Biodiversity and Environmental Assessment Toolkit

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The content of this Toolkit was prepared for the World Bank by Guy Duke and Maria Aycrigg of Environmental Resources Management (UK) Ltd under the guidance of Tony Whitten and Glenn Morgan of the East Asia and Pacific Region's Environment and Social Development Department. The content reflects current best practice in the treatment of biodiversity in environmental assessment, based on ERM's best professional judgement.

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1.1 INTRODUCTION

1.1.1 The Global Context

Biological diversity (or biodiversity) was placed firmly on the international agenda when the Convention on Biological Diversity (CBD) was opened for signature at the 1992 UNEP Earth Summit in Rio de Janeiro, where over 150 countries signed it. The CBD came into force in December 1993. Figure 1.1 gives the CBD definition of biodiversity, the general scope of the Convention, and Article 14, which deals with environmental assessment (EA).

Figure 1.1 Convention on Biological Diversity

Biodiversity is defined in the CBD as:

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

The three key goals of the CBD are:

· **The conservation of biodiversity** - through measures for *in situ* and *ex situ* conservation;

· **The sustainable use of biodiversity** ; the CBD promotes measures to ensure that future generations will benefit from today's biological resources;

· **The fair and equitable sharing of the benefits arising from the use of genetic resources**.

Article 14 of the CBD, which deals with EA, states:

"each contracting party, as far as possible and as appropriate, shall:

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

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

(source: Glowka et al.. 1993)

Local communities, and many sectors of national economies, depend upon the diversity of biological resources and the life-support functions and services they perform (for typical functions and services, see Figure 1.2). And yet the rate of loss of biodiversity is greater today than at any time since the extinction of the dinosaurs (Bagri, McNeely & Vorhies, 1998). The irreversibility of this species extinction, and loss of genetic strains, natural habitats and ecosystems through degradation and over-exploitation compromise options for present and future generations

Figure 1.2 Some Typical Functions and Services of Biological Resources

Ecosystem Services

· Protection of water resources (maintenance of hydrological cycles, regulation and stabilising water runoff and underground water tables, acting as a buffer against extreme events such as flood and drought)

· Purification of water (e.g. by wetlands and forests)

· Soils Formation and protection (maintenance of soil structure and retention of moisture and nutrientlevels helping to preserve soil's productive capacity)

· Nutrient storage and recycling (of atmospheric as well as soil-borne nutrients both necessary for the maintenance of life)

· Pollution breakdown and absorption (by components of ecosystems ranging from bacteria to higher life forms, and ecological processes)

· Contribution to climate stability (vegetation influences the climate at the macro and micro level)

· Maintenance of ecosystems (maintaining a balance between living things and the resources - such as food and shelter – they need to survive)

· Recovery from unpredictable events (such as fire, flood, cyclones and disasters initiated by humans);

Biological Functions - Supplier of:

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

Social Functions - Supplier of:

· Research, education and monitoring facilities (living laboratories for studies on how to get better use from biological resources, how to maintain the genetic base of harvested biological resources and how to rehabilitate degraded resources)
· Recreation and tourism facilities
· Cultural values (since human cultures coevolve with their environment, the natural environment provides for many of the inspirational, aesthetic, spiritual and educational needs of people)
· Warning signs (biological resources provide "indicators" of, for example, environmental degradation which can help humans mitigate against shortages, disasters)

(Sources: Department of Environment, Sport & Territories 1993; Bryant 2000)

1.1.2 Objectives of the Current Review

It is now more vital than ever that the functions and services of natural habitats are systematically assessed and evaluated as part of cost/benefit analysis of programs and projects. There is an increasingly urgent need for environmental assessment to pull its weight in order to prevent the degradation and over-exploitation of biodiversity.

The objectives of the current review are:

- to inform EA practitioners, task team leaders (TTLs), executing agencies and other project stakeholders about the costs and benefits of effective treatment of biodiversity in project design, acceptance and long-term sustainability (Part 2);
- to outline pragmatic and cost-effective approaches and methods to achieve effective treatment of biodiversity in EA and for a range of project investment types and scales (Part 3); and
- to assess the implications of the above for the management of EA in the World Bank (Part 4).

Annex 1 Possible questions that might be included in EA Terms of Reference for assessment of the state of biodiversity
Annex 2 SBSTTA Recommendations for a Core Set of Biodiversity Indicators
Annex 6 Glossary of Acronyms

The content of this toolkit was prepared for the World Bank by Guy Duke and Maria Aycrigg of Environmental Resources Management (UK) Ltd (http://www.ermuk.com), under the guidance of Tony Whitten (EASES) and Glenn Morgan (EASES). The content reflects current best practice in the treatment of biodiversity in environmental assessment, based on ERM's best professional judgement.
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1.2 BIODIVERSITY IN EA AT THE WORLD BANK

1.2.1 Mainstreaming Biodiversity in Development

The World Bank's ***Mainstreaming Biodiversity in Development*** **(1995)** sets out how the Bank can best direct efforts to support implementation of the CBD. The document points out that the Bank's support has in the past focused on traditional biodiversity conservation initiatives such as the establishment and management of protected areas and that, while these activities are important and necessary, they do not ensure the integration of biodiversity into sustainable national development. It proposes a broadening of the Bank's analytical and investment support to enable national policies and programmes to take account of biodiversity objectives. 'Investment operations in traditional sectors such as agriculture, forestry, energy, tourism, and urban and infrastructure development', it says, 'should gradually become more "biodiversity friendly".' It concludes that the Bank must more effectively use its key analytical and development assistance instruments, one of the most important of which is EA. The implications of this policy for EA should be that the Bank's EAs need not only to prevent negative impacts, but also need to enhance the positive impacts of projects - potentially involving the re-location and/or re-design of projects.

1.2.2 The Policy Framework

Since 1989, when the Bank adopted OD 4.00 - Annex A: *Environmental Assessment* (amended as OD 4.01 in 1991), EA has been a standard procedure for Bank-financed investment projects. The intended effect of EA in development planning is to prevent, minimise, mitigate, or compensate for, adverse environmental impacts and otherwise improve their design from an environmental (and often social) perspective.

EA is often carried out in parallel with economic impact assessment and social impact assessment. Other types of impact assessment are often applied as required according to the type of project being assessed - these may include health impact assessment, gender impact assessment, climate impact assessment, cumulative effects impact assessment, etc.

The World Bank has provided a variety of advice and guidance on both the policy and practice of incorporating biodiversity into EA over the last five years. The primary guidance documents are the newly revised *Operational Policy on Environmental Assessment* (**OP 4.01, January 1999**), which provides policy, procedures and good practice on EA, the *Environmental Assessment Sourcebook* (1991) and the *EA Sourcebook Update no.20 Biodiversity and Environmental Assessment* (October 1997).

OP 4.01 defines EA as "a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimising, mitigating or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favours preventive measures over mitigatory or compensatory measures, wherever feasible."

OP 4.01 states that, where a project is likely to have sectoral or regional impacts, sectoral or regional EA is required. *Update no.20* further states that the cumulative effects of development activities within a given sector or region on biodiversity are best addressed through the use of such Strategic EAs. Sectoral EAs can be used to take account of biodiversity issues in sectoral investment projects. Regional EAs may be applied where the borrower is engaged in regional development planning at a stage when alternative development strategies may still be considered. Additional information on sectoral and regional EAs is provided in *Update* nos. 4 and 15 respectively.

OP 4.01 requires the systematic screening of all proposed programs and projects for significant environmental impacts. It requires that a project be classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse or unprecedented. These impacts may affect a broader area than the sites or facilities subject to physical works. A potential impact is considered "sensitive" if it may be irreversible (e.g. lead to loss of a major natural habitat) or raise issues covered, notably, by **OP 4.04** *Natural Habitats*. **OP 4.01** requires that a project be classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats - are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects.

The policy on *Natural Habitats* **(OP 4.04, September 1995)** states that the Bank will not support projects that "in the Bank's opinion, involve significant conversion or degradation of critical natural habitats," which include existing or proposed protected areas, areas recognized as protected by local communities, and sites that maintain conditions vital for the viability of such protected areas.

Additionally, the Bank will only support projects that involve significant conversion of non critical habitat if "there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs." If there are no feasible alternatives, then the project must include "appropriate conservation and mitigation measures". The OP also calls for an analysis of the institutional capacity to implement environmental planning and management, and appropriate environmental expertise on project teams. **OP 4.04 Annex A** provides definitions of the terms "natural habitats", "critical natural habitats", "significant conversion" "degradation" and "appropriate conservation and mitigation measures".

OP 4.04 also summarises some important lessons learned in protecting natural habitats which include:
Natural habitat management objectives have to be translated into specific measures and activities and supported by policies that support natural habitat conservation objectives and recognise the rights and roles of local communities in resource management.
In order to meet the multiple objectives of natural habitat management, measures ought to be carefully designed beginning at the earliest stages of the project cycle.
Like any project component, successful protection of natural habitats depends on adequate financing and government commitment.
In deciding whether to support a project with potential adverse impacts on natural habitats, the Bank must take into account both the government commitment and its capacity to implement and enforce environmental management plans.

The Bank's policies on forestry, water resources management, and indigenous peoples also address biodiversity conservation.

1.2.3 Existing Practice Guidance

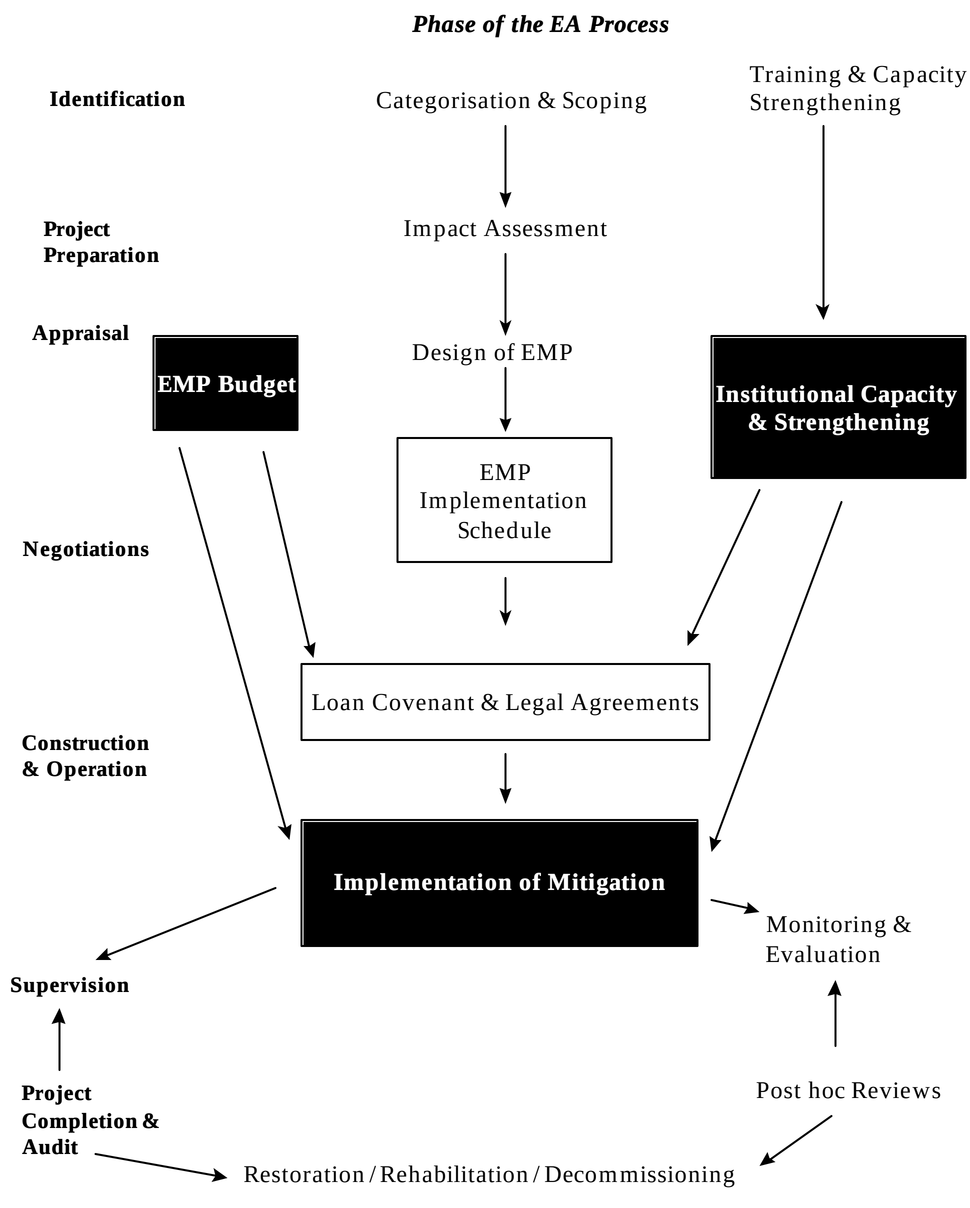
In addition to the good practice section of **OP 4.01**, the two main sources of good practice guidance are the ***EA Sourcebook*** chapter 2 (1991) and the ***Sourcebook Update no.20 on Biodiversity and Environmental Assessment*** **(1997).**

The *EA Sourcebook* provided the first comprehensive practical guidance for incorporating biodiversity in EAs. *Update* no.20 provides an outline of the policy framework for protection or enhancement of biodiversity, the relevant project contexts where biodiversity may be adversely affected (or which may provide opportunities for biodiversity enhancement) and, of most relevance here, guidelines for integrating biodiversity concerns into EA. *Update* no.20 identifies the following key steps for integrating biodiversity into EA:
Screening: potentially significant impacts of project siting and design on biodiversity should be identified at the beginning of the assessment through the screening process. The following three questions should be considered during screening: Is biodiversity likely to be significantly affected by the project? What, in broad terms, will the impacts be? And does the project have the potential to be biodiversity enhancing?
Scoping: Based on the results of the screening exercise, the significant impacts - both negative and positive - which should be specifically assessed should be identified.
Information gathering: Where there is a lack of information, relevant, up-to-date baseline data on the biodiversity that is affected should be gathered and analysed.
Prediction of Impacts: In broad terms, impacts can be predicted by answering the following question: "what is the significance of the identified impacts?" There is a need to consider cumulative, synergistic and induced impacts. Predicted impacts should be considered in a local, regional, national and international context, as well as in a broad strategic context. Project processing should include a careful analysis of the functions served by the affected habitats and ecosystems and the geographical distribution of costs and benefits of development at regional, national and trans-national levels.
Mitigation measures and management plan: EAs should provide options for eliminating, reducing to acceptable levels or mitigating impacts on biodiversity - involving project re-design and/or relocation. Such recommendations should be based on findings from the analysis of policy, legal and institutional issues as well as the biodiversity impacts. Opportunities for incorporating biodiversity components in the EMP, and enhancing positive impacts on biodiversity should be also explored as part of the project's EMP.

