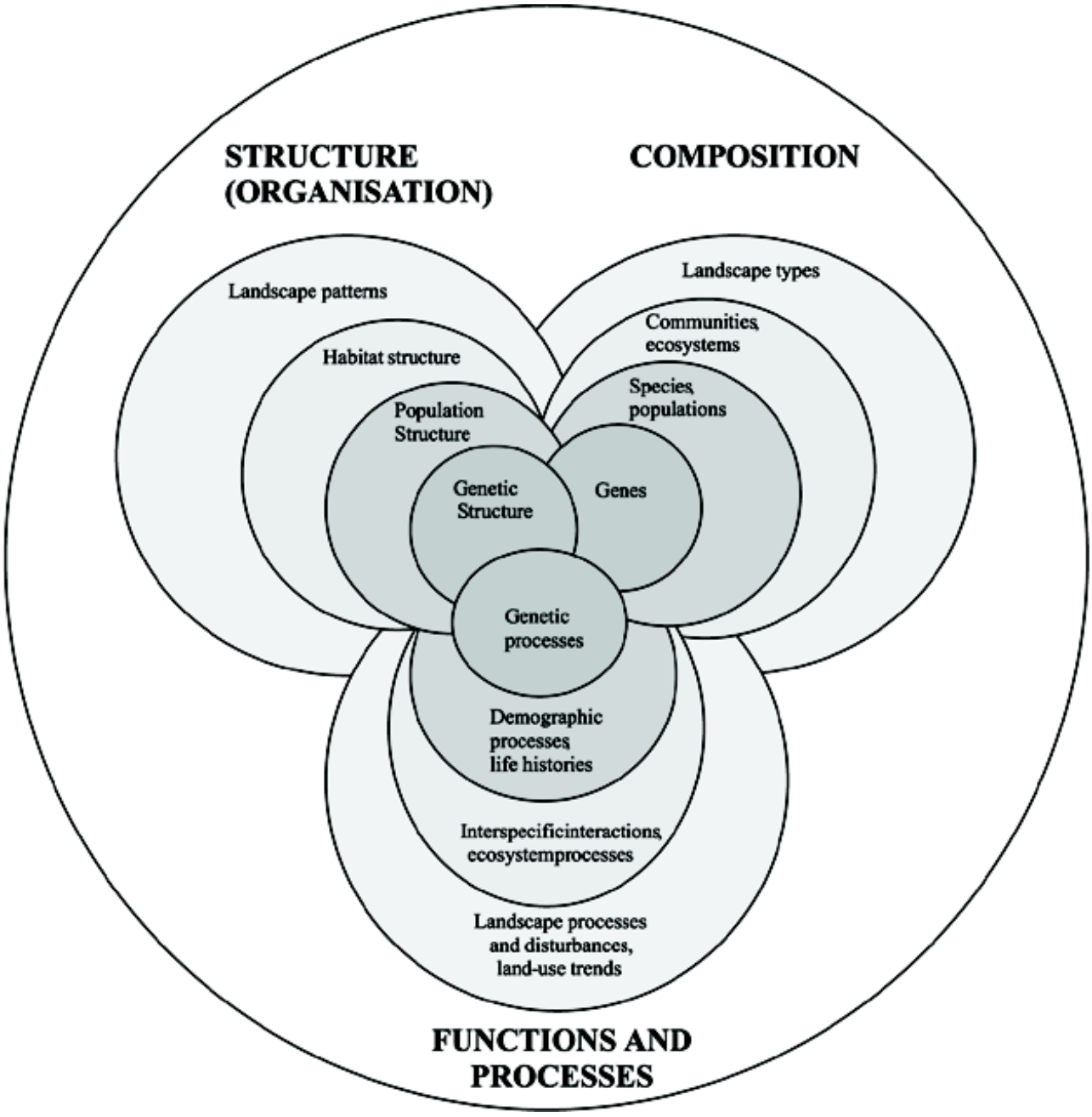

Table 1.1 Selected definitions of biodiversity

Definition	Source
Biological diversity refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity these items are organised at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus the term encompasses different ecosystems, species, genes and their relative abundance.	OTA, 1987[42].
Biodiversity is the variety of the world's organisms, including their genetic diversity and the assemblages they form. It is the blanket terms for the natural biological wealth that undergirds human life and wellbeing. The breadth of the concept reflects the interrelatedness of genes, species and ecosystems.	Reid and Miller, 1989[43].
Biological diversity encompasses all species of plants, animals and microorganisms and the ecosystems and ecological processes of which they are part. It is an umbrella term for the degree of nature's variety, including both the number and frequency of ecosystems, species or genes in a given assemblage	McNeely *et al*., 1990[36].
The genetic, taxonomic and ecosystem variety in living organisms of a given area, environment, ecosystem or the whole planet.	McAllister, 1991[35].
The total variety of life on earth. It includes all genes, species and ecosystems and the ecological processes of which they are part.	ICBP, 1992[26].
Biological diversity (biodiversity). Full range of variety and variability within and among living organisms, their associations and habitat-oriented ecological complexes. Term encompasses ecosystem, species and landscape, as well as intraspecific (genetic) levels of diversity.	Fiedler and Jain, 1992[14].
The variety of organisms considered at all levels, from genetic variants belonging to the same species through arrays of species to arrays of genera, families and still higher taxonomic levels; includes the variety of ecosystems which comprises both the communities of organisms within particular habitats and the physical conditions under which they live.	Wilson, 1992[58].
The variability among living organisms from all sources including, inter a lia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.	CBD Article 2; Use of Terms[7].
The structural and functional variety of life forms at genetic, population, species, community and ecosystem levels.	Sandlund *et al*., 1993[45].

2.2 Integrating Biodiversity Concerns with Decision-making for Development

Why is it so important that biodiversity concerns should be taken into account in decision-making for new development?
At one level, the answer to this question is simple:

* because we are losing too much biodiversity through poorly-evaluated and implemented development;
* because loss of biodiversity may have damaging consequences for people; and
* because we do not need to lose so much biodiversity whilst meeting realistic development goals.

2.2.1 Rates and causes of loss of biodiversity

The rate of loss of biodiversity is generally acknowledged to be greater today than at any time since the extinction of the dinosaurs[3]. The background rate of extinction has been estimated at less than 0.01% of species per century and the current known rate for birds and mammals is 100 to 1000 times higher than pre-human levels in well-known, but taxonomically diverse groups from widely different environments. If all species currently deemed threatened become extinct in the next century, then future extinction rates will be 10 times recent rates. Some threatened species will survive the 21st century, but many species not now threatened will succumb. Regions rich in species not found elsewhere (endemics) dominate the global patterns of extinction. Although new technology provides details of habitat losses, estimates of future extinctions are hampered by our limited knowledge of which areas are rich in endemics.

Not only have species-extinction rates accelerated, whole habitats have been lost or degraded. For example forests, which support at least two thirds of the earth's terrestrial species, have virtually disappeared in 25 countries of the World; 18 countries have lost more than 95% of their forests and another 11 have lost 90%[61]. Deforested nations are now drawing on the timber reserves of other countries to meet their requirements. The decision of the Chinese Government to halt logging in its virgin forests for purposes of flood mitigation has resulted in China becoming the second largest importer of timber in the World. More than half of the habitable surface of the planet has already been altered significantly in some way by human activity and as the human population continues to grow, pressures on biodiversity are bound to increase further. Against this background, there is a clear need to ensure that ongoing development does not undermine the natural resource-base. Human societies must operate within the biophysical limits of a finite and fragile earth[61].

By 2000, the world's 30,000 protected areas covered over 13,250,000 km2 of the land surface of the world (roughly the size of India and China combined). A much smaller proportion of the world's seas (barely 1%) are protected. This represents a tremendous investment by the countries of the world to protect their biological diversity for future generations[31]. However, designation of protected areas alone is demonstrably failing to safeguard overall biodiversity. Only a very small proportion of the earth's surface is protected for purposes of nature conservation and even in many protected areas, a considerable amount of human economic activity still occurs.

Impact assessment provides procedures and tools for ensuring that biodiversity considerations are included in the decision-making process for new development, whether this is taking place inside or outside protected areas. If used effectively it can result in development that is more sensitively planned and designed with respect to biodiversity.

2.2.2 Human dependence on biodiversity

Human and natural systems interact in complex ways, but it is not overstating the case to say that biodiversity is the 'foundation of human existence' and its loss has profound implications for economic and social development.

A large proportion of the world's economy and the subsistence needs of the poor are derived directly from biological resources, though their exact monetary value is unknown. It has been estimated that the human population uses 40% of the planet's photosynthetic product. Costanza *et al*[8] estimated that ecosystems provide at least US$33 trillion-worth of services annually. This is quite apart from potential new uses, as yet undiscovered.

Degrees of dependence on biodiversity vary. However, rural populations typically require the following for their livelihood: food, drink, fuel, fodder for livestock, medicine, material for construction and implements, and products to exchange or sell in markets. Traditional societies have always met these requirements from biological and other natural resources, in most cases from the ecosystems in which they live. At least 3,000 species of plants have been used through history for food purposes alone and approximately 21,000 species are known to have been used for medicinal purposes. The National Biodiversity Strategy and Action Plan (NBSAP) for Guyana records a total of 3,213 plant species with particular uses. For example, 34 species provide oils and waxes, 446 are used for food, 77 for utensils and tools, 65 for colouring products and dyes and an astonishing 2,449 are used for medication. In India even today, more than 3,000 species of plants are in use by tribal and non-tribal peasant communities for medicinal uses, and in one region of Peru, fruits of 193 species are consumed. Single species may also be put to a variety of uses: a single *Grewia* species is used in the Indian Himalayas for fodder, fuel, fertilizer, fibre, soap, and medicine[16]. Maintaining a variety of traditional uses for biodiversity is a critical response mechanism to ensure sustainability of resource use and is also a mechanism for spreading dependence so that no one species is over-pressured: ecosystems may become degraded and face collapse if some elements are overused, and many hunting-gathering or fishing communities do not have the luxury of switching to alternatives if this happens..

Maintaining the variety of life can therefore be seen as an insurance policy on which many human lives, livelihoods and futures depend.

There are four distinct ways in which biodiversity supports human existence:

(i) providing ecological services;

(ii) supporting sustainable flows of natural resources;

(iii) providing cultural and spiritual values; and

(iv) providing technical and scientific values.

Box 3 summarises some of the services and products provided by biodiversity.

Ongoing erosion of natural capital is likely to result in increased social hardship, economic hardship and cultural impoverishment. In India, dependence on biodiversity for provision of fodder for livestock, fuel, timber and forest produce has been an accepted way of life for a rural population that accounts for nearly 74% of India's total. However, the availability of forests to provide these resources has declined markedly per head of population, from about 20 ha per person in 1951 to about 0.11 ha in 1981[32] without any significant change in lifestyle or biomass needs. The ecological 'footprints' of major cities can be considerable. The 29 largest cities in Baltic Europe appropriate an area of forest, agricultural land, marine and wetland ecosystems 565-1130 times larger than the area occupied by the cities themselves to satisfy their resource consumption and waste disposal needs[18]. Naeem *et al*.[36,37], showed that declining biodiversity can alter the performance of terrestrial ecosystems. Biodiversity can therefore be an important indicator of environmental health and has a vital role in maintaining the quality of life[1].

Biodiversity as an indicator of environmental 'health'

'A crucial test of the health of a local environment is whether the wildlife community that is present fully reflects the animal and plant communities normally associated with the habitat in that area. In this way biodiversity is one of the most important indicators of the state of our environment.' [43]

In addition there are many cultural and aesthetic benefits associated with biodiversity which are harder to measure but no less important.

Box 3 Some typical services provided by biological resources

Ecosystem Services

* Protection of water resources (maintenance of hydrological cycles; regulation and stabilising water runoff and underground water tables, acting as a buffer against extreme events such as flood and drought);
* Purification of water (e.g. by wetlands and forests);
* Soil-formation and protection (maintenance of soil structure and retention of moisture and nutrient-levels helping to preserve the soil's productive capacity);
* Nutrient storage and recycling (of atmospheric as well as soil-borne nutrients both necessary for the maintenance of life);
* Pollution breakdown and absorption (by components of ecosystems ranging from bacteria to higher life forms, and ecological processes);
* Maintenance of air quality (e.g. carbon dioxide levels)
* Contribution to climate stability (vegetation influences the climate at the macro and micro level);
* Recovery from unpredictable events (such as fire, flood, cyclones and disasters initiated by humans).

Biological Products

* Food (animals, fish, plants)
* Genes (a huge resource which is being used for example to improve the quality and quantity of food supplies and the range and depth of medicines)
* Medicinal resources (one of the oldest uses of biological resources, the current supplier of many current medicines, such as antibiotics and the potential supplier of many future medicines, such as cancer treatment drugs)
* Biological control agents (natural pesticides and herbicides)
* Materials (fibres, coatings such as Shellac, keratins, adhesives, biopolymers, oils, enzymes)
* Wood products (including wood for fuel, construction and paper producing)
* Breeding stocks, population reservoirs (providing support systems for commercially valuable environmental benefits and resources)
* Future resources (a huge "bank" for discovered and not-yet discovered resources developed to increase human welfare);

Social and cultural services:

* Opportunities and resources for research, education and monitoring (living laboratories for ecological studies; studies to optimise use of biological resources, research on the genetic base of harvested biological resources and how to rehabilitate degraded resources)
* Recreation and tourism facilities
* Cultural values (since human cultures co-evolve with their environment, the natural environment provides for many of the inspirational, aesthetic, spiritual and educational needs of people)
* Environmental health 'barometers' (early warning signs or indicators of environmental degradation)

2.2.3 Finding a balance

Impact assessment may be used to evaluate the effects of a variety of development types. Some developments are based directly on exploitation of natural resources and there are clear and obvious links between the viability of proposals and the sustenance of the natural resources on which they depend: developments in the agriculture and forestry sectors are an obvious example. In other sectors, the links between economic viability and the sustainability of the natural resources affected are not so clear. Impact assessment can help to identify these links and provide the information needed to explore them. The use of impact assessment as a tool for sustainable development is considered in the following section.

Acting on the information provided by impact assessment to find sustainable solutions, however, requires robust systems of environmental or land-use planning. Increasingly, ecosystems are threatened by cumulative impacts that cannot be attributed to any one proposal and that cannot be managed effectively in isolation.

In most countries there is little experience in the integration of biodiversity considerations with sectoral or cross sectoral plans, programmes and policies (as required by Article 6(b) CBD) to ensure that cumulative threats to biodiversity can be regulated (eg see Case Study 13, UK, p5[53]).

2.3 Impact assessment as a tool for sustainable development

2.3.1 What is Impact Assessment?

'Impact Assessment' is the process of identifying, quantifying and evaluating the potential effects of development[25] and this term is inclusive of all of the other forms of impact assessment described below.

'Environmental Impact Assessment' is widely used throughout the world to balance environmental (including biodiversity), economic and social considerations in development planning (see Box 4). It is most commonly applied at the project level, as part of consent procedures for individual proposals.

Countries practising EIA differ with respect to terminology. In some, the 'environment' is interpreted in a strict biophysical sense; while in others a wider interpretation is used which encompasses social, cultural, ecological and economic considerations. Countries also vary with respect to the scope of EIA, or the range of factors included in the EIA process. These may be determined by legislative requirements, or they may result from less formal negotiation between developers, regulatory authorities and other stakeholders. A spectrum of impact assessment-disciplines has emerged for more detailed analysis of impacts in different environmental sectors, for example Health Impact Assessment, Ecological Impact Assessment, Social Impact Assessment, Economic Impact Assessment and so on. Detailed definitions and explanations of impact assessment-terminology can be found in Vanclay and Bronstein[55], Canter[6] and Treweek[50].

Most EIA-legislation requires some consideration of ecological impacts, but explicit requirements to consider effects on biodiversity per se have emerged relatively recently. It is now increasingly common for EIA to address impacts on biodiversity as a distinct category of assessment (Case Study 12[53], UK).

Box 4 Definition of Impact Assessment (after Glowka et al., 1994; IUCN, 2000)

Impact Assessment:
Analysis of the expected impacts of a proposed policy, programme or project on ecosystems and society. Its function is to evaluate the foreseeable effects of proposed projects and policy options, with the aim of avoiding or minimising harm and optimising benefits

Environmental Impact Assessment (EIA) is a procedure typically used to identify the environmental effects of a proposed project and to plan appropriate measures to avoid, reduce or compensate for its adverse effects. The environment should be considered in its widest sense, including effects on biodiversity, human health, local livelihoods and society at large.

In many jurisdictions where EIA procedures are required, they apply only to government-sponsored projects. In others, they are extended to both government and private sector projects. Projects subject to EIA vary between jurisdictions. An EIA report (or 'Environmental Impact Statement, EIS) is usually produced to outline potential environmental problems and identify measures to decrease a project's adverse environmental effects.

The main objective of EIA is to provide decision-makers with information about a project's environmental effects, to permit an informed decision about whether the project should go ahead. If good practices are used in EIA it should also help to produce more environmentally sound projects.

Impact assessment can also be used and adapted to aid the preparation and assessment of development programmes and policies (usually referred to as strategic environmental assessment or SEA), for example, multiple land use plans and sectoral investment plans.

Strategic Environmental Assessment (SEA) is used to evaluate the environmental, economic and social impacts of policies, plans and programmes. Therivel *et. al.*[50] provides a comprehensive introduction to SEA.

SEA identifies impacts on biodiversity further 'upstream' in the planning process. It enables consideration of the status of biodiversity over a longer time-frame, and for larger geographical areas. SEA offers solutions to some of the shortcomings commonly attributed to project-level EIA, including the difficulties inherent in considering cumulative or landscape-scale ecological effects. Many threats to the long-term survival of biodiversity are individually insignificant but collectively serious. By definition, 'cumulative' environmental effects are not attributable to any one source of activity and cannot be regulated in isolation[51].

Planning for new development must therefore take account of cumulative threats to biodiversity as well as those posed by individual proposals. It is difficult to achieve this on a project basis, although there are cases, for example in Eritrea, where planners have asked project proponents to document the number of similar projects within a specified distance, in order to indicate the potential for cumulative impacts caused by similar developments (David Duthie, pers.comm). To facilitate consideration of cumulative impacts and the early consideration of environmental and social constraints in the planning process, there has been a growing demand for SEA and an increase in the number of countries introducing SEA legislation. A recent report by the UK Biodiversity Challenge Partnership[1], for example identified a clear need for SEA to be applied to all development policies, plans and programmes, to ensure that biodiversity is considered at all stages in development planning The planning system should also be reviewed to check that all its elements contribute to the maintenance and positive enhancement of biodiversity. However, the methods by which biodiversity considerations would be incorporated into SEA have not been elaborated in any detail and still need to be determined and agreed.

The application of impact assessment to policies, plans and programmes is relatively new in many countries. For example, a European Directive on SEA has just been implemented. The Directive is now in force and needs to be implemented in Member States by mid-2004. Strengths of the Directive include an explicit requirement to assess impacts on biodiversity, a requirement for future Structural Fund and Rural Development Regulation plans and programmes to be subject to SEA, and a monitoring requirement (Byron, pers. comm.).

In many countries, including India (see Case Study 5) pressure to develop a capability for assessment of plans and programmes has come largely from application of operational directives of donor agencies. These may require environmental review of major investment programmes for civic infrastructure expansion, sectoral investment or programmes of environmental improvement. Both the US and Canada have posted Guidelines for Environmental Assessment of Trade Agreements on the internet.

2.3.2 Biodiversity in sustainable development

The need to use biodiversity resources sustainably is a key principle of the CBD: Article 10 specifically concerns 'sustainable use' of biodiversity. Assessing the status and trends of biodiversity is essential for sustainable development strategies at all levels, from village to nation to region[28].

For sustainable development to be attainable, it is necessary to ensure that proposed developments:

a) do not significantly reduce biodiversity and
b) enhance biodiversity wherever possible.

The Australian Environment Protection and Biodiversity Conservation Act of 1999 presents a number of principles of ecologically sustainable development. These are listed in Box 5.

Box 5 Principles of Ecologically Sustainable Development (Australian Environment Protection and Biodiversity Conservation Act, 1999)

(a) Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;

(b) The precautionary principle - if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;

(c) The principle of inter-generational equity - the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;

(d) The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;

(e) Improved valuation, pricing and incentive mechanisms should be promoted.

