International Association for Impact Assessment

Netherlands Commission for Impact Assessment

Proposed conceptual and procedural framework for the integration of biological diversity considerations with national systems for impact assessment

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Ministry of Foreign Affairs

agriculture, nature management and fisheries

Ministry of Housing Spatial Planning and Environment

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1. GENERAL INTRODUCTION

Rationale and history
Article 14 of the Convention on Biological Diversity (CBD) requires Parties to apply EIA to projects with a potential negative impact on biodiversity and to apply appropriate procedures for programmes and policies with a potential negative impact on biodiversity. Subsequent decisions of the Conferences of the Parties (COP) have recognised that in order to adequately implement this article, further consideration should be given on how biodiversity can be integrated into impact assessments (CBD, 2001).

In decision V/18 on Impact Assessment, Liability and Redress, the last Conference of the Parties (COP) of the CBD (held in Nairobi in 2000) '*requests the Subsidiary Body on Scientific, Technical and Technological Advice to further <u>develop guidelines for incorporating biodiversity-related issues into legislation and/or processes on strategic environmental assessment and impact assessment</u> … and further elaborate the application of the precautionary approach and the ecosystem approach, taking into account needs for capacity-building, <u>with a view to completion by the sixth meeting of the Conference of the Parties</u>.'* (CBD, 2000).

In response to this request, the Ecology and Biodiversity section of the International Association for Impact Assessment (IAIA) drafted Terms of Reference for an action programme for biological diversity and impact assessment during its meeting in Hong Kong (2000). A proposal for the action programme was prepared and submitted to the IAIA board as an IAIA initiative. It was agreed that the programme be completed before the sixth meeting of the COP.

The resulting sense of urgency led the Netherlands Ministry of Foreign Affairs to request the Netherlands Commission for EIA to implement an initial phase of the action programme. The output of this phase is a proposed conceptual and procedural framework for the integration of biological diversity considerations into national systems for impact assessment. The draft framework is contained in this document. An earlier draft was discussed by the Biodiversity and Ecology section of IAIA at the last annual conference in Cartagena, Colombia (May 2001). The IAIA 2001 Annual General Meeting endorsed the submission of an IAIA statement to SBSTTA7.

Objectives of this document
The long-term goal of this document, and the underlying action programme, is to incorporate biological diversity considerations into national procedures and legislation for EIA through a binding decision of the Conference of Parties of the Convention on Biological Diversity.

The immediate objective of this document is to *provide a conceptual framework and guiding principles on how to integrate biological diversity considerations into impact assessment.*

Since EIA legislation has been adopted mainly at the national level, the framework is intended to assist countries to develop their own mechanisms to integrate biodiversity considerations into their IA systems. This document has been prepared for agencies that have formal responsibilities to implement EIA legislation and agencies that have responsibility to conserve biological diversity. It is intended to be used by experts from EIA and nature conservation authorities with an ecological or related background to further develop the in-country mechanisms by including biological diversity considerations into their EIA systems. The document does not provide precise guidelines on how to do this; it provides conceptual and procedural guidance, specifically addressing questions related to screening and scoping. These are the crucial phases in which decisions are made on whether to carry out further studies (screening decision) and the issues to be studied are identified (scoping).

We propose that the framework be used for the development of in-country mechanisms on an experimental basis in a number of pilot countries. Close monitoring of the process will provide valuable lessons which can be used to improve the framework before final approval and dissemination.

The present version of the framework has been designed for project-level EIA; further development of the framework for application in strategic environmental assessment (SEA) is anticipated.

Link to the ecosystem approach
EIA is identified by the CBD as one of the cross-cutting issues of the Convention and as such should refer to the ecosystem approach for guidance. This document is in full compliance with the principles of the ecosystems approach as put forward by the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity (SBSTTA). The approach taken is 'based on the application of appropriate scientific methodologies focused on the levels of biological organisation which encompass the essential processes, functions and interactions among organisms and their environment' (UNEP/CBD/SBSTTA, 2000).

In more detail, the document builds on the following SBSTTA principles:

Principle 1: *The objectives of the management of land, water and living resources are a matter of societal choice.* By definition, environmental impact assessment is society making informed decisions on the way it deals with its environment. By providing information on biological diversity, decisions can contribute to the conservation and sustainable use of biological diversity, including the equitable sharing of the benefits that accrue to society from biological diversity.

Principle 3: *Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.* Again, EIA is a tool to bring to the fore the potential impacts that new developments may have on the environment, on-site and off-site. This document provides a comprehensive framework that assists in the identification of such effects.

Principle 5: *A key feature of the ecosystem approach is conserving ecosystem structure and functioning.* The conceptual framework presented in chapter two is a first attempt to operationalise this principle for application by local experts in everyday impact assessment practice.

Principle 10: *The ecosystem approach should seek the appropriate balance between the conservation and use of biological diversity.* The present document consistently addresses biological diversity from this dual perspective of the non-use and use values society derives from biodiversity-related functions.

Principle 12: *The ecosystem approach should involve all relevant sectors of society and scientific disciplines.* EIA is a highly structured approach that guarantees the involvement of relevant stakeholders and that identifies the relevant disciplines to be involved in the process. Despite the difficulties being encountered by the EIA community in dealing with biological diversity issues in EIA, there is no doubt that EIA is one of the few internationally recognised legal instruments to put principle 12 into practice.

One limitation with respect to the objectives of the CBD is that EIA does not deal with the principle of equitable sharing of benefits obtained from biological diversity. EIA is a means to provide sound information to the policy and decision makers (ideally being the representatives for society); they are responsible for the weighing of interests and for the final decision on the implementation of proposed projects, programmes or policies.

Link to the precautionary principle
The precautionary principle should be applied if there are significant risks of a loss of biological diversity even where the available information is not conclusive. The decision to apply the precautionary principle in a certain situation cannot be made by the EIA study team, but is the responsibility of the competent authority, i.e. the decision maker.

The task of the EIA team that carries out the study is to identify potential impacts on biodiversity, indicate the importance of this diversity and indicate to what extent the gaps in knowledge hamper the drawing of conclusions. There is a general misconception that the outcome of an EIA can prevent projects from going ahead. This can never be the case since the EIA process only results in valid information to support decision-making. EIA is not the decision-making process itself.

Structure of the document

Chapter 2 provides a comprehensive conceptual framework for gaining an understanding of the causal biophysical and social pathways through which activities lead to impacts. It is intended to accommodate all conceivable biophysical and social impacts, but for the purposes of this document it has been developed in detail for the identification of impacts related to biological diversity. An all-encompassing framework was chosen to ensure that biological diversity becomes an integral part of existing IA procedures and legislation. In other words, *no new instrument or procedures are proposed*.

Chapter 3 proposes a mechanism on how biological diversity considerations can be incorporated into the decision on whether further environmental studies are deemed necessary for a proposed activity, i.e. the screening phase of EIA.

Chapter 4 proposes a stepwise approach to assist in the scoping process for biological diversity issues, based on the conceptual framework presented in Chapter 2.

Chapter 5 provides some thoughts on priority activities for the near future to achieve the goal of incorporating biological diversity considerations into national procedures and legislation for EIA.

Figure 2.1: **Biophysical changes and social change processes resulting from project interventions** (adapted from Slootweg et al., 2001)

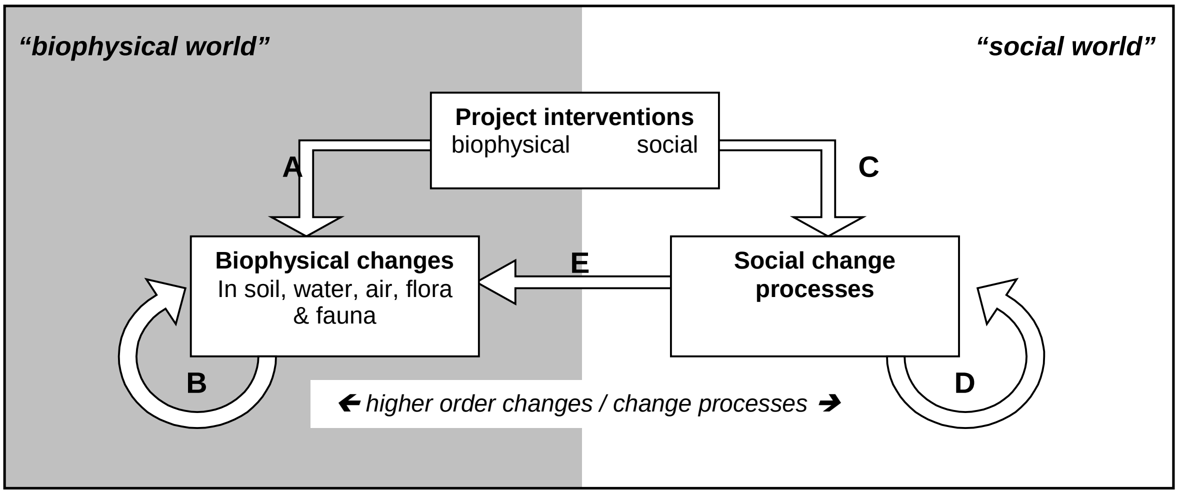
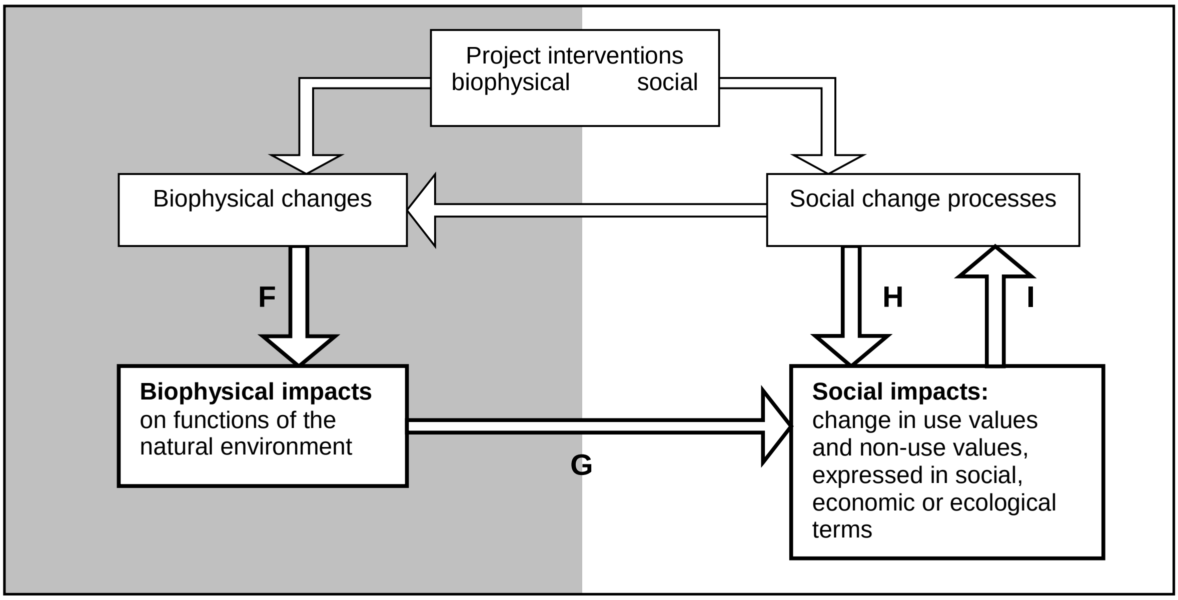


Figure 2.2: **Changes and impacts** (adapted from Slootweg et al., 2001)



2. FROM ACTIVITY TO IMPACT: THE CONCEPTUAL FRAMEWORK

2.1 Introduction

This section explains a comprehensive framework describing the mechanism by which chains of events lead from an activity to impacts. The framework considers social and biophysical mechanisms through which impacts occur, including impacts on biological diversity.

The framework is comprehensive in the sense that it covers all imaginable impacts, including those on biological diversity. It provides an integration framework for impact assessment studies, potentially encompassing impact studies for biodiversity, health, environment and society, although for each of these a further elaboration of the framework is necessary (Slootweg et al., 2001). This document deals with the elaboration of the framework from a biological diversity perspective.