To these steps can be added the following:
Monitoring and evaluation: post-EMP monitoring of the implementation of the EMP, allowing for review and adjustment of the plan as the impacts of planned actions are understood, should be provided for.

Goodland and Mercier (1999) suggest a new style EA process which places much heavier emphasis on post-EMP design activities (Figure 1.3), in particular on implementation of measures specified in the EMP, careful budgeting of the EMP and securing this budget, and strengthening capacity to implement.

Figure 1.3 New Style EA Emphasis: From Assessment to Implementation



(Source: Goodland & Mercier 1999)

1.2.4 Obligations of Bank Staff and Borrowers

According to **OP 4.01**, the borrower is responsible for carrying out the EA. The Bank undertakes environmental screening to determine the appropriate extent and type of EA, advises the borrower on the Bank's EA requirements, and reviews findings and recommendations of the EA to determine whether they provide an adequate basis for processing the project for Bank financing.

In regard to biodiversity, BP 4.04 *Natural Habitats* states that "early in the preparation of a project proposal for Bank financing, the project task manager (TM) consults with the Regional Environment Division and, as necessary, with the Environment Department (ENV) and the Legal Department (LEG) to identify natural habitat issues likely to arise in the project." The TM identifies any natural habitat issues in the initial Project Information Document (PID) and in early versions of the Environment Data Sheet (EDS), such as significant conversion/ degradation or exceptions to **OP 4.04**, para. 5 (that is, exceptions to the general rule that the Bank will not support projects which involve conversion of natural habitats, e.g. overall benefits outweigh environmental costs as considered after comprehensive analysis). Updated PIDs reflect changes in the natural habitat issues. 'Habitat issues' should be taken to include also landscape-, species/population-, and genetic-level biodiversity issues.

REDs coordinate the preparation and use of critical habitat lists, which are supplementary to lists recognized in **OP 4.04** (existing protected areas or officially proposed protected areas that meet the criteria of the IUCN classifications, areas recognized as protected by traditional communities, and sites that are vital for the viability of the protected areas) to be used during the preparation of the project. RED also assists with project preparation, including EA, and supervision when requested by the TM.

OP 4.01 states that, for Category A projects, the borrower is required to retain independent EA experts not affiliated with the project to carry out the EA. For Category A projects that are highly risky or contentious or that involve serious and multidimensional environmental concerns (which is frequently the case when significant impacts on biodiversity are likely) the borrower "should normally engage an advisory panel of independent, internationally recognised environmental specialists to advise on all aspects of the project relevant to the EA."

The TM typically assists the borrower in drafting the terms of references for any EA report. RED, when requested by the TM, reviews the coverage of the TOR to ensure adequate attention to critical issues, and assists in supervision of the EA. RED review the results of an EA ensuring that it is consistent with the TORs agreed with the borrower, and, depending on the quality of the EA, may recommend, *inter alia*, that the project proceed to appraisal, or that the appraisal be postponed, or that certain issues be re-examined during the appraisal mission.

The appraisal mission takes place only after the Bank has officially reviewed the EA report. For Category A projects, the appraisal team should include one or more environmental specialists with relevant expertise who will review the procedural and substantive elements of the EA with the borrower, resolve any issues, and assess the adequacy of the institutions responsible for environmental management, ensure the adequacy of financing arrangements for the EMP, and determine whether the EA's recommendations are properly addressed in project design and analysis. In particular, costs for conservation of compensatory areas should be included in project financing and mechanisms to ensure adequate recurrent financing should be incorporated in project design.

Bank staff identify relevant natural habitat issues for regional and sectoral EA reports, which indicate present location of natural habitats in the region/sector, analyse ecological functions and natural history relative importance, and describe relevant management issues. These are used later in project-specific screening and other EA work.

The Staff Appraisal Report (PAD) and the Memorandum and Recommendation of the President indicate the types and estimated areas (in hectares) of affected natural habitats; the significance of the potential impacts; the project's consistency with national and regional land use and environmental planning initiatives, conservation strategies, and legislation; the mitigation measures planned; and (again) any exceptions proposed under **OP 4.04**, para. 5. Exceptions are made only after consultation by the TM with RED, ENV and LEG, and approval by the Regional Vice President (RVP).

Finally, ENV disseminates best practice, provides training, reviews, advice and operational support to guide TMs, Country Directors (CDs) and REDs in implementation of **OP 4.04.**

1.2.5 Recent Bank Reviews of Biodiversity in EA

1995 Biodiversity and EA review

In 1995, the World Bank's East Asia Environment Unit undertook an internal (unpublished) review of the biodiversity components of a number of EAs to assess whether biodiversity was being appropriately studied, whether the information was geared to help the decision-making process, and to identify obstacles or challenges to more effective treatment of biodiversity concerns in EAs. The review looked primarily at infrastructure projects and several forestry projects. The study found that:

quantity, quality and presentation of biodiversity information was weak,
EA teams did not include biodiversity expertise when needed, for the most part,
methodologies were not well presented,
natural variability was not accounted for in most biodiversity studies,
mitigation plans were unclear, and
biodiversity restoration opportunities were not being exploited.

Medium- and long-term recommendations from the 1995 report included:
Because biodiversity assessment was a fairly new subject area of concern in EAs, more clear and detailed guidance (such as a best practice paper) was recommended in order to ensure high quality work.
The factors that are important to ensure best practice for biodiversity studies within an EA should be included in the TORs.
Since few developing nations have either the necessary baseline information or technical expertise to conduct relevant studies, the Bank should support the build up of information on a national or regional scale, should support the public availability and dissemination of EA reports, field guides, and recent field research, and should promote training programs to build expertise in borrowing nations.

The Impact of Environmental Assessment 1997

While the World Bank Environment Department' Second EA Review, *The Impact of Environmental Assessment* (1997) identified some positive trends in the treatment of biodiversity in EA, it also revealed a wide range of quality among the biodiversity sections of EA reports. It concluded that there is tremendous scope for improving the treatment of biodiversity issues, and noted in particular the following challenges in making EAs a more effective tool for decision making related to biodiversity:

Taking care to select appropriate consultants
Ensuring that biodiversity aspects are addressed throughout the EA, including the baseline inventory, impact assessment, and mitigation, management and monitoring plans Providing a meaningful context, including background information on biodiversity relevant to decision-making, and relevant maps Extending the focus to non-forest, non-protected and/or non-pristine habitats, and taking the consequent additional opportunities to promote biodiversity Incorporating natural variability, by providing for longer-term fieldwork to incorporate seasonality and year-to-year variability Promoting long-term initiatives to strengthen baseline information, expertise and experience;
Promoting greater awareness and levels of public involvement in EA (and, by extension, in the treatment of biodiversity in EA);
Promoting biodiversity concerns within strategic (sectoral and regional) EAs which are of increasing importance.

1.3 CONCLUSION

There is a clear policy imperative within the Bank to apply EA for the prevention of negative impacts and the optimisation of the positive impacts on biodiversity of the Bank's development strategies, sectoral and country programmes, and projects. Substantive policy and practice guidance exists, providing for the integration of biodiversity considerations at all stages of the EA process from the initial screening, to post-EA monitoring and evaluation. The obligations of Bank staff and borrowers are on the whole clear. However, recent reviews have identified serious weaknesses, resulting in a number of recommendations to improve the treatment of biodiversity in EA.

2 COSTS AND BENEFITS

2.1 INTRODUCTION

This section of the study outlines the costs (in terms of Bank funds and time) and benefits (unquantified, but evidently substantial) of the effective treatment of biodiversity in EA. While Bank costs are easily quantified, no attempt is made here to quantify the benefits, which may vary widely from project to project. However, the range and quality of benefits identified make a strong case for the effective treatment of biodiversity in EA. Benefits in the medium to long-term are likely in most cases to significantly outweigh the short-term costs.

2.2 COSTS

The Second EA Review, *The Impact of Environmental Assessment* (World Bank 1997) found that the direct costs of EA vary widely - recording costs of from $7000 to $500,000, with a normal cost for a Category A project of between $60,000 and $250,000. Those done entirely by local consultants generally cost under $100,000 while those done by international consultants generally cost $200,000-300,000. For projects where there is reason to expect significant and complex impacts and where environmental data are still lacking, there will normally be a data collection period of one year and - in many cases - international consultants for particular tasks. This will often be the case for projects with potential significant impacts on biodiversity. In these cases, costs normally exceed $250,000. These figures all apply to total EA costs, and not to the costs of the biodiversity component of the EA. Disaggregated figures do not exist for the cost of this biodiversity component, but in the past it has generally been only a fraction of the total cost. In terms of staff weeks, the average amount of RED time spent on the EA aspects of a project is 2-3 weeks, while for Task Managers the average is 1-2 weeks. Again, the amount of staff time spent on the biodiversity aspects of the EA is likely to be a small fraction of this time. There is concern in the REDs about the level of biodiversity resources available for EA supervision.

The above figures identify the direct costs of EA. However, these costs have rarely led to the effective treatment of biodiversity in EA to date. That is, the above costs are the costs of ineffective treatment of EA. This is not to say that additional resources are necessarily required if biodiversity is to be effectively treated in EA, but certainly that existing resources must be used to better effect. Ways in which to do this are detailed in Part 3.

2.3 BENEFITS

The effective treatment of biodiversity in EA can yield a variety of benefits, for lender, borrower, developer, local communities and other stakeholders. By providing information on the biodiversity issues which matter, and helping to explain the links and interactions between these and economic, social and technical factors, EA can both help the decision-making process and contribute to effective implementation.

2.3.1 Prevention of unsound proposals, identification of alternatives

The early treatment of biodiversity in EA facilitates the prevention, redirection or early withdrawal of unsound proposals, and in particular of projects located in critical natural habitats, resulting in significant savings in time and money. The treatment of biodiversity in sectoral and regional EA, in particular, helps prevent unsound location of proposals, and assists in the location of acceptable sites for development.

2.3.2 Improved project design

For a significant number of World Bank proposals, the effective treatment of biodiversity in EA will make an important contribution to ensuring that impacts are avoided, minimised, mitigated, compensated or offset as far as practicable, and/or that potential positive impacts are enhanced, while still meeting the proposal's development objectives. Benefits may include cost-effective improvements in project design, the introduction of environmentally appropriate technology, and the avoidance of risks, penalties and liabilities, and 'clean-up costs' arising from overlooking important biodiversity characteristics.

2.3.3 Public acceptance and cooperation

The effective treatment of biodiversity in EA, which should involve the meaningful participation of stakeholders including local communities, NGOs and the general public, can encourage public acceptance of, and co-operation in, the proposed development. It can assist in the resolution of issues raised by various stakeholders, and enhance the environmental credibility of the developer. It can also promote public concern about biodiversity issues, providing political support for measures by which countries may better realise their commitments under the Biodiversity Convention.

2.3.4 Avoidance of delays at the implementation stage

The effective early treatment of biodiversity in EA can assist in the avoidance of costly delays at the implementation stage. If biodiversity is not treated effectively in EA, unforeseen adverse impacts on biodiversity may arise during implementation, and these may force suspension or delays in works or operations. The restoration of biodiversity following such unforeseen adverse impacts will usually be much more costly than the early implementation of measures to prevent, minimise or mitigate impacts. Further, if biodiversity is not treated effectively in EA, strong conflicts commonly arise once adverse impacts start to become evident. These conflicts will tend to be much more severe and polarised than at the EA stage, as the developer and financing agency will be blamed for poor planning, and may again lead to costly suspensions or delays in works or operations.

2.3.5 Project long-term sustainability

By assessing the state of biodiversity in the study area (status and trends in the composition, structure and function of landscapes, habitats and species/populations), pressures on biodiversity (factors causing change), uses of biodiversity (values) and responses/capacity for the conservation and sustainable use of biodiversity (existing programmes and projects, human resources, legal and policy frameworks, institutions), the effective treatment of biodiversity in EA permits the design of long-term environmental management, monitoring and evaluation plans which support the ecological, social and economic sustainability of the development project.

2.3.6 Achievement of ancillary environmental and development objectives

The effective treatment of biodiversity in EA can identify valuable opportunities not only to prevent, minimise, mitigate or compensate for adverse impacts, but also to enhance or restore biodiversity. It can also result in the identification of 'green' business opportunities.

2.3.7 Indirect benefits

The treatment of biodiversity in EA may also have indirect benefits, such as the improvement of regulations and the definition of standards and targets for conservation and sustainable use of biodiversity, or increased environmental awareness within different government institutions and private companies. However, the achievement of such indirect benefits requires the proactive involvement of EA managers.

3 GUIDANCE AND METHODOLOGIES

3.1 INTRODUCTION

3.1.1 Key challenges

There are a number of key technical and managerial challenges for the effective treatment of biodiversity in EA, which echo those identified in *The Impact of Environmental Assessment* and *Sourcebook Update* no.20 *Biodiversity and Environmental Assessment,* as well as the more general challenges noted in *Sourcebook Update* no.16 *Challenges of Managing the EA Process*. (The stages at which these key challenges are met in the EA process are given below in parentheses.)

Selecting suitably qualified and experienced biodiversity specialists, in terms of both technical and managerial capabilities, and enabling them to play an effective role in the EA process *(all stages of the EA process*);

Identifying likely impacts on biodiversity and indicating their relative importance in the early stages of the process, and translating the results into coherent terms of reference (TORs) and schedules for undertaking the work (*Screening, Scoping*);

Determining the range and type of baseline data needed to make defensible and robust predictions of impacts on biodiversity, and selecting and applying robust methodologies for data collection and making the predictions. This includes: identifying both the current status of biodiversity and trends in biodiversity over time; providing for longer-term fieldwork to incorporate natural variability and seasonality elements; and extending the focus beyond the current bias towards forest habitats, protected and pristine areas, to ensure due weight is also given to other habitats (including wetlands, tundra, grassland, desert and semi-desert) and to unprotected areas (*Scoping, full EA*);

Predicting impacts on biodiversity and evaluating their significance (*full EA*);

Designing an Environmental Management Plan that prevents, minimises, mitigates against, compensates for or offsets adverse impacts on biodiversity (in that order of preference), takes advantage of opportunities to enhance or restore biodiversity, takes account of the capacities of proposed implementing agencies (*full EA*);

Providing for effective post-implementation monitoring and evaluation (*full EA, Monitoring & Evaluation*);

Effectively presenting the biodiversity information obtained at relevant decision making stages, including the presentation of appropriate contextual information such as maps, aerial photographs and other remotely sensed data (*Scoping, full EA, Monitoring & Evaluation*);

Promoting greater awareness and public involvement in the treatment of biodiversity in EA (*all stages*).