Principle (d) reinforces the need to make conservation of biological diversity and 'ecological integrity' a fundamental consideration in decision-making. In the Act, impact assessment is clearly presented as a tool for achieving ecologically sustainable development, rather than simply a procedure for ensuring that ecological sustainability is considered as just one aspect of development planning.

Similarly, the preamble to the EC EIA Directive refers to the need to assess *'effects of a project on the environment...to ensure maintenance of the diversity of species and to maintain the reproductive capacity of the ecosystem as a basic resource for life*' . The EC EIA Directive requires the identification, description and assessment of direct and indirect effects of a project on flora and fauna and the interaction between these and soil, water, air, climate and the landscape. Taking a purposive approach to the legislation, it is clear that the treatment of biodiversity is intended to be regarded as an integral part of EIA[5]. Recently, the discovery of populations of protected black-bellied European hamsters (*Cricetus cricetus*) at two proposed development sites in Germany blocked construction work. The costs of relocating the hamsters to allow development to proceed would be considerable (Weekly Telegraph 22-28/8/01). Enforcement of protected species legislation through the impact assessment process is one obvious way in which biodiversity conservation interests can be protected. In addition, the recently adopted EC SEA Directive explicitly mentions biodiversity and the need to take it into account early in the process of development planning.

2.3.3 Impact assessment for sustainable development

EIA and SEA are intended to provide the information that can be used to balance environmental (including biodiversity) economic and social considerations in development planning.

Article 14 of the CBD provides an explicit mandate for EIA and SEA as tools to minimise adverse impacts on biodiversity due to development. For impact assessment (EIA or SEA) to play a part in sustainable development, it must draw directly on any existing national and international objectives or targets for conservation of biodiversity. There is a clear role here for NBSAPs or other similar documents in providing 'biodiversity benchmarks' against which the implications of development proposals can be evaluated. There is also a need for tools to measure the state of biodiversity in relation to these agreed biodiversity objectives and to predict the extent to which any development proposal will alter the condition and state of biodiversity. A sample of the questions that would need to be addressed is provided in Box 6.

Box 6 Biodiversity information required for impact assessment (after IUCN, 2000[28])

What are the main components of biodiversity likely to be affected?

What are the status and trends of these biodiversity components?

Consider:

* Land ecosystems and habitats
* Inland water ecosystems and habitats
* Marine ecosystems and habitats
* Species
* Populations and genetic lines

(As appropriate in each case).

What are the main existing stresses on biodiversity components? Are these increasing, stable or declining?

What are the main benefits from biodiversity components? Are these stable, increasing or declining?

Have key stakeholders been consulted concerning traditional uses and values?

Effective treatment of biodiversity in impact assessment should result in:

* Avoidance or prevention of biodiversity damage through genuine efforts to pursue alternatives with less potential for biodiversity-loss.
* Minimisation of biodiversity damage through design-modification .
* Compensation for biodiversity loss or damage, taking account of biodiversity values as perceived by all affected parties/ stakeholders.
* Identification of opportunities for enhancement of biodiversity.

Impact assessment can help to ensure that the measures needed to protect biodiversity and ensure its sustainable use are respected in planning processes, and that developments are undertaken in such a way as to ensure the fair and equitable use of biological resources. However, impact assessment is simply a tool to ensure that well-informed decisions are made, and that biodiversity concerns are taken fully into account. It cannot guarantee that better decisions will actually be made from a biodiversity conservation perspective.

Techniques for integrating biodiversity concerns with impact assessment procedures and methods are considered in Chapter 3. These are intended to enhance the role of impact assessment in furthering sustainable development of biodiversity.

3 The Global Agenda for Biodiversity and Impact Assessment

3.1 Background

The conservation of biological diversity and the sustainable use of its components were identified as priority areas for international action as early as 1972, at the United Nations Conference on the Human Environment which led to the formation of the United Nations Environment Programme (UNEP). Biodiversity was placed firmly on the international agenda when the Convention on Biological Diversity (CBD) was opened for signature at the 1992 UNCED Earth Summit in Rio de Janeiro, and signed by over 150 countries. The CBD came into force in December 1993 and has now been ratified by 175. The CBD was intended to provide a means for nations to support each other in conserving the "richness, integrity and productivity of life"[23]. Most importantly, the CBD reinforces the fact that conservation of biological diversity is "a common concern of humankind" and must be considered an integral part of the development process.

Impact assessment in its various forms has many potential roles in implementing the CBD. These are explored in Section 2.2 below. There are a number of other global conventions that play a part in international efforts to conserve biodiversity and some of these can also benefit from the application of impact assessment (see Box 7).

Box 7 Global Biodiversity-related Conventions (from Glowka et al., 1994[17])

The Convention on wetlands of International Importance Especially as Waterfowl Habitats (Ramsar, 1971)
The Ramsar Convention requires each party to promote the conservation of internationally important wetlands and the wise use of all wetlands within its territory. Conservation measures are to be established in wetland areas to promote wetland and waterfowl conservation. Each party designates at least one wetland of international significance to be included on the world list maintained under the Convention.

The Scientific and Technical Review Panel (STRP) of the Ramsar Convention has established a working group on Impact Assessment which addresses the potential role of impact assessment-tools in delivering the objectives of the Convention.

The Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)
The World Heritage Convention requires parties to take steps to identify, protect, conserve, present and transmit to future generations the cultural and natural heritage within their territories. Cultural and natural areas of outstanding universal value are eligible for listing on the World Heritage List and the Convention establishes the World Heritage Fund, which can be used by the World Heritage Committee to assist countries with establishing and conserving World Heritage Sites.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973)
CITES regulates international trade of all species listed in its Appendices I, II and III. Appendix I lists species threatened with extinction which are or may be affected by trade. Trade in these species is banned except in exceptional circumstances, in accordance with the provisions of the Convention. Appendix II lists species not yet threatened with extinction, but which may become so unless their trade is subject to strict international controls. Appendix III lists species which any party identifies as subject to regulation within its jurisdiction to prevent or restrict exploitation, and which require the co-operation of the other CITES parties in the control of international trade.

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)
The parties to the Migratory Species Convention are to act within the Convention's framework to conserve migratory species and their habitat. Parties can undertake to: (1) adopt strict measures protecting migratory species categorised in Appendix I as endangered; and (2) adopt agreements to conserve and manage migratory species whose conservation status is unfavourable or which would significantly benefit from international co-operation.

3.2 The Convention on Biodiversity and the role of impact assessment

The Convention on Biodiversity (CBD)[7] is concerned with conservation of biodiversity as defined in Box 1. The CBD has three main objectives (Box 8) and 42 Articles summarising the principles of the CBD and the commitments made by Parties to conserve biodiversity and promote its sustainable use. Article 14 of the CBD makes explicit reference to the use of impact assessment to minimise adverse effects on biodiversity: its main provisions are summarised in Box 9. Article 14 also implies the need for provisions for EIA in a trans-boundary context, where adverse impacts associated with an activity originating in one state or country may affect biological resources under the jurisdiction of other states or countries. In addition, Article 14 requires contracting parties to promote national arrangements for emergency responses to activities or events that present a grave danger to biological diversity and to encourage international co-operation and the establishment of joint contingency plans.

Box 8 Goals of the Convention on Biodiversity

* The conservation of biodiversity - through measures for *in situ* and *ex situ* conservation;
* The sustainable use of biodiversity: the CBD promotes measures to ensure that future generations will benefit from today's biological resources;
* The fair and equitable sharing of the benefits arising from the use of genetic resources.

Box 9 Main Provisions of Article 14 of the CBD

Article 14 of the CBD:
"each contracting party, as far as possible and as appropriate, shall:

a) introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimising such effects and, where appropriate, allow for public participation in such procedures;

b) introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account;..."

There are a number of other articles of the CBD which have implications for EIA or which provide potential opportunities for its application. These are reviewed and summarised in the tables following this page. (Table 3.2)

The legal implications of the biodiversity-related conventions for impact assessment are explored in more detail in a separate report in this overall study (see: Legislative Complementarity and Harmonisation of Diodiversity-related Multilateral Environmental Agreements, available on the BPSP website[54]).

Table 3.2 The articles of the CBD and their implications for EIA

Article	*Article Provisions*	*Implications for EIA*
6 General Measures for Conservation and Sustainable Use		
6a	Each Contracting Party shall, in accordance with its particular conditions and capabilities, develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity, or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relative to the Contracting Party concerned	* Creates an obligation for national planning and to indicate how the obligations and objectives of the Convention will be fulfilled: this must include requirements for EIA where they do not already exist * Requirements for EIA should be reviewed periodically in tandem with any iterative reviews of strategies for fulfilling the requirements of the Convention * Ensure that EIA is applied to sectoral development programmes not just individual projects, to ensure that requirements to consider effects on biodiversity are incorporated into sectoral and cross-sectoral development plans
6b	Integrate, as far as possible and appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies	* Introduce EIA for sectoral and cross-sectoral plans, programmes and policies for major development sectors * Ensure that sectoral EIA procedures incorporate impacts on biodiversity in terms of conservation and sustainable use * Use EIA as a vehicle to apply sustainable use measures in development decision-making
7 Identification and Monitoring		
7	Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Articles 8 to 10:	
7a	Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I	* Identify ecosystems and habitats; species and communities; genomes and genes of social, scientific or economic importance that are critical for conservation and sustainable use in terms of 'distinctiveness', 'richness' and 'representativeness', 'cultural and economic importance or potential' and 'the extent to which they are threatened * Use EIA to determine whether these critical resources are likely to be significantly undermined by any proposal
7b	Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a), paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use	* Ensure monitoring programmes include components of biodiversity that can be used as indicators in EIA * Ensure that monitoring/ baseline data are available to impact assessment practitioners * Set up mechanisms for using the results of EIA in monitoring, eg library/ database of impact statements with open access
7c	Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques	* Ensure that processes and categories of activities that have or are likely to have significant adverse impacts on biodiversity are always subject to EIA (Include in EIA-screening) * Produce sectoral guidance on biodiversity-impacts and threats caused by these processes or activities
7d	Maintain and organise, by any mechanism data, derived from identification and monitoring activities pursuant to subparagraphs 7a, b and c	* Ensure data are freely available to EIA practitioners, planners and decision-makers * Financing for interpretation of data is important as well as storage and dissemination

Article	*Article Provisions*	*Implications for EIA*
8h In-situ Conservation		
8a	Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity	• Use EIA to predict the social, ecological and economic consequences of establishing protected areas. • Use EIA as a tool to optimise location and boundaries of protected areas • Use SEA to optimise location and distribution of protected area networks • Ensure EIA procedures respect protected areas. • Presence of a protected area should act as a trigger for EIA in Screening
8b	Develop, where necessary, guidelines for the selection, establishment and management of protected areas	• Use EIA as a tool in selection and establishment of protected areas. • Ensure that the EIA process includes social impact assessment and full public participation. • Require EIA for proposed developments within protected areas.
8c	Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use	• Derive 'sustainable use- measures' or 'sustainable use-indicators' that can be used as evaluation criteria in EIA • Include cumulative effects-analysis in EIA to ensure resources remain within sustainable use-limits. • Ensure national biodiversity strategies include targets for biological resource- status and use.
8d	Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings	• Take an ecosystem approach in EIA: do not focus only on species as units of assessment. • Use the concept of 'viable population' in evaluation for EIA (ie will the proposal cause environmental changes likely to make an important population unviable?) • Ensure that EIA takes account of need to maintain genetic diversity and reduce extinction risk. • Use the biodiversity planning process to provide guidance to EIA practitioners concerning minimum viable population size required to maintain genetic diversity in key species. • Use the biodiversity planning process to assess extinction risk (and key threats) for important species and populations.
8e	Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas	• Include buffer zones for protected areas as triggers in EIA-screening • Use biodiversity planning process to establish clear biodiversity objectives for buffer zones • Use planning process to specify permitted developments in buffer zones
8f	Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia* through the development and implementation of plans or other management strategies	• Use EIA-mitigation to rehabilitate and restore degraded ecosystems or to provide replacement habitat for threatened species • Use EIA to identify opportunities for rehabilitation and restoration

Article	*Article Provisions*	*Implications for EIA*
8g	Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health.	• Ensure EIA procedures and requirements make reference to 'Living Modified Organisms' (eg does a proposal use LMOs? If so the EIA should consider risks of escapes and longer term impacts on ecosystems) • use EIA/ human health risk assessment as part of the approval process for releases
8h	Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species	• NBSAPs should identify alien species that threaten native ecosystems, habitats and species and publish this information for use in EIA • EIA should be required for any proposal involving introduction or use of alien species • EIA may identify need or opportunities for control of aliens
8i	Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components	• EIA should identify whether current uses are optimal for biodiversity conservation
8j	Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biodiversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovations and practices	• Ensure that the EIA process pays due regard to traditional practices, land-uses and the rights and activities of indigenous and local people • seek involvement of indigenous and local people in the EIA process. Ensure that EIA process provides genuine opportunities for inclusion of indigenous and local communities • The EIA process should use traditional knowledge as a vital source of information (provided consent is given) • EIA practitioners need to understand how to seek involvement from holders of traditional knowledge in the EIA process (guidance required? Principles? Develop ethical guidelines/ code of conduct for collection and dissemination and benefit-sharing of traditional knowledge, innovations and practices) • EIA should consider whether a proposal will compromise the ability to 'respect, preserve and maintain the knowledge, innovations and practices of indigenous and local communities..' • The EIA process should therefore include traditional 'values' as evaluation criteria
8k	Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations	• EIA must respect regulatory provisions and laws concerning protection of threatened species and populations • Presence of protected species or their habitat should trigger EIA in screening even when these occur outside protected areas • EIA must consider availability of habitat for these species and should include cumulative effects analysis to ensure that individual proposals do not threaten viability

Article	*Article Provisions*	*Implications for EIA*
8l	Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities	• Article 7(c) requires parties to identify the processes and categories of activities which have, or are likely to have significant adverse effects on the conservation and sustainable use of biodiversity. • EIA should be required for any proposal within the categories identified • EIA should include assessment of cumulative effects caused by any of these processes or categories • Data collected in accordance with 7c should be made available in a form readily used by decision makers and EIA practitioners
8m	Co-operate in providing financial and other support for in-situ conservation outlined in paragraphs a-l above, particularly to developing countries	• EIA capacity has an important part to play in regulation of development and in ensuring that development consent procedures are compatible with efforts for in situ conservation of biological diversity • Capacity for EIA regulation and independent review is particularly important with respect to conservation of biological diversity • Use EIA to identify opportunities for biodiversity gain and include the costs of restoration, rehabilitation and biodiversity conservation in financing for major projects
9 Ex-situ Conservation		
9a	Adopt measures for the ex-situ conservation of components of biological diversity, preferably in the country of origin of such components	
9b	Establish and maintain facilities for ex-situ conservation of and research on plants, animals and micro-organisms, preferably in the country of origin of genetic resources	
9c	Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions	
9d		
9e	Co-operate in providing financial and other support for ex-situ conservation..	
10 Sustainable use of components of biological diversity		
		• EIA practitioners need to know which species are threatened and have been identified as candidates for ex-situ conservation efforts. • EIA can identify previously unrecorded locations and also identify potential opportunities for recovery and rehabilitation programmes

Article	*Article Provisions*	*Implications for EIA*
10a	Integrate consideration of the conservation and sustainable use of biological resources into national decision-making	• Ensure that EIA laws and procedures are reviewed in the light of results of national biodiversity planning • Ensure that EIA procedures and requirements are based on concepts of sustainable use • EIA should consider whether the proposed activity is likely to reduce the future use potential of any important component of biological diversity or impair its long term viability • Evaluation criteria used in EIA must include measures of sustainable use and national targets/ objectives for conservation • EIA should include recommendations for mitigation measures to restore biological resources to a sustainable state
10b	Adopt measures relating to the use of biological resources to avoid or minimise adverse impacts on biological diversity	• Use EIA to evaluate development proposals and identify and predict adverse impacts on biological diversity • Ensure that the EIA process requires thorough consideration of alternatives, including alternatives with lower impact on biodiversity • Ensure that EIA legislation requires recommendations for mitigation and also makes their implementation a mandatory requirement • Ensure that EIA takes account of regional and national stocks of biological resources and also their spatial organisation (ie identify activities likely to cause habitat fragmentation, habitat isolation etc) • Use an 'ecosystem approach' to EIA
10c	Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements	• Effective mechanisms for community participation are required • Evaluation criteria used in EIA must include traditional values • EIA should examine whether proposal will compromise traditional cultural practices that are compatible with conservation or sustainable use
10d	Support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced	• Use EIA mitigation requirements to identify and provide opportunities for local restoration programmes
10e	Encourage cooperation between governmental authorites and private sector in developing methods for sustainable uses of biological resources	?
Article 11: Incentive		
	Each Contracting Party shall, as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity	Use EIA to evaluate the economic, social and ecological implications of incentives, grants, taxes etc with respect to conservation of biodiversity

Article	*Article Provisions*	*Implications for EIA*
Article 12: Research and Training		
12a	Establish and maintain programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components and provide support for such education and training for the specific needs of developing countries	Develop training in EIA practice and EIA-review to ensure that practitioners and government regulators receive training on measures for the identification, conservation and sustainable use of biodiversity
12b	Promote and encourage research which contributes to the conservation and sustainable use of biodiversity, particularly in developing countries, *inter alia*, in accordance with decisions of the Conference of the Parties taken in consequence of recommendations of the Subsidiary Body on Scientific, Technical and Technological Advice	• Include information needs of EIA in prioritisation exercises for research on biodiversity • Ensure that results of efforts to identify and monitor components of biodiversity are made available to EIA practitioners • Include measures of biodiversity in monitoring programmes that can be used readily in EIA • Ensure that monitoring programmes address human interactions with ecosystems and species and provide reliable information on the ecological changes that are likely to occur following different kinds of human activity or disturbance
12c	In keeping with the provisions of Articles 16, 18 and 20, promote and co-operate in the use of scientific advances in biological diversity research in developing methods for conservation and sustainable use of biological resources	Ensure that advances in research on biological diversity (for example research on use of biodiversity indicators, or rapid evaluation techniques) are communicated to EIA practitioners, decision-makers and regulators
Article 13 Public Education and Awareness		
13a	Promote and encourage understanding of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes	
13b	Co-operate, as appropriate, with other States and international organisations in developing educational and public awareness programmes, with respect to conservation and sustainable use of biological diversity	
Article 14 Impact Assessment and Minimising Adverse Impacts		
1 Each Contracting Party, as far as possible and as appropriate, shall:		

Article	*Article Provisions*	*Implications for EIA*
14a	Introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimising such effects and, where appropriate, allow for public participation in such procedures	• Introduce EIA procedures if not currently in place • Review existing EIA procedures to ensure that they take account of impacts on biodiversity • Use EIA expressly to avoid or minimise significant adverse effects on biological diversity • Ensure that projects subject to EIA include those identified in Article 7c that are known to pose a threat to biodiversity • Use EIA to identify aspects of projects likely to have significant adverse effects on biological diversity at the genetic, species and ecosystem levels • Use EIA to check whether proposals comply with other environmental legislation • Introduce mechanisms for public participation in EIA and ensure that biodiversity concerns are included in public consultation exercises for proposed developments
14b	Introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account	• Introduce SEA to assess environmental implications of programmes and policies, particularly for those with major implications for natural resource use (especially forestry, agriculture, transport) • Ensure that SEA provisions include biodiversity and that national biodiversity monitoring data are used in the SEA process
14c	Promote on the basis of reciprocity, notification, exchange of information and consultation on activities under their jurisdiction or control which are likely to significantly affect adversely the biological diversity of other States or areas beyond the limits of national jurisdiction, by encouraging the conclusion of bilateral, regional or multilateral arrangements, as appropriate	• Introduce provisions for EIA in a trans-boundary context • Identify important migratory species for which habitat conservation in other jurisdictions is also important • Identify important 'stopping off' areas for migratory species • Identify activities with potential to cause trans-boundary effects
14d	In the case of imminent or grave danger or damage, originating under its jurisdiction or control, to biological diversity within the area under jurisdiction of other States or in areas beyond the limits of national jurisdiction, notify immediately the potentially affected States of such danger or damage, as well as initiate action to prevent or minimise such danger or damage	
14e	Promote national arrangements for emergency responses to activities or events, whether caused naturally or otherwise, which prevent a grave and imminent danger to biological diversity and encourage international co-operation to supplement such national efforts and, where appropriate and agreed by the States or regional economic integration organisations concerned, to establish joint contingency plans	• In cases of proposals that have potential to cause major biological damage, ensure that EIAs recommend appropriate emergency response provisions • EIAs should identify the risk of important and highly geographically restricted biological resources being destroyed by possible major accidents or events
14f	The Conference of the Parties shall examine, on the basis of studies to be carried out, the issue of liability and redress, including restoration and compensation, for damage to biological diversity, except where such liability is a purely internal matter	• EIAs should incorporate considerations of liability and redress in the event of biological damage that may be caused by a proposal