The conceptual framework is not intended to be a fixed procedure, nor is it intended to be a predictive model. It is a way of thinking to assist in the clarification of the issues that may need to be studied in an EIA, and to assist in communication between multidisciplinary teams of experts and stakeholders. It can be used in an iterative way, for example by first qualitatively identifying the issues at stake during screening and scoping for EIA, and later quantitatively during the actual EIA study.

As Treweek (1999) indicated, the inconsistency of methodologies and the inconsistency of reporting on methodologies and results have, among other reasons, seriously hampered the accumulation of one body of relevant experience and knowledge in the prediction of impacts on biological diversity. We hope that this framework can provide a tool for addressing issues related to biological diversity in a more consistent way.

2.2 The general framework

Activities and changes (Figure 2.1)

A: Activities lead to biophysical changes: proposed projects or activities consist of biophysical and social interventions. Biophysical interventions lead to biophysical changes, defined as changes in the characteristics of the recipient media soil, water, air, flora and fauna.

> *Example: A new mining activity will physically alter the site of the concession (clearing of site, relocation of streams, creation of dumpsites are physical interventions resulting from operation of the mine, use of processing water, etc.). The resulting biophysical changes may be a change in the quality and quantity of surface waters and aquifers, clearing of vegetated areas, noise and dust production, etc.)*

B: Higher-order biophysical changes. Each direct biophysical change can result in a chain of second and higher-order biophysical changes.

> *Example: A change in the water table in the mining concession may alter the water table in a surrounding forested area. Changes in the hydrology of a local stream may alter the flooding regime of wetlands located downstream.*

C: Activities lead to social change processes. Projects can also involve social[1] interventions that lead to social change processes, defined as changes in the demographic, economic, sociocultural, emancipatory, institutional, land use or other characteristics of social components (individuals, families, functional groups or a society as a whole).

[1] The term ‘social’ is used in the broad sense, including cultural, economic and institutional aspects.

Example: If the mining concession is located in a rural area, the mining company may have to attract additional labour, leading to an increase in the number of inhabitants, often with a skewed sex ratio and a skewed age distribution.

D: Higher-order social change processes. Each direct social change process can lead to second and higher-order social change processes.

Example: An influx of new inhabitants leads to an increased demand for public services, such as health and educational facilities.

E: Social change processes lead to biophysical changes. A change in the social characteristics of a community can lead to biophysical changes.

Example: An influx of migrant labourers will lead to increased land use for housing and public facilities, food production and leisure activities.

Box 2.1 Environmental functions – the supply of goods and services

The environmental functions of nature provide a large number of goods and services which can be exploited by human society and which are essential for the maintenance of biological diversity for future generations. Four categories of environmental functions can be distinguished:

Processing and regulation functions for the maintenance of life-support systems. The interactions between biotic and abiotic components result in complex processes that influence the conditions for life. These functions are often not recognised until they are disturbed.
Examples: groundwater recharge, maintenance of biological diversity, climatic stabilisation, carbon dioxide sink, protection against natural forces and harmful cosmic radiation, storage and recycling of organic matter, regulation of biological control mechanisms, maintenance of migration and nursery habitats, etc.

Carrying functions: the availability of space together with a particular set of environmental conditions associated with that space make an area suitable to perform certain functions for nature or for humans.
Examples: suitability of an area for human habitation and settlement, areas for nature-based recreation (e.g. mountain climbing, bushwalking, skiing, seaside tourism), waterways for navigation, sites for energy conversion (e.g. hydropower reservoirs), suitability of an area for nature conservation.

Production functions: goods produced by nature which people need to invest time and energy to harvest (natural production functions) or biological products (animal or plant) produced in ways that involve active management and inputs by people (nature-based human production functions).
Examples: water as a harvestable resource, naturally produced food, raw materials, fuel, fodder, in situ genetic resources, medicinal resources, cultivation of crops, animal husbandry, aquaculture.

Signification functions: nature provides opportunities for spiritual enrichment, cognitive development and recreation. Although it is often very difficult to measure or quantify the value derived from these functions, it is important to realise that the world's largest economic sector, tourism, is largely based on this function (i.e. human appreciation of nature and landscape).
Examples: aesthetic information (scenery, landscape), spiritual and religious information (religious sites, emotional attachment), historic information (historic and archaeological elements), cultural and artistic information (inspiration for folklore, music, dance, art), educational and scientific information (natural science classes, research, environmental indicators, etc.

(Adapted from R.S. de Groot, 1992, and W.T. de Groot, 1992)

Impacts (Figure 2.2)

F: Biophysical changes lead to biophysical impacts. Impacts are defined as changes in the quality or quantity of the goods and services provided by the biophysical environment (nature in the broadest sense, including the biotic and abiotic environment), in other words a change in the functions provided by the biophysical environment (see Box 2.1).

Example: A change in the water table will alter the production of timber from an exploited forest, and it may alter the capacity of the forest to maintain its biological diversity.

G: Impacts lead to changed values for society (social impacts). A change in the functions provided by the natural environment will lead to a change in their value for human society. The function concept is principally anthropocentric, translating nature into functions for human society. Society puts a value on these functions. Biological diversity provides functions that provide use and non-use values to human society. Values can be expressed in economic, social or ecological terms (see Box 2.2).

Example: A change in the timber productivity of an exploited forest may lead to a loss of income and jobs, marginalisation of rural villages, reduced GDP of the region (use values that can be expressed in economic and social terms) and reduced biological diversity (non-use values to be expressed in ecological terms).

H: Social change processes and social impacts. Under certain conditions, depending on the characteristics of the existing community, social change processes cause social impacts (not within the scope of this paper).

I: Because human beings, or society as a whole, are able to respond to impacts, the experience of social impacts in some cases leads to invoked social change processes.

Example: The marginalisation of rural villages forces people to migrate to urban areas.

2.3 Context dependency (Figure 2.3)

Biophysical changes and social change processes are context independent. This means that if an intervention is known to cause certain changes, these change will always occur if a suitable recipient is present. The magnitude and direction of change are determined by the combined characteristics of the intervention and the recipient involved.

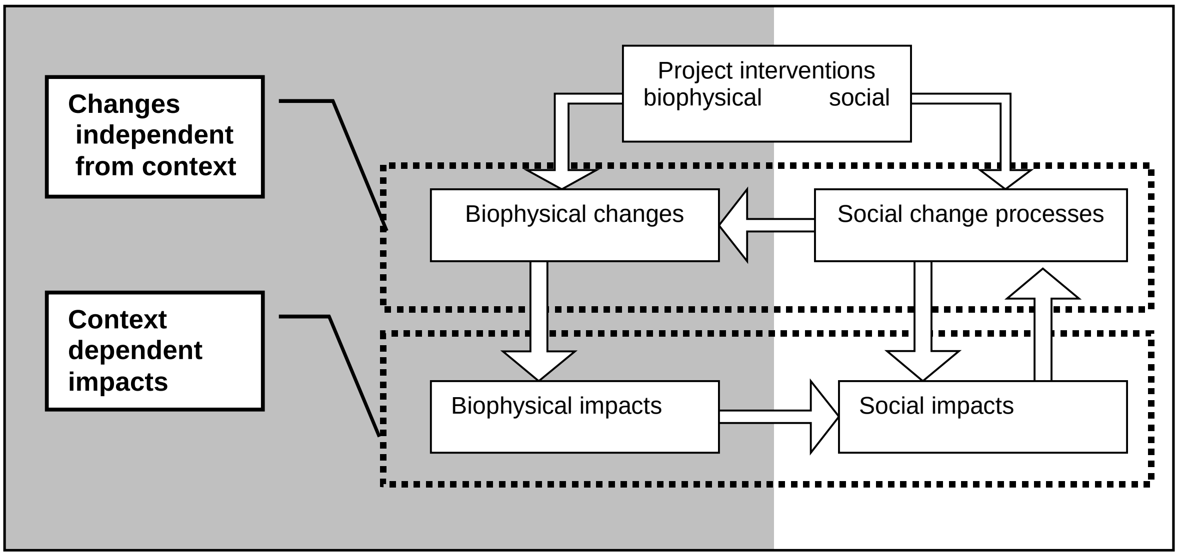
Example: Dams change the hydrology of existing watercourses. Immigration will change the demographic characteristics of an existing population.

While the notion of context-independent changes would seem trivial at first sight, it becomes important when considered in relation to *impact*. A further characteristic of biophysical changes and social change processes is that these can, if the state of technology allows, be predicted, measured and quantified by external experts.

Functions of the natural environment are determined by the type of ecosystem or land-use type where biophysical changes occur and by the level of recognition of these functions by local communities. This implies that functions are *context dependent*: one has to know the exact nature of the ecosystem or land-use type where biophysical changes occur *and* one has to know the use that a local community makes of these functions (including people’s perception of these functions). Outside experts will be capable of defining most functions of known ecosystems or land-use types. However, whether these functions are actually valued by a local community, and thus should be included in EIA studies, is completely dependent on the societal context – the norms and values system of a society, represented by its laws and regulations (customary rules or formalised legislation).

The important consequence of this notion of context dependency is that impacts cannot be determined by external experts only, but that representatives of the local society have to be consulted. This is highly important for the conservation of biological diversity. If one does not know the social perception of biological diversity it will be very difficult to consider and explain matters related to nature conservation in EIA studies, and even more difficult during project implementation.

Figure 2.3 Context of changes and impacts



2.4 The scope of biological diversity

A fundamental question is what exactly biological diversity is, and consequently, what needs to be included under the heading of biological diversity in EIA procedures and studies.

The Convention on Biological Diversity states: ‘Biological diversity means the variability among living organisms from all sources, 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.’ (UNCED, 1992). For the operationalisation of this definition in the context of EIA it will be necessary to concentrate on functions for the maintenance of biodiversity, the non-use values derived from these, and the impacts of biophysical and social change on these functions.

However, Article 10 of the Convention, referring to the sustainable use of components of biological diversity, requires a much wider view on biological diversity. In order to *‘protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirement’*, many of the functions to which society assigns use values would fall under the notion of biological diversity. For all main categories of functions it is fairly easy to provide examples.

- Production functions: harvestable products such as fish, firewood, bush meat, medicinal plants, wild fruits and nuts, etc.
- Processing and regulation functions: organisms that act as pollinators or biological control organisms in fruit plantations, the decomposition of organic material/waste by many species of relatively unknown invertebrates, etc.
- Carrying functions: the quality, health and safety of the living environment is often determined by local ecosystems. For example, mangroves protect coastal villages against storm surges, wetlands provide clean water, etc.
- Signification functions: nature-based leisure and tourism activities, many examples of religious sites, etc.