Building EA capacity in developing countries (*all stages*).

3.1.2 The global agenda on biodiversity and impact assessment

This chapter provides pragmatic guidance on good practice to meet the above key challenges. This guidance is provided with the proviso that more comprehensive guidance on the treatment of biodiversity in EA may soon become available as a result of the ongoing global agenda on biodiversity and impact assessment, under the umbrella of the Convention on Biological Diversity (Figure 3.1).

Figure 3.1 The global agenda on biodiversity and impact assessment

Impact assessment is identified by the Parties to the Convention on Biological Diversity (CBD) as a key tool for achieving the conservation of biodiversity, the sustainable use of its components, and the equitable sharing of that use. Article 14 of the CBD calls for the Contracting Parties to introduce appropriate procedures to ensure that the environmental consequences of projects, programmes and policies likely to impact on biodiversity are taken into account.

With impact assessment on the agenda for the fourth Conference of the Parties to the CBD in June 1999, IUCN organised a workshop at the 18th annual meeting of the International Association of Impact Assessment (IAIA) to discuss the potential role of impact assessment in the biodiversity agenda. The workshop resulted in a statement to the COP4 and a list of elements of a programme of work on biodiversity and impact assessment. This contribution was formally recognised by the Parties of the Convention and the ideas made a significant contribution to Decision IV/10c on Impact Assessment and Minimizing Adverse Effects. This Decision asks Parties to make more information available to the Secretariat to prepare a background document for SBSTTA4 held in June 1999. The resulting background document examines submissions provided on:

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

The final recommendations from SBSTTA4 recommends that the Conference of Parties:

(a) <u>Invite</u> Parties, Governments and other relevant organisations:

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

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

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

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

Conference of the Parties;

(e) Request the Executive Secretary also to make accessible and increase the call for case-studies, including negative impacts and, in particular, impact assessments taking the ecosystem approach into account, to compile and evaluate existing guidelines, procedures and provisions for environmental impact assessment, and make this information available, together with information on existing guidelines on incorporating biological diversity considerations into environmental impact assessment through inter alia, the clearing-house mechanism in order to facilitate sharing of information and exchange of experiences at regional, national and local level.

Biodiversity and EA were again the subject of a workshop at the 19th IAIA Meeting in Glasgow in June 1999, which resulted in a statement and outline programme of work, as a component of the joint programme of work on biodiversity and EA being implemented by representatives of the CBD, CMS, Ramsar, IAIA and IUCN Secretariats in December 1998.

(Sources: Bagri & Vorhies 1999; IUCN 1999)

3.1.3 Goal and guiding principles

The goal of the effective treatment of biodiversity in EA should be, in order of best to worst, to enhance positive impacts on biodiversity, and to prevent, minimise, mitigate against, or compensate or offset, adverse impacts on biodiversity. As stated in OP 4.01, "the Bank favours preventive measures over mitigatory or compensatory measures, whenever feasible," but there is a need to go beyond this preventive role of EA to enhancing positive impacts.

The Canadian Ministry of Supply and Services (1996) suggests, in a document entitled *A Guide on Biodiversity and Environmental Assessment* prepared jointly with the Canadian Biodiversity Convention Office, a series of guiding principles that the EA practitioner should consider in assessment of the environmental effects of a proposal on biodiversity:Minimum impact on biological diversity;no "net loss" of the ecosystem, species populations or genetic diversity; application of the "precautionary principle", which is employed to avoid irreversible loss; no effect on the sustainable use of biological resources; maintenance of natural processes and adequate areas of different landscapes for wild flora and fauna and other wild organisms; use inferential information, e.g. identify species that are rare or at the limit of their range and therefore a possible early warning of critical ecological damage; where possible, use indicator species or valued ecosystem components to focus the assessment; define the spatial parameters that characterise ecological processes and components in order to provide a regional context for an analysis of the proposed project; identify the best practical option for maintaining biological diversity; and examine the cumulative effects of other activities in the area/region to date and evaluate the added 'effect' that this project, and others likely to follow, will have on biological diversity.

3.2 SELECTION AND ENABLING OF BIODIVERSITY SPECIALISTS

The World Bank's EA Sourcebook Update no. 16 identifies as a key challenge the 'selection of an appropriate EA team, in terms of technical and management capabilities,' and both The Impact of Environmental Assessment and Update no. 20 specify the importance of effectively involving suitably qualified and experienced biodiversity specialists. The review of recent experience (Part 3) reinforces this challenge, highlighting the need to differentiate between the particular types of biodiversity expertise required, and the need to enable biodiversity specialists to play an effective role in the EA process.

3.2.1 How to identify the type of biodiversity expertise required

Suitable expertise is required for the EA team and, in the case of many Category A projects, for the independent advisory panel. *Update* no.20 recommends that the choice of expertise should be undertaken by the Task Manager in consultation with a Bank biodiversity or environment specialist. The type of expertise required will depend upon the scope of the project and the characteristics of the project's environment.

Dam projects, for example, will tend to require expertise in aquatic ecosystems composition, function and services; agricultural projects expertise in agro-ecosystems and in any ecosystems (e.g. forests) which may be transformed; oil pipeline projects expertise in those ecosystems to be traversed; etc. Regional or sectoral EAs and EAs for Category A projects are more likely to require a wider range of more specialist biodiversity expertise that Category B projects.

Biodiversity characteristics to be taken into consideration include: principle habitat types; the range of taxa represented, key taxa (e.g. rarities, endemics) and the extent of existing knowledge of the area's biodiversity at various taxonomic levels (family, genus, species); the relative importance of knowledge on species composition vs. the structural or functional characteristics of the ecosystems affected; the need for quantitative and/or statistical treatment of biodiversity data;
the need for autecological studies (e.g. focusing on the ecology or population biology of a single, little known, key species); the potential importance of biogeographical information; existing factors underlying trends in biodiversity in the project area (e.g. legal, policy, institutional framework, economic incentives); the potential importance of traditional knowledge, equity and IPR issues. Expertise exists for each of these areas of speciality. A list of various types of expertise that might be considered for EA is given in Figure 4.2.

However much care is taken in the selection of biodiversity experts, the *effective* assessment of biodiversity impacts will be dependent on the overall management and structure of the EA team and the extent to which this enables the biodiversity experts to work effectively (*Update* no. 16). The EA manager, if not him/herself a biodiversity specialist, must nonetheless ensure the quality of biodiversity impact studies and ensure the integration of biodiversity results into the overall 'picture' of environmental consequences. And biodiversity specialists must be able to work closely with other specialists involved in the EA, such as engineers, hydrologists and sociologists, if they are to accurately assess all potential impacts on biodiversity.

Where there is perceived risk that biodiversity aspects may be sidelined in the EA process, an option may be to commission a stand alone Biodiversity Impact Assessment (Bagri and Vorhies 1997). This is probably not a sound strategy, however, as the stand alone Biodiversity Impact Assessment may be ignored or treated as unofficial. If a separate Biodiversity Impact Assessment is considered, it is important that the biodiversity team has full access to project siting and design information and to specialists in other disciplines working in the main EA team, that the biodiversity assessment is implemented in parallel with the main EA, and that the biodiversity results are effectively integrated at key stages of the decision making process.

The appointment of suitable biodiversity expertise to an independent advisory panel can be critical in ensuring that biodiversity concerns are heard at the highest level of decision-making.

Figure 3.2 Types of expertise for treatment of biodiversity in EA The types of expertise required may include, *inter alia*:

general expertise in animal (zoologists) or plant (botanists) ecology, taxonomy or bio-sociology;

taxonomists, ecologists and bio-sociologists specialising in particular taxa of importance within the project area, e.g. mammologists (mammals), ornithologists (birds), lepidopterists (butterflies), primatologists (primates), mycologists (fungi), ichthyologists (fish);

ecologists specialising in particular habitat types of importance within the project area, e.g. montane ecologists, rainforest ecologists, wetland ecologists, marine ecologists, agricultural ecologists;

specialists in ecosystem structure or function;

ecological statisticians (for analyse of quantitative data), population ecologists (for studies on population dynamics, viability, etc.);

specialists in the conservation of biological diversity, including conservation biologists, protected areas planners and administrators;

biogeography specialists, including those skilled in remote sensing and GIS techniques, and in the identification of biogeographic affiliations;

specialists in ethnobiology, ethnobotany and ethnozoology (traditional knowledge of biodiversity);

specialists in the sustainable use of biodiversity, equity and intellectual property regime (IPR) issues;

specialists in the legal, institutional and policy aspects of biodiversity conservation;

specialists in stakeholder participation in biodiversity conservation;

specialists in organic agriculture (offering viable biodiversity-enhancing alternatives in agricultural projects);

specialists in the economics of biodiversity

3.2.2 How to find biodiversity expertise

l expertise should be used where adequate and available, but wherever this is not the case, international expertise must be brought in.

as inaccuracy is not tolerated in the engineering or economic aspects of pre-feasibility studies, it should not be tolerated in the biodiversity aspects of ronmental assessment. The introduction of international expertise should be used as an opportunity to build local capacity.

ble sources of local expertise include: government agencies (environment, forest, marine, wildlife, etc.), academic institutions, consulting firms, NGOs, pendent consultants, natural history museums, botanic gardens, and other projects. Suggested starting points for sourcing international expertise are d in Figure 3.3. An individual's competence may be judged based on employment history, experience record, publications record, and professional references. re 3.4 provides lists professional societies, membership of which may provide some indication of the competence.

Figure 3.3 Starting points for sourcing international biodiversity expertise for EA

Suggested starting points include, *inter alia*:

·The World Bank (Implementing agency for investment projects under GEF - GEF TMs are usually based in REDs): Washington DC, tel: + 1 202 473 1000 *http://www.worldbank.org*

·Consulting firms specialising in the provision of biodiversity services (too numerous to list)

·International Biodiversity convention and financing secretariats:

- CBD Secretariat, Montreal, Canada, tel: + tel: + 1-514-288-2220 *http://www.biodiv.org/*
- Ramsar Secretariat (for wetlands), Gland, Switzerland, tel: + 41 22 999 0170 *http://www.ramsar.org*
- Bonn Secretariat (Migratory species), tel: +49 228 815 2401 *http://www.wcmc.org.uk/cms*
- CITES (Trade in endangered species), Switzerland, tel: + 41 22 917 8139/40 *http://www.wcmc.org.uk/CITES/eng/index.shtml*
- GEF Secretariat (Global Environment Facility), Washington DC, tel:+ 1 202 473 0508 *http://www.gefweb.org*

· UN agencies dealing with biodiversity:

- UNEP (Implementing agency for biodiversity enabling projects under GEF), Nairobi, tel: + 254 2 520 140 *http://www.unep.org (old) http://www.unep1.org (new)*
- UNDP (Implementing agency for biodiversity technical assistance projects under GEF), New York, tel:+ 1 212 906 5000 *http://www.undp.org*
- IPGRI (Plant genetic resources) , Rome, tel: + 39 0651892 *http://www.cgiar.org/ipgri/*
- FAO (Agricultural biodiversity), Rome, tel: + 39.0657051 *http://www.fao.org*

·International biodiversity NGOs

- IUCN-The World Conservation Union - including specialist Commissions, e.g. Species Survival Commission (with its numerous taxa- and habitat-based specialist groups, such as the Cat Specialist Group, and the Pheasant Specialist Group), World Commission on Protected Areas; contact IUCN HQ in Gland, Switzerland, tel:+ 41 22 999 0001 *http://www.iucn.org*
- The World Conservation Monitoring Centre (WCMC), Cambridge, UK, tel: + 44 1223 277722 *http://www.wcmc.org.uk*
- WorldWide Fund for Nature (International or national offices) - WWF-International office in Gland, Switzerland, tel: + 41 22 364 91 11 *http://www.wwf.org*
- BirdLife International (IUCN Specialist Group on Birds) - source of expertise on the status and conservation of birds worldwide, tel: + 44 1223 277318 *http://www.ibv.de*
- Conservation International, Washington D.C., tel: + 1 202 429 5660 *http://www.conservation.org/default.htm*
- World Resources Institute, Washington D.C., tel: + 1 202 729 7600 *http://www.wri.org*
- Wetlands International, Websites: (Wetlands International websites:
- Africa, Europe, Middle East: *http://www.wetlands.agro.nl/*
- Asia-Pacific: *http://ngo.asiapac.net/wetlands*
- Americas: *http://www.wetlands.ca/wia*
- Botanic Gardens Conservation International, (UK - Richmond, Surrey tel: + 44-181-332 5953/4/5; USA - Wayne, Pennsylvania tel: + 1 610 254 0334 *http://www.bgci.org/*
- Biowatch South Africa (a national NGO dedicated to monitoring and researching the implementation of South African obligations towards the CBD) *http://www.geocities.com/biowatchsa/index.html*

·Biodiversity Networks

The UK Biodiversity and Development Support Network financed by the UK Department for International Development - maintains a roster of biodiversityand development specialists - both individuals and institutions. Most of those listed are British, however the desire is to expand the network to include specialists from developing countries. This is maintained by the World Conservation Monitoring Centre, Cambridge, UK. *(http://www.wcmc.org.uk/biodev This site is currently being revised)*

- Catalogue of European Biodiversity Resarch Organisations, provided by EC Research Directorate-General
- Canadian Biodiversity Information Network (CBIN) *http://www.cbin.ec.gc.ca/cbin.html*
- Red Mexicana de Información sobre Biodiversidad (REMIB) Mexican Network of Biodiversity Information
- United States Organisation for Biodiversity Information (US-OBI) *http://biodiversity.uno.edu/usobi*