Article	*Article Provisions*	*Implications for EIA*
Article 15 Access to Genetic Resources		
Article 15 is about rights and obligations regarding access to genetic resources and their subsequent use (Glowka *et. al*., 1994). While recognising the authority of individual governments to determine access, Parties should try and create conditions which facilitate access to genetic resources by other Contracting Parties for environmentally sound uses and minimise restrictions contrary to the Convention's objectives. Paragraphs 1 and 2 of Article 15 strike a balance between the rights of individual governments to determine access and their obligations to facilitate access by other parties. Subsequent Paragraphs (3 to 7 inclusive) concern benefits derived from the subsequent use of genetic resources, e.g. the fair and equitable sharing of research results (Glowka *et al*., 1994).		
		• It would be possible to use EIA as a means of addressing the likely ecological, economic and social consequences of developing genetic resources and to identify options for equitable sharing of the benefits of its development. • EIA can also be used to ensure that all key stakeholders are engaged in the process of developing genetic resources as required by Paragraphs 4 and 5 of the Convention
Article 16 Access to and transfer of technology		
Article 16 defines the basic obligations of each Contracting Party concerning technology transfer, the basis of transfer to developing countries and what measures are to be taken to institute the transfers contemplated		
Article 17 Exchange of information		
17(1)	Contracting Parties shall facilitate the exchange of information, from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of developing countries	• Ensure that information on EIA is included in the CHM • Make available literature and information on EIA
1 7 (2)	Such exchange of information shall include exchange of results of technical, scientific and socio-economic research, as well as information on training and surveying programmes, specialised knowledge, indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16 paragraph 1. It shall also, where feasible, include repatriation of information	• Provide information needed to assess the appropriateness or environmental impact of technology provided through Article 16 (para. 1)
Article 18 Technical and Scientific Co-operation		
Article 18 obliges Contracting Parties to promote international technical and scientific co-operation in all areas of biological diversity conservation and the sustainable use of its components.		
	Para. 2 refers *inter alia* to 'human resources development and institution building'.	• Ensure that EIA capacity is developed, both to research suitable biodiversity indicators for EIA, to ensure that Countries have the capability to review EISs with respect to biodiversity considerations and to review decisions and mitigation programmes
	Para 3 refers to the establishment of Clearing House Mechanisms	• Ensure that EIA information is made available through the CHM

Article	*Article Provisions*	*Implications for EIA*
Article 19 Handling of Biotechnology and Distribution of its Benefits		
Article 20 Financial Resources		
Para 1	Each Contracting Party undertakes to provide, in accordance with its capabilities, financial support and incentives in respect of those national activities which are intended to achieve the objectives of this Convention, in accordance with its national plans, priorities and programmes	• Seek to link conservation funding with development projects (see also 8(m)) • Use EIA-requirements for mitigation to draw funding into the alleviation of adverse impacts on biodiversity, eg set up process of mitigation banking
Article 21 Financial Mechanism		
Article 22 Relationship with other International Conventions		
		• Ensure that requirements and provisions for EIA and SEA are consistent between the Biodiversity-related Conventions, in particular the Ramsar Convention which also makes explicit reference to EIA and SEA

Box 10 summarises the main steps in the evolving agenda for biodiversity and impact assessment. Further information is available on the IUCN's Biodiversity Economics Site[30]. A summary of the decisions taken by the COP and the SBSTTA is provided on the CBD Web-site[7].

Box 10 The developing global agenda on biodiversity and impact assessment

1992-1993
Article 14 of the CBD requires Contracting Parties to introduce EIA for projects likely to have significant adverse effects on biodiversity and to provide for environmental assessment of programmes and policies. It refers to the need for EIA in a trans-boundary context and for international collaboration to conserve biodiversity of global significance, migratory species and the habitats on which they depend.

1998
'Impact Assessment' is on the agenda for the fourth Conference of the Parties to the CBD.
IUCN workshop at the 18th annual meeting of the International Association of Impact Assessment (IAIA) discusses the potential role of impact assessment in the biodiversity agenda.
IAIA submits a statement to COP4. The contribution is formally recognised by the Parties to the Convention and the ideas presented make a significant contribution to Decision IV/10c on Impact Assessment and Minimizing Adverse Effects. This asks Parties to make more information available for the Secretariat to prepare a background document on impact assessment for SBSTTA4 (June 1999).

1999
The resulting background document examines submissions on:

* impact assessments which consider environmental effects and interrelated socio-economic aspects relevant to biodiversity;
* SEA;
* ways and means of fully incorporating biodiversity considerations into EAs; EAs which relate to the thematic areas addressed in the CBD; existing legislation, procedures and guidelines which incorporate biodiversity into EAs; and mitigating measures and incentive schemes which enhance compliance with existing EA systems.

The final recommendation from SBSTTA4 (Recommendation IV/6) recommended that the Conference of Parties:

(a) invite Parties, Governments and other relevant organisations to:

* implement Article 14 of the CBD in connection with other components of the Convention and integrate EIA into the work programme on thematic areas, such as inland waters, marine and coastal, forest, agricultural biological diversity, dryland ecosystems, and on alien species and tourism;
* address loss of biological diversity, and the interrelated socio-economic, cultural and human health aspects relevant to biological diversity in carrying out EIAs;
* consider biological diversity concerns in the development of new legislative and regulatory frameworks from the early stages of the drafting process;
* ensure the involvement of interested and affected stakeholders in a participatory approach at all stages of the assessment process, including governmental bodies, the private sector, research and scientific institutions, indigenous and local communities and non-governmental organisations, including the use of appropriate mechanisms, such as the setting up of committees at various levels;
* organise experts meetings, workshops, seminars, as well as training, educational and public awareness programmes and exchange programmes, in order to promote the development of local expertise in methodologies, techniques and procedures;

(b) Encourage Parties, Governments and relevant organisations to use SEA to assess impacts not only of individual projects, but also of the cumulative and global effects, incorporating biological diversity considerations at the decision making/environmental planning level, to include the development of alternatives, mitigation measures and consideration of the elaboration of compensation measures in EIA;

(c) Request Parties to include in their national report practices, systems, mechanisms and experiences on the subject;

(d) Request the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to further develop guidelines on the incorporation of biodiversity-related issues into legislation and/or processes on EIA, in collaboration with the scientific community, the private sector, indigenous and local communities, non-governmental organisations and relevant organisations at the international, regional, sub-regional and national level, such as the Scientific and Technical Review Panel of the Convention on Wetlands, the scientific body of the Convention on Migratory Species, DIVERSITAS, IUCN and the International Association for Impact Assessment, the United Nations Environment Programme and the Parties, and further elaborate the application of the precautionary approach and the ecosystem approach, with a view to completion by the sixth meeting of the Conference of the Parties;

(e) Request the Executive Secretary to make accessible and increase the call for case-studies, including negative impacts and, in particular, impact assessments taking the ecosystem approach into account, to compile and evaluate existing guidelines, procedures and provisions for EIA, and make this information available, together with information on existing guidelines on incorporating

Box 10 ... *continued*

biological diversity considerations into environmental impact assessment through *inter alia*, the clearing-house mechanism in order to facilitate sharing of information and exchange of experiences at regional, national and local level.

Biodiversity and EA are again the subject of a workshop at the 19th IAIA Meeting in Glasgow in June 1999, which resulted in a statement and outline programme of work, as a component of the joint programme of work on biodiversity and EA being implemented by representatives of the CBD, CMS, Ramsar, IAIA and IUCN Secretariats.

2000
COP 5 requested SBSTTA to develop guidelines for incorporating biodiversity-related issues in legislation and/or processes on SEA with a view to completing this work by COP 6[1]. The development of further guidance in this area to be done in collaboration with the CBD, Ramsar, CMS, IUCN, and the International Association for Impact Assessment (IAIA)[25].

2001
A meeting is held at the 21st IAIA Meeting in Cartagena, Colombia to discuss a conceptual and procedural framework for integration of biodiversity with national environmental assessment processes and to discuss the case studies prepared under this project (see associated report).

(Source: Bagri, McNeely and Vorhies 1999[3] and CBD website[7])

It should also be noted that CBD SBSTTA 4 made Recommendation IV/6 on the incorporation of biological diversity considerations into EIA based on recognition of:

* the current lack of scientific data on the status and trends of biological diversity in many countries; including information on threatened and endangered species and their habitats which can be used for effective impact assessment.
* the importance of considering indirect, cumulative and trans-boundary impacts on biological diversity and the quality of life for human beings,
* the importance of developing alternatives and mitigation measures to ensure that biological diversity and the quality of life for human beings is sustained in the light of cumulative and trans-boundary impacts,
* the importance of assessing the environmental impacts of policies, plans, programmes and projects that might have direct, indirect or cumulative significant adverse effects on biological diversity,
* the urgent need for capacity-building, including the development of local expertise in assessment methodologies, techniques and procedures, to permit, at the very least, the identification of impacts of major importance on biological diversity.

These represent important factors in development of best practice in impact assessment. They highlight the need for practical measures to enhance the availability of reliable information on biodiversity and to strengthen institutions so that they can carry out effective regulation of EIA and SEA. Subsequent decisions of the COP emphasised the need to ensure involvement of interested and affected stakeholders in all stages of the assessment process, including indigenous and local communities embodying traditional lifestyles and also NGOs. A recurring theme is the need to ensure that the cumulative and global effects of development on biodiversity are considered in strategic environmental decision-making and planning. Parties have been encouraged to assess not only impacts of individual projects, but also their cumulative and global effects through SEAs, incorporating biodiversity considerations at the decision-making and/or environmental planning level (Decision V/18, Para.2(a)).

3.3 The Role of Impact Assessment in National Biodiversity Strategies and Action Plan Implementation

One of the major actions demanded by the CBD is the preparation and implementation of National Biodiversity Strategies and Action Plans (NBSAPs). The primary function of a NBSAP is to make specific recommendations for national action on conserving biological diversity and sustainable use of its components. There is no set formula for preparing national biodiversity strategies[17], but strategies should at least:

- identify areas for action
- identify obstacles to effective action, such as national capacity, finances, technology, conflicting policies, inadequate laws or institutions
- identify relevant government sectors and affected constituencies, such as local communities, business and industry
- identify cost-effective solutions and
- assign tasks and responsibilities[29].

A National Biodiversity Strategy needs to go beyond a national environmental or biodiversity profile in that it should make specific recommendations concerning national action to conserve biodiversity and *also* to use it *sustainably*.

NBSAPs form the basis for detailed programs setting out how individual countries propose to manage their biological resources. They also provide information on biodiversity that can be drawn on for impact assessment. Knowledge of the distribution and status of important biodiversity resources makes it possible to evaluate impacts on biodiversity in relation to local, national and international objectives.

With respect to impact assessment, the NBSAP process can therefore provide:

- vital information on the distribution and status of biodiversity and;
- objectives against which impacts on biodiversity can be evaluated.

The principal steps in the NBSAP development process are summarized in Box 11. Parties may develop local or regional strategies that are then adopted nationally and together cover the whole national territory. This enables them to prioritise areas with relatively high concentrations of biodiversity, high degrees of endemism or a vital role, for example as a 'biodiversity sink' or a migratory 'stepping stone'.

Box 11 Principle steps in the development of biodiversity strategies and action plans

1. Organisational phase — the creation of structures (such as a steering committee and a planning team) to undertake the planning process.

2. Stocktaking and assessment — this phase consists of:
   - taking stock of the biodiversity within the country, (both wild and domestic);
   - identifying and assessing threats to this biodiversity;
   - identifying and assessing the causes of these threats;
   - gathering information on socio-economic issues and the use of biodiversity resources;
   - assessing the extent to which present use of biodiversity resources is sustainable;
   - assessing the extent to which benefits from the use of biological/genetic resources are shared equitably;
   - assessing the legal, policy and institutional framework governing the use and conservation of biological resources within the country.

3 Definition of priorities and objectives – definition of priorities for biodiversity conservation, based on the results of the stocktaking phase, (to be carried out in a participatory manner.)

4 Identification and analysis of options for achieving objectives — a strongly participatory phase involving those stakeholders that use biological resources, those that are involved directly or indirectly with the causes of biodiversity loss and those who have a stake in the sharing of the benefits from the use of biodiversity resources.

5 Drafting of the national strategy — the final strategy should clearly define national priorities and objectives and those options that emerge from the planning process as the most effective for achieving the stated objectives for biodiversity conservation.

6 Preparation of the national action plan — the action plan defines:
   - ·the resources needed to implement the strategy and timetable for implementation;
   - ·a definition of the roles and responsibilities of institutional and other stakeholders;
   - ·a monitoring and evaluation plan;
   - ·a calendar for implementation.

Source: Hagen (1999)[19]

Many countries are now at an advanced stage in producing NBSAPs. Box 12 summarises progress in countries represented at the BPSP workshop (Lechwe Lodge, Zambia, 30th April-4th May 2001), held to discuss the country status reports produced under this project.

Box 12 Dates of ratification of the CBD and status of NBSAP processes and EIA legislation

Country	Ratification of CBD	NSA	NBS	NBSAP	EIA legislation
Afghanistan	1992 (signed)	Some progress	-	-	-
Cameroon	1994	Yes		draft	1996
Colombia	1994			On-going	1994
Eritrea	1996	1988		2000	1999
Guyana	1994	1992	1997	1999	1996
India	1994	1997	On-going	On-going	1994
Kenya	1994	1992		2001	—
Kyrgyz	1996	1998		draft (1998)	draft (1999)
Nepal	1993	1995		draft	1997
Niger	1995	1997		draft (1998)	draft (1997)
Romania	1994	—		1995	1995
South Africa	1995		White Paper 1997	Proposed	1989
Tanzania	1996	1998		draft	—
UK	1994			1994	1988
Yemen	1996	1996		1999	1997
Zambia	1993			draft	

In many countries, a 'top-down' approach has been adopted to NBSAPs. By contrast, the NBSAP process in India (See Case Study 5[54], India) was deliberately designed to "reach out to a large number of village-level organisations and movements, NGOs, academics and scientists, government officers from various line agencies, the private sector, the armed forces, politicians and all those who have a stake in biodiversity conservation". A variety of methods have been used to engage public interest, including brochures translated into 16 Indian languages, special 'Biodiversity Festivals and exhibitions[27].

Article 6 of the CBD calls on Parties to develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity or to adapt existing strategies, plans or programmes for this purpose. Additionally, it commits contracting parties to the integration of conservation and sustainable use of biological diversity into relevant sectoral and cross-sectoral plans, programmes and policies. Ideally, NBSAPs should be developed in tandem with national development strategies (NDSs), so that their objectives can be harmonised with respect to impacts of development activities on biological resources. However, it is important that national development strategies and NBSAPs should be compatible with one another and not make conflicting demands.

Countries differ in the extent to which obligations to conserve biodiversity are incorporated in key development policies and plans. For example, Guyana's National Biodiversity Action Plan (NBAP), was developed as a product of national policy intended to elevate concern for biodiversity to the level of planning and action. It recognises biodiversity as an important national asset that offers the country manifold economic options. Biodiversity forms the basis of sectors based on primary production (agriculture, fisheries, forestry) and for these sectors in particular the maintenance of diversity is considered to offer considerable opportunities and advantages (Guyana NBSAP). Nevertheless, in common with many other countries, biodiversity is not among the subject areas treated directly in Guyana's National Development Strategy.

3.4 National Development Strategies

Much of the potential value of information generated by the NBSAP process is lost if there are no opportunities for integrated assessment of NBSAPs and strategies for development. In countries where national development strategies (NDSs) have been produced, it is important for them to be reviewed with respect to inclusion of important biodiversity concerns. The status of participating countries with respect to production of NDSs is summarised in Box 13

Progress in the those countries case-studied in this reveiw"

Country	Likely Progress – 6b	Main Constraints	NDS
Cameroon	Soon?	• Institutional roles and responsibilities are unclear • Funding	Urgent action plan
Guyana	Need more enforcement	• Funding • Institutional capacity	2000
India	By 2002, then partial implementation	•	Ongoing
Kyrgyz	Adopt in 2002	• Funding to implement (only partial now)	
Nepal	2002?	• Funding: 125$million financial gap	—
Niger	Review to identify gaps	• Funding (currently none available)	Ongoing
Romania	Biodiversity Information Management System (BIMS) and Regional Programs, eg Danube Initiative	• Lack of co-ordination • Funding	—
Tanzania	Partial Sectoral Implementation Integration	• Funding • Changing priorities (donors)	Vision 2025
Yemen	Partial implementation	• Lack of public awareness • Funding	2025

One important requirement is to review NDSs (where they exist) to check that their priorities are consistent with biodiversity goals and objectives as laid down in NBSAPs. (However, note that not all NBSAPs include such objectives).

South Africa has produced a White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity[10] that differs in some respects from the conventional Global Environmental Facility (GEF) description for a National Biodiversity Strategy and Action Plan. It does, however "go some way towards fulfilling national obligations towards Article 6 of the CBD, which requires Parties to develop or adapt national strategies, plans or programmes for the conservation of biodiversity" (see Case Study 10[54], South Africa).

The White Paper has 6 goals:

1. To conserve the diversity of landscapes, ecosystems, habitats, communities, populations, species and genes in South Africa;
2. To use biological resources sustainably and to minimise adverse impacts on biodiversity;
3. To ensure that benefits derived from the use and development of South Africa's genetic resources serve national interests;
4. To expand the human capacity to conserve biodiversity, to manage its use and to address factors threatening it;
5. To create conditions and incentives that support the conservation and sustainable use of biodiversity;
6. To promote the conservation and sustainable use of biodiversity at the international level.

Clearly these goals cannot be met unless development strategies are compatible with them.

3.5 The role of land use planning

NBSAPs are intended to promote the conservation and responsible use of biodiversity by identifying areas where action is required and providing guiding principles for conservation and wise-use of biodiversity. They can only be used as an effective tool in the management of biodiversity if they are integrated into planning systems at local, regional, sectoral, and national levels. Social equity, economic growth, environmental conservation and the sustainable use of biological diversity depend on well-informed decision-makers and strong institutional and legislative mechanisms to ensure that the requirements of International Agreements and Conventions are met and national laws respected.

Strategic Environmental Assessment (SEA) or related instruments may offer potential for analysing the compatibility of NBSAPs and NDSs. In the meantime it remains important for national EIA systems to strengthen legal requirements for consideration of biodiversity and to revise all planning guidance to ensure that the planning system as a whole contributes to the maintenance and positive enhancement of biodiversity (Avery *et al.*, 2001). However, even in Parties to the Convention with well-developed EIA systems, there may be no explicit requirement to consider 'biodiversity' per se. For example 'biodiversity' is not explicitly mentioned in either the European EIA Directive nor the EIA Amendment Directive (which was agreed in 1997). This may be largely explained by the fact that the EC EIA Directive was agreed in 1985 before the CBD. As shown in Box 13, countries differ with respect to progress in biodiversity action planning and the implementation of EIA procedures. The integration of national biodiversity strategies with planning and impact assessment for new development is an important next step.

There are many ways in which the NBSAP process can generate valuable information about biodiversity for use in EIA or SEA. These are summarised in Box 14.

Box 14 Ways in which the NBSAP process can provide information for use in EIA

NBSAP		EIA
Taxonomic gaps or lack of expertise	→	* EIA cannot address impacts on biodiversity in the absence of taxonomic information or expertise. * There is a growing 'taxonomic impediment' with implications for EIA.
NBSAP process provides information on distributions and status of biodiversity	→	* What species do we expect to find and where? * What are their habitat needs? * Use in scoping to ensure studies are designed appropriately
Biodiversity stock-taking	→	* Primary resource * Facilitates interpretation of local impacts on biodiversity
Traditional + Local Knowledge (Parataxonomy)	→ →	* Use local knowledge of locations, distributions and uses to design surveys and evaluate impacts * If little biodiversity information exists, EIA/SEA can contribute to the knowledge-base
NBSAP benefits if mechanism exists for exchange NBSAP benefits if mechanism exists for exchange and best practices/ survey techniques are officially endorsed Protected areas and species	←	* EIA is pragmatic, eg provides for rapid appraisal * Can generate data on number of species standard survey time using standard techniques
Priorities for conservation action	→	* Locations are known, therefore action can be taken to seek alternatives or ensure integrity of protected areas/species is maintained.
	→	* Can be used to evaluate mitigation options and to inform management planning

Some NBSAPs make particular reference to impact assessment as a tool. In Guyana, for example, six specific actions in the NBSAP have relevance for impact assessment. These are listed in Box 15, together with an indication of progress to date. South Africa's White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity[10] also states a specific policy objective (2.3) to "Integrate biodiversity considerations into land use planning procedures and environmental assessments".