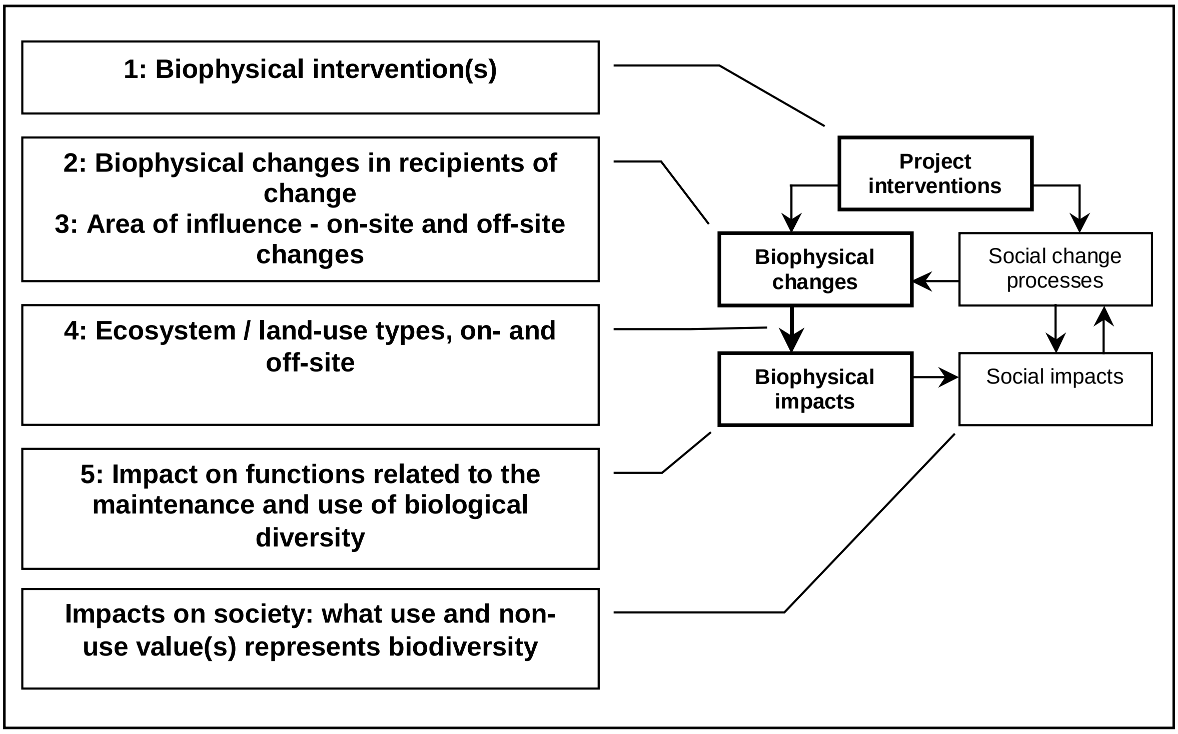
Differences between national EIA systems are reflected in the way biological diversity is considered in EIA procedures. In general, one can say that the ‘older’ EIA systems of many industrialised countries make relatively rigid distinctions between physical impacts, social impacts and impacts on biological diversity. Consequently, only the non-use values of biological diversity are considered, often resulting in separate biodiversity impact assessment studies. In contrast, countries with relatively new EIA systems (predominantly developing countries) tend to have a more integrated approach to EIA, interpreting biological diversity in the broad sense as having use and non-use values.

When assessing possible impacts on biological diversity in EIA studies, the following questions have to be answered:

- For non-use values related to biological diversity: Does the intended activity affect the physical environment in such a manner or cause such biological losses that it influences the risk of extinction of cultivars, varieties or populations of species, and the loss of habitats or ecosystems?
- For use values derived from functions related to biological diversity:
  - for production functions: Does the intended activity surpass the maximal sustainable yield of a resource, population, or ecosystem?
  - for processing and regulation functions, carrying functions and signification functions: Does the intended activity surpass the maximum allowable disturbance level?

These questions will be elaborated in the section dealing with screening and scoping.

Figure 2.4: **A more detailed look at the biophysical side**



2.5 A closer look at the 'biophysical world' (Figure 2.4)

The biophysical part of the framework is worked up in more detail to describe the possible mechanisms through which impacts on biological diversity may occur, and thus to provide methods for scoping these impacts. A number of steps are described to guide the reader through a logical sequence of questions.

Step 1: Define biophysical interventions in the proposed project. Each proposed activity or project consists of various interventions, a number of which can be physical or biological in nature.

> *Example: mining activities consist of quarrying, processing using large amounts of water, dumping of waste, etc.*

Step 2: Define biophysical changes and the recipient(s) of change. The biophysical interventions cause biophysical changes in soil, water, air, flora and fauna. These changes can be described as changes in a number of parameters (or characteristics) of these recipients of change. (Note: biophysical changes can also be the result of social change processes caused by social interventions.)

> *Example: open air processing of ores in a mine creates large quantities of dust, causing air quality to change; the diversion of a stream for processing water leads to changes in the hydrology downstream.*

Step 3: Delineate the area of influence. Most biophysical changes will only affect the area where the activity is carried out; i.e. on-site changes. However, a number of biophysical changes will have a wider area of influence and will cause off-site, secondary and higher-order changes. A knowledgeable expert will be able to determine the geographical range of influence of these changes. Each change can also be characterised by the medium through which it operates.

> *Example: dust produced by the processing of ores will be carried by the wind to neighbouring villages. Knowing the prevailing weather conditions and the behaviour of dust particles, a meteorologist can predict the geographical area of influence. A hydrologist can*

model and determine the downstream effects of diverting water for use in processing the ore, concluding that the flooding pattern of the downstream wetlands will change (secondary change).

Step 4: Define ecosystems and land-use types in the affected area. Knowing the potential area of influence of the proposed activity, one can determine the ecosystems and land-use types that lie within the boundaries of the area of influence. It is important to keep in mind that different biophysical changes can have different areas of influence. For each expected biophysical change one has to define the area of influence and determine the ecosystems and land-use types. It is important not to aggregate the information (see next section).

Example: Under prevailing wind directions the dust from the mine quarry may reach neighbouring villages located in a relatively undisturbed forested area; furthermore, the necessary diversion of a stream may affect a downstream wetland area and a neighbouring rice growing area.

Step 5: Define impacts on the function of the ecosystems/land-use types, including functions related to the maintenance and use of biological diversity. The impacts on functions can be determined for each of the affected areas.

Example: the dust pollution produced by the mining activity affect living conditions in the villages (function: suitability for human settlement) and may affect the surrounding forests (function: firewood production and maintenance of biological diversity); the changes resulting from stream diversion affect rice cultivation (nature-based human production function) and affect the multiple functions of the wetland (production of fish, shellfish, reeds, freshwater; maintenance of biological diversity, regulation of water table, etc.).

Step 5 will be expanded in the next section.

Last step: **Define use and non-use values for society and express these values in appropriate terms** (see Box 2.2).

2.6 How to define impacts on the use and maintenance of biological diversity

In the sections above it has been shown how a proposed activity leads to a number of biophysical changes (either directly, or through social change processes). Furthermore, it has been demonstrated that, having identified these changes, it is possible to define the geographical area in which these changes occur and make an inventory of landscapes types (natural, semi-natural ecosystem and land-use types) that may be influenced by the proposed activity. The last step is to describe these landscapes and identify the possible impacts on biological diversity in them.

This section explains a mechanism that allows the impacts on biological diversity to be identified, once the biophysical changes and their area of influence have been established. It also provides a mechanism to define potential impacts on biodiversity, *even if the exact genetic, species or ecosystem diversity are not exactly known or described*.

2.6.1 Levels of biological diversity

Three levels of biological diversity can be distinguished: genetic diversity, species diversity and ecosystem diversity:

Genetic diversity is the hereditary variation within species. Genetic diversity makes changes (mutations) possible and is the basis of (natural) selection and thus of breeding and other forms of

Box Figure 2.4**:** A more detailed look at the biophysical side **2.2 Values – the demand for goods and services**

Different categorisations of values exist. In order to make a direct link to the two main objectives of the CBD (sustainable use and conservation) and for communication purposes, this document makes a simple distinction between
- **use values**, which relate to those functions of the natural environment that are recognised and used by society, expressed in terms of social or economic values (see below), and
- **non-use values**, which relate to those functions of the natural environment that maintain biological diversity itself, usually expressed in terms of ecological values. These values are often overlooked, but as the realisation of the importance of biodiversity conservation grows, social values (e.g. the feeling of reassurance that biodiversity is 'safe', and concern for our children) and economic values (e.g. genetic resources) are now assigned to the maintenance of biodiversity. Ideally, the distinction between use and non-use values will be seen as artificial and thus redundant.

The scheme below provides a simplified summary of the many different classifications of values.

This document	*Other categorisations of values*
use values:	social-economic values - use values o direct values (harvestable) o indirect values (ecosystem services)
non-use values:	- non-use values o optional (reservoir) o bequest o existence o spiritual
	intrinsic values

Values can be expressed in the following terms:

Social values
These refer to the quality of life in its broadest sense and can be expressed in many different units, depending on the social context and cultural background.
Example: Health and safety (e.g. expressed as the number of people protected from the forces of nature), housing and living conditions, space for settlement, the value of the environment as a source of non-monetary income, religious and cultural values, etc.

Economic values
These are related to both the direct consumption (e.g. water for navigation) and the inputs to the production of other goods and services (e.g. water for irrigation, water storage in floodplains reduces downstream flood damage).
Example: Value can be expressed in monetary terms assigned to individual economic activities (agriculture, industries, fisheries, construction) or to per capita Gross Regional or Domestic Product, as an overall indicator for the income of the society as a whole.

Ecological values
These refer to the value that society places on/derives from the maintenance of the earth's life-support systems. They come in two forms. **Temporal ecological values** refer to the potential future benefits that can be derived from biological diversity (genetic, species and ecosystem diversity) and key ecological processes that maintain the world's life-support systems for future generations. **Spatial ecological values** refer to the interactions of ecosystems with other systems, and thus perform functions for the maintenance of other systems.
Examples of spatial values: Coastal lagoons and mangroves serve as breeding grounds for marine fish, supporting an economic activity elsewhere; wintering areas for migratory birds; flood plains that recharge aquifers for neighbouring dry lands or act as a silt trap that prevents downstream rivers and reservoirs from silting up.
Temporal or future values reflect concern for maintaining the biological diversity and ecological processes to support future generations.

(Adapted from Slootweg et al., 2001)

Table 2.1: **Examples of functions of the natural environment that are derived directly (flora and fauna) or indirectly (services provided by ecosystems, such as water supply) from biological diversity** (not exhaustive)

PRODUCTION FUNCTIONS
natural production
- timber production
- firewood production
- production of harvestable grasses (construction and artisanal use)
- naturally produced fodder and manure
- harvestable peat
- secondary (minor) products
- harvestable bush meat (food)
- fish and shellfish productivity
- drinking water supply
- supply of water for irrigation and industry
- water supply for hydroelectricity
- supply of surface water for other landscapes
- supply of groundwater for other landscapes

nature based human production
- crop productivity
- tree plantations productivity
- managed forest productivity
- rangeland/livestock productivity
- aquaculture productivity (freshwater)
- mariculture productivity (brackish/saltwater)

CARRYING FUNCTIONS
- suitability for constructions
- suitability for indigenous settlement
- suitability for rural settlement
- suitability for urban settlement
- suitability for industry
- suitability for infrastructure
- suitability for transport infrastructure
- suitability for shipping/navigation
- suitability for road transport
- suitability for rail transport
- suitability for air transport
- suitability for power distribution
- suitability for use of pipelines
- suitability for leisure and tourism activities
- suitability for nature conservation

PROCESSING AND REGULATION FUNCTIONS
Land-based processing and regulation functions
- decomposition of organic material (land-based)
- natural desalinisation of soils
- development/prevention of acid sulphate soils
- biological control mechanisms
- seasonal cleansing of soils
- soil-water storage capacity
- coastal protection against floods
- coastal stabilisation (against accretion/erosion)
- soil protection

water-related processing and regulation functions
- water filtering function
- dilution of pollutants function
- discharge of pollutants function
- flushing/cleansing function
- biochemical/physical purification of water
- storage for pollutants function
- flow regulation for flood control
- river base flow regulation
- water storage capacity
- groundwater recharge capacity
- sedimentation/retention capacity
- protection against water erosion
- protection against wave action
- prevention of saline groundwater intrusion
- prevention of saline surface water intrusion
- transmission of diseases

air-related processing and regulation functions
- filtering of air
- carry off by air to other areas
- photochemical air processing (smog)
- wind breaks
- transmission of diseases

SIGNIFICATION FUNCTIONS
Cultural/religious/landscape functions

Box 2.3 Components of biological diversity

Composition. Descriptions of the composition of the biological diversity of an area include the flora and fauna present and how abundant it is. In the general perception, the *species* composition of an area is often the only aspect that is considered. In a good analysis, composition also applies to genetic composition (level of inbreeding; number of local varieties of cultivated plants) and ecosystem composition (types of ecosystems in the area, naturalness of the ecosystems).

Structure. How the elements of biodiversity are organised in *time* and *space*.