· Internationally renowned zoological institutes, botanic gardens, natural history museums, e.g.:
- Smithsonian Institute (US) tel: +1 202 357 2700 *http://www.si.edu*
- American Natural History Museum Center for Biodiversity and Conservation
- Zoological Society of London (UK) tel: + 44 20 7449 6262 *http://www.zsl.org*
- Royal Botanic Gardens Kew (UK) tel: + 44 20 8332 5000 *http://www.rbg.kew.org.uk*
- British Natural History Museum (UK) tel:+ 44 20 7942 5000 *http://www.nhm.ac.uk*
- Smithsonian Tropical Research Institute (Panama) tel: + 1 507 212 6000 *http://www.stri.org*
Alexander von Humboldt Biological Resources Research Institute (Colombia) tel: + 57 1 3383900 ext *338 www.humboldt.org.co/default-ing.htm*
- Indian Institute of Science, Centre of Ecological Sciences (Bangalore, India) *tel: + 91 80 3600985 http://www.iisc.ernet.in/*
- National Institute of Biodiversity (Costa Rica) tel: +506 244 0690 *www.inbio.ac.cr/en/default.html*
- Royal Ontario Museum Centre for Biodiversity and Conservation Biodiversity tel: +1 416 586 8059 *http://www.rom.on.ca/biodiversity/cbcb/*
- Tropical Data Base (BDT - Andre Tosello Foundation, Brazil) tel: +55 19 2427022 *http://www.bdt.org.br*
- Australian Environmental Resources Information Network
- Chinese Biodiversity Information Centre
- National Botanical Institute (Kirstenbosch, South Africa)
·University departments with an international reputation in biodiversity related subjects
Edward Grey Ornithological Institute, Zoology Department, Oxford University. Tel: + 44 1865 271234
http://units.ox.ac.uk/departments/zoology/orniandbehav/egi.html
- Rutgers University Biodiversity Center, The State University of New Jersey tel: +1 908 932 9890 *http://aesop.rutgers.edu/~biodiversity/*
- Uconn Center for Conservation and Biodiversity, University of Conneticut tel*:* +1 860 486 4059 *http://darwin.eeb.uconn.edu/ccb/ccb.html*
- Onderzoekschool Biodiversiteit Research School, University of Amsterdam tel: + *31 20 525 6635 http://www-biodiv.bio.uva.nl/default.html*

Figure 3.4 Professional societies and memberships for biodiversity specialists

The following is a small selection of international and UK societies - comparable societies exist in other countries:
· IUCN Commissions - e.g. Species Survival Commission, World Commission on Protected Areas, Commission on Ecosystem Management
· International Association for Impact Assessment (IAIA) - includes biodiversity specialists as well as many other types of EA specialist *http://www.iaia.org/*
· International Society of Ecological Economics (ISEE) *http://www.ecologicaleconomics.org/*
· Association for Environmental and Resource Economists *http://www.aere.org/*
· International Society of Tropical Foresters *http://www.umich.edu/~uofmistf/*
· The Association for Tropical Biologists *http://atb.botany.ufl.edu/index.html*
· World Association of Wildlife Veterinarians
· Smithsonian Institute
· Association of Natural Resources Enforcement Trainers *http://www.birdid.com/anret/*
· Institute of Environmental Management and Assessment, UK (IEMA) *http://www.greenchannel.com/iea/*
· Institute of Biology, UK *http://www.iob.org/*
· British Ecological Society, UK *http://www.demon.co.uk/bes/*
· International Association of Bryologists, USA (IAB) *http://www.devonian.ualberta.ca/iab/*
· The Ecological Society of America *http://www.sdsc.edu*
· Soil and Water Conservation Society *http://www.swcs.org/*
· The American Institute of Biological Sciences (AIBS) *http://www.aibs.org/core/index.html*
· Society for Conservation Biology, USA *http://www.conbio.rice.edu/scb/*
· Botanical Society of America, USA *http://www.botany.org/*

3.3 IDENTIFICATIONS OF IMPACTS

Update no.20 points out that the effective integration of biodiversity conservation in World Bank projects requires that potential impacts on biodiversity be identified during the screening and scoping stages, and that this can greatly improve the efficiency of subsequent data collection and management. The review of recent experience (Part 3) reinforces the importance of the accurate identification and prediction of impacts at this stage of the process, and of translating this 'scoping' into coherent terms of reference (TORs) and schedules for undertaking the work.

3.3.1 How to carry out initial identification of biodiversity impacts during screening - using biodiversity criteria

The initial identification of biodiversity impacts should take place during screening. To ensure that projects having impacts on biodiversity are subjected to EA, it is important that screening includes biodiversity criteria. Suggested criteria, derived from the text of the CBD, are given in Figure 3.5 and Figure 3.6.

A project's spatial context is also important in screening, and projects, programmes or policies proposed in areas in or adjacent to critical habitat (which may or may not be designated as a protected area) should be subjected to full EA or regional environmental assessment. It is important also to identify impacts on wide-ranging species that rely on various habitats (Bagri, McNeely & Vorhies 1998) and on dispersed species, such as most birds of prey.

A number of attempts have been made to list the ecological impacts associated with various types of projects. At best, such lists serve as an *aide memoire*. It is vital to consult a professional ecologist at this stage. Professional ecologists who are regularly involved with EA can quite quickly identify the likely significant impacts of any type of project if reasonably familiar with the landscapes, ecosystems and species in the project location.

Figure 3.5 Suggested biodiversity criteria (derived from the text of the CBD) for screening and scoping

EA should address projects which (directly, indirectly, or cumulatively):

Article 8 In-situ conservation

- impact on an established protected area;
- impact on biological resources important for the conservation of biological diversity (see Figure 3.6);
- impact on attempts to protect ecosystems or promote the recovery of threatened species;
- release living modified organisms resulting from biotechnology which may have adverse environmental impacts (this is often difficult to predict - it is perhaps best to adopt the precautionary principle is any such release is anticipated);
- present risks to human health;
- introduce alien species which threaten ecosystems, habitats, or species;
- impact on the knowledge, innovations, and practices of indigenous and local communities embodying traditional lifestyles;
- impact on attempts to conserve components of biodiversity in an *ex situ* context;
- impact on measures being taken for the recovery and rehabilitation of threatened species and/or their reintroduction into natural habitats;

Article 10 Sustainable Use of Biological Diversity

- impact on the attempts of local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced;

Article 12 Research and Training

- impact on research which contributes to the conservation and sustainable use of biodiversity;

Article 15 Access to Genetic Resources

- impact on the sovereign right of states over their biological resources and their authority to determine access to genetic resources;
- impact on endeavours to facilitate access to genetic resources for environmentally sound uses;
- impose restrictions that run counter to the objectives of the CBD.

(Adapted from: Bagri, McNeely & Vorhies 1998)

Figure 3.6 Biological resources important for the conservation of biological diversity

These may include:

Internationally, regionally, nationally or locally designated protected areas, or areas under consideration for designation;
Ecosystems or habitats which fall wholly or partly within an internationally, regionally or nationally identified 'biodiversity hotspot' (including 'megadiversity sites', 'zones of extinction', 'centres of endemism', 'endemic bird areas', 'important bird areas', etc.);
Primary habitat or secondary, semi-natural habitat;
Populations of one or more threatened, restricted range, endemic, or protected species;
Populations of one or more species of social, economic, cultural or scientific importance;
Populations of one or more species containing genetic material of potential social, economic, cultural or scientific importance.

3.3.2 How to focus on important biodiversity impacts during scoping: four important principles

The impacts which are to become the focus of a full assessment are identified in the scoping stage. Bagri, McNeely and Vorhies (1998) identify four important principles which should be considered at this stage for the effective treatment of biodiversity: biodiversity criteria, spatial context, cumulative effects, and public participation:

1. Biodiversity criteria (Figures 3.5 and 3.6) should again be employed at the scoping stage to ensure that all potential impacts are taken into account.

2. Time and spatial parameters of the study are defined in scoping and it is vitally important to the long term viability of biodiversity that these definitions consider ecological processes and components such as migratory or nesting patterns for birds, in order to provide a regional context for the impacts. *Update* no. 20 stresses the importance of using maps and/or GIS in determining the spatial context of the project and in relating proposed development actions and their potential impacts to natural habitats and ecosystems.

3. Projects may have direct, indirect, secondary, cumulative, short-, medium- and long-term, permanent & temporary, positive and negative impacts. Particular attention needs to be paid to cumulative impacts in the treatment of biodiversity in EA - that is the added effect of the project taken with other existing and proposed activities.

4. The scoping should entail discussions and consultations with interested parties to gather background information and to ensure that the different issues and concerns raised by the various groups are considered (Roe, Dalal-Clayton & Hughes, 1995). A process of meaningful participation at the scoping stage can help avoid misunderstandings and costly mistakes. Meaningful participation requires the dissemination of adequate information on the proposed project through appropriate media. For the purposes of the treatment of biodiversity in scoping, consultations should engage, in addition to the biodiversity experts on the EA team, local communities, regulatory authorities, decision makers and outside experts from a variety of disciplines including ecology, economics and sociology (see *Update* no. 5).

3.3.3 How to focus on important biodiversity impacts during scoping: methods for impact identification

Impact identification is a continuous process which occurs during screening and scoping and continues through impact prediction as new information becomes available and insights are obtained. A systematic and rigorous approach to identifying impacts can be based on the following methods:
checklists;
interaction matrices;
flow diagrams or networks; and
overlay mapping/GIS.

Each has advantages, drawbacks and potential application in other EA tasks. They can be used in combination as well as singly; for example, a matrix can be used to identify direct impacts which in turn can be used as a basis for constructing networks. The following text on these methods is adapted from *Update* no. 16.

Checklists

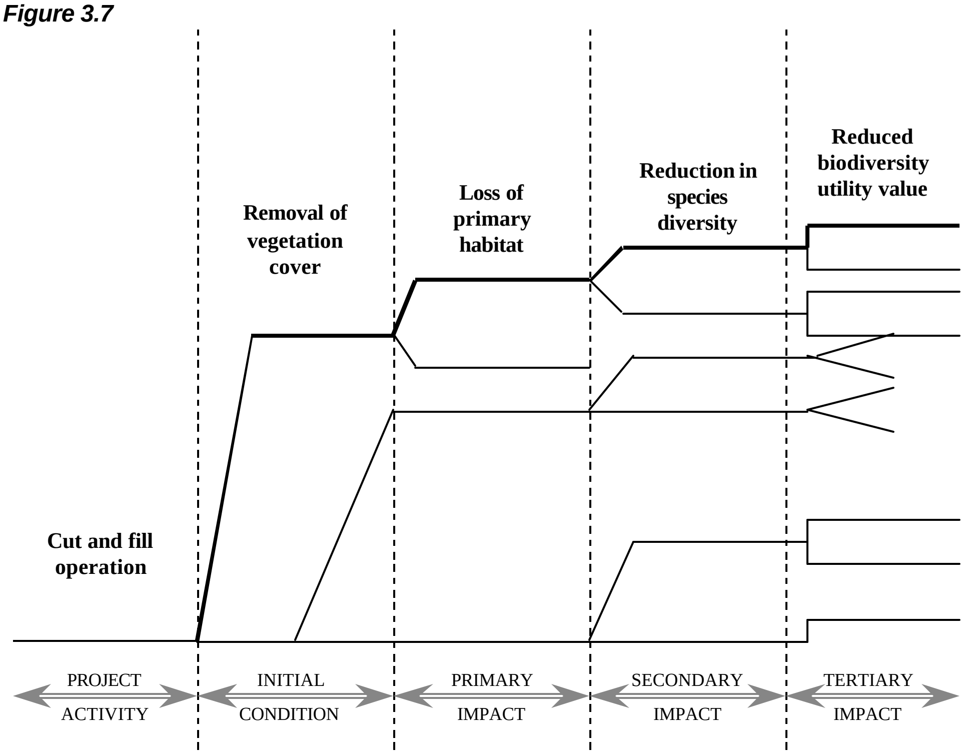
Checklists for biodiversity impact assessment may be simple lists of biodiversity factors including status and trends in biodiversity (including trends in the composition, structure and function of biodiversity at each level - landscape,

ecosystem, population/species, genetic), uses of and pressures on biodiversity, and responses (measures taken, capacities) for biodiversity conservation and sustainable use (See 3.4.1, and Annexe 1).
Alternatively, checklists may list both these biodiversity factors and development actions likely to cause impacts. By systematically comparing these lists, likely impacts are identified. Alternatively, checklists listing the typical impacts of specific project types on biodiversity may be derived from more general checklists of environmental impacts, which are easily available (provide references - especially those useful for developing countries).

Interaction Matrices
A matrix is a diagram which links biodiversity features (as above) or potential impacts on these features, with actions associated with the proposed project. Matrices may be constructed before scoping, and used to guide scoping sessions with participants discussing the significance of proposed actions for biodiversity features. The decision is recorded by marking the Figure representing the intersection between an action and a biodiversity feature. While it should be used with other tools and should not be relied on alone, the completed matrix assists in determining required EA work and can be updated as necessary. One difficulty with matrix methods is the inability to clearly identify the links between impacts. This is of particular concern for biodiversity impact assessment, where indirect or cumulative impacts may often be more significant than direct impacts.

Flow diagrams and networks
The network, or flow diagram, can be used to identify the links between different biodiversity impacts and the ways in which biodiversity may be affected by more than one impact "pathway". A generic structure is shown in Figure 4.7. Networks may be partially constructed in advance of scoping sessions or they can be "built up" as part of the session. Once constructed, they provide a framework to guide EA work and can be updated or amended as work progresses.

Example of generic structure for network
Figure 3.7



(Source: World Bank 1996a)

Overlay mapping/GIS

To use overlay maps it is necessary to prepare maps that show the position, nature and extent of biodiversity and human attributes of an area. Attributes which may be mapped include biodiversity status and trends (e.g.. habitat types, concentrations of threatened, rare or endangered species, or changes in these over time), pressures and uses (e.g.. forest management regimes, human population densities, visitor concentrations, etc.), and responses (protection areas, locations of species recovery programmes, locations of existing conservation projects, distribution of wildlife staff, current expenditure on conservation actions per unit area, etc.). The features mapped should be those expected to be most sensitive to the project. Individual transparency maps are overlaid to provide a composite picture of the state of biodiversity in the area, of pressures on or uses of biodiversity, and of existing measures for the conservation and sustainable use of biodiversity. If available, computer technology and relevant expertise allow overlay mapping to be incorporated within a Geographic Information System (GIS) (further details of GIS methods are provided in *Update* no. 3 *Geographic Information Systems for Environmental Assessment and Review* and no. 9 *Implementing Geographic Information Systems in Environmental Assessment*). Interpretation skills and ground truthing are essential if GIS is to be used.