Box 15 Actions in Guyana's NBSAP with relevance to impact assessment

Action no.	Action description	Status
1.	Integration of EIA and auditing into policy formulation, planning and development activities for all public and private sector agencies through EPAs legislative and administrative measures.	Good (Some emphasis on enforcement and monitoring needed for small scale operations - EPA Act, 1996).
2.	Establishment of impact assessment standards and guidelines.	Good (Rules and procedures, generic and 3 key sectoral guidelines developed - Aug. 2000).
3.	a) Promotion and coordination of the development of national biosafety guidelines. b) Strengthening of national quarantine processes.	Poor (A National Committee has been established and is currently meeting and consulting). Poor (Except during times of global disease threats).
4.	Government's full cooperation with regional and international partners in implementing protocols and instituting new agreements	Good (CBD signed in 1992, ratified in August 1994; Strategy developed 1997; Action Plan development 2000; active participation in COP and subsidiaries Moderate with respect to EIA requirement.
5.	Governments use measures in Environmental Protection Act to correct or penalise offending parties	Monitoring and enforcement of penalties somewhat weak
6.	Identification of agencies and facilities for contract work on biodiversity impact assessment, auditing, chemical analyses and long-term programme of physical and human resource strengthening.	Generally, poor. No comprehensive biodiversity studies for EIA;usually cursory/rapid identification of abundant species done on a selective basis. Lack of full involvement of biodiversity specialists in a number of EIA cases. Weak human resource base.

EIA at the project level relies heavily on a sound spatial planning framework with clear biodiversity priorities. Biodiversity priorities can be established through the NBSAP process. However, "Supporting biodiversity information must be clearly mapped and accessible to EIA practitioners. Without a reliable spatial planning framework, clear goals and objectives for biodiversity conservation and ready access to reliable biodiversity data, the results of project-EIA are likely to remain unreliable from a biodiversity perspective" (refer to Case Study 10[54], South Africa).

Some form of land use zoning assists effective application of both EIA and SEA. The NBSAP process has an important part to play in identifying areas critical for biodiversity conservation, and also areas where biodiversity may be threatened by different development sectors. In Uruguay, for example, some regulation of cattle ranching in the east of the country could help to conserve the palmgroves ecosystems of Palma Butiá (*Butiá capitata*). Cattle eat the buds of the palm trees and prevent them from regenerating, but there is currently no regulation of cattle ranching-activity due to the lack of any form of land use zoning (See Case Study 12[54], Uruguay).

From a biodiversity perspective, the adoption of a bio-regional approach to planning is desirable, whereby natural boundaries (eg catchment or watershed boundaries) are used to facilitate integration of conservation and development needs and to ensure that biodiversity conservation objectives can be proactively incorporated into land-use plans (see Case Study 10[54], South Africa).

4 The Integration of Biodiversity Concerns with Impact Assessment

4.1 Background

Integration of biodiversity with impact assessment is a two-way process: impact assessment draws on information about biodiversity but can also generate useful biodiversity data. In India, EIA-studies conducted for some major projects have contributed to biological resource inventories and have enhanced ethno-botanical knowledge, for example in the Narmada Basin (see Wildlife Institute of India, 1994[57]).

Historically, some components of biodiversity (endangered species and wildlife habitat) have been better addressed in impact assessment than others (genes and ecosystems). For example, EIAs rarely address diversity of non-threatened species, diversity within species, or the functional components of biodiversity[3,34,22]. Components of biodiversity which are already protected (protected areas or species, for example) are more likely to be included in EIA than components which hold less popular status but may be important to the long-term productivity of ecosystems and maintenance of biodiversity[3]. Species that are charismatic or appealing are more likely to be surveyed and studied for purposes of EIA than species that are, in fact, better indicators of overall impact. EIA practice needs to be amended to encompass the full range of biodiversity [receptors and] impacts[3,22,52,53].

In order to achieve this, it is important to consider:

* What aspects of biodiversity should be addressed in EIA?
* At what stages in the EIA process should biodiversity be addressed and what is the appropriate amount of detail for their consideration at each stage?

4.2 Which aspects of biodiversity should EIA address?

There has been considerable debate about what measures of biodiversity are suitable for inclusion in EIA. Some of those commonly used include:

* species diversity,
* habitat diversity,
* phylogenetic relatedness,
* genetic or taxonomic distinctiveness.
* endemism

For EIAs, typically with time and resource constraints, the key issue is to ensure that the data collected are relevant i.e. that appropriate data are collected to answer clearly defined questions about impacts[5].

Various attempts have been made to derive frameworks for analysis, the majority of which have been based on 'levels' and 'components' of biodiversity. Le Maitre *et al.*[34], for example, used the framework for classification of biodiversity provided by Noss (1990) to derive questions relating to assessment of biodiversity for EIA (see Figure 1). Noss's framework[41] recognises three components of biodiversity (composition, structure and function) each of which can be represented at four levels (genes; species or populations; communities, habitats or ecosystems and finally landscapes). Le Maitre *et al.*[34] used this to produce a checklist for deriving Terms of Reference (TORs) for EIA as summarised in Box 16. The number of questions has been minimised by not repeating those which may apply at several levels (e.g. measures of composition, and impacts on composition may apply from landscape level down to genetic level).

Box 16 Checklist of questions relating to assessment of impacts on biodiversity in EIA (after Le Maitre *et al.*[34])

Landscape composition

* What is the distribution pattern and richness of patch/habitat types (vegetation types, biomes) in the study area?
* How do these patterns compare with those outside the study area (is the area unique or rich or does it comprise types that are poorly conserved elsewhere)?
* What are the development trends in the adjacent area (eg. is any particular habitat type being radically or rapidly transformed)?
* How might distribution patterns of vegetation types/biomes change as a result of the proposed development (eg, reduction in area, change in shape)?

Landscape structure

* How are biodiversity units organised in time and space?
* What are the spatial relationships between the above units and how may these change as a consequence of development?
* What are the structural/ habitat requirements of important species?
* Will successional trends be affected?
* Will habitat loss, fragmentation or re-organisation affect overall provision of feeding and breeding requirements?

Landscape function

* What role do biodiversity units play in maintaining processes and dynamics?
* What is the local and regional functional role of each type (eg. catchment cover, retarding storm flow or spread of fire)?
* What is the functional relationship of one type to another (eg. water yield, refugia for species?)

Community composition

* What is the distribution pattern, and richness, of communities in the study area?

Community structure

* What are the relationships between communities and environment and how does this relate to the proposed development (eg. changes in watertable, flooding or fire regime)?

Community function

* What processes maintain community boundaries and structure (herbivory, predation, dispersal)?
* What is the functional role of threatened communities?
* Will any wetlands or riparian zones be affected?

Population/species composition

* What are the distribution patterns (abundance)?
* Are any flagship (popular, charismatic) species present and threatened by development?
* Are any vulnerable species (rare, genetically inbred, etc.) present and threatened by development. If so, what category (of threatened species) is involved?
* What is the taxonomic position of threatened species?

Population/species structure

* What controls distribution patterns (eg environmental gradients)?
* What is the population structure of important species?
* What is variation within species/populations?

Population/species function

* What are the demographic processes determining recruitment patterns (what controls age size/structure)?
* Are any keystone species present and threatened?
* Are any umbrella species present? What are habitat and range requirements of these species?

Environmental Impact Assessment should aim to address:

- all relevant levels of biodiversity (bio-regional-, landscape-, ecosystem-, habitat-, community-, species-, population-, individual- or gene-level as appropriate).
- connections between these levels of biodiversity ie all relevant structural and functional relationships -currently there is little emphasis on processes or functions in EIAs in most countries

In her 'good practice guide for EIA' Byron[5] suggested that EIA should consider biodiversity at any of the levels of organisation summarised in Box 17, taking account of structural and functional relationships both within and between these levels as appropriate. Biodiversity should be addressed at whatever level is necessary to 'capture' significant impacts, depending on the characteristics of the proposal being assessed and the distribution of biodiversity in the affected area.

Box 17 Levels of biodiversity and associated structural and functional relationships that may need to be considered in EIA (after Byron, 2000[5])

* bioregion
* landscape
* ecosystem
* habitat
* community
* species
* population
* individual
* gene

EIA may need to address structural and functional relationships within or between the levels identified above:
Structural relationships include: connectivity, patchiness, fragmentation, vertical habitat differentiation, distribution of key physical features, availability of niches, seasonal availability of habitat, water availability.
Functional relationships include: disturbance, nutrient cycling, energy flows, hydrological processes, population and metapopulation dynamics.

Review of current experience and the case studies produced for this project, suggests that EIA analysis most commonly focuses on the species-level, despite the fact that the viability of species clearly depends on processes operating at the genetic, ecosystem and landscape levels. The reasons for this are unclear, but lack of adequate data is probably a major factor. For example, the wider consequences of genetic alteration are poorly understood, making it difficult to evaluate impacts at the 'gene-level'.

4.2.1 The 'gene level'

In addition to the widespread failure to include 'gene-level' impacts in EIA/SEA, there has been a failure to apply EIA/SEA to projects that might have a significant impact on biodiversity as a result of gene-level processes. In Uruguay, for example, more than 400,000 ha. of exotic trees (mainly eucalyptus and pine) have been planted for forestry without any environmental assessment. In Colombia, government policy on fisheries has resulted in the introduction of at least 32 fish species to the watersheds of the Amazon, Cauca, Orinoco and Catatumbo, substantially reducing native populations.

Genetic engineering promises the potential to increase food production, decrease pressure on land use, increase sustainable crop yields in marginal lands or inhospitable environments and reduce use of water and agrochemicals in agriculture. However, relatively little is known about the interaction of genetically modified organisms (GMOs) with the ecosystems into which they are released. Some concerns include unintended changes in the competitiveness, virulence, or other characteristics of modified species; the possibility of adverse impacts on non-target species (such as beneficial insects) and ecosystems; the potential for weediness in genetically modified crops (where a plant becomes more invasive than the original, perhaps by transferring its genes to wild relatives); and the the possibility that a gene inserted into an organisms might lose its effectiveness or be re-transferred to another host).

In agriculture, introduction of new crops or livestock throughout the world has resulted in general loss of genetic variability, whether because traditionally produced crops or livestock are replaced, or through hybridisation. Examples of extinctions of native species

caused by escaped alien invasives are legion. The introduction of the wild boar (*Sus scrofa*) to Uruguay, for example, at the beginning of the century resulted in extinction of the peccary (*Taysassu tajacu*). Hybridisation between escaped aliens and native species is also common. Escaped salmon from fish farms have hybridised with wild salmon in a number of countries, and in India, there has been genetic 'swamping' of wild buffalo breeds through inter-breeding with domesticated buffalo.

Introduced crops are often more productive, but require higher inputs than traditional varieties or cultivars that are adapted to local environmental conditions. There are also many examples where locally adapted maize or rice varieties have been replaced by introduced varieties that lack resistance to local diseases (refer to case studies from Niger, Tanzania and India). Introduced crops and livestock can also carry diseases to which native wildlife species have low resistance[62]. Controlling diseases with pesticides and fungicides is often prohibitively expensive and can also result in considerable damage to agro-biodiversity (non-target organisms, soil microbes etc).

Genetic impoverishment of agricultural crops and livestock is risky because it reduces the genetic base for adaptation, for example to changed climatic conditions (increased prevalence of drought) or to pest outbreak. Finally, crops introduced for purely economic reasons (for example because of higher potential productivity) may not actually be appreciated by local people. The social and ecological consequences of crop introductions are inadequately assessed in most countries.

Box 18 Genetic impacts currently inadequately addressed in EIA/SEA

* Loss of valuable wildlife species (e.g.through hybridization, transgenic pollution, disease)
* Loss of endemic species (eg endemic races or cultivars replaced by introduced crops or removed for other forms of development)
* Loss of species with potential future value for medicine, new agricultural crops, new breeds of livestock
* Loss of disease resistance
* Introduction of new diseases to which native species are unadapted
* Reduced viability of endangered species (critical variation)
* Loss of 'elite trees' through poorly regulated logging of forests with consequent loss of future production
* Loss of local tree provenances
* Loss of microbial associations essential for viability or production (eg mycorrhizal assocations or soil microbial associations)

- Analysis at the 'gene level' is important because the viability of species depends on within species genetic variation.

Many species have genetically distinct populations. Hughes *et al*.[24] estimated the number of populations per area of a sample of species (using literature on population differentiation) and also the average range area of each species. They found that there were an estimated 220 populations per species in tropical forests. Assuming population extinction to be directly related to habitat loss, they estimated that approximately 1800 populations per hour (16 million each year) were being lost in tropical forests alone, with obvious negative impacts on within-species genetic variation.

The fact that genetic variation below the species level must be considered in impact assessment is further reinforced by work carried out by Cowlinshaw[9], who demonstrated how deforestation is forcing forest primates to occupy decreasing areas of habitat worldwide. Although no primate species have been lost since records began, remaining habitat is becoming too small to support them all in the long term. Habitat fragmentation leaves primates vulnerable. If only small areas of habitat remain to support a species, one catastrophic event such as a hurricane can wipe that species out.

- Review screening guidelines to check that EIA is required for developments likely to result in gene-level impacts

Consideration of gene-level effects in EIA is particularly important for sectors such as Agriculture, Forestry and Aquaculture where the long-term sustainability of intensive production systems can be greatly affected by genetic alteration, or the availability of alternative gene stocks (see Case Study 4[54], Guyana). It is also an important issue in any situation where there is risk of new GMO-release or the introduction of alien or non-native species. There is an urgent need for development of impact assessment techniques to evaluate the wider social and environmental consequences of new GMO-release: most accepted risk assessment procedures have a very narrow focus and fail to address important social and ecological issues.

Ensure EIA addresses impacts on biodiversity at the gene level at least for:
- arge agricultural or forestry projects,
- large-scale aquaculture projects, particular those based on introduced species,
- projects affecting endemic species that are endangered or rare and declining,
- projects affecting isolated populations of species, or known sub-species,
- projects involving use of foreign or introduced seed (this currently happens In Guyana but not in Tanzania),
- projects involving introduction of aliens or for which there is a risk of introduced species escaping
- projects involving the release or use of genetically modified organisms.

For purposes of impact assessment, assessment of possible effects on genetic diversity is likely to be justified in situations where genetically modified or non-native species have a high probability of being introduced into highly sensitive ecosystems or ecosystems supporting endemic species. It may also be justified in situations where rare species already have highly restricted and/or fragmented distributions, are known to be declining and are at risk of permanent loss of genes or extinction due to inbreeding and isolation. Finally, impacts on genetic diversity should be taken into account in any situation where there are thought to be unique, locally adapted genotypes of a species.

- EIA/SEA should at least review the risk of significant impacts at the gene-level and suggest ways to avoid, reduce or minimise them

For genetic traits with no obvious phenotypic expression, it is difficult to measure impacts on diversity without laboratory testing. While it may be difficult to predict and quantify genetic impacts in detail, impact assessments should at least identify situations where significant genetic impacts could be expected to occur.

4.2.2 The 'species level'

Impacts on species are commonly included in impact assessments, but in general, impact assessments provide poor analyses of the outcomes of development for species.

- Species should not be assessed in isolation from the ecosystems in which they occur. Use an ecosystem approach.

It is common for impact assessments simply to identify the possibility that certain species may be affected and not to indicate exactly what will happen to the species in the area immediately affected and what will happen to it more generally if the proposal is implemented. To understand impacts on species it is necessary to take an ecosystem approach to impact assessment.

- Reasons for selecting species as a focal point for impact assessment should be clearly explained

There are many reasons why EIAs have retained a focus on species. These include:
* popular appeal (flagship or emblematic species),
* religious and cultural significance,
* species as a unit of biodiversity that can link genes and ecosystems,
* the concept of a 'species' as a unit of biodiversity is relatively easily understood,
* economic value (eg trophy animals),
* ubsistence use.

Select species for detailed assessment if they are:

- protected,
- endemic
- rare or restricted in range,
- declining
- vulnerable to the proposed activities
- indicators of environmental 'health'
- emblematic
- indicators of environmental change.
- valuable to people
- culturally or religiously significant

It is noteworthy that, even for well-known 'flagship' or 'emblematic' species, the information needed to make reliable predictions in EIA is rarely provided. Further, a surprisingly high proportion of such species remain endangered and threatened, even species regarded as 'national emblems'. This is true, for example of the bear and European Bison in Romania, the Black Lechwe in Zambia, the lion in Gujarat, India, the snow leopard in Kyrgystan, the Arabian leopard in the Republic of Yemen and the pheasant in Nepal. Interestingly and contrastingly, in Afghanistan, the status of the Marco Polo sheep has played a part in maintaining it through years of war.

There is an almost universal tendency for impact assessments to neglect certain taxa in assessing impacts on biodiversity. In Guyana, for example, no EIAs have addressed impacts on fungi, bryophytes, soil microbes or soil invertebrates. Even groups or species with known value as indicators (for example lichens as indicators of air pollution) are excluded in favour of species that are popular, well-known, easily recorded and for which specialists are available. Lack of taxonomic expertise, combined with failure to include a full complement of biologists with appropriate expertise on EIA teams are considered to be key underlying factors (see Case Study 4[54], Guyana).

- The 'species level' encompasses individuals and populations

'Species' are represented by individuals and populations. Impacts measurable at the species level might therefore include:

* mortality or direct destruction of individuals,
* change in the number of individual representatives of a species (relative to overall abundance),
* altered breeding success within a species,
* altered range or distribution for a species,
* destruction or loss of genetically distinct populations,
* change in the total number of species occurring in an area,
* change in the identity of species occurring in an area (altered species composition)
* altered viability of one species relative to another.

Both quantitative and qualitative changes in the species represented in an area may be important from a biodiversity perspective.

4.2.3 The ecosystem level

Genes, species and other units or levels of biodiversity exist within ecosystems. It is generally recognised that impact assessment requires analysis of ecosystem functions and processes in order to predict impacts on genes and species. It is also important to evaluate impacts in terms of the provision of ecosystem products and services for people, such as flood attenuation, or the provision of wildlife to hunt.

The impact assessment process should therefore 'capture' important ecosystem services such as:

* flood attenuation (prevention of deaths and damage to property)
* prevention of soil erosion, loss and maintenance of agricultural and forest productivity
* prevention of desertification
* maintenance of water quality
* natural resource production (fisheries, game, construction materials).

When carrying out studies of biodiversity for purposes of EIA/SEA there are certain aspects of biodiversity that need to be considered from an ecosystem perspective. In fact, it is often argued that taking an ecosystem perspective is the most efficient way to ensure that all other relevant impacts on other levels of biodiversity will be captured in the impact assessment process. However, for this to be possible, the limits of the affected ecosystem need to be clearly defined. One pragmatic way to do this is to use the boundaries of catchments or watersheds, for example.

- An ecosystem approach can be the most efficient way to address impacts on biodiversity

Ecosystem-level impacts are difficult to analyse on a project-by-project basis (ecosystems may be difficult to delineate 'on the ground', or only part of an ecosystem may be affected by a proposal) and again, there is a lack of knowledge about the consequences of ecosystem change in terms of the functions and services that are valued by people.

However, failure to consider biodiversity at the ecosystem level results in:

* inability to detect negative impacts on important life-support functions;
* failure to recognise the importance of ecosystem services;
* mis-allocation of resources within EIA by failing to see the 'big picture';
* failure to understand variation in time and space (without a baseline, impacts cannot be predicted with confi dence);
* inability to define utility-space for important components of biodiversity.