- **Horizontal** structure: spatial distribution of ecosystems, species or genetic variability. *Example: Species and ecosystems may have a patchy distribution or can follow a gradient which creates gradual changes from one ecosystem to another (ecotone).*
- **Vertical** structure: the vertical structure is often related to strong vertical differentiation of physical parameters, such as penetration of light, local temperature (thermocline), oxygen (stratification). *Example: Forests are vertically layered, each layer having its own communities of plants and animals. Plant and animal communities in coastal zones vary distinctly with depth.*
- **Temporal** structure. Many species and ecosystems are adapted to cyclic phenomena, such as seasonality (*e.g. summer–winter, dry–wet season in relation to breeding, flowering, migration, hibernation, etc.*), tidal rhythm (*mangroves; mud flats*), diurnal rhythm (*nocturnal animals*) or lunar cycles (*Chaoborus mosquitoes appearing at full moon*). These phenomena can be regular or irregular, such as adaptations to prolonged droughts.

Key process. A relatively small set of plant, animal and abiotic processes structure ecosystems across scales of time and space. A *key process* is defined as a process that plays a dominant role in structuring or maintaining ecological units (population, habitat, community, ecosystem, landscape) and/ or in structuring or maintaining processes between units.

Key processes may be of a completely abiotic nature, biotic nature or a mix of both. For example, plants and animals colonise newly created habitats and live in pioneer communities that are dominated by abiotic factors (temperature, rainfall, soil quality, tidal rhythm, etc.); in contrast climax situations create and regulate their own environment, and biotic processes dominate.
Example: seed dispersal in pioneer vegetation occurs predominantly by wind or water; in tropical rainforests by birds, bats and terrestrial mammals. Similarly, microclimatic conditions and nutrient supply in pioneer vegetations are dominated by physical processes, while rainforests maintain their own microclimate and nutrient cycles. Other examples of key processes: natural fires and grazing are key processes in the maintenance of savannah systems; yearly floods define floodplain ecosystems.

(genetic) manipulation by man, for example for agricultural purposes (varieties, cultivars and strains, including clones and hybrids). The deliberate manipulation of the genetic material is now also possible as a technique to influence the genetic diversity of living creatures by creating genetically modified organisms (GMOs).

Species diversity is the variety of taxonomically distinguished species. Lower-order differences result in subspecies and varieties or, in agriculture, cultivars. Higher-order variety is expressed in various levels of systematically created groups of species, reflecting the evolutionary history of all living organisms, i.e. species, genus, family, order, class , phylum and kingdom. Traditionally, the species level of biological diversity has received most attention, so much so that for many people species diversity is synonymous with biological diversity.

Ecosystem diversity describes the multiplicity of interactions between species in areas which can be regarded as forming an ecological entity, for example a woodland ecosystem, a savannah, coral reef or mountain ecosystem. An ecosystem is an ensemble of components (soil, water, air, plants and animals) and processes (such as photosynthesis and evolution). It comprises a community of organisms and their physical environment which interact together as a unit. Systems cannot be defined as precisely as species or genes. For example, ecosystems can be described at various levels of detail, ranging from ecozones at a mapping scale of > 1:50,000,000, to eco-elements at a mapping scale of < 1:5,000.

If one wants to predict or study the consequences of a proposed activity on biological diversity, it is imperative that impacts are studied at all three levels of diversity. In practice, however, the number of species in an area is often taken as a measure of its biological diversity, and then usually only vertebrate species representing only a fraction of the total species diversity.

The practical problems in describing the biological diversity of an area may be overwhelming, usually due to lack of data. However, the approach as presented here allows for the identification of serious threats to the maintenance and use of biological diversity, even if one is not capable of exactly describing this diversity at all three levels. Ecological knowledge has progressed far enough to make certain predictions, based on generally applicable knowledge and rules of thumb.

2.6.2 Interpretation of Step 5 for the *use functions* of biological diversity

Table 2.1 shows a list of biodiversity-related functions of the natural environment that may constitute use values for society. Not all of these functions are performed by each ecosystem or land-use type. Many man-made land-use types perform a very limited number of functions, such as production functions for agriculture or forestry. These functions are optimised, usually at the cost of other functions (such as other biodiversity-related functions).

Step 5 of the schedule above implies that for use values an experienced ecologist determines what functions might be affected, if the biophysical changes, and the ecosystems or land-use types where these changes will occur, are known.

The societal context within which these impacts occur defines whether the functions are recognised and indeed valued by the local society and, therefore, whether the expert has to confer with local stakeholders/representatives to be able to produce a definite list of use values of biological diversity and to determine which of these may be affected by the proposed project (Box 2.2 gives some background on how values may be expressed).

2.7.2 Interpretation of Step 5 for maintenance functions of biodiversity (non-use values of diversity itself)

Apart from the level of diversity presented above, one other concept of diversity has to be introduced before being able to define potential impacts on biological diversity: the components of biological diversity. This approach is based on Noss' 1990 classification of biodiversity, elaborated by Le Maitre and Gelderblom (1998) and further operationalised by Koning and Slootweg (1999).

Each of the three levels of diversity (i.e. genetic, species and ecosystem level) can be characterised and described in detail by answering three questions, referring to *components* of biological diversity (see Box 3.2):

- What is there? This refers to the *composition*.
- How is it organised in space and time? This refers to *structure*.
- What process(es) is (are) of key importance for its creation and maintenance? This refers to physical, biological or biophysical processes, i.e. *key processes.*

To be able to define the issues that may need to be studied in an EIA, identification of the components takes place at all three levels of biological diversity. This results in an issues table; its structure is presented below, but the table and its use will be further elaborated in Chapter 4 on scoping.

The '**issues table**':

	genetic	species	ecosystem
composition	*issues*	*issues*	*issues*
structure	*issues*	*issues*	*issues*
key process	*issues*	*issues*	*issues*

Step 5.1. **Biophysical changes influence a component of diversity**. Determine for each biophysical change what component of diversity is directly affected by it. One should be aware that, due to the high interconnectedness within and between ecosystems, most biophysical changes will result in a cascade-like chain of events. Therefore, it is important to identify the first point where such a chain of events starts. The examples raise a number of considerations.

> *Example 1– composition and spatial structure: Selective logging in primary forest will influence the species composition of the forest ecosystem (for reasons of simplicity, not taking into account the direct damage caused by falling trees and the logistics of logging), and it changes the spatial distribution (structure) of the logged species .*
>
> *Example 2 – spatial structure: New linear infrastructure, such as roads and railways, cut through existing ecosystems. For many invertebrates and smaller vertebrates this implies being split into two, reproductively isolated populations. If the original ecosystem was small, this may result in the creation of two populations that both are under the minimal viable population threshold; both will suffer from genetic erosion, and in the end both will disappear. In turn, the disappearance of one or more species will cause other biodiversity-related impacts at the ecosystem level, but the initial cause is the changed spatial structure of the populations and its effect at the genetic level.*
>
> *Example 3 – temporal structure: Proposed dredging activities in a wetland area coincide with the reproductive season of marine bivalves of economic (fisheries) and ecological (food for shorebirds) importance. The turbidity caused by the dredging will cause massive death of young bivalves. Rescheduling of the dredging activities to a later season is enough to avoid great ecological and economic damage.*

Example 4 – key process (abiotic). The damming of a river results in reduced discharge of sediments in the river's estuary. The sediment balance in the estuary is disturbed, causing massive erosion of the mangrove ecosystem, in turn reducing the numbers of fish and shellfish that breed in the mangroves, and thus decreasing the numbers of waders that prey upon these organisms, etc. etc. The physical change of reduced sediment discharge in the estuary affects the key process of maintaining a delicate balance in sediment deposition and removal in an estuarine mangrove ecosystem.

Example 5 –key process (biotic). A man-made wetland in the Netherlands has, unintentionally, become a Ramsar site of international importance because of the presence of tens of thousands of wintering geese that have halted the succession of wet reedlands into dry shrubland. Intensive grazing prevents the development of vegetation in the shallow open water and peat formation has largely stopped. The intended conversion of the area into a business park has been cancelled and the area designated as a nature reserve. (The intended biophysical change – creation of new land – was effectively stopped by geese, thus creating a new ecosystem due to the introduction of a key structuring process.)

Step 5.2: **Changes in components of biological diversity may result in changes in genetic and/or species and/or ecosystem diversity.**

In Step 5.1 the components of biological diversity that will be affected by the expected biophysical changes were defined. The next step is to determine the issues that need to be studied. This is done by combining the available information on the ecosystems that lie within the area of influence with the information from Step 5.1, i.e. the components of diversity that may be affected by the expected biophysical change.

Example: A logging activity leads to a selective removal of a few species of trees (biophysical change), which influences the species composition of the forest. The area of influence for the removal of trees is obviously only the area that is logged (higher-order biophysical changes, such as changed run-off and erosion characteristics with off-site influences, may occur, but these need a separate analysis and are not considered here for simplicity). If the ecosystem is a dipterocarp tropical rainforest, characterised by high species diversity, the changed species composition may not have a significant impact on the functioning of the forest ecosystem (unless the exploited species perform key functions), but it may lead to a total disappearance of the exploited species since the remaining ones may suffer from reproductive isolation. If the ecosystem is a species-poor temperate forest, removal of one species alters the composition in such a way that the entire ecosystem is threatened.

Example: The diversion of water from the Amu Darya river to irrigation systems has changed the hydrology (biophysical change) in the downstream delta and Aral sea, causing secondary changes in the water table, flooding regime, salinity and water level of the Aral sea. These changes have affected key structuring processes, such as flooding patterns of wetlands, groundwater flow and soil water conditions of vegetated areas, the complete drying up of 50% of the lake surface, etc. Many key processes were so fundamentally affected that entire ecosystems have disappeared or become severely impoverished by the disappearance of many species. The maintenance of the biodiversity function has been severely affected, having a wide impact on ecological values elsewhere, since the delta area is (was?) an important stepping stone in the Arctic–South Asia/Africa flyway, and an important spawning area for fish from the entire river and lake systems.

The examples above show that it is possible to make statements about possible impacts on biodiversity without detailed knowledge of the species composition and abundance in the ecosystems. Establishing the possible impact mechanisms makes it easier to define exactly the research questions that need to be dealt with in an EIA study.

3. SCREENING FOR BIOLOGICAL DIVERSITY

3.1 Introduction

Screening is a procedure to determine which proposed new projects need further environmental consideration, exclude those unlikely to have harmful environmental impacts and indicate the level of environmental appraisal that a project will require. Information for screening should be available in the submitted project proposal; missing or additional information may be obtained from the proponent or by a field visit (UNEP, 1996).

This chapter deals with the identification of screening criteria to enable a formal decision to be made on whether further environmental studies need to be carried out for a proposed project. The approach presented below may in the long term contribute to an appropriate representation of biological diversity considerations in different types of screening procedures of national EIA systems. In the short term the aim is that the approach, which is formulated as a generally applicable, step by step approach, will be adopted and implemented on a pilot basis for various national screening systems.

The translation of the generic approach presented here into country specific criteria will provide experience that can be used to improve upon the approach. The first (target) group to use this document consists of well-informed experts, knowledgeable in their national EIA system and involved in the development or implementation of the EIA system. These are the persons qualified to further develop screening criteria specifically designed for national use. They will also be able to provide valuable feedback on the generic approach so that other countries can benefit from the pilot countries.

The approach below is written from the perspective of expected impacts on biological diversity only. The proposed screening criteria should supplement the existing ones. While many of the activities described below would legally require an EIA on environmental grounds, biological diversity is often neglected if attention is not explicitly directed towards possible impacts on biological diversity.

3.2 The screening system

Types of existing screening mechanisms are:

i. screening based on a positive list of types of projects requiring EIA
ii. screening based on expert judgement (with or without a limited study, sometimes referred to as 'initial environmental examination' or 'preliminary environmental assessment')
iii. screening based on a combination of a positive list and expert judgement; for a number of activities an EIA is simply required, for others an expert judgement is needed to determine the need for EIA.

The third system is most widely used.

A possible system of simple and straightforward screening criteria is presented below. These criteria are intended to trigger the discussion for the formulation of in-country or in-house screening criteria. The proposed criteria may interact well with the existing types of screening systems listed above. The proposed screening mechanism is based on the well known A, B and C categories. The result of screening can be:

(A) An environmental impact assessment is required.

(B) 1: A limited environmental study is sufficient because only limited environmental impacts are expected, or
2: There is still uncertainty whether an EIA is required and an initial environmental examination has to be conducted.

(C) The project does not require an EIA.