Direct and indirect impacts can be identified, broadly and generally, by superimposing a map showing the proposed development (with required infrastructure such as roads and transmission lines) and associated projects onto the composite map. Overlay maps are useful for identifying impacts on biodiversity and comparing alternatives for all types of development, and achieve most usefulness for EAs of linear developments (pipelines, roads and transmission lines) and multiple investments or activities resulting in cumulative impacts.

3.3.4 Impact prediction

Prediction is a complex activity: *Update* no. 16 proposes the following techniques which may be used to quantify the nature, magnitude and significance of impacts:

mathematical models (such as noise propogation models, air or water dispersion models, income multipliers);
physical models (such as wind tunnels and hydraulic models of, for example, estuaries);
field experiments ;structure or semi-structured approaches to produce a mix of qualitative and quantitative predictions (e.g. landscape change and social impacts); and scientific experience and judgement.

Most EAs use a mixture of these techniques - many appear to rely heavily on the latter two.
Prediction must also provide information on the following aspects of impacts:

- duration (time period over which they will occur);
- likelihood or probability of occurrence (very likely or unlikely, etc.);
- reversibility (natural recovery or aided by human intervention);
- area affected (size and whether near or far from the project);
- number (and characteristics) of people likely to be affected and their locations;
- transboundary aspects - do impacts cross national borders?

Where a specific natural habitat is subject to a range of impacts, the cumulative impact must be identified and evaluated. Collation of information on individual impacts will therefore help assessors determine the geographic overlap of impacts and identify their relative spatial and temporal distribution, through the use of a GIS for example.

Impact prediction within an EA is also vital for ensuring the sustainability of a project. Feedback loops within a project cycle can occur, through which the sequence of events caused by a project can ultimately affect it. Early warning of possible threats, and initiation of measures to prevent or reduce their severity can therefore reinforce a project's sustainability.

3.3.5 Maintaining focus on biodiversity impacts in the full EA - how to translate scoping into coherent TORs for baseline studies and analytical work

When scoping indicates a need for further assessment of biodiversity impacts, it is important to 'translate' the scoping results into coherent terms of reference (TORs) and schedules for undertaking this work. *Update* 16 states that:

"…scoping should therefore normally precede development of detailed TORs for the involvement of (biodiversity) expertise in the EA or, alternatively, be an integral part of preparing the TORs. Experience shows that TORs "ground-truthed" through scoping are more focused on the key environmental issues and risks than desk-based TORs, which tend to demand coverage of all issues. Too often, such TORs result in production of voluminous and unfocused EA reports. Since the outcome of the scoping (for example, a short report or a TOR) may significantly influence the focus and cost of any further EA work, it should be subject to review by the Bank and Borrower prior to proceeding with any such work."

Site visits are essential for accurate scoping.

Care should be taken to ensure that all relevant issues are addressed by the TORs, with focus on those key impacts identified at the scoping stage. Le Maitre & Gelderblom (1998) propose a list of key questions, organised according to the principle *components* (compositional, structural, functional) and *levels* of biodiversity (landscape, habitat, population/species), that might be considered for inclusion in the TORs. Their list, however, addresses only the 'state' of biodiversity (current status and trends), and does not address 'uses' of or 'pressures' on biodiversity (causes of change) or 'responses' (programmes and projects, human resources, legislation, institutions, financing). The Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) of the CBD is developing a core set of indicators of biological diversity, which include state, use, pressure and response indicators (SBSTTA 1998) (See 3.4.1 and Annex 2). These might serve as a more comprehensive framework for the development of questions to be addressed within TORs. Alternatively, reference can again be made to relevant Articles of the CBD (Figure 3.5), to ensure that all relevant issues are covered in the TORs.

3.4 COST-EFFECTIVENESS IN BASELINE STUDIES

The review of recent experience (Part 3) highlights the need to use appropriate methodology to assess status and background trends in biodiversity, potential impacts, and the importance of providing a clear description of the methodology employed in the EA document. It also highlights the importance of allowing enough time and resources to identify temporal variations in biodiversity, including diurnal, seasonal and year-to-year variations. And the importance of extending the focus beyond the current bias towards forest habitats, protected and pristine areas towards other habitats including wetlands, tundra, grassland, desert and semi-desert. There are many ways in which baseline studies can be accelerated and costs minimised while meeting these demands. Effective screening and scoping (as outlined above) prevents the wastage of time and money on the gathering of irrelevant data. Below, guidelines are given on the types of data worthy of consideration, effective use of secondary data, and methodologies for the collection of new, primary data (including rapid appraisal methodologies).

3.4.1 Data worthy of consideration

Scoping will have identified potential impacts and their relative importance. The next step is to gather baseline data to investigate, verify and elaborate these potential impacts. These data will be based on information provided by consultees, background (secondary) sources of information, and the results of new site-specific surveys (primary data collection). The description of baseline biodiversity conditions is vitally important for subsequent stages of the EIA. Again, the aim is not to produce a voluminous document providing a comprehensive assessment of all aspects of biodiversity related to the proposed project, but to produce an assessment focused on the key impacts and risks. *Update* no.20 stresses that the relevance of the data is much more important than the amount, particularly as time and resources for data collection are typically constrained.

The CBD again provides a useful universal framework incorporating all types of biodiversity information worthy of consideration, as follows:

the status and trends of biological diversity (composition, structure, function) at each level (landscape, ecosystems, species/populations, genes); the causes of biodiversity loss or the effects of processes or categories of activities which have or are likely to have significant adverse impacts on biological diversity;
the effectiveness of current measures (ie. pre-project measures) taken for biodiversity conservation and sustainable use.

The potential scope of relevant data is thus wide and complex. As stated in *Update* no. 20, "Biodiversity experts working on EAs have a responsibility to ensure that they exercise best professional judgement as to the minimum data needed to characterise the environment and to make defensible impact predictions. The challenge is to produce sufficiently detailed impact analysis in the face of: insufficient data; inadequate knowledge of the affected ecosystem(s), habitat(s), or species; and uncertainties over cumulative impacts."

If suitable biodiversity indicators were available, this would facilitate less costly and time-consuming assessments. The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), the expert advisory body of the CBD, is currently working towards a *core set of biodiversity indicators* for the assessment and monitoring of biological diversity, with the aim that a 'fast track' set of indicators are available by 2000 (UNEP 1997). Further details on this are given in Annex 2.

3.4.2 How to make effective use of secondary data

Baseline studies normally involve both the review of relevant secondary data, and the collection of new (primary) data. The review of relevant secondary data should be both thorough and judicious. Secondary data should be from recent and reliable sources, and any gaps or deficiencies in the data or the methodology used to obtain it should be highlighted. Older secondary data may be of value, but the age of the data should be taken into account in assessing its relevance - for example, old data on species presence and abundance must be updated to be of much value. Care should be taken, in particular, with species lists, which should be cross-checked for reliability against standard reference handbooks on species distribution. Most professional ecologists will be able to make a rapid judgement on the reliability or otherwise of such checklists.

The *potential* scope of relevant secondary data is wide, including, as detailed above, data on status and trends of biodiversity, pressures on biodiversity (causes of changes), uses of biodiversity, and responses/capacity for the conservation and sustainable use of biodiversity. However, screening and scoping will have narrowed in on the focus of the assessment with regard to biodiversity, this focus will have been reflected in the TORs, and consequently the *actual* scope of relevant secondary data will be narrowed, with resulting savings in time and cost.

Most assessments will require access to information on priority areas for the conservation of biological diversity. Attempts to maintain in-house data in the Bank have been patchy. The Bank's Regional Environmental Units are required to maintain lists of biodiversity hotspots or critical habitats, and examples are provided by the *Critical Natural Habitats in Latin America and the Caribbean* (Latin American and Caribbean Environmental Division) and work in progress to update the list of Protected Areas of the Indo-Malayan Realm. An online biodiversity information system has been developed but is DOS-based: new Bank IT procedures mean that access to such third party software requires specific clearance. There is as yet no systematic procedure within the Bank for cross-checking priority areas, and reference must be made to a number of external sources.

Potential institutional sources of secondary data are given in Figure 3.8 and useful web site addresses are given in Figure 3.9. *Update* no. 20 provides a list of some of the key publications providing data of potential relevance, and this list is elaborated below in Figure 3.10.

Also of frequent relevance is data on biodiversity impacts of similar projects at similar scales implemented in similar habitat types elsewhere. Many studies have been carried out of the biodiversity impacts of particular types of development projects (e.g.. of roads, dams, pipelines) in various ecological environments (e.g.. rainforest, tundra, wetlands). Care should be taken to review best practice studies in order to identify impacts and assess their potential significance. Important sources include the academic press relating to biodiversity and to environmental assessment, and the proceedings of conferences of relevant organisations such as the International Association for Impact Assessment (IAIA) and IUCN-The World Conservation Union (http://www.economics.iucn.org).

Figure 3.8 Institutional sources of secondary data on biodiversity

World Bank Environmental and Geographic Information Systems team (ENGIS) in the Bank's Environment Department;
International and local conservation NGOs - publications and web-based services - e.g.. IUCN SSCs, WCMC, WWF, BirdLife, Conservation International, Wetlands International, World Resources Institute;
International biodiversity-related convention secretariats - for publications and web-based services (CBD, CITES, Ramsar, Bonn, World Heritage…);
Multilateral commissions and secretariats (e.g.. GEF Secretariat, CBD Secretariat, UNEP) - for grey literature (policy documents, reports and studies), databases;
Government agencies (e.g.. environment, forest, fisheries, wildlife, agriculture departments) - for grey literature, databases;
International and local academic institutions working on biodiversity - for unpublished theses and research, collections;
International and local natural history museums, botanic gardens and zoological societies - for collections and field research reports.

Figure 3.9 Key web sites for biodiversity information

There are numerous websites with biodiversity information - the following is a sample of some of the most usefull:
Clearing House Mechanism (CHM) of the CBD - http://www.biodiv.org/chm/
Biodiversity Conservation Information System (BCIS) - http://www.biodiversity.org - provides a guide to available biodiversity information
Bionet website at http://www.bionet-us.org/. Bionet (the Biodiversity Action Network) is an NGO network that aims to strengthen biodiversity law and policy and inform the environmental community and others about biodiversity issues.
The International Institute for Sustainable Development website at http://iisd1.iisd.ca/ has good links to other useful biodiversity websites
Economics of biodiversity website http://biodiversityeconomics.org/
Biodiversity Information Network 21 (BIN21) http://www.bdt.org.br/bin21/bin21.html
World Resources Institute Biodiversity Website http://www.wri.org/wri/biodiv/biodiv.html
Inter-American Biodiversity Information Network (IABIN) http://www.nbii.gov/iabin/
Association for Biodiversity Information (for Central, North and South America) - http://www.abi.org
Nature Conservancy's Heritage Site - http:// www.heritage.tnc.org
OECD Biodiversity Site - http://www.oecd.org/ehs/icgb/biodiv.htm
Internet Biodiversity Service - http://ibc.uel.ac.uk/ibs
Biodiversity and Biological Collections Webserver - http://www.biodiversity.uno.edu/
DIVERSITAS (An international Programme of Biodiversity Science) http://www.icsu.org/diversitas/
BIOSIS and the Zoological Society of London - Internet Resources Guide for Zoology - http://www.york.biosis.org/zrdocs/zoolinfo/biodiv.htm has a large number of links

Figure 3.10 Key biodiversity publications

Protected areas, critical habitats, biodiversity hotspots, centres of endemism, etc.

· IUCN. 1994. *United Nations List of National Parks and Protected Areas*. World Conservation Union, Gland, Switzerland.

· IUCN. 1994. *Guidelines for Protected Area Management Categories*. World Conservation Union, Gland, Switzerland.

· WCMC 1997 *Protected Area Systems Review of the Indo-Malayan Realm* World Conservation Press, Cambridge, UK

· World Conservation Monitoring Centre (WCMC) 'Biodiversity Map Library', *http://www.wcmc.org.uk*

· National Biodiversity Action Plans, National Conservation Strategies, National Environmental Action Plans, National Reports to the CBD Conference of the Parties

· BirdLife International. 1992 *Putting Biodiversity on the Map: Priority Areas, Global Conservation,* BirdLife International, Cambridge, UK.

· BirdLife International. (ongoing) - series on *Important Bird Areas: Priority Sites for Conservation* (Europe, Middle East), BirdLife Conservation Series, BirdLife International, Cambridge, UK

· Mittermeier R.A., Goettsch Mittermeier C, Myers N. and Robles Gil P. 1999. *Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecosystems*. CEMEX, Mexico.

· WWF-International. 1999 *Global 200 Ecosystems: The Geographic Setting*, Report by WWF-International, Switzerland.(http://www.worldwildlife.org/global200/spaces.cfm)

· Mittermeier R.A., Goettsch Mittermeier C and Robles Gil P. 1997*. Megadiversity: Earth's Biologically Wealthiest Nations*, Cemex, Mexico.

· WWF and IUCN (Hamilton A). 1994-97. *Centres of Plant Diversity A Guide and Strategy for their conservation*. 3 volumes. IUCN Publications, Cambridge, UK.

· World Bank/WCMC. 1998. *Critical Natural Habi tats in Latin America and the Caribbean*. Draft. World Bank, Latin American and Caribbean Environmental Division.

· Directory of Ramsar Sites/lists of important wetlands

· Marine Biodiversity: World Conservation Monitoring Centre *http://www.wcmc.org.uk/marine/data/*

· Marine Biodiversity: World Resources Institute *http://www.wri.org/biodiv/marihome.html*

· Marine Biodiversity: DIVERSITAS *http://www.icsu.org/DIVERSITAS/Plan/pe7.html*

Threatened species, rare species, endemics

· Bailie & Groombridge (eds) 1996 IUCN Red List of Threatened Animals.

· Collar, N.J., Crosby, M.J. and Stattersfield, A.J. (1994) Birds to Watch 2. BirdLife International, Cambridge, UK.

· IUCN. 1997. *The IUCN 1997 Red List of Threatened Plants*. IUCN, Gland, Switzerland.

· WRI Millennium Assessment (in progress)

· IUCN SSC's Species Action Plans. IUCN, Gland, Switzerland.

· Numerous handbooks and field guides - useful listings can be obtained from the Natural History Book Service, UK (*http://www.nhbs.com*)

Global biodiversity overviews

· Heywood (ed) 1995. *Global Biodiversity Assessment*. CUP (commissioned by UNEP)

· Wilson (1998) *Biodiversity* National Academy Press.