- Ecosystem-level assessment can help identify 'biodiversity-friendly alternatives that are sometimes cheaper and more effective

As all levels of biodiversity are linked, it is possible that biodiversity concerns in impact assessment might be addressed most efficiently by taking an ecosystem approach. By taking an ecosystem approach to impact assessment, it is also possible to identify development alternatives that are not only more 'biodiversity-friendly' but are also sometimes cheaper and more effective. An example can be found in the United States, where development in the Catskill Mountains began to reduce the ability of soils and forests in New York's 1600-square mile watershed to conserve the quality of New York's drinking water. It became obvious that filtration would be required to meet the stringent water quality standards set by the Environmental Protection Agency (EPA) and it was estimated that a suitable filtration plant would cost about $8 billion, with a $300 million yearly operating cost. Restoring the integrity of the watershed, however, would cost less than $2 billion.

An ecosystem-approach to economic analysis of the environmental impacts of dam construction on the Tana River in Kenya showed that construction of the proposed dam to incorporate a simulated flooding regime could have both environmental benefits and economic benefits by sustaining agriculture and fishing in areas downstream[30].

If impact assessment is carried out in advance of proposal-design and if alternatives are fully addressed, expensive mistakes can be avoided and 'win-win' solutions (in terms of both economics and biodiversity) are more likely to be found.

4.2.4 The landscape level

- Maintenance of genetic diversity depends on processes operating at the landscape scale.

Assessment of impacts at the landscape level is therefore necessary to evaluate the ability of the environment to sustain overall genetic diversity and also specific gene pools.

The concept of 'habitat' is useful to link genetic diversity with the processes and activities associated with development.

- 'Habitat' is the sum of biotic and abiotic conditions available in a specific place to support the existence of a particular species.

The continued existence of a species in an area affected by a proposal depends on the availability of enough habitat of appropriate quality. The Habitat Evaluation Procedures (HEP) developed by the United States Department of the Interior (USDI) Fish and Wildlife Service[55] uses indices based on habitat amount and quality for selected species to assess the impacts of proposed developments. Optimum habitat requirements for selected indicator species are defined and used to evaluate the relative quality and availability of habitat in areas affected by a proposal. Habitat Suitability Indices (HSIs) are assigned, ranging from '0' (unsuitable) to '1' (optimum). This approach has also been used in other countries, for example in India[57], to estimate the impacts of proposed dam construction on availability of suitable habitat for key wildlife species such as the Chital and Sambar antelopes.

- Analysis at the landscape scale is necessary to assess cumulative effects on biodiversity and to evaluate the relative importance of local losses of habitat.

Development can cause loss and fragmentation of habitat. It is only at the landscape level that it becomes possible to assess the cumulative effects of development on the overall availability of habitat for a species or a group of species. The impacts of local habitat losses depend on the amount and quality of alternative habitat that will remain. Will loss of one small part of a species' habitat mean that the species can no longer meet its needs for survival? Similarly a landscape-approach is necessary to assess mitigation options: i.e. the availability of suitable replacement habitat or the availability of land on which habitat can be restored.

- Impact assessment must take account of the ways in which different species use the landscape

Most species have a variety of habitat requirements and some are very mobile, travelling over large distances to meet their needs. They have large home-ranges and some of their habitat needs may not be immediately apparent by studying at a local scale.

Other species lack mobility and are less able to re-locate should some of their habitat be destroyed. Impact assessments must therefore take into account the ways in which different species use the landscape. Types of impacts that must be addressed using a landscape-level approach include:

* Any trans-boundary impact, for example air or water pollution
* Habitat loss (is alternative habitat available?)
* Reductions in quality of feeding or breeding habitat (can species compensate and maintain viable populations?)
* Changes in species composition, or introductions of alien species (will introduced species displace native species and reduce the habitat available to them?)
* Barriers to movement, including migrations (will characteristic migration routes be sustained or can populations of a species interbreed?)
* Habitat fragmentation and reconfiguration
* Disturbance
* Access to habitat for management purposes by people

- Habitat availability (diversity, amount and configuration) determines the carrying capacity of a landscape

For impact assessment it can be useful to measure the number of habitat types represented in the study area compared with the wider landscape and to identify the species associated with them. By measuring the quality of habitat in the area affected by a proposal, compared with those examples of similar habitat type elsewhere, it is possible to evaluate impacts on overall habitat amount and quality.

4.2.5 The need for assessment across levels

Often problems of genetic impoverishment are caused by landscape-scale processes such as habitat fragmentation and are actually expressed in terms of the viability of species or their individual populations. The imposition of barriers to mobility, for example, can isolate populations, reduce levels of genetic exchange between populations, and ultimately increase extinction risk for a species. While use of distinct 'levels' can simplify analysis of impacts on biodiversity, it is important to remember that they are inextricably linked in reality.

Box 20 provides a checklist of biodiversity elements to take into account when carrying out an impact assessment. The list should not be regarded as exhaustive and it is preferable to produce checklists tailored to suit the specific conditions associated with any particular proposal.

4.2 Checklist of biodiversity elements to consider in EIA or SEA

Landscape

* Habitat requirements for migratory species (migratory stop-over sites, migration routes)
* Areas of endemism or high global diversity
* Availability, quality and spatial organisation of all habitats in the landscape
* Connectivity of habitats, landscape mobility, barriers
* Seasonal use of the landscape for breeding/feeding
* Patterns of dispersal (in time and space)
* Opportunities for mitigation (habitat creation/enhancement)
* Availability of replacement sites
* Cumulative, time- and space-crowded effects
* Important habitats and communities including priority/NBSAP habitats and species
* Biodiversity hotspots, sources and sinks
* Management and uses of biodiversity

Ecosystem level

* Distribution of communities and number represented
* Interactions and interdependencies between species
* Role of keystone species
* Key ecological processes and functions
* Productivity of ecosystem (eg biomass measurements)

Species level

* Include species that are:
* endemic

4.2 Checklist of biodiversity elements to consider in EIA or SEA ... *continued*

* or included in action plans or recovery programmes
* characteristic of particular habitats
* keynote species
* flagship species
* good indicators for impacts identified
* charismatic (have popular appeal)
* threatened or declining rapidly
* declining throughout their range,
* Also include species that have :
* high sensitivity to proposed activities,
* low reproductive capacity, eg most large mammals,
* high sensitivity to disturbance,
* low mobility and therefore with low ability to escape impacts or relocate,
* Consider habitat needs, home-range sizes, social organisation, critical population sizes, mortality rates, known responses to proposed activities etc

Population level

* critical population levels required for long term viability (eg salmon stocks in some rivers),
* populations of species at the limits of their range,
* declining populations,
* metapopulations and scope for recolonisation,
* isolated and locally adapted populations,
* density dependence.

Gene level

* Genomes and genes of social, scientific or economic importance (eg agricultural crop varieties),
* Isolated populations (particularly those isolated for some time),
* Risk of invasion by aliens or inter-breeding between introduced and native gene stocks,
* Possible effects of GMOs.

4.4 The EIA process

EIA has a series of commonly recognised stages, many of which provide opportunities to ensure that potential impacts on biodiversity receive full consideration. These stages are summarised in Box 19 and discussed in more detail in the next section. Box 20 outlines how biodiversity information could be included at each of these stages. Note that exact EIA procedural stages can vary between the different systems used in different countries (see editions of the EIA Newsletter published by the EIA Centre[12]).

Box 19 Stages in EIA	
EIA stage	Main purpose
Screening	Is an EIA required?
Scoping (Focusing)	What issues will the EIA address and how?
Impact prediction	What will the impacts of the proposed activities be?
Impact evaluation	Of the impacts identified, which are significant?
Mitigation	What actions will be taken to avoid, reduce, minimise or compensate for significant adverse effects?
Evaluation of residual impacts	Post mitigation, what significant impacts will remain?
Review of EIS	Is the Impact Statement or report satisfactory?
Monitoring	What is the actual outcome of the development? Were the impacts as predicted?

4.5 At what stage in the EIA process should biodiversity be considered?

Box 20 Integrating biodiversity considerations with project EIA

EIA Procedural Stage	Biodiversity considerations
Screening *Are there important biodiversity-concerns which indicate the need for EIA?*	Include biodiversity considerations in screening procedures. The need for EIA might be indicated if the proposed project affects: * designated or protected areas, areas of cultural importance (eg sacred groves), * areas used by protected species, * watercourses or wetlands, * large continuous areas of 'pristine' habitat, even if not protected.
Scoping *Derive terms of reference (ToRs) for the EIA*	* Ensure EIA takes account of potential impacts on biodiversity: include assessment of biodiversity in ToRs. * Consult widely and early with all stakeholders, especially people with cultural dependence on biodiversity in the affected area.
Focusing *Refine the ToR on the basis of biodiversity values which will be used in decision-making.*	Select biodiversity components for more detailed study, for example, focus on: * indicators (eg of disturbance or pollution), * species valued for hunting, medicinal purposes, ecotourism, * keystone species (on which others depend), * important ecosystem functions (eg flood attenuation caused by wetlands, * key breeding or feeding sites, especially for protected species, * migratory routes and stop-over sites etc.
Impact identification or prediction *Predict impacts: identify, describe and provide the data necessary to quantify the effects of proposal(s) on measures of biodiversity.*	Specify magnitude, duration and range of impacts, eg for: * areas of habitat to be lost (include breeding, feeding, refuge areas), * habitual routes to be severed (number and relative importance to maintenance of mobility in the landscape), * number of individuals likely to be killed, * proportion of population to be disturbed, * quality of remaining habitat for key species, * ecosystem functions lost or impaired etc.
Impact significance *Rank impacts, taking into account biodiversity values and the reversibility of impacts.*	Consider: * magnitude, duration, timing and reversibility of impacts, * effectiveness of mitigation measures, * post-development carrying capacity of remaining habitat, * viability of remaining populations, * 'utility' and sustainability of valued biodiversity components, * ability of afffected habitats, populations or species to recover using known techniques, or to relocate elsewhere.
Impact Mitigation *Most EIA law requires proponents to suggest measures to avoid, reduce or remedy adverse impacts.*	* Ensure mitigation is recommended for significant adverse impacts on biodiversity. Avoidance is always the best form of mitigation. * To what extent will proposed mitigation measures reduce impacts? Demonstrate whether they have been successful elsewhere. * Mitigation for biodiversity may require land acquisition for compensation. * Assign responsibilities for implementing mitigation and following up the results * Consider use of mitigation bonds
Impact Evaluation *Are the impacts identified important or significant?*	How important or significant are residual impacts on biodiversity, allowing for implementation of mitigation measures?
Environmental Impact Statement (EIS)	* Explain biodiversity impacts clearly. * Provide detailed, practical advice concerning measures to protect biodiversity during construction or to mitigate for operational impacts. Provide a schedule for activities and a contingency plan in the event of mitigation failure.
Review and monitoring	* Did impacts on biodiversity happen as predicted? * Were mitigation measures effective and implemented successfully?
What really happened?	* What was the outcome for biodiversity?

4.5.1 Screening

- When determining the need for EIA, ensure that all relevant biodiversity considerations are taken into account.

Countries differ in their approach to screening proposals to determine the need for EIA. In India (Case Study 5[54]), all proposals are subject to some form of EIA, while in other countries the need for EIA is dependent on the type and magnitude of the proposed activities. In Yemen (Case Study 13[54]) and Cameroon (Case Study 4[54]), for example, EIA is required for proposals falling within certain categories.

For example, EIA might be required for:

* all projects
* projects of a certain type
* proposals over a certain size
* proposals involving risk of major accidents or environmental hazards (eg nuclear power stations; chemical plant)
* proposals affecting sensitive areas.

- Develop criteria that can be used to determine the need for EIA from a biodiversity perspective.

In jurisdictions where the importance or sensitivity of the areas affected by a proposal is taken into account, screening criteria will be required. These may be prescribed in law, or they may be relatively informal. With respect to biodiversity value, risk of impacts on protected areas is most commonly used as a screening criterion, EIA being required for any proposal directly affecting a protected area or occurring within a certain distance from one. In Nepal (Case Study 7[54]) and Niger (Case Study 8[54]), for example, EIA is always required for proposals affecting a protected area. In Tanzania (Case Study 11[54]), guidelines are available to indicate when EIA is likely to be required and these include wildlife considerations.

However, biodiversity is not always included as a trigger for EIA. Lists of protected species and habitats, information about their distribution and status and up-to-date knowledge of threats are all necessary to ensure that cases where biodiversity might be an important issue are recognised. Survey and inventory work to generate such lists must remain a priority in many countries. SEA or bioregional assessments can provide an opportunity to ensure that this information is available before individual proposals proceed. Suitable criteria for determining the need for EIA can also be a useful output of the NBSAP process. At present there are few examples of EIA-triggers based on ecosystem or landscape-level criteria or biodiversity goods and services which underpin livelihoods. These are an urgent need, particularly for countries where biodiversity data are lacking.

To ensure that screening procedures take account of biodiversity:

- include pre-determined limits or thresholds for biodiversity (areas of habitat, numbers of species, critical population sizes etc)
- Develop and maintain a central database of important habitats and species (including information on distribution and status, ie whether areas or populations are stable, declining or increasing)
- Develop and maintain a central, preferably spatial database of approvals or consents, and monitor types and numbers of proposals occurring in relation to biodiversity
- Use SEA to provide a framework for evaluating cumulative effects
- Identify, map and publicise 'no go' areas for development with respect to important and irreplaceable biodiversity resources

Box 21 summarises some considerations that should be taken into account when screening proposals for possible significant effects on biodiversity.

Box 21 Screening proposals to determine whether important impacts on biodiversity are likely

Is the proposed policy, plan, programme or project likely to give rise to important impacts on biodiversity?

To answer this question it is important to diaggregate the word "biodiversity" and assess impacts on the components of biodiversity separately (see below).

Use available matrices, checklists and experts to determine whether significant impacts on biodiversity are possible, eg in India screening checklists are available for all the major development sectors.

The following considerations may be of assistance:
Will the proposal affect an area known to have significant biodiversity interest?

- Check for presence of protected areas (maps, official public records) within the area affected by the proposal.
- Consult with biodiversity experts or statutory authorities with a responsibility for biodiversity.

Will the proposal affect an area which may have significant biodiversity interest as yet undesignated or recorded?

- Consult with local experts, biodiversity monitoring centres, NGOs concerning possible presence of endemic species, high diversity of species or habitats.

Will the proposal affect 'sensitive' ecosystems or landscapes that supply important services, eg forested watersheds, wetlands?

Will the outcomes of the proposal affect the achievement of a biodiversity goal, objective or target (eg ability to maintain viable populations of endemic species)?

Will the proposal affect land or water with the potential for restoration to high biodiversity value?

Will the proposal give rise to long-term, hard-to mitigate impacts on environmental quality (eg through air, water or soil pollution) with implications for provision of wildlife habitat?

Does the proposal involve new processes or technologies with high levels of risk?

Will the proposal contribute to cumulative effects on biodiversity, i.e. have developments of a similar type already eroded biodiversity resources in the region?

Are the biodiversity resources affected universally threatened by developments of a similar type throughout their range?

Always remember that the results of EIA must feed into a clear decision-making process. This process should not end at the point of development consent being granted (or not). It should be iterative and ongoing, including procedures for acting on the results of monitoring and review.

- EIA must recognise diversity of use as an important biodiversity measure and must identify situations in which a proposal may compromise it.

Cultural dependencies and traditional uses of biodiversity should be taken into account when determining the need for EIA, in addition to information on biodiversity conservation status per se.

- Produce and maintain a register of screening decisions. In particular, record reasons for screening proposals out. The screening register should be linked to post-implementation monitoring data.

Screening procedures may exclude proposals of a size and nature deemed unlikely to have significant environmental effects when considered on an individual basis. However such developments can nevertheless have a significant cumulative effect. Biodiversity resources in one area may be affected by multiple development proposals of the same or different types. Increasing levels of habitat fragmentation and species isolation are occurring throughout the world, emphasising the need to ensure that developments are regulated in their entirety, and not just on a case-by-case basis.

In India, preliminary environmental appraisals are used as a basis for scoping in different sectors. Application forms and questionnaires for environmental clearances in India are available from the Ministry of Environment and Forests, Government of India, New Delhi. Based on the preliminary information elicited through these questionnaires, the Ministry of Environment and Forests can determine the level of detail required in subsequent impact assessments.

Biodiversity concerns are usually taken into consideration at the screening stage by requiring EIA for any proposal affecting an area with important elements of biodiversity. It is important that screening procedures should permit biodiversity concerns to trigger the need for EIA.

4.5.2 Scoping

- Produce guidance on scoping (eg sectoral scoping checklists) for incorporation of biodiversity into impact assessment.

Some countries (eg India) have produced sectoral scoping guidelines to assist development proponents, regulators and practitioners in identifying key issues. These guidelines might outline the main activities likely to be involved in any proposal within a sector or clarify legal requirements with respect to protected species or designated sites. They help to publicise key biodiversity concerns to all stakeholders in the impact assessment process and to ensure that they are studied appropriately.

- Identify biodiversity concerns to be addressed in full consultation with stakeholders and design impact assessment to ensure that reliable information is provided to decision-makers.

Scoping is used to define terms of reference for EIA. Its purpose is to identify the main impacts likely to be associated with a proposal and to clarify the information required to address them. It is important to ensure that the collection of baseline information for prediction of impacts is adequately supported by information generated through systematic and well-planned field studies as prioritised through a good scoping exercise (see Case Study 5[54], India).

Scoping is usually based on existing information. To be effective, ready access to relevant information is required. This should include information about:

* locations and characteristics of protected areas;
* locations and characteristics of sensitive or important ecosystems, eg wetlands;
* distributions of protected species;
* distribution of habitat for protected species (including seasonal, feeding and breeding requirements);
* experts in different components of biodiversity, including taxonomic experts.

- Maintain one, official and legally recognised list or map of important biodiversity resources and assign responsibility for updating it.

It is important that there should be one, official and legally recognised list or map of important biodiversity resources and that clear responsibility should be assigned for updating the information. In Romania, for example, there is no one officially recognised list of protected species, resulting in confusion about legal requirements and appropriate subjects for EIA (see Case study 9[54], Romania).

- Simplify insitutional arrangements for consultation about biodiversity and assign clear responsibilities for statutory consultation.

Dialogue with the proponent and the relevant decision-making authority is also required to ensure that biodiversity issues are covered adequately from the outset of the EIA process. In Tanzania, the National Environmental Management Council checks the proposed ToRs and can ask for them to be revised and resubmitted (See Case Study 11[54], Tanzania). Consultation with stakeholders is considered an important part of the process. In other countries there are sometimes very complex institutional arrangements and responsibilities for biodiversity. In Cameroon, for example, there are at least three government departments with responsibilities for biodiversity and development (See Case Study 2[54], Cameroon), and in Niger there are at least 4 (See Case Study 8[54], Niger).

- Formalise requirements to consult appropriate wildlife organisations during scoping.

A requirement for formal consultation with wildlife organisations helps to ensure that there is always an opportunity for biodiversity concerns to be discussed at an early stage. It is then less likely that important biodiversity concerns will be neglected.

- Make provisions for full and wide public consultation concerning biodiversity during the scoping phase.

Because information about biodiversity is rarely complete, consultation is important to identify potential unofficial sources (including anecdotal information held by local people) and to ensure that all relevant biodiversity concerns are incorporated. Extensive public participation in scoping can be both a strength and a weakness with respect to biodiversity. It is generally acknowledged that open, transparent impact assessment procedures based on full public consultation are more likely to proceed without controversy and public dissent. However, in South Africa, a heavy reliance on consultation to derive terms of reference for EIA has sometimes resulted in a failure to include key biodiversity issues, due to a general lack of understanding of biodiversity and the impacts of development on it (refer to Case Study 10[54], South Africa).

- Include a requirement to elicit information about biodiversity values where significant impacts on traditional uses of biodiversity are suspected.

There are many reasons why impact assessment should incorporate biodiversity values and take account of the social contexts for biodiversity conservation and use. Most importantly, the actions of people largely determine whether biodiversity is maintained or

destroyed. If social aspects are omitted, important biodiversity-related needs and values will also be neglected in development-planning. Ethical, cultural and religious values are important as well as social and economic considerations, and these should be developed with an eye to the need of future, as well as present generations of people. If these biodiversity values are omitted, impact assessment cannot be used effectively as a tool for sustainable development.

Traditional uses of biodiversity by people should be considered during the scoping phase to ensure that relevant information can be collected throughout the impact assessment process. Effective consultation with indigenous people may require long and careful preparation. For some religions, the sanctity of life is believed to be fundamental. Conservation of all forms of life is an underlying tenet of Islam, for example, and respect for plants and animals is required as a form of spiritual observance. It is important to recognise spiritual, religious or cultural dependencies on biodiversity at the scoping stage.

- Require the production of scoping reports to outline key biodiversity issues and the intended approach to study and evaluate them.