Category B is a combination of different screening systems. B1 implies that a screening decision is made which determines the level of assessment needed. Usually, this is based on a set of criteria with quantitative norms or threshold values. Ideally, the project proposal should provide the information that is needed to apply the criteria.

Category B2 implies that a limited study is needed to determine whether the project does or does not require an EIA. This means that the purpose of the B2 category is to determine whether a project gets a category A or C rating. This preliminary environmental assessment (sometimes referred to as an initial environmental examination) may include a visit to the project site.

How does this mechanism relate to the different screening systems? What needs to be done?

Countries with system (i): positive list. The criteria presented combined with the conceptual framework covered in Chapter 2 provide guidance for the reconsideration of the existing positive list on biological diversity considerations. By assessing the possible impacts of (categories of) activities on biological diversity the existing list can be adjusted, if required.

Countries with system (ii): expert judgement. In this system the professionals who make screening decisions often carry out a 'mini EIA' to come to this decision. The presented way of thinking in Chapter 2, combined with the practical hints from this chapter and the guidance on scoping covered in the next chapter, will provide these professionals with sufficient means to come to a considered decision. Furthermore, this structured approach will contribute to the transparency and consistency of the screening decisions.

Countries with system (iii): combined positive list and expert judgement. In these systems the decision often will be taken by a person in public administration, not necessarily an expert. Country-specific guidelines are usually developed in countries using this screening system, often including quantitative norms or thresholds, so the responsible administrators are able to make a well-founded and defendable decision.

The conclusion is that it has to be emphasised that the approach presented in this document does provide relevant input to all existing screening systems, but it cannot simply be copied. For each screening system the approach has to be further elaborated in detail at the country level.

3.3 Methodological guidance for the development of screening criteria

3.3.1 Pertinent questions about screening for impacts on biological diversity

Considering the dual objective of the CBD on conservation *and* sustainable use of biological diversity, two fundamental questions need to be answered in an EIA study:

- Does the intended activity affect the physical environment in such a manner or cause such biological losses that it influences the risk of extinction of cultivars, varieties, populations of species, or the chance of loss of habitats or ecosystems? (i.e. leading to the loss of biological diversity = *issues related to the conservation of biological diversity*).

- Does the intended activity surpass the maximal sustainable yield or the maximum allowable disturbance level of a resource, population, or ecosystem? (i.e. leading to a reduction or loss of use functions derived from biological diversity = *issues related to sustainable use of biological diversity*).

At the screening stage a decision has to be taken on whether further environmental assessment is necessary or not. The two questions above, therefore, have to be further elaborated on the three levels of biological diversity (genetic, species and ecosystem diversity), and qualitative or quantitative criteria are needed for decision-making. To facilitate the development of criteria, the two questions above have been reformulated for the three levels of diversity.

Table 3.1 shows six possible categories and 16 subcategories of questions related to the two objectives of the CBD and the three levels of biodiversity, that in theory all need to be answered when a proposed activity is screened for possible impacts on biological diversity. In practice, however, the number of questions can be significantly reduced because

- there is no legal or procedural means to substantiate all questions at the screening stage
- a number of questions are irrelevant for screening
- a number of questions are practically and/or scientifically impossible to answer.

This results in a minimal set of questions which realistically cover all relevant aspects of biological diversity at the screening stage (adapted from Kolhoff, 2000).

Genetic diversity
As agriculture is a totally controlled activity, it can be expected that the potential loss of traditional/local varieties and breeds can simply be determined on the basis of a project document. In this case it makes no sense to make a distinction between impacts on diversity or impacts on sustainable use, since agro-biodiversity inherently covers both issues simultaneously.

The pertinent screening question with respect to agro-biodiversity is:

I. Does the intended activity cause a local loss of varieties/cultivars/breeds of cultivated plants and/or domesticated animals?

The potential loss of natural genetic diversity (genetic erosion) is extremely difficult to determine, and does not provide any practical clues for screening. The issue probably only comes up when dealing with highly threatened, legally protected species which are limited in numbers and/or have highly separated populations (rhinos, tigers, whales, etc.), or when complete ecosystems become separated and the risk of genetic erosion applies to many species (the reason to construct ecoducts across major roads). These issues are dealt with at the species or ecosystem level.

The introduction of genetically modified organisms is a totally new and rapidly developing theme. Usually this is dealt with under the heading of introduction of exotic species (species level.)

Species diversity
For the conservation and sustainable use of biological diversity at the species level the following pertinent questions should be answered at the screening stage:

II. Does the intended activity cause a loss of a population of a species?

III. Does the intended activity affect the sustainable use of a population of a species?

The definition of the level at which 'population' is to be defined fully depends on the screening criteria a country or organisation uses. For example, in the process of obtaining a special status, the conservation status of species can be assessed within the boundaries of a country (for legal protection), or can be assessed globally (IUCN red lists).

Ecosystem diversity
At the ecosystem level of biodiversity the following pertinent questions should be answered at the screening stage:

Table 3.1: **Screening questions to be answered in theory**

	Impacts on biological diversity (non-use)	*Impacts on sustainable use*
Genetic diversity	1a: cultivars/breeds 1b: natural genetic variation	2a: cultivars/breeds 2b: natural genetic variation
Species diversity	3a: population level 3b: metapopulation level 3c: global level	4a: population level 4b: metapopulation 4c: global level
Ecosystem diversity	5a: natural ecosystems 5b: managed ecosystems 5c: man-made land-use types	6a: natural ecosystems 6b: managed ecosystems 6c: man-made land-use types

Table 3.2: **Questions pertinent to screening for biological diversity impacts**

Biological diversity perspective → *Level of diversity* ↓	Conservation (maintenance) of biological diversity *sensu stricto* (non-use values)	Sustainable use of biodiversity (use values)
Genetic diversity in agriculture	(I) Does the intended activity cause a local loss of varieties/cultivars/breeds of cultivated plants and/or domesticated animals?	
Species diversity	(II) Does the intended activity cause a loss of a population of a species?	(III) Does the intended activity affect the sustainable use of a population of a species?
Ecosystem diversity	(IV) Does the intended activity lead to serious damage or total lost of (an) ecosystem(s) or land-use type(s), thus leading to a loss of ecosystem diversity (i.e. the loss of indirect use values)?	(V) Does the intended activity affect the sustainable exploitation of (an) ecosystem(s) or land-use type(s) by humans in such a manner that the exploitation becomes destructive or non-sustainable (i.e. the loss of direct use values)?

IV. Does the intended activity lead to serious damage or total loss of (an) ecosystem(s) or land-use type(s), thus leading to a loss of ecosystem diversity?
V. Does the intended activity affect the sustainable exploitation of (an) ecosystem(s) or land-use type(s) by humans in such manner that the exploitation becomes destructive or non-sustainable?

It is of no relevance to differentiate between the type of ecosystem or the scale at which ecosystems are defined, since this fully depends on the kind of criteria that are used to come to a screening decision.

Table 3.2. summarises the screening questions according to the level of biological diversity and whether it concerns non-use or use values derived form biological diversity.

3.3.2 Translating screening questions into criteria

Realistic criteria need to be developed for each of the questions I–VI. The conceptual framework presented in Chapter 2 of this document can be used for the identification of the proper screening criteria. Very often criteria relate to the biophysical changes which may result from an activity. For example, standards for water quality apply to all activities producing waste water effluent, and usually indicate a maximum accepted level of pollution. The problem with for example water quality standards is that they are designed for a limited number of functions of water, i.e. water for human use (household supply or recreational activities). The criteria have not been designed to consider other functions, such as the maintenance of biological diversity.

By going through the framework for different categories of activities step-by-step and defining their potential impacts on biological diversity, through changes in the biophysical environment, it is possible to identify criteria and norms relevant to biodiversity. Determination of norms or threshold values is partly a technical and partly a political process, the outcome of which may vary for countries and (ideally) even for ecosystems.

Steps 1 and 2: Interventions and biophysical changes. Projects carry out biophysical and social interventions. These will lead to direct biophysical and social changes, which in turn may lead to higher-order changes. The description of activities and the resulting direct changes would take into account characteristics such as the type or nature, magnitude, extent/location, timing, duration, reversibility/irreversibility, likelihood and significance of the activity. Furthermore, good technical design not only takes into account the direct effects, but will also look for indirect effects (e.g. the indirect biophysical consequences of social changes, such as the relocation of people or planned influx of migrant workers needing housing facilities, cumulative and synergistic effects and, possibly, residual effects if the project document already includes proposed mitigation measures for some of the interventions).

Step 3: Area of influence. Knowing the biophysical changes which result from the proposed activity, the expected area of influence of these changes can be modelled or predicted.

Steps 4 and 5: Ecosystems and land-use types under influence and the expected impacts on biological diversity. Since the area of influence of the proposed activity is known from Step 3, the influenced land-use types or ecosystems can be determined (Step 4). Subsequently, the impacts in biodiversity can be determined (Step 5).

Having determined (categories of) activities, biophysical changes, area of influence and impacts on biodiversity, the best possible criteria now have to be determined with unequivocal decision rules. These criteria can be derived from:

- activities: magnitude of the activity (surface area occupied, tonnage of produce, amounts or types of raw materials used, use of specific technology, introduction of species, etc.)

BOX 3.1 IUCN Protected Area Management Categories

CATEGORY	**Name** and short description
Definition	
I	**Strict Nature Reserve/Wilderness Area**: protected area managed mainly for science or wilderness protection
Ia	**Strict Nature Reserve**: protected area managed mainly for science
Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.	
IB	**Wilderness Area**: protected area managed mainly for wilderness protection
Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition	
II	**National Park**: protected area managed mainly for ecosystem protection and recreation
Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.	
III	**Natural Monument**: protected area managed mainly for conservation of specific natural features
Area containing one or more specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.	
IV	**Habitat/Species Management Area**: protected area managed mainly for conservation through management intervention
Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.	
V	**Protected Landscape/Seascape**: protected area managed mainly for landscape/seascape conservation and recreation
Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.	
VI	**Managed Resource Protected Area**: protected area managed mainly for the sustainable use of natural ecosystems
Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.	

Source: http://wcpa.iucn.org/wcpainfo/protectedareas.html

- biophysical changes (level of air emissions or noise, maximum allowable change in water temperature, percentage of a population harvested each year, etc.
- geographical area in relation to the siting of proposed activities (areas with special legal status such as sensitive ecosystems or nature reserves, distribution maps of protected species, etc.)

In the next section a fairly detailed list of criteria is presented which represents a mixture of these criteria.

3.4 The screening criteria

3.4.1 Category A: EIA mandatory from a biological diversity perspective

EIA is considered mandatory only if there is formal legal basis on which a screening decision can be based. A legal basis can be provided by

- national legislation, for example on protected species and protected areas
- international conventions, such as CITES,CBD, Ramsar, etc.
- directives from supranational bodies, such as the EU Habitats and Birds directives.

(The reference to *screening questions* is explained in section 3.4 on *Methodological guidance*)

EIA is mandatory for the following types of activities.

At the species level (*relates to screening question II and III*)

- A1: activities that directly affect legally protected species, for example by extractive, polluting or other disturbing activities
- A2: activities that indirectly affect legally protected species, for example by reducing their habitats, altering their habitats in such a manner that their survival is threatened, and introducing predators, competitors or parasites of protected species
- A3: all of the above for species that are legally protected in other countries (e.g. stopover areas for migratory birds, spawning grounds of migratory fish, commercial trade in species protected by the CITES convention).