Other

· Gordon, S. & Tunstall, D. 1996. *World Directory of Country Environmental Studies*. IIED, London, UK. (A product of INTERAISE, a joint project of IIED, WRI and IUCN - provides a guide to the content and availability of hundreds of national and regional environmental and natural resource profiles including coverage of biodiversity - also available on diskette).

· Brown, J.H. & Lomolino, M.V. 1998. *Biogeography.* Sinauer, 2nd edition.

· Cox, C.B. and Moore, P.D. 1999. *Biogeography - An Ecological and Evolutionary Approach*. Blackwell Science

Useful Journals

Oryx, Biological Conservation, Biodiversity and Conservation, Systematic Biology, Ambio, Conservation Biology, Conservation Ecology, Environmental Conservation, Environmental Research, The International Journal of Sustainable Development and World Ecology, Journal Environmental Sciences, Natural Areas Journal, Society and Natural Resources, Journal of Animal Ecology, Journal of International Wildlife Law and Policy.

3.4.3 How to gather new (primary) data: cost-effective and time -saving methodologies

Primary data may be gathered through direct methods (e.g.. transect sampling) or indirect methods (e.g.. anecdotal information from hunters or fishermen on species caught). A large number of useful reference works exist on the range of assessment methods available for the collection of primary data on biodiversity and more specifically on effectively accessing local knowledge - some key references are given in Figure 3.11.

It is vital to select robust methodologies for data collection to provide a sound basis for impact prediction. This includes providing for longer-term fieldwork to incorporate natural variability and seasonality elements. Ideally, this means providing for fieldwork over a period of more than one year and covering at least two breeding seasons for key species. This fieldwork should also be designed in such a way as to provide a basis for long-term monitoring, and every opportunity should be taken to build local capacity in data collection to provide the human resources for future monitoring.

Particular care should also be taken to identify and map spatial variation. Detailed sampling may be required to assess the variability of inherently diverse and patchy habitats such as coral reefs. Again, full use should be made of maps, and, where expertise is available, of remote sensing and GIS (see 1.3.3, and *Updates* nos. 3 and 9). Particular care should also be taken to identify and map spatial variation.Detailed sampling may be required to assess the variability of inherently diverse and patchy habitats such as coral reefs. Again, full use should be made of maps, and, where expertise is available, of remote sensing and GIS (see 1.3.3, and *Updates* nos. 3 and .9). Assistance may be sought within the bank from the GIS unit (in Dec), which is developing ann in-house database using ArcInfo (patended GIS software). Box 3.12 provides a list of useful reference materials on the use of mapping, GIS and remote sensing for ecological assessment.

For many species, it is not realistic or indeed necessary to obtain absolute figures for abundance. Figures on relative abundance (e.g.. relative density of the species in the project area compared with other known locations) may be equally useful for the purposes of biodiversity impact assessment. Relatively simple methodologies exist for establishing relative abundance, such as dawn call counting for pheasants.

Use may be made of particular taxa as indicators of overall diversity: birds or butterflies are frequently used as indicators of overall species diversity - evidence exists in some areas to support the assertion that where diversity is high in birds, it will be high in other taxa such as plants or mammals.

Figure 3.11 Key references on ecological assessment methodologies for baseline data collection

·Bibby, C., Hill, D. and Burgess, N. 1992. *Bird Census Techniques*. Academic Press, UK. (Immensely valuable for consultants engaged in species estimation).
·Brookshire, D., Thayer, M.A., Schulze W.D. & d'Arge R.C. 1982 Valuing public goods: a comparison of survey and hedonic approaches. *American Economic Review* 72, 165-178
·Buckland, S., Anderson, D., Burnham, K. & Laake J. 1993. *Distance Sampling: Estimating Abundance of Biological Populations*. Chapman & Hall, UK (First comprehensive treatment of distance sampling methods, notably point and line transects).
·Calabrese, E.J. & Baldwin L. 1993 *Performing Ecological Risk Assessment* Lewis USA
·Calabrese, E.J. & Kostecki P.T. 1992 *Risk Assessment and Environmental Fate Methodologies*. Lewis, USA
·Carter, J. (ed.) 1996. *Recent Approaches to Participatory Forest Resources Assessment*. Overseas Development Institute, UK.
·Casley, D.J. and Lury, D.A. 1987. *Data Collection in Developing Countries* Oxford University Press, Oxford, UK.
·Hawksworth, D (ed.) (1996) *Biodiversity: Measurement and Estimation*. Chapman Hall.
·Hillborn, R. & Walters, C. 1991. *Quantitative Fisheries Stock Assessment: Choice Dynamics and Uncertainty*. Chapman & Hall, UK.
·Heyer, R. et al. (eds.) (1994) *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Biodiversity Handbook Series 1*. Smithsonian IP, USA.
·HMSO (1996a) *Biodiversity Assessment: A Guide to good practice, Volume 1* HMSO.
·HMSO (1996b) *Biodiversity Assessment: A Guide to good practice, Volume 2 (Field Manual 1: Data and Specimen Collection of Plants, Fungi and Micro-organisms)*. HMSO.
·HMSO (1996c) *Biodiversity Assessment: A Guide to Good Practice, Volume 3 (Field manual 2: data and specimen collection of animals)*. HMSO.
·Institute of Environmental Assessment (ed.). 1995. *Guideline for Baseline Ecological Assessment*. Spon, UK. (Best practice guidelines for the UK).
·Krebs, C. 1996. *Ecological Methodology*. Addison Wesley Longman, UK. (Standard text for ecologists, presents statistical methodology).
·Magurran, A. 1996. *Ecological Diversity and its Measurement*. Chapman & Hall, UK. (Authoritative on guidelines for interpretation of biodiversity indices).
·Noss, R. (1990) Indicators for monitoring biodiversity: a heirarchical approach. *Conservation Biology* 4: 355-364.
·Peyster De, A and Day, K. 1998. *Ecological Risk Assessment: A Meeting of Policy and Science.* SETAC, USA.
·Schmitt, R & Osenberg, C. (eds.) 1996. *Detecting Ecological Impacts: Concepts and Applications in Coastal Habitats*. Academic Press, UK.
·Southwood, T. 1987. *Ecological Methods With Particular Reference to the Study of Insect Populations*. (2nd edn.) Chapman & Hall, UK.
·Spellerberg, I. 1994. *Evaluation and Assessment for Conservation: Ecological Guideline for Determining Priorities for Nature Conservation*. (Summarises large amount of material for scientific literature).
·Spellerberg, I.F. 1994 *Evaluation and Assessment for Conservation: Ecological Guidelines for Determining Priorities for Nature Conservation.* Chapman and Hall,USA.
·Sutherland, W. (ed.) *Ecological Census Techniques*. CUP, UK. (A major text covering the main techniques used by field ecologists).
·Sandu,S., Jackson, L., Austin, K., Hyland, J and Melzian B 1998 *Monitoring Ecological Conditions at Regional Scales*: Proceedings of the Third Symposium of the Environmental Monitoring and Assessment Program (EMAP). Albany, USA.
·Sayre, R. 2000 *Nature in Focus: Rapid Ecologist Assessment.* Island Press, USA
·Suter, G.W. 1993 *Ecological Risk Assessment,* Lewis USA
·Treweek, J. 1997. *Ecological Assessment*. Blackwell Science. (Explains assessment science, process and good practice).
·Wilson, D., *et al*. (eds.) (1996) *Measuring and Monitoring Biological Diversity: Standard Methods for Mammals. Biodiversity Handbook Series 2*. Smithsonian IP, USA.

(Adapted from: NHBS. 1999. *Environmental Assessment: A Buyer's Guide to Key Professional Literature*. Natural History Book Service, UK)

Figure 3.12 Useful references on mapping, GIS and remote sensing for ecological assessment

Goodchild, M., Parks, B & Steyaert, L. 1993. *Environmental Modelling with GIS*. OUP, UK.
Haines-Young, R, Green, D. & Cousins, S. 1994. *Landscape Ecology and GIS*. Taylor & Francis, UK. (Includes methodologies).
Johnston, C. 1997. *Geographic Information Systems in Ecology. Methods in Ecology Series.* Blackwell Science, UK. (Provides examples at scales of organisms to landscapes).
Miller, R. (ed.) 1994. *Mapping the Diversity of Nature*. Chapman & Hall, UK. (Applications of species and habitat mapping in conservation and development).
Sample, V. (ed.) 1994. *Remote Sensing and GIS in Ecosystem Management*. Island Press, USA. (Applies GIS and remote sensing to forest ecosystems).
Wilke, D, and Finn, G. 1996. *Remote Sensing Imagery for Natural Resources Monitoring: A Guide for First Time Users*. Columbia UP, USA. (Introduces principles and practices).

(Adapted from: NHBS 1999)

Rapid Appraisal Methodologies

In recent years, a number of rapid appraisal methodologies have been developed to reduce the time required and the cost of carrying out biodiversity surveys. Examples are given in Figures 3.13, 3.14 and 3.15.

Figure 3.13 Rapid Assessment Program (Conservation International)

The Rapid Assessment Program (RAP) is a multidisciplinary programme designed to conduct rapid and intensive surveys of ecosystems with high levels of biodiversity facing imminent threats. It is thus particularly applicable to the EA context. The program works by small RAP teams of expert international and host country tropical field biologists conducting first-cut assessments of the biological value of selected areas over a 3-4 week time period. The teams then provide conservation recommendations to local governmental agencies and NGOs, international policy makers, and conservationists based on the area's biological diversity, its degree of endemism, the uniqueness of its ecosystems, and its risk of extinction on a national and global scale. The RAP scientists record the diversity of selected indicator groups of organisms, and analyse this information in tandem with social, environmental and other ecosystem information to produce recommendations in a time-frame which suits managers and decision-makers. The results from the RAP are made immediately available on the internet and in preliminary reports. The final reports, with complete species lists, are generally published by RAP, within a year of each expedition.

Part of the RAP, the **Aquatic Rapid Assessment Program (AquaRAP)** is devoted to identifying conservation priorities and sustainable management opportunities in freshwater ecosystems in Latin America. Its mission is to assess the biological and conservation value of tropical freshwater ecosystems. AquaRAP is advised and directed by the AquaRAP Steering Committee, an international team of scientists from seven countries. The team developed, revised and now overseas a protocol and parameters for selecting sites for conservation action. For example, in Brazil, an AquaRAP team of international and Brazilian scientists uncovered an incredible diversity of fishes, plants, invertebrates and amphibians during their rapid assessment of the world's largest wetland, the Pantanal, in Mato Grosso do Sul, Brazil in August-September 1998.

(Source: http://www.conservation.org/)

Figure 3.14 BioRap - rapid assessment of biodiversity (the Australian BioRap Consortium)

BioRap is the name given to a methodology and a set of tools for rapid biodiversity assessment. It represents a planning tool for determining priority areas within a region for biodiversity protection. The BioRap project brought together scientists from four Australian organisations: Commonwealth Scientific and Industrial Research Organisation (CSIRO), Environmental Resources Information Network (ERIN), Centre for Resources and Environmental Studies (CRES), Great Barrier Reef Marine Park Authority (GBRMPA). Management of the BioRap project was coordinated by the World Bank and the project was financially supported by AusAID. The complete BioRap report consists of the *Guidelines for using the BioRap methodology and tools* plus a User's Guide consisting of four volumes:

1. *The BioRap biological database*
2. *Spatial modelling tools*
3. *Tools for assessing biodiversity priority areas (software tools)*
4. *Tools for storing and mapping spatial data*

Further information may be obtained from:
CSIRO Division of Wildlife and Ecology, PO Box 84, Lyneham, A.C.T. 2602, Australia, email: d.faith@dwe.csiro.au

Figure 3.15 New Approaches to Rapid Assessment

New approaches to cost-efficient rapid assessment of biodiversity require:

- An operational definition of biodiversity;
- A cost efficient, gradient-based sampling approach that is capable of detecting species ranges along underlying natural resource or land use intensity gradients (eg. rainfall seasonality, pristine and secondary forests, plantations and degraded lands);
- carefully calibrated sets of readily observable indicators of broad biodiversity pattern that can be used for baseline inventory and monitoring by persons with limited resources and experience;
- a generic and readily transferable method of rapid survey;
- a cost efficient means of spatially extrapolating and testing survey outcomes (eg. species distribution maps under different land use types);
- a theoretical and practical basis for coupling biodiversity with profitability;
- an understanding of the key determinants of plant and animal distribution;
- a ready means of communicating survey outcomes that can be used in decision support for adaptive management and policy intervention.

Recent developments in rapid biodiversity assessment (RBA) include a generic field proforma that enables the rapid recording of spatially-referenced site physical data, vegetation structure, vascular plant species richness and richness in plant functional types (PFTs) [combinations of adaptive morphological attributes that indicate plant response to varying levels of light, water and nutrients] (Gillison, 1988; Gillison and Carpenter, 1997). When used together with gradient-based transects or gradsects (Gillison and Brewer, 1985; Wessels *et al.,* 1998) this method is more efficient than purely systematic or random sample designs in recovering information about plant-animal distribution. Recent baseline studies using a standard sampling protocol with 40x5m strip transects along global, ecoregional gradients in Sumatra, Cameroon and Thailand have shown improvements in the complementary use of species and PFTs in estimating distribution patterns of certain key fauna and in forecasting impacts of land use on biodiversity (Gillison and Liswanti, 1999). The method is supported by user-friendly computer software for data collection and analysis (PFAPro, Gillison and Carpenter, unpubl.) and for potential mapping of species (DOMAIN: Carpenter *et al.,* 1993). Training workshops in various tropical countries(Cameroon, Indonesia, Thailand, Vietnam, Brazil, Peru) indicate the method is readily transferable to people with different cultural, research and management backgrounds.

(Source: pers. comm. Gillison 1999 - based on Carpenter, Gillison & Winter 1993, Gillison & Brewer 1985, Gillison 1988, Gillison 1999, Gillison and Carpenter 1997, Gillison and Liswanti 1999)

Using local anecdotal or other indirect information

Local anecdotal information can often provide a rapid and cost-effective means of narrowing down the study area for scientific field surveys. Figure 3.16 gives some potential sources of local anecdotal information. However, caution must be taken in the use of anecdotal data, and every opportunity taken to cross-check the data. Farmers, for example, may exaggerate abundance of animals that prey on livestock or damage crops, and under-estimate abundance of economically inconspicuous species. The same local name may apply to more than one species. There is a human tendency to exaggerate past abundance. Informants may simply aim to please the researcher, providing the information he/she thinks the researcher wants to hear, with little regard for the accuracy of the information conveyed. Informants may even have an unconscious or conscious intent to mislead, for various reasons. Anecdotal information should be cross-checked between informants, and confirmed wherever possible through scientific research.