This provides an opportunity for all stakeholders in the impact assessment process to discuss the coverage of the intended study and to raise any outstanding issues. It is likely to reduce subsequent controversy and delays.

- Define 'biodiversity' unambiguously. Specify measurable attributes to be used in the impact assessment.

It is at the scoping stage that clarity about the use of the term 'biodiversity' is particularly important. To avoid ambiguity it is advisable to use the word 'biodiversity' once, thereafter using terms that refer to components of biodiversity with clear and generally accepted definitions ('ecosystem', 'habitat', 'gene' etc).

- Clarify legal requirements with respect to protection and conservation of biodiversity.

One objective of scoping is to clarify legal requirements with respect to biodiversity. In many countries there is a wildlife protection act. In Afghanistan (Case Study 1[54]), the Yemen (Case Study 13[54]) and Eritrea (David Duthie, pers. comm.) there is no such act, making it harder to use EIA as a tool to ensure that legal requirements for protection of biodiversity are respected unless voluntary compliance can be achieved.

- Design ToRs to ensure that the impact assessment will address all relevant variation in biodiversity and specify suitable survey methods.

Another purpose of scoping is to ensure that the EIA process is based on effective techniques for surveying and evaluating biodiversity concerns. It is important that adequate time should be allocated for seasonal variation to be captured in EIA studies, or for particular life stages to be studied if necessary. ToRs must also specify surveys over a suitable study area.

Scoping for project-level EIA often fails to ensure that regional or landscape-level impacts on biodiversity are considered. Ecosystem functions are often omitted and there is insufficient focus on local peoples' values for biodiversity. In situations where biodiversity information is lacking, Terms of Reference (ToR) for EIA are more likely to omit biodiversity considerations.

- Produce sectoral guidelines or checklists to assist in identifying potential impacts on biodiversity.

Sample ToRs for different development sectors might help to provide guidance on the use of scoping to identify potential impacts on biodiversity. Sectoral guidelines or checklists of this kind are already available in some countries (See Case Studies 3[54], Colombia and 5[54], India).

- Discuss the decision-making framework at the scoping stage to derive appropriate evaluation criteria for biodiversity.

Scoping should also take account of evaluation criteria. These are currently under-developed for biodiversity at the ecosystem-level. An important aspect of scoping is the need to ensure that EIA terms of reference provide the biodiversity data needed to make informed decisions, and that EIA-studies focus on biodiversity aspects and considerations that are of relevance to the decision-making process. Guidance is required to assist practitioners to focus on key biodiversity issues and to design their studies accordingly.

Changes to the UK EIA system resulting from implementation of the EIA Amendment Directive in 1999 make it possible for proponents to seek scoping advice (a formal 'scoping opinion') from the planning authority (see Case Study 13[54], UK, p17).

With respect to biodiversity, good scoping should:
- clarify legal requirements for assessment of impacts on biodiversity
- be based on full and appropriate consultation
- provide a survey design that incorporates seasonality and allows adequate lead-times for study of biodiversity
- specify a study team with appropriate expertise
- provide TORs for a study design based on clear evaluation and decision-making criteria
- provide TORs for a study design based on ecosystem boundaries, not just jursidictional or administrative boundaries provide for evaluation of impacts on biodiversity not just biodiversity inventory

4.5.3 Refining the TORs

It is not possible to survey everything for the purpose of EIA, so how can EIA practitioners identify those aspects of biodiversity for which detailed information and analysis are most likely to assist the decision-making process? Generally applicable criteria for selecting aspects of biodiversity on which to focus for purposes of EIA are needed.

One useful approach is to identify 'valued ecosystem components' (VECs), using a range of criteria as appropriate to select what to study.

- Produce checklists of criteria for selecting aspects of biodiversity that require detailed study for EIA.

For species, VECs for which detailed information might be sought could include:

* Protected species
* Umbrella species
* Keystone species
* Specialists (species with exacting habitat requirements)
* Endemic species
* Species used and valued locally for provision of food, construction materials etc
* Species of cultural importance
* Species at the edge of their range
* Species with restricted distributions
* Species that are threatened and declining throughout their range
* Rapidly declining species
* Migratory species that are internationally protected
* Indicator species

For habitats, detailed information might be sought for:

* Rare habitats
* Habitats supporting any of the species identified above
* Habitats providing important services or products
* Wetlands
* Habitats already affected by similar proposals elsewhere
* Habitats for which a high proportion is affected by a proposal
* Biodiversity-rich habitats
* Fragile or sensitive habitats
* Internationally important habitats
* Globally threatened habitats (see CBD listings for example)

- Provide guidance on biodiversity indicators that are suitable for use in EIA (see checklist in Box 17).

4.5.4 Impact assessment and prediction

Most impact assessment procedures require provision of the information required to make a well-informed decision about the ecological, economic and social acceptability of a proposal.

Biodiversity specialists working on EIAs therefore have a responsibility to ensure that they exercise sound professional judgement as to the minimum data needed to characterise the environment and to make defensible impact predictions. The key challenge is to produce a sufficiently detailed impact analysis in the face of: insufficient data; inadequate knowledge of the affected ecosystem(s), habitat(s), or species; and uncertainties over cumulative impacts.

- Use primary sources of biodiversity information for impact assessment.

Few studies of biodiversity carried out for purposes of EIA are based on sound methodologies. Biodiversity information available is often limited and descriptive and cannot be used as a basis for firm or quantitative predictions. In many countries the bulk of information on biodiversity is derived from secondary sources, sometimes being 'recycled' from other studies and having questionable relevance to the proposal in question (See Case Study 3[54], Colombia).

- Define 'impact zones' based on proposed development activities during construction, operation and decomissioning.

The proposal must be described in such a way that potential impacts on biodiversity can be identified during scoping and followed up accordingly. Impacts during all phases of the proposal should be identified and outcomes predicted for biodiversity under best- and worst-case operating conditions. If TORs have been produced following a scoping exercise, check that they remain appropriate. If not, check that the magnitude, extent, timing and duration of development activities are known.

Take account of:
* the geographic area affected by the activity (include all on-site and off-site impacts),
* all known direct and indirect impacts (based on experience elsewhere),
* the timing, frequency and duration of activities,
* the degree of confidence with which the impacts of the action are known and understood,
* possible alternative sites, locations, designs, schedules.

- Base the study area on 'impact zones' and biodiversity distributions (spatial and temporal): take an ecosystem approach.

Any components of biodiversity falling within the 'impact zone' should be studied, but so should those proportions of their habitat, population or gene pool not directly affected. If a proportion of habitat for a protected species will be directly destroyed by a proposal, will sufficient habitat of a suitable quality remain to support the species? By taking an ecosystem approach it is more likely that indirect impact on biodiversity will be detected.

- Agree on a definition of baseline conditions for biodiversity.

Impacts on biodiversity cannot be predicted without reliable baseline examples or experience for comparison. In impact assessment, the baseline is frequently taken to be the pre-project situation, but it is important to remember that biological baselines are not static. The ecosystem affected by a proposal may be degraded but improving, and high biodiversity value might be restored in time in the absence of the proposal. The effective treatment of biodiversity requires at least some consideration of this theoretical optimal baseline. For practical purposes, a postulated baseline, based on expert judgement (eg based on pre-industrial times), is therefore likely to be most appropriate. In some situations it may be possible for biodiversity experts to determine a set of baseline characteristics representing a similar cultural landscape with high biodiversity.

- Measure impacts against the baseline.

For each impact identified, attempt to provide the following information:
* magnitude
* extent
* timing
* duration

This information should be used to determine how baseline conditions will be altered by the proposal.

Box 22 Summary of good impact assessment and prediction practice (after Byron, 2000[5])

- If possible, quantify the magnitude or physical extent of predicted impacts eg areas of land taken, percentage of habitat lost or numbers of communities, species or individuals affected. Place these in an international, national, regional or local context where appropriate.
- Provide information on the nature of the impact, ie impact magnitude, duration, timing, probability, reversibility, potential for mitigation, likely success of mitigation, significance of impact before and after mitigation. It may be useful to summarise this information for each impact in a table. Information also needs to be provided on the cumulative effects of different impacts.
- Describe the elements of wildlife affected, their importance, sensitivity, and ability to escape, relocate or adapt/habituate.
- Describe impacts that may occur during construction and, if appropriate, decommissioning phases of the project as well as those arising during the operational phase.
- Consider short or medium term as well as long term or permanent impacts; consider positive effects that might enhance nature conservation interest as well as negative effects.
- Specify uncertainties in prediction.
- Assess the significance of impacts likely to arise from the project against the projected baseline data rather than against existing conditions revealed in the field surveys. The EIS should describe the likely changes in biodiversity that would result without the project going ahead. For example, if the proposed project did not go ahead, traffic levels on the existing road may increase, leading to higher pollution levels with associated impacts on vegetation.

- Develop techniques to elicit biodiversity values

EIA must make provision for asking stakeholders about biodiversity functions, uses and also spiritual or religious beliefs. Simple, practical, participatory methods are required as well as methods for stakeholder analysis to identify conflicts in biodiversity conservation and use (see Box 23).

Techniques for eliciting biodiversity values are not currently well developed in EIA. Practical guidance is required, based on good and bad examples of the application of available techniques. Techniques might include:

* checklists (eg for use in scoping to ensure that biodiversity values are considered and the necessary information obtained during the EIA process);
* accompanied transect walks, for example to collect ethno-biological information;
* semi-structured questionnaires;
* Participatory Rural Appraisal (PRA);
* Stakeholder meetings (all groups).

There is some guidance available concerning the integration of indigenous knowledge in project planning and implementation, for example the recent guidelines issued by the International Labour Organisation, the World Bank, IDA and KIVU Nature Inc[13]. However, this does not address biodiversity specifically and there remains a need for practical guidance concerning the inclusion of indigenous knowledge values in EIA and SEA.

Box 23 Requirements for eliciting biodiversity values in EIA

Understanding local management systems and needs

* Review of indigenous/customary systems of access to resources and resource management
* Participatory review of customary claims to land and natural resources
* Review of national policies and laws affecting resource management
* Assessment of local uses of natural resources
* Social impact assessment

Planning to integrate conservation and local needs

* Open meetings among stakeholders
* Special events and 'ideas fairs'
* Visits to successful conservation/development initiatives
* Building upon local knowledge and skills in resource management
* Participatory planning to integrate local needs
* Zoning to separate incompatible land uses

Generating benefits for local stakeholders

* Primary environmental care (PEC) projects
* Jobs for local people
* Local distribution of revenues from the conservation initiative
* Compensation and substitution programmes

Enhancing the sustainability of benefits to stakeholders

* Feasibility studies
* Linking benefits with efforts in conservation
* Supportive links with relevant services and programmes
* Monitoring land tenure and land values in sensitive areas
* Incentives to conservation accountability
* Biodiversity monitoring and area surveillance by local people
* Integrating the conservation initiative with local empowerment in welfare, health and population dynamics

- Adopt a landscape scale approach to elicit biodiversity values

A landscape perspective helps ensure that all important biodiversity resources are identified and that there are genuine options for alternative project sites or designs (not just 'paper fiction' alternatives).

4.5.5 Evaluation

- Evaluate all impacts on biodiversity and determine their significance on the basis of agreed criteria.

Evaluation is used to determine the importance of impacts on biodiversity. It is important that EIAs and SEAs should provide reliable and objective information about the likely outcomes of proposals for biodiversity. For decision-making, this information must be interpreted and compared against other types of impact (eg social or economic). Subjective value judgements may be required, based on wisdom and experience, to compare impacts of different types. All players in the impact assessment process need to agree the criteria that will be used to evaluate biodiversity. It is important to have measurable standards or objectives against which the significance of individual impacts on biodiversity can be evaluated. An all-encompassing goal may be to aim for 'no net loss' of biodiversity, but to determine whether or not overall losses will occur requires some sort of 'accounting' system. It is necessary to define standards against which impacts can be evaluated. For example these might be based on biological carrying capacity or 'utility' (degree of usefulness) to determine what extent of habitat loss is tolerable, or what level of resource-use can be sustained for viable populations of a particular species to be maintained. For some biodiversity uses, it may be possible to derive monetary values.

'Inherent' values are notoriously difficult to measure, as are cultural and religious values. Even if quantitative scales of measurement are unavailable, however, it is important to ensure that values are identified and addressed, using qualitative approaches if necessary.

- Use EIA to determine the extent to which biodiversity values will be altered by a proposal and to recommend measures for ensuring no net loss of biodiversity value.
- Significance depends on the importance of the receptor and the severity of the impact.

Will the proposal restrict local access to biological resources and their traditional use?

- Develop biodiversity indicators for use in impact assessment.

There has been some research carried out on biodiversity indicators that might be of use in EIA. The Subsidiary Body on Scientific and Technical Advice (SBSTTA) of the Convention made some recommendations for a core set of biodiversity indicators. These were based on a Background Paper prepared by the Liaison Group on Indicators of Biological Diversity for the Third Meeting of the SBSTTA held in Montreal, Canada from the 1st to the 5th of September 1997.

To assess the status and trends of biodiversity, SBSTTA in 1997 proposed a core set of 3 complimentary, universal indicators:
* ecosystem quantity (losses or gains at ecosystem level);
* ecosystem quality (state relative to postulated baseline, eg species abundance and or distribution; species richness, ecosystem structure and complexity);
* the relative number of threatened and extinct species (species and ecosystems threatened according to definitions relevant to the CBD, eg based on IUCN Red List).

These indicators could make it easier to select attributes for detailed study in impact assessments. For defensible decisions to be made, an EIA should be based on measurable biodiversity attributes that can be measured and compared, either against baseline data or against examples of a similar type that are considered to be of 'high quality'. Box 24 summarises measurable attributes of this kind that could be used to evaluate ecosystem structure, complexity and heterogeneity in forest ecosystems, eg in relation to relatively 'pristine' examples.

Box 24 Potential attributes that could be measured to evaluate ecosystem structure, complexity and heterogeneity

* the ratio between dead and living wood
* the percentage of intact canopy cover
* the percentage of intact understorey
* the percentage area of bio-reserve and primary forest
* the percentage area of sustainably managed forest
* the percentage area of secondary forest
* the percentage area of degraded forest
* the percentage area of tree plantation with and without endemics
* the percentage of major habitat qualifying as wilderness (self-regenerating terrestrial, freshwater and coastal ecosystems more than 20 km from a road, railroad or other point of access)
* identification of remaining flood-plain characteristics from satellite images to show distribution of natural river systems
* the number of well defined habitat types as an indicator of agricultural diversity related to the postulated baseline (traditional agricultural systems)
* the percentage of natural patches <100 ha in agricultural habitat
* the percentage of vital reefs, mangrove and/or sea grass coverage in marine ecosystems

Similarly, with respect to developments possibly giving rise to species introductions, suitable measurable attributes might be:
* Total number of non-indigenous species as a percentage of a particular group;
* Relative abundance/biomass of non-indigenous species, as well as the relative abundance of populations of these species to native flora and fauna.

In practice, measurable attributes should be derived to match the ecosystems affected in any particular case.

4.5.6 Mitigation

Most countries require mitigation for significant adverse effects, where these cannot be avoided. Economic considerations are usually brought into play to argue overriding concerns.

- Applying the precautionary principle, explore all options for avoidance of impacts on biodiversity before resorting to other forms of mitigation (reduction, replacement, compensation).

The first priority is to avoid adverse impacts on biodiversity wherever possible. Damage might be avoided by:
* deciding to adopt the 'do-nothing' option
* desisting from specific activities that will damage biodiversity
* seeking alternative locations or designs with lower impacts on biodiversity
* avoiding important sites or areas for biodiversity (eg areas of high endemism)
* avoiding sensitive times (eg breeding seasons)

- If avoidance of damage to biodiversity is not possible, attempt to reduce the severity of impacts on biodiversity by modifying the proposal.

It may be possible to alter the design of a proposal or the timing of key activities to reduce their severity of impact. Common measures include avoidance of bird breeding seasons, or the use of fencing to ensure that construction machinery does not damage sensitive vegetation.

Production of an environmental management plan (EMP) to accompany engineering designs can help to ensure that measures intended to protect biodiversity values are implemented.

- If it is not possible to avoid or reduce damage to biodiversity through design modifications, explore options for replacement or restoration of biodiversity on-site.

Many biodiversity values are site-specific and are not easily replaced elsewhere. In particular, this applies to biodiversity resources that are used and valued by local people. Even if off-site mitigation is intended to replace the same type of ecosystem, habitat or species, local genetic variation may be lost. Restoration in the close vicinity of the biodiversity that has been damaged or lost is most likely to be effective provided that site
conditions are similar and that the areas available are sufficiently large to support viable habitats, populations or ecosystems.

- As a last resort, or to reinforce other mitigation strategies, seek opportunities to compensate for damage to biodiversity.

In some countries mitigation banking procedures are increasingly being used to provide ecological compensation. Mitigation banking is one mechanism for ensuring that developers invest funds in effective projects that are sited in suitable locations and managed with appropriate expertise. Care should be taken to ensure that compensation projects do not substitute habitat types (eg wetlands for forests) unless maintenance of overall or regional stocks of important habitat types can be assured by other means. Some sort of biodiversity accounting mechanism will be required to ensure no net loss of biodiversity.

Key questions to ask about proposed mitigation measures:
* Have adequate steps been taken to deal with issues affecting ecosystems outside the project boundaries?
* Have local communities dependent on the affected area(s) been included in the preparation and implementation of the project? Are arrangements agreed for compensation and/or concessions to groups adversely affected by the project?
* Is the project design flexible enough to manage the predicted changes? Does the project draw adequately upon scientific and local knowledge to inform adaptive management of the natural environment?
* Does the project involve all the relevant sectors and disciplines?

Wherever and whenever possible, seek opportunities to enhance biodiversity over and above what is required for mitigation

Consider whether the proposal may actually enhance the benefits local populations can derive from natural ecosystems, or provide opportunities for biodiversity conservation on land not earmarked for commercial use.

Include mitigation to ensure sustainable use of biodiversity

Consider whether the proposal will permit sustainable access to the biodiversity resources used to sustain livelihoods and search for mitigation measures to ensure provision of adequate alternatives should local access to traditional use of biodiversity be restricted.

Create a legal requirement for implementation of mitigation (not just a legal requirement to make recommendations

There are a great many examples where unrealistic mitigation recommendations have been made, without any evidence of their likely effectiveness, or the actual techniques that would be used to implement them. Mitigation measures may not be implemented once development consent is given, or may be poorly managed. There are many examples of mitigation failure with respect to biodiversity objectives.

Require the production of an environmental management plan for all proposed mitigation measures.

A summary of proposed mitigation measures, together with a provisional implementation plan, helps to ensure that realistic mitigation strategies are adopted. Plans should refer to other examples where similar measures have been successful and should provide basic information about proposed techniques, locations and costs.

4.5.7 Evaluation of residual impacts

- Evaluate the post-mitigation significance of impacts on biodiversity (ie how important are the impacts that will remain after all proposed mitigation measures have been implemented?)

In effect this stage is a further iteration of the evaluation carried out in 4.5.5. The same criteria should be used to produce a definitive statement of the significance of residual impacts. This stage of the process is very important and should always involve an experienced ecologist or biodiversity specialist.

A final conclusion should be reached about the significance of impacts from a biodiversity perspective, so that decision-makers can then proceed to compare biodiversity impacts against other categories of impact.

4.5.8 Review

- Provide guidance for independent review of environmental statements from a biodiversity perspective.

Standard review criteria can be produced to ensure that all relevant biodiversity considerations have been taken into account, that all relevant legislation has been respected and that adequate information has been provided for a well-informed decision to be reached.

A simple checklist can help, and this should be tailored to match any advice given at the scoping stage. There are few good examples of biodiversity review criteria available however.

4.5.9 Decision-making

- Ensure mechanisms exist for requesting additional biodiversity information if necessary.

It is important to be able to request additional biodiversity information even if this results in delays and additional costs.

- Place conditions on development consent that maximise opportunities for biodiversity conservation

It is possible to place conditions on development consent. Agreements may be entered into between developers and planners to establish and maintain biodiversity conservation measures. In countries where there is no legal requirement to actually implement proposed mitigation, this may be the only way to ensure that effective mitigation takes place.