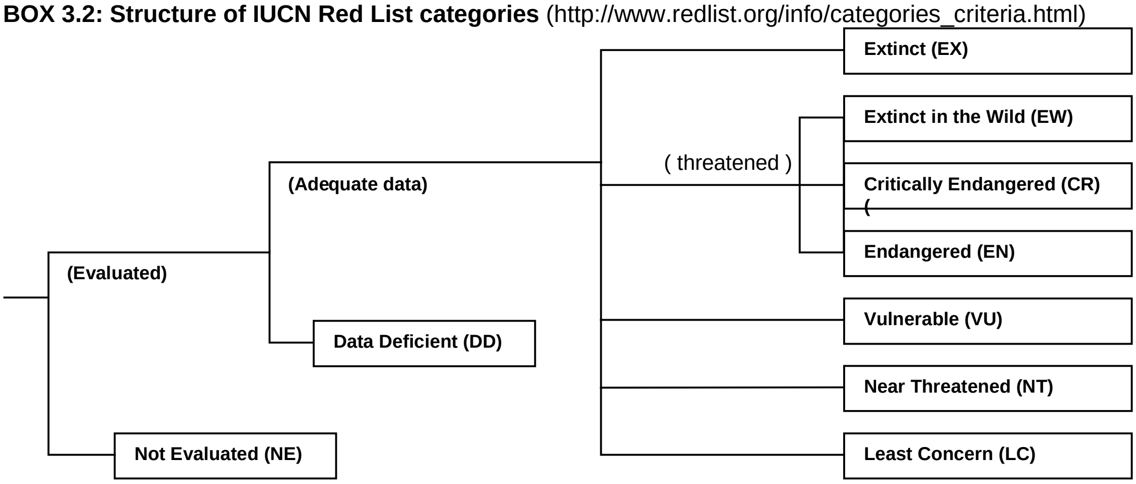
At the ecosystem level (*screening questions IV and V*)

- A4: activities located in legally protected nature reserves
- A5: activities located in the vicinity of legally protected nature reserves
- A6: activities that have a direct influence on legally protected nature reserves, for example by emissions into the area, diversion of surface water that flows through the area, extraction of groundwater in a shared aquifer, disturbance by noise or lights, etc.

3.4.2 Category C: No EIA required from a biological diversity perspective

Activities which are not covered by one of the categories A or B, or are designated as category C after initial environmental examination under category B2.

BOX 3.2: Structure of IUCN Red List categories (http://www.redlist.org/info/categories_criteria.html)



BOX 3.3: Sites, habitats and species that trigger ecological assessment in Hong Kong
Source: Hong Kong EIA Guidelines Annex 16: Guidelines for ecological assessment

Note1: Recognized sites of conservation importance

- 1-4 existing or gazetted proposed species areas, country parks, marine reserves, marine parks
- 1 restricted areas listed under the wild animals protection ordinance, chapter 170
- 2 sites of special scientific interest
- 3 Ramsar site
- 4 Inner Deep Bay and Deep Bay buffer zones
- 5 Any other area declared by the government as having special conservation importance

Note 2: Important habitats where an ecological assessment will be necessary:

1. over one hectare of woodland
2. over one hectare/500 metres of undisturbed natural coast
3. over 0.5 ha of intertidal mudflats
4. established mangrove stands of any size
5. over 0.5 ha of freshwater or brackish marshes
6. established seagrass bed of any size
7. over 100 metres of natural stream courses and rivers of significant length
8. over one ha wetlands (as defined by the Ramsar convention) other than those mentioned in 2 to 7 above
9. established coral communities of any size
10. other habitats considered as having special conservation importance by documented scientific studies

Note 3: Species of conservation importance

1. listed in IUCN Red Data Books or those of the South China region
2. listed in international conventions for conservation of wildlife
3. endemic to Hong Kong or South China
4. listed under local legislation (+ details on acts)
5. considered as rare in the territory or having special conservation importance by scientific studies other than those listed above

Source: Hong Kong Environmental Protection Department (1997).

The challenge of this document is to avoid negative phrases such as the one above and to provide positive, clearly defined lists of activities that most probably do not have an impact on biological diversity. Examples may be:

- activities in urban environments
- activities in industrial and business complexes, if no external influence is generated
- activities without physical interventions, such as education, capacity development, institutional reform, etc.

It is uncertain whether this approach can be maintained successfully. For example, is urban biological diversity considered as an artefact caused by human interventions, or is it considered to be genuine biological diversity that merits the same attention as 'natural' biological diversity?

The generic nature of this document does not allow for the positive identification of types of activities or areas where EIA is not needed from a biodiversity perspective. At the country level, however, it will be possible to indicate geographical areas where biological diversity considerations do not play an important role, and conversely, areas where they do play an important role (biodiversity sensitive areas).

3.4.3 Category B: The need for EIA, or level of EIA required, from a biological diversity perspective still to be determined

This category covers cases where there is no legal requirement for an EIA, but there is reason to suspect that the proposed activity may have a significant impact on biological diversity, and cases a full fledged EIA may not be necessary, but a limited study is needed to solve uncertainties or design some limited mitigation measures.

This section includes the frequently used concept of 'sensitive areas'. In spite of its frequent appearance in documents on biological diversity in EIA, in practice it has been very difficult to operationalise. At present there are few examples of EIA triggers based on ecosystem or landscape-level criteria (see Treweek, 2000 for a recent discussion). As long as sensitive areas do not have any legal protected status it appears to be difficult to use the concept in practice. The word sensitive immediately raises the question: Sensitive to what? An area can only be defined as sensitive in relation to a clearly defined category of interventions or related biophysical changes that influence the area. It is impossible to define sensitive areas in general terms, so an attempt is made to provide a practical alternative below.

The following categories of criteria point towards possible impacts on biological diversity, and further attention is thus required:

B(a): Activities in, or in the vicinity of, or with an influence on areas with some form of legal status., This legal status need not be directly related to biological diversity but is linked to it (*relates to all five screening questions*). Examples are:

- B(a)1: areas allocated to indigenous or tribal groups, which may indicate the presence of valuable agricultural cultivars or breeds and the knowledge related to agricultural practices (*relates to screening question I*)
- B(a)2: extractive reserves
- B(a)3: landscape preservation areas
- B(a)4: sites covered by one of the international treaties or conventions for the preservation of natural and/or cultural heritage, such as UNESCO Biosphere Reserves, World Heritage Sites, the Ramsar convention

Box 3.1 contains the list of IUCN protected areas management categories as an example.

B(b): Impacts on biological diversity likely, but attention to biological diversity in EIA is not necessarily triggered by the legislation:

At the genetic level

- B(b)5: replacing agricultural varieties or breeds with new varieties (for example, high yielding varieties HYVs), including the introduction of genetically modified organisms (GMOs) (*screening questions I and II*).

At the species level

- B(b)6: all introductions of non-indigenous species (*question II and III*)
- B(b)7: all activities which directly or indirectly affect threatened species, which are not protected by law (good reference is provided by the IUCN Red Lists; see Box 3.2 for IUCN red list categories referring to the global conservation status of species) (*question II*)
- B(b)8: all extractive activities related to the direct exploitation of biological diversity (fisheries, forestry, hunting, collecting of plants, etc.) (*question III*)
- B(b)9: all activities leading to reproductive isolation of populations of species (linear infrastructure) (*question II*).

At the ecosystem level

- B(b)10: all extractive activities related to the use of resources on which biological diversity depends (exploitation of surface and groundwater, open pit mining of soil components such as clay, sand, gravel, etc.) (*questions IV and V*)
- B(b)11: all activities involving the clearing of land (*questions IV and V*)
- B(b)12: all activities leading to pollution of the environment (*questions IV and V*)
- B(b)13: activities leading to the displacement of people (*questions IV and V*)
- B(b)14: all activities leading to reproductive isolation of ecosystems (linear infrastructure) (*question IV*)
- B(b)15: all activities in areas of known importance for biological diversity (*questions IV and V*), such as (see Box 3.3 for a practical example from Hong Kong):
  - areas with a high level of endemism
  - areas with large numbers of species (hot spots)
  - highly representative areas for rare, unique or threatened ecosystems
  - areas where rare species occur
  - areas providing important functions to other areas
  - areas providing important functions for the livelihood of people
- B(b)16: all activities that significantly affect ecosystem functions that represent use values for society.

For screening system B1 (limited assessment only) the above set of criteria has to be put into effect. This implies clearly defined, country specific and practical criteria that define categories of activities, including thresholds for the magnitude of the activity, size of the intervention area, or magnitude of biophysical change caused by the activity, and maps indicating areas with a special status, such as extractive reserves, Ramsar sites and distributions of protected species.

For screening system B2 (preliminary environmental assessment or initial environmental examination) each project has to be analysed for its possible impacts on biodiversity. This exercise is very similar to the analysis needed for scoping. Section 3.4 of this chapter provides further guidance, based on the concepts elaborated in Chapter 2 of this document.

4. SCOPING FOR BIOLOGICAL DIVERSITY

4.1 Introduction

Scoping is a process to determine what kind of information should be studied in an EIA (UNEP, 1996). Scoping enables the competent authority

- to guide the study team on significant issues and alternatives to be assessed, how they should be examined (methods of prediction and analysis, depth of analysis) and which guidelines and criteria to use
- to provide an opportunity for stakeholders to have their interests taken into account in the EIA
- to ensure that the resulting EIS is useful to the decision maker and is understandable to the public.

The final result of scoping is a Terms of Reference (sometimes referred to as guidelines) for the EIA study. During the scoping phase promising alternatives can be identified for more detailed study during the EIA study.

As Treweek (2000) pointed out, in situations where biodiversity information is lacking, Terms of Reference for EIA are more likely to omit biodiversity considerations. There is an obvious need for a scoping procedure which accommodates uncertainties and lack of data. This section presents a highly structured approach on the most relevant issues regarding biological diversity during a scoping process. As in Chapter 2 of this document, the structure presented is rigid to make the issues at stake in the negotiation process as transparent as possible, which is the purpose of scoping. The long-term goal of this section is to provide scoping guidelines for different groups of stakeholders in the EIA process (e.g. project proponent, competent authority, EIA practitioners). The immediate objective is to develop a generally applicable, step-by-step approach which provides guidance to the development of country-specific procedures in a number of pilot countries. These pilot activities will provide valuable lessons for improving this generic approach, from which other countries will benefit.

The scoping will be carried out according to the conceptual framework described in Chapter 2, following an ordered list presented in section 4.3.1. The list of steps is designed for iterative use, first to identify impacts qualitatively, then to assess the order of magnitude of impacts, and finally to make a quantitative analysis of impacts during the EIA study itself.

4.2 Scoping system

Two situations can be distinguished:

Situation A: Information resources on biological diversity are plentiful, or financial resources to collect information are sufficient.

Situation B: Information and financial resources are scarce.

Approach in situation A
In the screening phase there are clear indications which trigger the need for an EIA. These indications may point towards valuable genetic resources, protected or threatened species, or ecosystems which may suffer significant damage. By going through the a stepwise approach (explained in the next section) the relevant issues to be studied can be identified.

The combined knowledge of the components of diversity that will be altered (composition, structure or key processes) and the level of biodiversity needing attention (genetic, species, ecosystem) allows the number of issues requiring in depth study to be limited; these should be highlighted in the Terms of Reference for the EIA study.

Approach in situation B
As in situation A the relevant issues need to be identified, but a lack of data, prohibitive costs of obtaining data, the inaccessibility of the terrain or other valid reasons make it impossible to assess the issues identified in the analysis that need to be studied. The issues table presented in the next section provides clues on how to provide 'as good as one can get' information, for example by studying relatively well-known ecosystem features instead of little known species within that ecosystem.

Ecological knowledge has progressed enough to be able to make a good qualitative judgement on the influence of biophysical changes on ecosystems, even if the exact species composition and abundance or the inter- and intra-specific relations within the system are not fully known. An experienced ecologist will be able to make comparative statements on the magnitude of impacts when comparing alternative project options, and thus provide relevant information on the expected impacts on biological diversity, without necessarily having to go into details.

Box 4.1 'Recipients' or 'carrying media' of change with some characteristics that may be affected

Soil: quality and quantity
- Quality further described in: change in soil chemistry (may be further detailed in salts, acidity, naturally poisonous elements), structure, texture, moisture, fertility, man-induced pollution.
- Quantity: sedimentation and scouring of stream beds, susceptibility to wind erosion, water erosion, landslides, subsidence.

Water: quality and quantity of surface water, groundwater and run-off water
- Quality: salt/freshwater balance (sea-land interface), sediment load, turbidity, acidity, man-induced chemical pollution, poisonous elements in groundwater, oxygen contents, nutrient contents, temperature, stratification.
- Quantity: regime of peak flow, base flow and flooding, change in water level or water level dynamics of surface and groundwater reservoirs, flow velocity, stream profile (wet section).