Figure 3.16 Possible local sources of anecdotal information on biodiversity

local communities, user groups, e.g.. hunters, gatherers, farmers, pastoralists;
local NGOs, e.g.. birdwatching clubs, hiking clubs;
local sports clubs, e.g.. hunting, fishing, diving;
staff in local academic institutions, e.g.. zoologists, botanists;
local government officials - e.g.. wildlife and forest guards;
staff of other field projects in the area;
local markets - e.g.. for mammal and bird skins, fish caught in the region, identification of species with local use values.

3.4.4 How to evaluate biodiversity importance

Once adequate data have been obtained on biodiversity in the project area, it is necessary to evaluate the importance of this biodiversity against appropriate criteria. A number of documents propose criteria for the evaluation of biodiversity importance in developed countries, some focusing on sites of scientific interest (e.g.. Ratcliffe, 1977, Nature Conservancy Council 1989), others on species of importance (e.g.. English Nature 1994a), but these are mostly developed for developed country situations. Suggested criteria for developing country application are given in Figures 3.17 and 3.18.

Figure 3.17   Criteria for Evaluating Biodiversity Importance - Sites and Habitats

Biodiversity Hotspots

Does all or part of the area to be impacted by the project include one or more of the following 'biodiversity hotspots' (key references provided in parenthesis)?

· Stattersfield, A.J., Crosby, K.J., Long, A. J., Wege, D.C. 1998. *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*, BirdLife International

· Important Bird Area (BirdLife International. (ongoing) - series on *Important Bird Areas: Priority Sites for Conservation* (Europe, Middle East), BirdLife Conservation Series, BirdLife International, Cambridge, UK

· Centres of Plant Diversity A Guide and Strategy for their conservation. (1994-97. 3 volumed IUCN Publications. Cambridge, UK.)

· WWF Global 200 Ecosystems (1999 *Global 200 Ecosystems: The Geographic Setting*, Report by WWF-International, Switzerland)

· Critical natural habitat (World Bank refs?)

· Zone of extinction (World Bank/WWF ref?)

· Megadiversity site (Mittermeier R.A., Goettsch Mittermeier C and Robles Gil P. 1997. *Megadiversity: Earth's Biologically Wealthiest Nations*, Cemex, Mexico.)

· other internationally recognised hotspots for biodiversity

Internationally recognised protected area or sites with internationally protected species

Does all or part of the area to be impacted by the project include one or more of the following internationally designated protected areas?

· World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage)

· Biosphere Reserve (UNESCO Man & Biosphere Programme)

· Ramsar Site (Wetland designated under the Ramsar Convention)

· Sites hosting species listed under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals)

· Sites hosting species listed under CITES (Convention on Trade in Endangered Species)

· Sites otherwise recognised to be of importance for biodiversity, e.g. among the international scientific community, or in national lists of threatened species.

Presence of habitat of regional, national or local importance

Does all or part of the area to be impacted by the project (including its zone of influence) include:

· one or more areas designated as a protected area under regional or national legislation or agreement, and warranting recognition within an IUCN protected area category?

· one or more areas *not* designated as a protected area, but otherwise recognised in policy documents and/or by the scientific community as of regional or national importance for biodiversity?

Other Does all or part of the area to be impacted by the project include previously unknown/unrecognised biodiversity of international, regional, national or local importance?

Does all or part of the area to be impacted by the project include previously unknown/unrecognised biodiversity of international, regional, national or local importance?

Figure 3.18 Criteria for Evaluating Biodiversity Importance - Species and genes

Presence of species of international, regional or national importance

Does all or part of the area to be impacted by the project include one or more populations of Red data Book species, or of species listed as protected in national legislation or under regional agreement , or of species otherwise considered to be of economic, cultural, scientific or intrinsic value?

Presence of genes of international, regional or national importance

Does all or part of the area to be impacted by the project include one or more populations of one or more species containing genetic material of recognised biodiversity importance, e.g.. as wild relatives of domesticated livestock or crops, or as source of medicinal products?

3.5 EVALUATION OF IMPACT SIGNIFICANCE

The review of recent experience (Part 3) highlights the need to ensure a rigorous impact analysis. An important step in this analysis is to provide relevant details of the proposed development, sufficient to permit readers to assess the adequacy of the impact analysis without recourse to other documentation. Analysis of alternatives is also particularly important in the effective treatment of biodiversity in EA.

3.5.1 Evaluation of Significance

Update no.20 states that, in helping to evaluate impacts, the umbrella question "*What is the significance of these impacts*?" should be addressed. *Update* 16 points out that quantifying impacts is an objective, technical task whereas evaluating significance is subjective and political.

To evaluate the significance of impacts on biodiversity, questions should be asked about the intrinsic, utility, functional and structural values of biodiversity affected by the project. Consideration should be given to the potential significance of impacts on composition, structure and function of biodiversity at the four levels of landscape, habitat/ecosystem, species/population, and genes. The list of key questions proposed by Le Maitre & Gelderblom (1998) (see **Annex 1**), suggested for use at the scoping stage, is again helpful here in considering the range of potential impacts on the status of biodiversity. Consideration should also be given to the potential significance of impacts on existing uses of, and pressures on, biodiversity, and on existing measures for the conservation and sustainable use of biodiversity. Biological systems, human uses and pressures on these systems, and measures taken in response to these pressures, are all dynamic - that is they change over time. The proposed development project will alter these dynamics.

A summary of good impact prediction and assessment practice is given in Figure 3.21. Figure 3.22 provides some questions to consider when analysing effects on biodiversity. Familiarity with key ecological concepts is important in the prediction of impacts, and a number of the more relevant concepts are briefly defined in Figure 3.23.

For biodiversity, assessment of the significance of cumulative effects of a project or program is of particular importance. This will include looking at interactions among effects the project itself may have, as well as interactions with the effects of other existing or proposed projects and programs. The same methodologies listed above may be applied and examples of methodologies are discussed in detail in the *Cumulative Effects Assessment Practitioners Guide* (CEAA, 1998) (available on the CEAA website at (*http://www.ceaa.gc.ca*). However, it is not always possible to consider cumulative impacts at the project-specific level and they may be better addressed at a more strategic level.

Figure 3.21 Summary of good impact prediction and assessment practice

If possible, present the magnitude or physical extent of predicted impacts in quantifiable terms, e.g.. areas of land taken, percentage of habitat lost or number of communities, species or individuals affected. Place these in international, regional, national or local context where appropriate.

Consider favourable impacts, direct, indirect, induced, cumulative impacts, interactions between environmental, social and economic impacts; indirect impacts may often be more significant than direct, and cumulative impacts are often of particular importance for biodiversity.

Assess the significance of impacts on biodiversity, for all project components and options, on the basis of: biophysical context and sensitivity of receptors (e.g. describe elements of wildlife and earth science interest affected, their importance, sensitivity, ability to escape or relocate); socio-economic and cultural context (e.g. number and characteristics of people likely to be affected and their locations, social systems that may be disrupted); characteristics of the impacts such as probability of occurrence (very likely, or unlikely); duration (time period over which they will occur); area affected (size, and whether near or far from project); reversibility (natural recovery, or aided by human intervention); applicable environmental laws and regulations (including Bank policies); and transboundary aspects.

Consider short- or medium-term as well as long-term or permanent impacts; consider positive effects which might enhance biodiversity, as well as negative effects.

Establish cause and effect, and specify uncertainties in prediction resulting from gaps in data or knowledge.

Assess the significance of impacts likely to arise from the project against the projected baseline rather than against existing conditions revealed in the field surveys.

State the predicted post-mitigation significance of impacts, i.e. the significance of residual impacts **after** all proposed mitigation measures have been taken into account.

Assess favourable impacts.

(adapted from: Byron 1999, Duke 1996, World Bank 1996)

Figure 3.22 Questions to consider when analysing effects on biodiversity

Impacts on Status of, and Trends in, Biodiversity - Composition, Structure and Function

What impact will the project have on current landscape diversity and on projected (without-project) trends in landscape diversity?

What impact will the project have on current ecosystem diversity and on projected (without-project) trends in ecosystem diversity? To what extent will ecosystems be fragmented? Will the proposed project make ecosystems more vulnerable to stochastic events?

What impact will the project have on current family/genus/species/population diversity and on projected (without-project) trends in this diversity? To what extent will species' populations be fragmented? Do the species affected demonstrate sensitivity or adaptability to change?

What impact will the project have on current genetic diversity (the genetic variety within each species) and on projected (without-project) trends in genetic diversity? Are different genotypes of the same species likely to be isolated from each other?

What impact will the project have on the values attached to biodiversity (utility, intrinsic)

What abiotic effects will result - change in seasonal flows, temperature regime, soil loss, turbidity, nutrients, oxygen balance, etc.?

Is the landscape/ecosystem/species at the limit of its range?

Have sustainable yield calculations, including population dynamics parameters, been determined (e.g. lake capacities, population thresholds)?

Impacts on Uses Of, and Pressures On, Biodiversity

What impact will the project have on current uses or, and pressures on, biodiversity and what knock-on impacts on biodiversity status will these induce?

Impact on Measures/Responses for Conservation and Sustainable Use of Biodiversity

What impacts will the project have on current (pre-project) measures/responses (impacts on the enabling framework [legislation, policies, institutions, financing], on programmes and projects, and on supporting measures [eg. education, training, information management, research) for conservation and sustainable use of biodiversity, and what knock-on impacts on biodiversity status will these induce?

Generic questions

Are the data dependable? What are the sources used?

Is the assessment based on long-term ecological monitoring, baseline survey, reconnaissance-level field observations and primary research?

Are plans made throughout the assessment for meaningful data input from the public, non-government organisations and other stakeholders?

What level of confidence or uncertainty can be assigned to interpretations of the effects?

(adapted from CEAA 1996/ Byron 1999)

Figure 3.23   Some key ecological concepts relevant to the prediction of impacts

· Habitat: The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

· Ecosystem services: The functions provided by the interacting synergism of all living organisms in a particular environment; every plant, insect, aquatic animal, bird, or land species that forms a complex web of interdependency.

· The organisms of a particular habitat, such as a pond or forest, together with the physical environment in which they live; a dynamic complex of plant, animal, fungal, and microorganism communities and their associated non-living environment interacting as an ecological unit. Ecosystems have no fixed boundaries; instead, their parameters are set according to the scientific, management, or policy question being examined. Depending upon the purpose of analysis, a single lake, a watershed, or an entire region could be an ecosystem.

· Ecological Niche: Is all of the physical, chemical and biological conditions required by species for survival, growth and reproduction.

· Island biogeographic theory: The generalizations, emerging from the work of - amongst others - MacArthur R.H. 1972 *Geographical Ecology*, New York, which highlight the differences between island and mainland biogeography, influenced by the size of islands and their proportionate distance from other land masses. The main generalizations are that:

- no island has nearly the same number of species it would have if part of the mainland;
- a large island is likely to have a greater variety of habitats, and therefore contain a greater number of species, than a small one;
- adaptation to the new environment of an island may be difficult for an immigrant;
- the precariousness of some of the ecosystems based on the low diversities of flora and fauna makes them susceptible to rapid, sometimes catastrophic change;
- adaptations to islands take a number of well-known forms.

· Species-area relation: A particular grouping of species in an area

· Species composition: the percentage of each recognised tree species comprising the forest type based upon the gross volume, the relative number of stems per hectare or basal area.

· Fragmentation: The process of transforming large continuous forest patches into one or more smaller patches surrounded by disturbed areas. This occurs naturally through such agents as fire, landslides, windthrow and insect attack. In managed forests timber harvesting and related activities have been the dominant disturbance agents.

· Corridors: A band of vegetation, usually older forest, which serves to connect distinct patches on the landscape.

· Edge effect: habitat conditions (such as degree of humidity and exposure to light or wind) created at or near the more-or-less well-defined boundary between ecosystems, as, for example, between open areas and adjacent forest.

· Reserve design: design of an area of forest land that, by law or policy, is not available for timber harvesting or production.

· Viable populations: a self-sustaining population with a high probability of survival despite the foreseeable effects of demographic, environmental and genetic stochasticity and of natural catastrophes.

· Food chains: A sequence of organisms, each of which uses the next, lower trophic level member of the sequence as a food source. Movement of energy through the trophic levels of organisms.

· Food webs: A model describing the organisms found in a food chain. Food webs describe the complex patterns of energy flow in a trophic level by modelling who consumes who.

· Aquatic biodiversity concepts:

· Benthic organisms: Any of a diverse group of aquatic plants and animals that lives on the bottom of marine and fresh bodies of water. The presence or absence of certain benthic organisms can be used as an indicator of water quality.

· Benthic Region: The bottom of a body of water. This region supports the benthos, a type of life that not only lives upon, but contributes to the character of the bottom.

· Eutrophication: The slow ageing process during which a lake, estuary, or bay evolves into a bog or marsh and eventually disappears. During the later stages of eutrophication the water body is choked by abundant plant life due to higher levels of nutritive compounds such as nitrogen and phosphorus. Human activities can accelerate the process.

· Canopy opening: The opening of the canopy layer of vegetation - formed by the leaves and branches of the forest's tallest trees.

Adapted from :

- *http://environment.about.com/newsissues/environment/library/weekly/blgloss22.htm*
- *http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/gloss.htm*
- *http://www.wri.org/wri/biodiv/gbs-glos.html*
- *http://www.for.gov.bc.ca/PAB/PUBLCTNS/GLOSSARY/GLOSSARY.HTM*
- *http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/biodiv/gloss.htm*

The key issues in impact prediction and assessment are assessing the *magnitude* of impacts - either absolutely or by using a defined scale - and then evaluating the *significance* of predicted impacts. It is essential that the criteria by which magnitude and significance are judged are clearly set out in the EA report. One approach to the determination of magnitude of impact, developed by the UK Department of Transport and the Regions (DETR) is set out in Figure 3.22 The DETR approach then compares the impact magnitude category against the biodiversity importance of the site, to arrive at an "assessment score" which ranges from "very large adverse impact" to "large positive impact". An alternative approach to determination of significance, developed by the UK Highways Agency, is given in Figure 3.24.