4.5.10 Monitoring and follow-up

The general lack of follow-up has already been referred to. Lack of impact monitoring and EIA follow-up were identified as principal weaknesses in EIA in South Africa[60], but monitoring and follow-up are also lacking in most other countries. Lack of follow-up may contribute to a general inadequacy of mitigation procedures, and has certainly hindered development of reliable impact prediction methods for biodiversity. In some countries, such as South Africa, measures proposed to mitigate adverse impacts are legally binding once stipulated as conditions of consent, lack of follow-up means that actual implementation is poorly policed.

4.5.11 Legal requirement for follow-up, including biodiversity monitoring if appropriate

Despite the prevalence of impact assessment as a decision-making tool throughout the world, little is known about its effectiveness, due to a general lack of follow-up. Research carried out to test predictions made in EIA suggests that they are often inaccurate, or are stated in such vague subjective terms at the outset that their accuracy is impossible to test. For biodiversity considerations this is a particular problem, due to the inherent complexity of ecosystems and the acknowledged uncertainty of predictions. EIA and SEA have the potential to add to baseline information on biodiversity, but the absence of requirements for follow-up means this opportunity is largely wasted.

Lack of follow-up means that:

* predictions are not tested or verified
* implementation of mitigation proposals is not 'policed'
* success of mitigation cannot be evaluated
* no corrective action can be taken should impacts prove worse than predicted,
* no corrective action can be taken should mitigation measures fail to safeguard biodiversity
* biodiversity monitoring data cannot be obtained and the predictive base is weakened as a result

Ideally, decisions should be based on full information. Monitoring is required to strengthen the knowledge base and enhance the accuracy of future impact assessments. It is also required to check whether mitigation measures were effective and to provide opportunities for corrective action if necessary. Results of monitoring should be widely circulated to help improve future scheme designs and mitigation.

The International Association for Impact Assessment (IAIA) is currently reviewing the status of 'follow up' in EIA and some preliminary information is available from the Executive Office (www.IAIA.org).

5 Strategic Environmental Assessment

SEA is the "formalised, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making"[50]. Its purpose is to ensure that the environmental consequences of a proposed policy, plan or programme are appropriately addressed at the earliest appropriate stage of decision-making, on a par with economic and social considerations.

Although EIA was always intended to be an integrated decision-making tool, project-EIAs have often failed to address all relevant impacts at an appropriate scale. This is particularly true of biodiversity impacts.

Project EIA often fails to address biodiversity issues effectively because:

* Screening excludes small projects which have insignificant impacts in isolation but which constitute a significant collective threat.
* Baseline conditions are not defined or understood.
* Biodiversity issues are not sufficiently clear-cut to be identified and included at the scoping phase.
* Lead-times are too short to collect biodiversity data where they don't already exist.
* Impacts outside development area, complex interactions and delayed impacts are not 'captured'.
* Linked or connected projects are not assessed in their entirety.
* Time- and space-crowding effects are not detected on a case-by-case basis.
* Only charismatic components of biodiversity are assessed.
* Evaluation criteria are lacking, so results cannot be interpreted meaningfully.
* Implementation of proposed mitigation is not always mandatory

Some of these common shortcomings can be avoided if impact assessment is carried out sufficiently early in the development planning process to identify viable alternatives that have lower impacts on biodiversity. It is generally agreed that efficient safeguard of biodiversity is only possible if ecological constraints and possibilities are identified well in advance of individual development proposals. A tiered approach is ideal. SEA may be applied to individual government policies, sets of policies, national or regional plans, or programmes of development activity. For example, SEA could be applied to a national transport policy, a regional transport plan or a road-building programme as shown in Box 26. Whatever its application, the main stages in SEA are likely to be as outlined in Box 25.

Box 25 SEA: Key stages

1. Set environmental objectives (including biodiversity) and identify development priorities.
2. Inventory resources (eg national or regional biodiversity resources).
3. Identify stakeholders and establish dialogue.
4. Revise priorities and objectives in the light of stakeholder analysis. Review need for development and establish alternative options.
5. Define planning zones in relation to opportunities and constraints both for development activities and environmental resources, including biodiversity.
6. Establish regulatory framework, eg to include 'limits of acceptable use' for natural resources.
7. Implement monitoring programme to establish environmental and social baseline in advance of proposed activities.
8. Review development priorities and environmental objectives on a regular basis, using monitoring results.

Box 26 Application of SEA to policies, plans and programmes

Type of proposal	Example	Incorporation of biodiversity
Policies	National transport policy	Review proposed transport policy for potential conflicts with national biodiversity goals and objectives, eg as specified in the NBSAP. Check lists of protected species and designated wildlife sites are up to date and reliable. Review international obligations with regard to conservation of biodiversity and clarify legal obligations.
Plans	Regional transport plan	During formulation of plan, identify regional biodiversity experts and form a network. Carry out regional reviews and consultations to identify any sites of high biodiversity value that are not designated. Publicise areas important for biodiversity and explore alternative strategies for achieving both transport and biodiversity objectives. Carry out regional biodiversity accounting to set regional targets for biodiversity, eg for mitigation purposes.
Programs	Road building program	Use impact assessment to identify 'least impact' alternatives/ corridors from a biodiversity perspective. Ensure that biodiversity constraints are included in all exploratory studies for corridor-selection. Establish a biodiversity monitoring framework for main proposed route-corridors. Identify potential biodiversity mitigation or enhancement options.
Projects	Individual road project	Follow standard EIA procedure as outlined in section 44. Predict and evaluate impacts attributable to proposed project and identify suitable mitigation options consistent with international, national, regional and local targets and objectives for biodiversity.

Assessment of impacts on biodiversity must form an integral part of land-use planning. SEA is one way to incorporate biodiversity concerns into the planning process in advance of consent procedures for individual proposals or projects.

SEA is a form of 'top-down' assessment but also enables impact assessment to be applied as a horizontal measure, for example to evaluate impacts on regional biodiversity caused by activities in a number of different sectors. In this context, SEA has been used to assess management plans for national parks or other protected areas, including World Heritage Areas (WHAs).

There are many development sectors where application of SEA has helped to resolve potential conflicts between economic goals and biodiversity concerns. For example, application of SEA to the Finnish Forest Program in 1999 revealed that the National Program was based on unfounded assumptions about economic benefits. Another example is the SEA of the Bara Forest Management Plan in Nepal in 1994.

5.1 Role of SEA in mitigation

SEA also has a potential role in improving mitigation for adverse impacts on biodiversity caused by development. At the project level, mitigation for biodiversity impacts is often ineffective because:

* on-site mitigation options are limited
* there are no economies of scale
* individual operators or proponents may lack expertise in biodiversity or ecological restoration
* no resources are secured for management in perpetuity
* biodiversity 'stocks' cannot be managed to ensure continuity of regional supply
* replacement 'in kind' may be impossible on-site and suitable similar sites may be unavailable in the vicinity
* mitigation measures are not followed-up or monitored, so there is limited documented experience
* there are insufficient funds or expertise for anything but cosmetic measures

SEA can help by:

* ensuring that important sites or areas are identified early and proposals zoned accordingly, to include potential sites for enhancement through mitigation
* providing a framework for co-ordinated mitigation programmes carried out by multiple operators and stakeholders (eg mitigation banks)
* giving longer lead-times for baseline survey and mitigation planning
* providing a framework for longer term follow-up and biodiversity monitoring including assessment of:
  - cumulative effects
  - landscape-level assessment
  - habitat fragmentation
  - gene-flow
  - regional trends in population
  - population and habitat viability
* allowing detection of emerging trends and scope for proactive management

For SEA to cater effectively for biodiversity, certain requirements must be met, particularly with respect to biodiversity information and understanding of threats. Some of the information required for effective SEA is summarised in Box 27.

Box 27 Biodiversity information requirements for SEA

Biodiversity information to include:
Species distribution data at a suitable scale. Status (stable, declining, increasing?). Information on habitat suitability and availability. Levels of current and historic habitat use. Understanding of variability/ trends. Reliable and up-to-date monitoring data including maps. Registers of taxonomic experts. Information about use and management.
Information about threats
Activities that pose a threat. Vulnerability. Exposure to specific threats throughout range.
Information about responses to threats
Ability to recover. Ability to re-locate (eg mobility relative to distance between suitable habitat areas). Availability of mitigation techniques and potential replacement sites.

SEA should be considered as a potential tool for incorporation of biodiversity consideration in situations where:

* comprehensive biodiversity monitoring has not been instituted
* there is a high risk of cumulative impact on biodiversity
* ecosystem behaviour is poorly understood, so long lead-times are required to collect reliable baseline information
* ecosystems are unstable or fluctuating, so more baseline data are required for predictions to be reliable
* important biodiversity resources are limited and fragmented
* important biodiversity resources are threatened throughout their range
* mitigation options are limited (eg few suitable alternative sites are available)
* replacement options are all long-term (eg restored habitats will take a long time to establish)
* biodiversity resources are threatened from many sources or by activities in a number of sectors
* there are many stakeholders requiring local uses of biodiversity to be sustained

SEA creates a logical framework for longer-term biodiversity monitoring, but can also generate biodiversity monitoring data.

6 Conclusions and recommendations

6.1 Introduction

EIA and SEA can undoubtedly be of considerable benefit in safeguarding biodiversity where good practices are followed. In some countries EIA is considered to have contributed to enhanced conservation of biodiversity, despite some of the shortcomings identified and a tendency to cause increased costs and delays in development consent procedures (see Case Study 11[54], South Africa; Case Study 3[54], Cameroon). However, the extent to which EIA results in 'better' decisions from a biodiversity perspective is difficult to evaluate, due to the lack of any formal requirement for follow-up in most countries.

In many of the countries involved in this study, EIA laws and regulations have been introduced relatively recently, and in some (Case Study 1[54], Afghanistan) they are yet to be introduced. By identifying shortcomings, barriers and problems, it is possible to begin the quest for practical solutions to improving the integration of biodiversity with decision making for development. This chapter summarises examples of good and bad practice as identified in country status reports, case studies and the workshop. Note that these examples do not necessarily represent normal practice in the participating countries, they are simply examples used for purposes of illustration. These have been drawn upon to identify barriers to the integration of biodiversity concerns with EIA/SEA. The remainder of the chapter provides recommendations concerning the institutional strengthening and capacity building that may be required to ensure that the good practice recommendations given in Chapter 4 can be implemented.

Table 6.1 summarises impact assessment practices and principles as applied in the countries involved in this study. Note that the information included in the table is drawn from the national status reports and case studies: it should be regarded as indicative, not definitive.

Tables 6.2 and 6.3 give examples of good and bad practice, respectively, drawn from case-studies.

Practice or principle applied	Afghanistan	Argentina	Cameroon	Colombia	Guyana	India	Kyrgyzstan	Nepal	Niger	Romania	South Africa	Tanzania	UK	Uruguay	Yemen
NBSAPprocess provides information for use in impact assessment				Not yet					Not yet				Yes		
NBSAP process indicates role for impact assessment					Yes		No	No	Yes				Not explicit		
Impact assessment improves consideration of biodiversity in development planning	No		Yes (p20)	Yes	Yes	Yes	No documented examples	Rarely	Rarely (see p17)	No documented examples		Good eg's exist	Good eg's exist		
SEA for development plans and programmes, taking account of biodiversity	No					Yes	No	No	Yes under consideration	Some examples					
EIA laws and processes include references to biodiversity	NA		Yes		Yes	Yes	No	No	Yes	In effect (no specific mention of BD).					
Appropriate institutions involved in impact assessment	NA		Too many involved		Yes	Yes,but weak coordination	No	Weak coordination	Yes, but under-resourced	Poor co-ordination					
Screening															
Significant threat from unregulated development	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Main development threats are subject to EIA	No		Yes	Not all	Yes (p9)			No							
Lists of protected species and habitats available			Yes		Yes	Yes	Not completed	Yes but out of date	No	Not one definitive list		Yes			
Impact assessment required for proposals affecting protected areas	NA			Yes	Yes	Yes	Not clear	Yes	Yes	Not clear		Yes	Yes		

Practice or principle applied	Afghanistan	Argentina	Cameroon	Colombia	Guyana	India	Kyrgyzstan	Nepal	Niger	Romania	South Africa	Tanzania	UK	Uruguay	Yemen
Screening guidelines available (making reference to biodiversity)	N A			Yes	Yes	Yes	Not clear	Yes, but not based on BD-concerns	No	Not clear	Yes	Yes	Yes		
Scoping															
Scoping guidelines available				Yes	Yes	Yes	No	Draft	No	No	Yes				
Assessment of impacts on biodiversity															
Impacts on genes	NA		No		Some times	No	No	No	Some times				rarely		No
Impacts on species	NA		Yes		Yes	Yes	Yes	Yes	Yes				Yes		Yes
Impacts on ecosystems	NA				Some times	Some times	No	No	Yes, for pro-tected species				rarely		No
Mitigation															
Review															
Independent review, including biodiversity	NA				Yes	Yes	No	No	No	Not in all cases		Yes	No		No
Decision-making															
Biodiversity concerns influence decision									Some example	No					
									Sexist						
Post development															
Post development audit and evaluation required					Yes	Some cases	No	Yes in theory	Rarely	No			No		

Table 6.2 Examples of good practice

Practice or principle applied	Example	Case Study Reference
Political will to balance biodiversity concerns with development	Integrated and participatory framework for developing economic, social and ecological functions of biodiversity	Case Study 12, Tanzania
Strong institutional frameworks for integration of biodiversity concerns with development planning (including impact assessment)	India has a strong hierarchical framework for environmental decision-making that includes impact assessment and ministries responsible for wildlife conservation and management	Case Study 6, India (p16)
Appropriate laws are in place	Biodiversity concerns are recognised in laws relating to environmental management, though they need strengthening	Case Study 3, Cameroon (p5)
Wide consultation and high levels of publicity helped to ensure public participation in the biodiversity action planning process	Guyana's NBSAP India's NBSAP is being developed through a participatory planning process involving all major stakeholders, including the public	Case Study 5, Guyana (p4) Case Study 6, India (p9)
NBSAP recognises and reinforces the role of impact assessment	Guyana's NBSAP identifies clear actions relating to impact assessment	Case Study 5, Guyana (p5)
Reliable biodiversity data are available for use in impact assessment	Many sources of information exist, including guides and atlases India has many major institutions contributing to information on biodiversity, not just in protected areas	Case study 3, Cameroon (p15) Case Study 6, India (p23-24)
Development of biodiversity information system	'Biodiversity Information Management System' (BIMS) in Romania and similar system planned for Colombia India has 2 national database centres housing computerised databases on biodiversity resources (http://www.wcmc.org.uk/igcmc/main.html and http://www.wii.gov.in Biodiversity databases also developed for Kwa-Zulu Natal, South Africa	Case Study 10, Romania Case Study 4, Colombia (p32) Case Study 6, India (p25) Case Study 11, South Africa
Use of SEA to permit identification and avoidance of ecologically sensitive zones	Sectoral environmental evaluation of transport in Cameroon: Provided opportunities to identify ecologically sensitive areas and to modify designs to avoid impacts	Case Study 3, Cameroon (p 14)
Screening and scoping		
Screening and environmental clearance procedures respect biodiversity concerns	India requires impact assessment for proposals affecting notified ecologically sensitive areas, but also has some 'no development zones', eg round Numaligarh and Pachmari Nepal's EIA schedules require EIA for projects in 'sensitive' areas, including national parks, wildlife sanctuaries and conservation areas	Case Study 6, India (p17) Case Study 8, Nepal (p12)
Sectoral scoping guidelines provide information on threats to biodiversity from different development sectors and indicate suitable assessment methods	Colombia's Ministry of Environment is considering how to strengthen impact assessment guidelines for different sectors and to include biodiversity. Guyana's EPA is developing sectoral EIA guidelines for tourism, road construction, housing, agriculture and manufacturing industries, to include biodiversity India has specified biodiversity-related information to include in environmental appraisal for different sectors, see http://envfor.nic.in/ Nepal has national EIA guidelines and also sectoral EIA Guidelines, some still in draft form	Case Study 4, Colombia (p20) Case Study 5, Guyana (p7) Case Study 6, India (p22) Case Study 8, Nepal (p10)

Practice or principle applied	Example	Case Study Reference
Public consultation on proposed terms of reference	In Nepal, proponents must publish notices of their intent to develop and invite public comments on the scope of the EIA	Case Study 8, Nepal (p12)
Impact assessment		
Impact assessments include less' charismatic' species	Inclusion of algae and aquatic arthropods in addition to fish in post cyanide spill-assessment of the Omai gold mines	Case Study 5, Guyana (p11)
Impacts on species interpreted in terms of habitat requirements and availability	For assessment of the Narmada Sagar dam project in India, Habitat Evaluation Procedures were used to determine impacts on key species in terms of their home ranges following development. Systematic baseline biodiversity monitoring provided the necessary data	Case Study 6, India (p34)
Cumulative impacts assessed	For EIA of the Samira gold mining project, Liptaco-Gouma Region, western lowlands of Niger, cumulative effects on valued biophysical components of the environment were assessed	Case Study 9, Niger (p24)
Impact evaluation		
EIA focuses on features of biodiversity valued by society or local communities	For EIA of the Samira gold mining project, Liptaco-Gouma Region, western lowlands of Niger, socio-cultural and economic criteria were used to evaluate impacts	Case Study9, Niger (p23)
Review of impact statement and biodiversity information		
Independent review including biodiversity specialists	Government of India convenes independent review committees for major projects, including biodiversity specialists. For the Sankosh Multipurpose Project, independent review revealed shortcomings in the EIA that had failed to capture unique biodiversity values. These were later incorporated in the development planning process, resulting in considerable modification of the proposal for biodiversity reasons.	Case Study 6, India (p38-42)
Decision-making process		
High perceived value and uniqueness of biodiversity influences decision	HEP project 'Arrieros del Micay' Some recorded cases in India, eg Silent Valley HEP project in Kerala and the Bodhghat HEP project in Central India (due to risk of extinction of Wild Buffalo from its Central Indian home range	Case Study 4, Colombia Case Study 11, South Africa Case Study 6, India (p20-21)
Post-development: monitoring and follow-up		
Post project compliance monitoring, including biodiversity	In India post-project monitoring is required to check whether mitigation measures have been undertaken and to evaluate actual impacts. Following the EIA of the Narmada-Sagar dam, the Government of India constituted a Narmada Control Authority to monitor progress in implementation and compliance of environmental safeguards.	Case Study 6, India (p20; p34)
Impact assessments provide useful biodiversity monitoring data	EIA for proposed 560km Haldia-Barauni Pipeline Project of the Indian Oil Corporation Ltd included detailed ecological baseline studies carried out by the Wildlife Institute of India. These studies revealed the presence of the river dolphin on the Rupnarayan River in West Bengal, outside its known range. In other examples, generation of biodiversity data through EIA has helped prioritise areas for upgrading to protected status.	Case Study 6, India (p26)
Awareness-raising for business and industry to advertise biodiversity business opportunities	Colombian Bio-Commerce Initiative	Case Study 4, Colombia

Table 6.3 Examples of bad practice

Practice or principle applied	Example	Country Status Report Reference
Limited awareness of biodiversity importance	Colombia is internationally recognised as a 'mega biodiverse' country, but there is little public awareness of this	Case Study 4, Colombia (p35)
	In Romania, there is little public awareness of the importance of biodiversity and little interest in the impact assessment process, despite major environmental problems, including the notorious Baia Mare mining company cyanide leak	Case Study 10, Romania (p20)
Lack of information on distributions, habitats and populations of threatened species, together with a lack of monitoring data for many groups of species and communities	Kyrgyzstan has no complete inventory of its protected areas and there has not been any detailed scientific research on the distribution of endemic species	Case Study 7, Kyrgyzstan (p21)
	Nepal suffers from a lack of reliable biodiversity information, with incomplete coverage geographically and across taxa. Biodiversity data are inadequate for meaningful impact assessment	Case Study 8, Nepal (p19; p21)
Lists of protected species are out of date	This is a problem in many countries, eg Nepal, where the lists of protected species under the National Parks and Wildlife Act have not been updated since 1973	Case Study 8, Nepal (p20)
Lack of coordination among government agencies involved in biodiversity conservation, development planning and impact assessment	Cameroon's Ministry of Environment and Forests (MINEF) is the principal government institution in charge of management of biological resources, but does not participate actively in impact assessment for developments affecting biodiversity	Case Study 3, Cameroon (p19)
	Colombia's institutional arrangements for biodiversity have diluted responsibilities for safeguarding it	Case Study 4, Colombia (p35)
	India's agencies are poorly co-ordinated: eg EIA and environmental clearances are managed by Central Government, but pollution control, coordination of public hearings and grants for forest clearance are a State responsibility	Case Study 6, India (p19)
	In Nepal inter-sectoral coordination within government is weak, resulting in neglect of biodiversity issues	Case Study 8, Nepal
EIA not applied to developments having adverse effects on biodiversity	In Kyrgyzstan, EIA laws have been introduced relatively recently. EIA is not applied to many projects having adverse effects on biodiversity.	Case Study 7, Kyrgyzstan
	In Nepal, many unregulated processes and developments cause biodiversity loss, even in protected areas. These include over-grazing and associated soil erosion, introduction of alien species, illegal hunting and poaching.	Case Study 8, Nepal (p3)
Biodiversity not an issue in screening	In many countries, screening thresholds to determine the need for EIA do not take account of biodiversity concerns, eg Nepal	Case Study 8, Nepal (p15, p19)
Appropriate EIA methods not required by law	Suitable EIA methods not specified so standards are often low	Case Study 3, Cameroon (p21)
Weak enforcement of laws	In Nepal, national requirements to undertake EIA are not always complied with	Case Study 8, Nepal (p15)
Lack of scoping guidelines	In Nepal, responsibility for scoping lies with the project proponent and there are no scoping guidelines or review criteria to ensure that TORs are adequate	Case Study 8, Nepal (p16)