Air: micro- and macroclimatic change (complex of factors related to temperature, humidity, force and frequency of weather phenomena), air-borne solid particles (dust, asbestos), odours, noise level, chemical pollution, greenhouse gasses.

Flora: removal of vegetation (clearing, felling), infestation with terrestrial or aquatic weeds, algal bloom, plant diseases, invasion of exotic species, replacement of traditional plant varieties or cultivars by high yielding varieties.

Fauna: removal of indigenous species (hunting), breeding of disease-transmitting animals, pest infestations (nematodes, insects), damage by animals (rodents, birds), invasion of exotic species, replacement of traditional animal breeds, breeding of pathogenic organisms.

Another important feature of comparing alternatives is that it often is not necessary to study all relevant issues. Issues which do not have any distinctive comparative value do not have to be studied for each alternative. Also, if one possible impact caused by one of the alternatives meets with a legal objection to the alternative (for example impacts on a strictly protected area), their appears to be no need to study further impacts for this alternative. A good scoping exercise will provide the minimum necessary information for informed decision-making.

4.3 Methodological guidance on scoping

4.3.1 The approach

The process begins with the application of the step-by-step approach for each identified alternative. In practice, much of the information required for the EIA can be used for a number of the alternatives to be studied.

Activities lead to biophysical changes

Step 1. Define biophysical interventions in the proposed project: describe the type or nature of activity, its magnitude, location, timing and duration.

Step 2. Define the expected biophysical changes. Biophysical interventions cause biophysical changes in soil, water, air, flora and fauna (i.e. the recipients of change).

Step 3. Define potential higher-order biophysical changes. Each direct biophysical change may result in a chain of second and higher-order biophysical changes, depending on the nature and magnitude of change and the characteristics of the environment.

Step 4. Determine for each of the potential biophysical changes whether they will significantly alter the recipients of change. These changes can be described as changes in a number of parameters (or characteristics) of these recipients of change: change in quality or quantity, magnitude of change, timing, extent, reversibility/irreversibility, likelihood and significance (see Box 4.1).

Activities lead to direct and higher-order social change processes

Step 5. Define social interventions in the proposed project.

Step 6. Define social change processes.

Step 7. Define biophysical changes that result from social change processes.

Step 8. Continue from Step 2 with this information.

Box 4.2 'Recipients' or 'carrying media' for biophysical changes and their range of influence
(not exhaustive)

Soil	Predominantly local changes, vertically through soil layers
Air: noise	Local and neighbouring areas following noise contour lines
Air: dust, odour	Local and neighbouring areas following the direction of the prevailing wind
Open surface water	Local and downstream, permanently or temporarily submerged areas connected to the water course
Run-off water	Terrestrial and aquatic areas downhill from the activity
Groundwater	Local and neighbouring areas sharing the same aquifer
Aquatic organisms	Upstream and downstream, permanently or temporarily submerged areas connected to the water course
Disease-transmitting flying insects	Human settlements and domestic animals within flying range of insects (approx. 2–5 km)
Diseases transmitting aquatic snails	Aquatic habitats used by people immediately downstream of a snail breeding area (approx. 2 km)

Area of influence

Step 9. Determine the geographical range of influence of each biophysical change that is considered to be of relevance (see Box 4.2). Note that biophysical changes may only be tangible after a prolonged period of time, so include time considerations in the assessment.

Ecosystems, land-use types and their direct use functions

Step 10. Define ecosystems and land-use types which may be affected; this should be done for each individual biophysical change, since each change leads to different impacts in a different geographical area.

Potential impacts on biological diversity

Step 11. Determine which component of biological diversity is directly altered or influenced by each of the expected biophysical changes, i.e. with the composition, the temporal/spatial structure or key processes.

Step 12: For each alternative, define mitigation and/or compensation measures to counteract the expected impacts.

Step 13. With the help of the issues table (next section), determine which issues are of relevance to the ecosystems and/or land-use types that are affected by a biophysical change, taking into account the mitigation and/or compensation measures.

Use values
Step 14. Identify in consultation with stakeholders the current and potential use functions of biological diversity provided by the ecosystems or land-use types, and the values these functions represent.

Step 15. Determine which of these functions will be significantly affected by the proposed project.

Non-use values
Step 16. Determine which issues can realistically be studied at each level of biological diversity for the identified ecosystems or land-use types, and which will provide information relevant to decision-making.

Appraisal and comparison of expected impacts on biological diversity

Step 17. Provide information on the severity of impacts, i.e. apply weights to the expected impacts for the alternatives considered, including mitigating measures. To be able to do this the expected impacts have to be appraised and weighed against a reference situation. Different reference situations can be envisaged:

- **Existing situation:** a static picture of the present situation regarding biological diversity. This is most useful in situations where the existing ecosystems represent a more or less natural situation, i.e. where natural composition, structure and key processes are still recognisable.
- **Historical reference situation:** is there information on what is considered to be the ‘ideal’ natural situation in the study area. In some countries the available data from a certain year in the past are considered to describe the ideal or desired situation regarding biological diversity and landscape values. New projects should, if possible, contribute to reinstating this situation; this usually only applies to restoration projects or projects that have to compensate for loss of biological diversity. It is most useful in situations where biological diversity has significantly deteriorated in the not too distant past or where its ‘naturalness’ is questionable. The need for good reference data complicates this approach.

Table 4.1: **Issues for scoping for biological diversity**

LEVELS OF BIOLOGICAL DIVERSITY		COMPONENTS OF BIOLOGICAL DIVERSITY			
		Composition	***Structure (temporal)***	***Structure (spatial: horizontal and vertical)***	***Key processes***
	Genetic diversity	• Minimal viable population (avoid destruction by inbreeding/gene erosion) • Local cultivars • GMOs	• Cycles with high and low genetic diversity within a population.	• Dispersal of natural genetic variability • Dispersal of agricultural cultivars	• Exchange of genetic material between populations (gene flow) • Mutagenic influences • Intraspecific competition
	Species diversity	• Species composition, genera, families, etc., rarity/abundance, endemism/exotics • Population size • Known key species (essential role) • Conservation status	• Seasonal, lunar, tidal, diurnal rhythms (migration, breeding, flowering, leaf development, etc.,)	• Minimal areas needed by species for survival • Essential areas (stepping stones) for migrating species. • Niche requirements within ecosystem (substrate preference, layer within ecosystem)	• Regulation mechanisms such as predation, herbivory, parasitism, fertility, mortality, growth rate, reproductive strategy.
	Ecosystem diversity	• Types and surface area of eco(sub)systems • Uniqueness/abundance • Succession stadium, existing disturbances and trends (=autonomous development)	• Adaptations to/dependency on regular rhythms: seasonal • Adaptations to/dependency on irregular events: droughts, floods, frost, fire, wind	• Spatial relations between landscape elements (local and remote) • Spatial distribution (continuous or discontinuous/patchy) • Minimal area for ecosystem to survive • Vertical structure (layered, horizons, stratified)	• Structuring process(es) of key importance for the maintenance of the ecosystem itself or for other ecosystems.

- **External reference situation**: if restoration of a previous natural situation is envisaged, external reference situations may provide clues to the composition of the biological diversity in the project area before it was removed. The external reference should be an ecosystem similar to the one that existed in the area affected by the project, be situated in the same climatic zone, and represent the composition, structure and key processes of this ecosystem in a natural state.

The expected impacts of the proposed activity, including identified alternatives, should be compared with the selected reference situation and with the *autonomous development* (what will happen to biological diversity over time if the project is not implemented). The autonomous development is often referred to as the zero alternative (or the 'do nothing' alternative). There should be awareness that doing nothing may in some cases also have significant effects on biological diversity, sometimes even worse than the impacts of the proposed activity (e.g. projects counteracting degradation processes).

At present, evaluation criteria for biological diversity, especially at the ecosystem level, are underdeveloped and need serious attention when developing in-country mechanisms to incorporate biodiversity into EIA (Treweek, 2000).

4.3.2 The use of an issues table

The issues table provides an overview of all the aspects of biological diversity that may be of relevance to EIA studies. The table is not intended to expand the required workload, but rather to provide a selection mechanism to determine which issues are most relevant for study.

The stepwise approach in section 4.3.1 has provided information on the type of activities, the biophysical changes which can realistically be expected, the area under the influence of these biophysical changes, and consequently the ecosystems and/or land-use types affected.

The combination of the information on expected biophysical changes and the affected ecosystems or land-use types provides insight into the affected components of biodiversity and whether these impact would occur at the genetic, species or ecosystem level. With the help of the issues table, one can now define the issues to be studied at the genetic, species or ecosystem level.

Table 4.1 is an example of how this issues table may look. It must be stressed that this is a preliminary version; *the ecological community has to develop and adapt this table for the various biomes in the world*. The thematic approach of the CBD provides a good basis for the further elaboration of these issues tables because it is structured according to the major biomes of the world.

Another main challenge is to describe the structuring process(es) of key importance for the maintenance of an ecosystem. An example of a list of key processes for a number of broadly defined ecosystem is provided in Table 4.2.

Table 4.1: Examples of key processes in the formation and/or maintenance of ecosystems
(adapted from Koning and Slootweg, 1999; unpublished)

Key ecological processes	*Relevant for ecosystems*
soil-surface stability and soil processes	lowland dryland rainforest, montane tropical forest, coniferous montane forest, coastal dunes
soil erosion patterns due to wind	coastal dunes, degraded land
soil erosion patterns due to water	desert, coastal dunes, degraded land
erosion patterns of upland area and riverbed	upper, middle and lower course of rivers and streams
erosion patterns of soil and vegetation due to wave action	rocky coastlines and beaches, freshwater lakes, mangroves and sea grass beds
sedimentation patterns	middle and lower course of rivers, floodplains, estuary, tidal flats, mangrove
replenishment of sand by updrift sources	beaches, tidal flats, mangroves
topography and elevation due to wind erosion	desert
local climate (temperatures) determining plant available moisture	desert, rocky coastline
seasonal drought/desiccation patterns determining available moisture to plants	deciduous forest, non-forested mountains, savannah, steppe, desert
seasonal hydrological situation (evaporation, water quantity, water quality and current/velocity)	beach, rivers and streams, freshwater, saline or alkaline lakes, reservoirs
tidal influence (tidal rhythms, tidal range and tidal prism)	all coastlines, estuary, lagoon, tidal flat, mangrove, seagrass beds,
permanently waterlogged soil	peat swamp
salinity levels and/or brackish water gradient	lowland river, saline lakes, estuary, mangrove, seagrass beds, coral reef
water depth, availability of sunlight and/or thermocline stability	freshwater lake and reservoirs, coral reef, coastal sea
regional groundwater flow and water table (source or sink function of landscape)	freshwater marsh or swamp, saline or alkaline lakes
flooding patterns (frequency, duration)	tropical flooded forest, floodplain, freshwater swamp or marsh, mangrove
hydrological processes (vertical convection, currents and drifts, transverse circulation)	coral reef, coastal sea, open (deep) sea
biological processes in the root system	all dryland forests
protection of soil humus layer by vegetation cover	lowland tropical rainforest
canopy density determining light intensity and humidity	lowland tropical rainforest, deciduous forest
plant-dependent animal reproduction	lowland tropical rainforest
animal-dependent plant reproduction	lowland tropical rainforest
grazing patterns by herbivorous mammals	savannah, steppe (grasslands), tropical flooded forest, floodplain, freshwater swamps or marsh
grazing patterns by herbivorous birds	freshwater lake, floodplain, tidal flat
grazing patterns by herbivorous fish	freshwater lake, floodplain
grazing patterns by herbivorous marine mammals	seagrass beds
seed dispersal due to water	mangrove
seed dispersal by animals (birds, primates)	lowland tropical rainforest, tropical flooded forest, freshwater swamp or marsh
pollination due to environmental factors (e.g. wind)	deciduous forest, mangrove
pollination by animals (insects, birds, mammals))	lowland tropical rainforest, montane tropical forest, deciduous forest, mangrove
production of pelagic and benthic organisms	saline or alkaline lake or marsh, estuary
primary production by phytoplankton	saline or alkaline lake or marsh, coastal sea, open sea
nutrient inflow due to environmental factors (i.e. water run-off, drainage)	upper and middle course of rivers, freshwater lake, tropical flooded forest, tidal flat, seagrass bed
nutrient input by animals	
nutrient cycling due to water movement/rainfall	non-forested mountains, lagoon
nutrient cycling due to fire	savannah, steppe
nutrient cycling by juvenile fish	tidal flat, mangrove
nutrient cycling by arthropods/insects	lowland tropical rainforest, savannah, steppe
nutrient cycling by invertebrates (earthworms, bivalves, starfish, crabs, shrimps)	montane tropical forest, deciduous forest, coniferous montane forest, rocky coastline, lagoons, tidal flat, mangrove, coastal sea, open sea
nutrient cycling by fungi and bacteria	deciduous forest, savannah, steppe

nutrient cycling by filter feeders	coral reef
gallery forest structure providing shade and nutrient input	upper course of river
disruption of vegetation structure due to fire	lowland tropical rainforest, montane tropical forest, deciduous forest, savannah, steppe, tropical flooded forest, floodplain
disruption of vegetation structure due to storms/hurricanes/cyclones	lowland tropical rainforest, deciduous forest, coniferous montane forest, (coconut) beaches, mangrove
disruption of vegetation structure due to wave action	(coconut) beaches, mangrove
disruption of vegetation structure due to land slides/mud flows	montane tropical forest, coniferous montane forest, non-forested mountains
disruption of vegetation structure by animals (herbivores)	savannah, range land, sylvipastoral associations
peat building by decaying vegetation (accumulation rates *versus* decomposition rates)	peat swamp
dynamics of sedimentation, accretion, and grazing of the coral skeleton	coral reefs
predation of coral polyps by starfish and fish (parrotfish, butterfly fish), and smothering of coral polyps	coral reefs