Practice or principle applied	Example	Country Status Report Reference
EIA project teams do not include biodiversity specialists	Practitioners with inadequate experience, training and knowledge undertake biodiversity assessments for EIA, partly due to lack of a certification system. This is a problem in many countries, including India , Nepal, South Africa and the UK	Case Study 6, India Case Study 8, Nepal (p16) Case Study 11, South Africa Case Study 13, UK
Original or primary data on biodiversity not obtained	Recycling of environmental impact statements may occur, as noted in Nepal where EISs for two different developments clearly included re-cycled information about biodiversity In Romania, biodiversity concerns are not given high priority and irrelevant biodiversity data may be presented, eg as in the EIA for an andezit quarry in the Calea Balului-Bucuresci area.	Case Study 8, Nepal (p 26) Case Study 10, Romania (p20)
Lack of compliance monitoring for conditions on consent relating to biodiversity	In India, 6 regional offices of the Ministry of Environment and Forests are responsible for post-project monitoring of all cleared projects. Limited staff availability and long distances between project sites make the task very difficult	Case Study 6, India (p19-20)
Feasibility (technical, financial, administrative etc) of proposed mitigation measures is not assessed	In India, very few projects have included sound mitigation planning In the UK, proponents are required to recommend suitable mitigation measures, but not to demonstrate that they can be implemented and are likely to be effective. Many unrealistic recommendations are made In Nepal, although monitoring and follow-up are required in theory, there is insufficient institutional capacity for compliance monitoring and enforcement of conditions on development consent	Case Study 6, India (p27) Case Study 13, UK Case Study 8, Nepal (p18)
Undertakings to carry out mitigation for impacts on biodiversity are not respected	The Mumbai-Pune Expressway, Maharashtra, India was subject to EIA which identified a number of mitigation measures to offset significant impacts on biodiversity. These mitigation measures were not properly implemented and no compliance monitoring was carried out.	Case Study 6, India (p49)
Lack of review criteria for biodiversity impacts	In the absence of official review criteria, it is not possible to determine whether biodiversity impacts have been evaluated appropriately. In Nepal, this makes it difficult for planners and decision makers to take account of biodiversity information presented in environmental impact statements	Case Study 8, Nepal (p22)
Biodiversity concerns do not over-ride economic considerations even in areas of high biodiversity value	Upper Modi Hydro-electricity project, Kaski District, Gandaki Zone, Nepal: within Langtang National Park, but main reasons for suggested alternatives were technical	Case Study 8, Nepal (p23)

6.4 Good Practice or principle applied

A shorter list of exemplary practices drawn from case studies[54] should highlight:

* Open debate about social and cultural values attached to species and landscape diversity (South Africa, India)
* High perceived value and uniqueness of biodiversity influences decision (Colombia, HEP project 'Arrieros del Micay'; South Africa)
* Application of the precautionary principle (South Africa)
* Specialist studies in biodiversity undertaken by suitably qualified professionals
* Monitoring of mitigation effectiveness with respect to biodiversity/ ecology
* Participation of local communities (India, South Africa)
* Development of guidelines that incorporate biodiversity concerns (Colombia, India)
* More stringent mitigation required for more important biodiversity-impacts (Colombia, Tanzania)
* Awareness-raising for business and industry to advertise biodiversity business opportunities (eg Colombian Bio-Commerce Initiative)
* Development of biodiversity databases, eg as in Kwa-Zulu Natal, South Africa, Romania and Colombia, in some cases supported by GIS
* Specialist field studies of biodiversity carried out for purposes of EIA make a significant contribution to understanding of biodiversity and to databases in important ecosystems (South Africa)

6.5 Poor practices or principles to be alert for

Again shorter list of poor practices identified through the case studies[54], to be on the alert to avoid, should highlight:

* Failure to consider alternative sites with lower impacts on biodiversity (eg Colombia, HEP project 'Arrieros del Micay')
* Lack of monitoring for compliance with conditions of consent/approval (South Africa, UK)
* Inconsistency in application of laws and international conventions
* Failure to study all potentially significant impacts on biodiversity
* Failure to include biodiversity use values (eg impacts on *Eperua* species in Guyana omitted)
* Methods used to survey biodiversity not presented (Guyana)
* Failure to include key groups or taxa (most countries)
* Failure to predict outcomes for ecosystems and ecosystem-processes (most countries)
* Practitioners with inadequate experience, training and knowledge undertake biodiversity assessments for EIA, due to lack of a certification system (South Africa, India, UK)

6.6 Key limitations

There are a number of shortcomings or barriers to the effective integration of biodiversity with impact assessment. These are common to many countries and most do not have simple solutions.

The case studies were used to review the success with which biodiversity is currently incorporated in EIA and SEA. Participants in the BPSP workshop at Lechwe Lodge, Zambia (30th April to 4th May) drew on their own experience to summarise the main barriers to good practice. Box 28 shows the main barriers identified and their relative importance (based on the number of workshop participants who listed each barrier in the top 5).

Box 28 Barriers to incorporation of biodiversity in EIA practice

Barrier to effective incorporation of biodiversity in EIA	Number listing this barrier in the top 5
Lack of capacity (institutional, regulatory) for enforcement of EIA regulations	10
Lack of public awareness (development and environment)	8
Lack of reliable, up-to-date data on biodiversity distributions, status and threats	8
Lack of follow up or post-project monitoring	8
Lack of biodiversity/EIA expertise (lack of trained professionals)	5
Inadequate legislation	4
Poor or weak enforcement of existing legislation	4
Failure to consider biodiversity in national development strategies or to link NBSAPs with NDSs	4
Lack of concern for biodiversity/ biodiversity issues given low priority compared with other overriding concerns, for example economic imperative	4
Lack of agreed methodologies and techniques for assessing impacts on biodiversity	3
Financial constraints	3
Lack of transparency in the EIA/SEA and planning processes	3
EIA/SEA focuses only on certain taxa and therefore often generates unreliable results with respect to impacts on biodiversity	3
Failure to include biodiversity specialists in EIA/SEA	2
Lack of consistency in definition of biodiversity, contributing to difficulties in communicating its importance	2
Lack of political support for biodiversity concerns	2
Lack of public involvement	2
Lack of independent review	1
Lack of accreditation/ low professional standards	1
EIA focuses only on certain taxa	1
Corruption	1
High natural resource dependency coupled with lack of viable alternatives	1
Lack of accreditation/ low professional standards	1
Lack of legal requirement for implementation of proposed mitigation	1
Lack of guidance on good practice for incorporation of biodiversity in EIA/SEA	1
Total number of references	84

Additional shortcomings identified during the study include:

* Development types potentially having a significant impact on biodiversity are un-regulated and not subject to EIA
* Projects having a potentially significant cumulative impact on biodiversity are screened out and are not subject to EIA, eg due to individual small size
* Terms of reference for specialists contributing to EIA from a biodiversity perspective are inadequate
* Levels of awareness and understanding of biodiversity among EIA practitioners, the public, decision-makers and policy-makers are often low, to the detriment of effective integration of biodiversity concerns with EIA processes
* Biodiversity information is patchy, often out-of-date and difficult to obtain

* Biodiversity studies for EIA/SEA focus on charismatic or commercially important species. They do not address all levels of biodiversity as appropriate, or take an ecosystem approach to identify important support processes and functions
* Analytical frameworks and criteria to evaluate impacts on biodiversity are lacking
* There is little auditing of environmental performance after project authorisation. There is often no legal requirement for compliance monitoring, or follow-up checks to ensure effective mitigation, monitoring and ongoing management of impacts on biodiversity

6.7 Recommendations for institutional strengthening and capacity building

All impact assessments should pay due regard to biodiversity concerns, taking into account the implications of new developments for the status of biodiversity at appropriate levels, and generating information sufficient to make defensible and robust impact predictions[3]. This section suggests possible solutions to some of the limitations identified throughout the study.

- Ensure that impact assessment is required for all projects likely to have a significant effect on biodiversity (including cumulative effects).

EIA and SEA can only be effective where they can be applied. In many countries biodiversity is eroded by unregulated developments for which EIA has no application. In Afghanistan this applies to almost all development. Even in other countries with well-established impact assessment procedures, unregulated activities such as hunting, grazing by livestock and collection of fuel-wood are some of the most damaging for biodiversity.

- Clarify governmental responsibilities for biodiversity and impact assessment and establish formal communication channels

Responsibilities for regulating impact assessment and biodiversity conservation are not always clear. If many government departments are involved, roles and responsibilities may become blurred. There are sometimes very complex institutional arrangements and responsibilities for biodiversity. In Cameroon, for example, there are at least 3 government departments with responsibilities for biodiversity and development, and in Niger there are at least 4.

More emphasis could be given to communication within governments, for example to ensure that Ministers with responsibilities for different development sectors are aware of the potential value of their country's biodiversity and its vulnerability to present and possible future threats.

Guidance may be required concerning generic threats to biodiversity associated with different development sectors such as mining or tourism. This is available in India and Colombia, for example. For different development sectors and the government ministers responsible for them, threats to biodiversity will vary considerably. Nevertheless, the land and/or the sea remain a common denominator, with land-use planning the key to inclusion of biodiversity conservation in development-regulation. It is therefore likely that there is some scope for the development of generic guidance for different development sectors.

One effective mechanism appears to be the establishment of Parliamentary sub-committees for the environment, provided that these include biodiversity specialists, or people with an understanding of biodiversity concerns. Regular review is advisable to ensure that communication channels remain open.

The following can help to raise awareness within government:
* use opportunities as they arise in timetables for policy review
* seek representation from suitably qualified people on biodiversity committees and form such committees if they do not already exist (eg Parliamentary sub-committees for the Environment that include biodiversity specialists or people with an understanding of biodiversity concerns.
* conduct reviews or establish dialogue with key policy makers in key development sectors and present a united front (eg conservation and tourism).
* produce concise 'position' or policy statements summarising key issues relating to biodiversity for different development sectors.
* publicise national goals for biodiversity.
* use dialogue with Ministers if possible to establish:
    - where agreement can be reached concerning goals for biodiversity
    - put in place rules and processes for negotiation where agreement cannot be reached
    - publicise examples of good practice (what has worked, where and why).

- Impact assessment is most effective when it is used within a strong framework for spatial planning that permits biodiversity concerns to be addressed from the outset. Ensure that consideration of biodiversity is included in all decision-making affecting land use and natural resource exploitation.

A number of reports emphasised the importance of the relationship between EIA and planning systems (eg South Africa, Uruguay, UK). EIA applied at the project level will always demonstrate shortcomings, unless it is not applied within a framework of spatial planning that incorporates biodiversity concerns from the outset. Ideally, the NBSAP process and national development planning operate in tandem, biodiversity information, values and uses providing a clear bottom-line for land use planning. This is particularly important for any development entailing direct exploitation of natural resources.

It is important that EIA procedures should be streamlined so that they do not become overly bureaucratic. In some countries environmental licensing procedures are complex and unwieldy and it is unclear how biodiversity can be incorporated without exacerbating the problem. It is primarily for this reason that a clear focus is needed, together with analytical frameworks that permit evaluation of biodiversity data.

- Use SEA to ensure that biodiversity concerns are addressed from the earliest stages in the design of development projects.

In countries where there is no tradition of land use planning (such as Afghanistan and Uruguay, for example), some of the limitations of project-EIA can be overcome by using strategic environmental assessment (SEA) to ensure that biodiversity concerns are taken into account earlier in the process of decision-making for new developments.

SEA can provide opportunities for strategic baseline assessment of all ecologically sensitive areas where developments of different types might be expected to occur.

- Use the biodiversity data generated by the NBSAP process to provide the information needed for impact assessment.

In many countries there is a lack of reliable, regularly updated information on biodiversity. However, considerable progress is being made in some countries as a direct result of the NBSAP process. Colombia and Romania are currently developing comprehensive biodiversity information systems. These could play a critical role in providing biodiversity information for use in EIA and SEA (See Case Study 4[54], Colombia, p32). Some of the potential benefits include:

* knowledge of locations of critical habitat, sensitive ecosystems and movement corridors that should be prioritised for conservation outside protected areas
* updated, reliable, officially recognised information on distributions of species
* case studies exemplifying how different types of projects or activities might affect biodiversity
* collation of biodiversity information collected in EIA studies
* practical examples of how to use the ecosystem approach for land use planning and environmental licensing.

The NBSAP process can also be used to provide measurable biodiversity targets as benchmarks for evaluation in EIA/SEA.

Where possible, carry out integrated assessment of NBSAPs and NDSs (where they exist) to identify possible conflicts or opportunities for biodiversity enhancement.

- Produce and endorse definitive maps of important biodiversity areas. Update them regularly.

It is important to have one, officially recognised and definitive map of areas important for biodiversity. Regular updating of maps is essential, together with regular review of procedures and biodiversity information (e.g. Red Data Lists). Responsibility for updating and quality control should be clearly assigned. In Romania (Case Study 10[54]), the fact that there is no one officially recognised map of important biodiversity areas has resulted in lack of awareness of where boundaries actually lie.

- Produce web-based databases on biodiversity/impact assessment with national and international information and contacts, including a roster of experts.

In addition to the biodiversity information systems currently being developed in Romania and Colombia , exchange networks are also being produced to facilitate communication and networking. Rosters of biodiversity experts can facilitate the identification of appropriate

taxonomic experts for inclusion in impact assessment study or review teams. Enhanced access to biodiversity data is urgently needed in many countries.

* establish regional networks of biodiversity/EIA professionals, databases of biodiversity information and rosters of experts (for example as established by the SAREAA (South Asian Regional Environmental Assessment Association) and some country EIA associations
* ensure that biodiversity data, or lists of contacts are included in regional EIA networks where these are available
* evaluate national biodiversity monitoring data for applicability in decision-making
* review the availability of data collected using standard survey methods that could provide suitable baseline information for EIA/SEA
* derive suitable biodiversity indicators for use in EIA/SEA (see SBSTTA recommendations[7]),
* ensure national EIA associations maintain lists of specialists
* ensure that the CHM includes information on EIA, SEA and information on the integration of biodiversity with EIA/SEA.

- Provide for mandatory inclusion of suitably qualified biodiversity specialists in EIA study and review teams.
- Consider professional accreditation schemes for biodiversity specialists working in EIA/SEA.

It is important to ensure that the potential impacts of policies, plans, programmes or projects on biodiversity are assessed by competent professionals. Qualified or competent biodiversity professionals are not always included in EIA study or review teams. Mandatory inclusion of biodiversity specialists should be considered for any policy, plan, program or project likely to have significant impacts on biodiversity. Biodiversity expertise is often also lacking within regulatory bodies.

- Provide training for trainers in impact assessment/biodiversity.

Lack of trained professionals with an awareness of biodiversity conservation requirements and EIA/SEA has been identified as a problem in many countries. There is adequate expertise world-wide, but often insufficient local expertise and capacity. Failure of biodiversity planners and professionals to communicate the need for incorporation of biodiversity in EIA and SEA was also raised as an issue. Targeted training on biodiversity/EIA/SEA for all stakeholders in the impact assessment process should be considered, including training in taxonomy. In some countries combined training programmes have been organised for EIA professionals and biodiversity planners in an attempt to raise professional awareness in both groups (Niger and the UK, for example).

- Produce impact assessment guidelines (possibly sectoral) that incorporate biodiversity concerns and specify appropriate biodiversity assessment methodologies.

Some countries have officially recognised impact assessment guidelines. These may represent a voluntary code or practice, or adherence to guidelines may be required by law. These guidelines should make specific reference to biodiversity concerns and should indicate appropriate methods for assessment and evaluation of biodiversity. In Colombia (Case Study 4[54], p20), voluntary guidelines have been developed in conjunction with different development sectors. These guidelines are weak with respect to biodiversity and have not yet been produced for some of the development sectors with most serious implications for biodiversity (road construction, for example). There has been some discussion about the possibility of introducing technical guidelines with an associated certification scheme.

- Review school and university curricula to ensure inclusion and integrated coverage of biodiversity and impact assessment.

School and university curricula do not always include biodiversity or impact assessment. Those that do often compartmentalise them, thereby losing opportunities to capitalise on shared interests between groups of students studying related courses. For example, it might be possible to ensure that EIA courses incorporate modules that address biodiversity and vice versa, or to develop integrated or shared modules.

- Develop and implement biodiversity conservation awareness programs to demonstrate linkages between biodiversity conservation and the sustained well-being of human society.

In many countries, general awareness of the importance of biodiversity and the extent to which it is threatened by development is very low. Even in some of the most biodiverse countries, such as Colombia, there is very little awareness of the importance and value of biodiversity. In India, on the other hand, public pressure has been successful in raising the profile of biodiversity concerns within the EIA process and has had a strong influence on the decision-making process for some major proposals. Raising public awareness is the first step in achieving an open, transparent EIA/SEA process with full public participation.

Possible steps for raising public awareness include:

* conducting an exercise to discover what biodiversity means for the public.
* using consistent definitions of biodiversity.

* seeking clarity by using the term 'biodiversity' once in reports or presentations and thereafter using unambiguous terms and measures that are easily understood.
* launching biodiversity awareness campaigns to demonstrate the values of biodiversity and to provide information about biodiversity businesses and opportunities.

In some countries use of the media (radio, television, newspapers) has helped to raise the profile of environmental issues, including biodiversity. In others it is routinely used as a part of the EIA/SEA process to engage or inform the public. In some countries, efforts have been made to train environmental journalists with specific emphasis on biodiversity as an issue (Guyana, Afghanistan and Romania, for example). Nepal has established a forum for environmental journalists and uses newspapers and fly-posters to advertise development proposals and to indicate whether EIA will be undertaken. Guyana broadcasts environmental skits on radio and runs competitions in environmental journalism.

However, inadequate attempts have been made in most countries to ensure that the methods used to broadcast information about biodiversity and development are actually appropriate and accessible to the majority of the public. In many countries levels of literacy are low, and access to technology (radios and televisions) is limited. Alternative methods are therefore required for raising awareness.

- Provide for independent review, including review by biodiversity specialists.

Independent and unbiased review by biodiversity specialists helps to ensure that all significant biodiversity impacts are appropriately addressed, that good practices are followed and there are no important omissions. Key opportunities for review are at the scoping stage and on production of the environmental statement.

Good practice entails:
* Mandatory or legal requirement for review.
* Review team with appropriate biodiversity expertise.
* Review committee should be defined during scoping.
* Maintenance of rosters of experts.
* Proponent pays (as in Tanzania and Eritrea).

Guyana has an Environmental Assessment Board with specific functions related to review, (Case Study 5[54], Guyana, p10), but there is a shortage of qualified EA professionals with appropriate expertise to carry out review (p11).

- Publish and record the decision together with its justification.

Openness and transparency in decision-making benefit from publication of development decisions, together with the main reasons for granting or refusing consent. Maintaining a record of these decisions also makes it possible to review the effectiveness of the decision-making process and the extent to which it takes account of important biodiversity concerns.

6.8 Conclusions

This report has identified a number of ways in which impact assessment can be used to enhance consideration of biodiversity in development and land-use planning. It has also identified a number of common shortcomings. The recommendations in Chapter 4, if implemented in conjunction with the measures for institutional strengthening and capacity building identified in this chapter could help to overcome some of these shortcomings.

7 Endnotes

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