5. LOOKING FORWARD

The conceptual framework and procedure for screening and scoping presented in this document are just the first step in a process that should lead to worldwide recognition of the importance of including biodiversity considerations into national systems for EIA, including the necessary implementation or adaptation of laws, regulations, tools, guidelines, capacity and general awareness.

The steps envisaged for the near future are:

Convention on Biological Diversity
Presentation and discussion of the main topics from this document at SBSTTA 7, November 2001, with a request by IAIA to SBSTTA to consider this draft framework and subsequently forward it in a suitable form for endorsement by COP 6.

International Association of Impact Assessment
Identification of interested donors for implementation of the IAIA action plan Biodiversity in EIA, encompassing:

- Activity 1: Production of a framework to integrate biological diversity into IA; this document completes the first phase. The document needs to be tested and finalised in a number of pilot activities, preferably linked to activities 4 and 5. A similar document on procedures for use in Strategic Environmental Assessment will be drafted, discussed and tested.
- Activity 2: Analysis of lessons learned from countries and international organisations; this has been partially completed with work submitted by IAIA under appendices 2 and 4. More countries are interested in producing case studies.
- Activity 3: Links with relevant global conventions.
- Activity 4: Communication and capacity development. Each implementation activity should have a capacity development and communication component to create awareness, enhance skills and implementation capacity, and to share information.
- Activity 5: Assist countries in developing their own mechanisms. Using the framework provided, countries can start developing their own mechanisms. A number of pilot countries will start the process to test and refine the available documents. The Netherlands has started an experimental process, and Ghana has indicated that it will include the approach in its ambitious 5 year EIA capacity development programme (GEACaP), which is in its second year.

Follow-up to the framework for integration of biological diversity into impact assessment
To further develop the approach presented in this document we can immediately identify a number of follow-up tasks. These can be taken up by the biodiversity and EIA communities. Some of the proposed concepts and procedures need to be further operationalised in generic form before they can be elaborated at the country level.

The issues in the issues table presented in the scoping section need to be defined in a way that makes the concepts readily available to and applicable by the EIA community. The idea is that long lists of issues of relevance to EIA studies will be defined for each biome of the world. These lists will be narrowed down again to minimal but comprehensive national sets of issues that can reasonably be studied in the countries concerned. Key processes need to be defined and operationalised for each ecosystem.

The thematic approach followed by the CBD provides a good framework for applying the concepts above to each biome and, preferably, each ecosystem. Subjects that need attention are:

- What is it? Explaining the issue to an informed but non-specialist audience.
- The causal relationship with biophysical changes. What biophysical changes typically lead to the need to study a particular issue?

- How can the issue be described? Is it easy/difficult, and how does it depend on the context?
- How relevant is it for EIA? If it is difficult to study, in what special cases should it be included in the ToR?
- Provide thresholds or define ranges of acceptable change, to determine the relevance of an impact for decision makers.
- Provide indicators for comparison, monitoring and evaluation.
- What are the options for obtaining second-best information if necessary?

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Summary of work and discussions at IAIA 2001, Cartagena, Colombia

A proposed conceptual and procedural framework for the integration of biological diversity considerations into national systems for impact assessment

IAIA Annual General Meeting (AGM) (Wednesday 30 May 2001)
Under agenda item 8: *Written submissions to the AGM*, the Biodiversity and Ecology section requested the AGM to endorse the submission of a statement to the 7th meeting of the Subsidiary Body on Scientific Technological and Technical Advice (SBSTTA) of the Convention on Biological Diversity (CBD). The AGM unanimously endorsed the work of the section.

Workshop: Session #15 Biodiversity in IA
Co-chairs: Arend Kolhoff/Nick King

Tuesday 29 May: 1:30–3:00 PM
- Miroslav Martis – Experience with the integration of biodiversity into EIA in the Czech Republic.
- Arend Kolhoff: Integrating biodiversity in EIA. An experiment. Groundwater extraction in a wetland area.
- Roel Slootweg 1: A draft *conceptual* framework for the integration of biological diversity into impact assessment.

Tuesday 29 May: 3:30–5:00 PM
- Nicholas King. Including Biodiversity in IA – can we include that which we don't know?
- Treweek, Duthie, Zanewich. Strengths and weaknesses of biodiversity integration with national environmental assessment processes.
- Roel Slootweg 2: A draft *procedural* framework for the integration of biological diversity into impact assessment.

Wednesday 30 May: 1:30–3:00p PM
- Alvarez. Prevention of environmental impacts on the biodiversity of linear projects in Colombia: Percolation theory application.
- Andrea Athanas: Introduction to the discussion with an explanation of decision COP V/18 with respect to Article 14, and the role of the SBTTA.
- Discussion on IAIA's contribution to SBSTTA 7.

Wednesday 30 May: 3:30–5:00 PM
- In-depth discussion on the conceptual and procedural framework.

Participants
Andrea Athanas (IUCN, HQ), Jo Treweek (Komex, UK), Nick King (BioNET, U.K.), Arend Kolhoff (Dutch EIA Commission), Roel Slootweg (SevS consultancy, Netherlands), Raphael Mwalyosi (University of Dar es Salaam, Tanzania), Ross Marshall (Scottish Power, UK), Carlos Florez (National Parks, Colombia), Willem DeFloor (Nature conservation and transport, Belgium), Hidefumi Kurasaka, (Ass. Professor, Kobe Univ., Japan), Abdulrahman Issa (IUCN EAFRO, Kenya), Kevin Franklin (Univ. Warwick, UK), Klever Chavez (Ministry of Environment, Ecuador), Vasiliki Tsiaoussi (EIA review, Greece), Dave Pritchard (RSPB, UK), Opal Brent, Katina Henderson (USA), Robert Bos (WHO, HQ), Pippo Gianoni, Roger Creasey, Gonzolo Arango, Bill Kennedy (EBRD, UK), Richard Grassetti, Emma Christmas (New Zealand), Gabriel Escobar (USAID), Benoit Gagnon (HydroQuebec, Canada), Danielle Mendiuru.

Biodiversity and Ecology Section meeting (Thursday 31 May)
- Discussion of the draft text of a two-page statement to be submitted by IAIA to the 7th SBSTTA of CBD.

- Division of tasks to be carried out by the members of Cartagena conference, to be submitted to SBSTTA by 1 July 2001:
  - Finalising the two-page statement for SBSTTA
  - Drafting a covering letter to the CBD secretary, to be signed by Elvis Au, president of IAIA
  - Prepare appendix 1 to the statement: Materials from the Biodiversity and Impact assessment course at IAIA
  - Prepare appendix 2: case studies on the role of SEA in linking National Biodiversity Strategy and Action Planning processes to national development planning processes
  - Finalise appendix 3, based on comments obtained at IAIA 2001 in Cartagena: *Proposed conceptual and procedural framework for the integration of biological diversity considerations with national systems for impact assessment*
  - Finalise appendix 4: case studies from UNDP/UNEP/GEF funded BPSP studies.

Closing Plenary (Friday 1 June)
Conference Highlights, opening with a statement on the results from the Ecology and Biodiversity Section.

Board meeting (Saturday 2 June)
- Discussion of the umbrella *Action Programme on Biodiversity in IA*, submitted by the Ecology and Biodiversity Section of IAIA, to become an official IAIA initiative.
- Approval of the statement to be sent to SBSTTA, including the submission of 4 appendices with amendments, as discussed in the workshops and section meeting.

Main elements from the discussion in the Biodiversity and IA stream #15
We should request CBD to link IAIA to the clearing house mechanism. IAIA's website will soon have an EIA glossary, to which a biodiversity heading will be added. A key citation index is planned for the coming year, with Internet sources and an overview of literature.

Discussion on the possible problem of parallel/interfering activities: There is no need to fear multiple activities; this will all feed into the SBSTTA, which is the body that will coordinate/harmonise activities.

The group expressed concern about the supply-driven nature of the activities; the need is expressed in general terms. There are some written statements of the need for the work from Ghana and the Netherlands, and other countries have expressed interest. In general, the supply driven nature is true.

Case studies: These should provide lessons and should indicate the needs. There is an obvious need for more good case studies. Global Environmental Outlook emphasises the lack of good information on the present state of implementation of the convention.

Discussion on what the IAIA section will contribute: Preparation of a statement for board approval and then submission to the CBD Secretariat for submission to SBSTTA7, based on the work that has been carried out this year, linked to decision V/18.

Discussion on one of the major outputs: the conceptual and procedural framework: The scope of the document should be as broad as possible:
- Stress that 'social' includes cultural, economic and institutional
- The framework will be used in very different situations, so it is intended to be generic
- It was felt that the framework presented had this broad and generic approach; a number of editorial suggestions improved the text in this respect.

The group expressed a need for final editing of the framework to ensure consistency of terminology with terminology used in the CBD. A discussion arose on the different interpretations of the 'values' concept, and the decision was made to include an explanatory box.

The schematic model describing the relations between activities and their social/biophysical effects has been discussed in depth, resulting in a slightly adapted and generally approved version.

Elaborate in the introduction and statement:

- Conceptual framework for people building guidelines and procedures, people drafting EIA and biological diversity guidance (practitioners, administration, competent authorities)
- How they should use it
- A general framework for broad application

Embedding the framework in national processes to integrate biological diversity into national EIA procedures should obviously be linked to simultaneous capacity-building activities while testing/implementing the framework. This was a generally accepted prerequisite for successful implementation.

The scoping section of the document received significant attention, resulting in an improvement of the order and description of steps to be made to include biodiversity in scoping. Furthermore, it is critically important to have an idea of the end use of the information to be able to prioritise it at the scoping stage. The group recommended including a paragraph explaining the importance of thinking about how the information will be interpreted, what its end use will be and its relevance to decision-making with the aim of prioritising the studies to be conducted in the EIA.

It has to be emphasised that the document should be presented as a ‘living’ document that will have to be improved and refined according to the experience that will be obtained from using it. This was not considered to be an obstacle for submission to SBSTTA as this has been done before with other documents under development. In particular, further development of later stages of integrating biodiversity with impact assessment was seen as vitally important to participants. In this regard, tools for evaluating and prioritising impacts and interpreting results for decision makers need to be developed. The framework should be expanded as experience is gained in these areas.

Capacity building was raised as an issue. The group felt that it was important to build capacity in the process of testing and implementing the framework.

Stakeholder participation came up several times in the discussions. In particular, stakeholders should be consulted during the identification of current and potential uses of biodiversity and the values of biodiversity.