Figure 3.24 Impact magnitude categories (adapted from DETR 1998)

IMPACT MAGNITUDE CATEGORY	CRITERIA
Major negative impact	If, in light of full information, the proposal (either on its own, of together with other proposals) may adversely affect the integrity of a site, in terms of the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species for which it was classified.
Intermediate negative impact	If, in light of full information, the site's integrity will not be adversely affected, but the affect on the site is likely to be significant in terms of its ecological objectives. If, even in the light of full information, it can not be clearly demonstrated that the proposal will not have an adverse impact on integrity, then the impact should be assessed as a major negative.
Minor negative impact	If neither of the above apply, but some minor negative impact is evident. In the case of internationally recognised sites of biodiversity importance, they may nevertheless require a further appropriate assessment if detailed plans are not yet available.
Positive impact	Where there is a net positive wildlife gain. Examples include a mitigation package where previously fragmented areas are united through habitat creation work (the concept of connectivity), a scheme which diverts existing impacts away from a damaged site, and other proposals which do provide general wildlife gain through new design features.
Neutral impact	If none of the above apply, that is, no observable impact in either direction.

Figure 3.25 Example of categories of significance of impact (adapted from Highways Agency,1994)

Impact significance	Explanation	Impact
EXTREME	Adverse impacts that are of international significance and thus represent key factors in the decision-making process. Typically no mitigation of the impact is possible. Effects may be such as to prevent a scheme from progressing.	ANY impact on a site of international biodiversity importance; or HIGH impact on a site of national biodiversity importance.
SEVERE	Adverse impacts that are of national significance and are important factors in the decision-making process. Mitigation of the adverse effects is not usually possible and if it is, there are likely to be residual impacts. Effects may be of such scale as to radically influence project location or design.	MEDIUM impact on a site of national biodiversity importance.
SUBSTANTIAL	Adverse impacts that are of provincial significance and are important factors in the decision-making process. Mitigation is usually possible to a certain extent but residual impacts are likely to remain. Will influence decision-making process but are not likely	LOW impact on a site of national importance; or MEDIUM-HIGH impact on a site of provincial biodiversity importance.

	to be a deciding factor.	
MODERATE	Adverse impacts that are of local significance and are likely to influence the decision-making process only if other factors are not an issue. The scope for mitigation is usually high, especially habitat creation.	LOW impact on site of provincial biodiversity importance; or MEDIUM-HIGH impact on site of local biodiversity importance.
SLIGHT	Adverse impacts are so small that they appear to be of little or no significance.	LOW impact on a site of local biodiversity importance.

3.5.2 Analysis of alternatives

A key purpose of EA work according to OD 4.01 is to assess investment alternatives (alternative locations or project designs) from an environmental perspective. This is of particular importance for the effective treatment of biodiversity in EA, as the analysis of alternatives offers some of the most innovative and progressive options for addressing impacts and making developments sustainable (Bagri, McNeely and Vorhies 1998). The early analysis of alternative project designs or locations often offers the best possibility to prevent or avoid adverse impacts on biodiversity. If analysis of alternatives is missing, or carried out too late in the EA process, the possibility of preventing adverse impacts on biodiversity is reduced, and it is likely that EA will result at best in measures to reduce or mitigate impacts.

The Impact of Environmental Assessment (World Bank, 1997) points out that EA as currently practised in Bank projects is rarely used as a tool for developing and considering alternatives, for a number of reasons, notably that alternatives are rarely proposed, and that major design and location decisions have often been made by the borrower by the time the Bank becomes involved. To address these problems, the Bank promotes the increasing use of sectoral and regional EAs to introduce environmental (including biodiversity) concerns at an earlier (or "upstream") stage of the project planning process.

Guidance on methodologies for the analysis of alternatives is provided in Update no.16: *Challenges of Managing the EA Process,* and *Update* no. 17: *Analysis of Alternatives in Environmental Assessment*.

3.6 ENVIRONMENTAL MANAGEMENT PLANS, AND MONITORING & EVALUATION

The review of recent experience (Part 3) highlights the need to ensure that the Environmental Management Plan is built logically around the preceding analysis of impacts. Further, it highlights the need for the plan to incorporate costed and time-bound measures to prevent, minimise, mitigate and/or compensate for adverse impacts on biodiversity, and to specify implementation agencies for each measure. The EMP should also take every opportunity to enhance or restore biodiversity (such as the creation of new protected areas or re-introduction of native species). The EMP should assess the capacity of proposed implementing agencies to implement the EMP and specify measures required for organisational change, technical assistance and/or training or other means of capacity-building.

The guiding principle in the development of the Environmental Management Plan (EMP) is to prevent or avoid adverse impacts on biodiversity and to create opportunities to enhance biodiversity, wherever possible. Where prevention is not possible, the EMP should identify ways to minimise or mitigate against adverse impacts, to ensure that there is no significant biodiversity loss. Compensation, or offset (the conservation of biodiversity elsewhere) should be viewed as a last resort. Opportunities should be taken wherever possible for the enhancement of biodiversity. It is useful for the EMP to define these various terms (see Figure 3.26). Figure 3.27 elaborates on the limitations of habitat creation and translocation.

The EMP should clearly identify its long-term goals with respect to the conservation of biodiversity, and then detail how this goal will be achieved through the elaboration of specific objectives, components and activities, inputs (human, physical, financial) and outputs. A clear budget and schedule for implementation is also required, with identification of the agencies responsible for financing, supervision and implementation, and other relevant stakeholders interests, roles and responsibilities. The use of logical framework analysis helps in the development of this logical plan, in which objectives are clearly linked to the problems to be addressed, and activities to objectives. For the purposes of monitoring and evaluation, the logframe should identify objectively verifiable indicators, means of verification and assumptions for each activity.

Figure 3.26 Definition of mitigation terms (in relation to biodiversity)

Avoidance

Measures taken to avoid damage, such as locating the main development and its working areas and access routes away from areas of high biodiversity interest, protecting sensitive areas during the construction period , or timing works to avoid sensitive periods. Also includes alternative or "do nothing" options.

Minimisation

Measures taken to reduce adverse impacts, e.g.. modifications to the design of the development, such as the creation of reed bed silt traps to prevent polluted water running directly into ecologically important water courses. The preservation of "wildlife corridors" between habitats which would be separated by a proposed development may reduce the possible effects on some fauna.

Compensation

Compensation involves measures taken for residual adverse effects which cannot be entirely avoided. These usually take the form of replacing (or at least trying to) what will be lost, e.g.. the relocation of important grassland habitats from the development site to another area identified as suitable (using techniques such as soil or turf transfer), or the creation of new habitats.

Offset and Enhancement (to be separated out as 2 separate actions)

The genuine enhancement of biodiversity interest, e.g.. improved management of existing biodiversity features external to the area affected, or creation of new habitats or features, with the result that there is a **new** benefit to biodiversity.

(Based on Byron 1999, DoE 1995, RSPB 1995)

Figure 3.27 Habitat creation and translocation

The following warning observations on the limitations to the use of habitat creation and translocation as mitigation measures, are based on a study of the use of such measures in the UK. Given the relative lack of knowledge of habitats in developing countries, habitat creation and translocation are likely to be all the more risky as mitigation measures.

Habitat creation and translocation are frequently proposed as mitigation for damage to important sites. However, from research available, it is concluded that these measures are totally unacceptable as mitigation unless it can be shown that the site can be recreated in full at minimum risk, and within a short time span;

In most cases, high value sites consist of long-established habitats of great complexity, with small scale variation in plant and animal communities reflecting the underlying patterns of soils and ambient environmental factors, and the reasons for the complex, inter-related patterns found are not fully understood. It is impossible, therefore, to re-establish them.

Habitat translocation has been attempted in many situations to rescue something of the threatened habitats. In many respects this can (if carried out proficiently) recreate a better resemblance of the original habitat than habitat creation because it is re-using soils and a proportion of the plant life. In some cases, some animals may also be transferred. Habitat translocation can be regarded as the best way of re-using material that is worth keeping, but which is not derived from high value habitats. The dividing line between acceptable and unacceptable use of habitat translocation for nature conservation is a fine one. It can be used for scheme enhancement, as a building block for habitat creation, but it does not provide compensation for loss or damage to high value, non-replaceable sites.

It must be concluded that neither habitat creation nor translocation provide compensation or acceptable mitigation for the loss of all or part of high value sites.

(Source: English Nature 1994b)

In addition to drawing on the prediction of impacts and analysis of alternatives, the EMP should be set within the enabling framework of laws, policies/strategies and institutions. Some of the more frequently found policy/strategy documents to which reference should be made are listed in Figure 3.28.

Figure 3.28 Typical environmental policy/strategy documents providing context for EMPs

- National Environmental Action Plan (NEAP), Regional Environmental Action Plan (REAP), Local Environmental Action Plan (LEAP)
- National Conservation Strategy
- National Sustainable Development Strategy
- National Biodiversity Strategy / Action Plan (pursuant to CBD requirements)
- National Action Plan to Combat Desertification
- National Agenda 21
- Local Agenda 21 Strategy

National Forestry Programme (NFP)

Examples of typical mitigation measures (from avoidance to enhancement) are given in Figure 3.29.

Figure 3.29 Typical mitigation measures

full site protection through project re-location or re-design (avoidance);
strategic habitat retention (minimisation);
restricted conversion or modification (minimisation);
measures to minimise ecological damage (minimisation);
post-development restoration works (compensation);
ex situ measures, e.g.. captive breeding, plant seed banking (compensation);
translocation and/or re-introduction of species (compensation);
restoration of degraded habitats (enhancement);
establishment and maintenance of ecologically similar protected area of suitable size and integrity (enhancement or offset)

(Adapted from: Update No. 20)

Some key questions to ask of proposed mitigation measures are given in Figure 3.30.

Figure 3.30 Key questions to ask about proposed mitigation measures

Does the project address issues concerning the integrity of natural habitats and ecosystems and maintenance of their functions?
Do the project boundaries encompass the relevant natural habitats/ecosystems within limitations of political and administrative boundaries? Have adequate steps been taken to deal with issues affecting the ecosystems outside the project boundaries?
Have local communities dependant upon the affected area(s) been included in the preparation and implementation of the project? Are arrangements agreed on compensation or concessions to groups adversely affected by the project?
Is the project design flexible enough to manage the predicted changes? Does the project draw adequately upon scientific and local knowledge to inform and implement adaptive management of the natural environment?
Does the project involve all the relevant sectors and disciplines? Are there adequate mechanisms for coordination and collaboration among sectoral agencies? Are the roles and responsibilities of government, the private sector and non-governmental organisations (NGOs) clearly identified?

(Source: Update no 20.)

Institutional aspects are critical. Options for institutional measures within the EMP are given in Figure 3.31.

Figure 3.31 Typical institutional measures within EMPs

strengthen existing agencies with management responsibility for protected areas, other conservation areas, and biological resources in general;
establish new institutions, procedures or regulations;
promote regional perspectives in development planning to avoid loss of biodiversity through cumulative or intersectoral impacts;
strengthen land use planning and control institutions and instruments;
support scientific research relevant to biological diversity.

(Source: Update no. 20)

In designing the biodiversity elements of the EMP, consideration should be given to important ecological considerations such as species-area relationships, protected area design, viability of species populations, connectivity of habitats, etc. (Figure 3.21).

As stated in *Update* no.20, "appropriate design features are best determined by conservation specialists working in multidisciplinary teams in close cooperation with local people and NGOs affected by the project." Reference can again be made to Figure 3.2 in considering the range of expertise required.

The EMP should include a programme for monitoring and evaluation, which is essential to understanding the effects of the project and to evaluating the degree of implementation and the success or failure of mitigation efforts, and their correction as needed (CEAA, 1996). Monitoring methods should be established at the impact prediction and EMP development stages of EA, and biodiversity data obtained through monitoring should be included in global data services such as the Clearing House Mechanism of the CBD, and the Biodiversity Conservation Information System (BCIS) (Box 3.9). (Figure 3.32) outlines the elements of a monitoring programme. Manchester University EIA Centre (1999) provides further guidance on monitoring and post-auditing in the EA process.

Figure 3.32 Developing a monitoring programme

Many of the elements necessary for adequate monitoring will have been developed as part of project planing and environmental analysis. These include the following:

Gathering data
Establishing baseline conditions
Identifying ecological elements at risk
Selecting ecological goals and objectives
Predicting the likely project impacts
Establishing the objectives of mitigation
Implementing the EMP

The following additional monitoring-specific steps can build upon these elements:

Formulate specific questions to be answered by monitoring
Select indicators, verify usefulness, add others as needed
Identify control areas/treatments
Design and implement monitoring
Confirm relationship between indicators and goals and objectives
Analyse trends and recommend changes to management

The breadth, depth and specificity of the monitoring programme will be determined by the biodiversity goals and objectives established as part of project planning and environmental analysis.

(Source: US CEQ 1993)

3.7 PRESENTATION OF INFORMATION

There is clearly a need for the EA report to provide an adequate description of the biodiversity importance of the project area. This includes information on the biodiversity importance of the immediate project area and of adjacent or downstream areas which may be directly or indirectly affected, and the need to set this importance within the provincial, national, regional and global context.

EA documents should possess the following distinct qualities:

- focus - the document must identify and be appropriately focused on the key environmental issues;
- accuracy - the document must be scientifically and technically sound;
- presentation - the statement must be clearly organised and presented for ease of comprehension.

These three qualities apply equally to the Executive Summary, which is frequently the only document read by decision makers.
EA reports should provide a detailed description of the key design elements of the proposed project options, including clear graphics (maps, remote images, annotated photographs) relating these elements to the existing environment. They should provide an objective, comprehensive and balanced description of all relevant socio-economic and ecological characteristics of the project area, highlighting key features such as the presence of indigenous peoples, of critical habitats of global importance, or of important populations of threatened species. Particular reference should be made to ongoing and proposed projects and programmes in the study area and surrounding region for the conservation or sustainable use of biodiversity. Figure 3.33 gives a summary of good practice relating to the biodiversity information to be provided in the EA report.

Figure 3.33 Biodiversity information in EA reports - summary of good practice

Include a “biodiversity method statement” describing:
the specialists responsible for the biodiversity part of the EA;
the scoping process including planning new surveys and the areas considered but not dealt with in detail and the reasons for this;
the level of contact with biodiversity consultees; criteria used to evaluate: the importance of biodiversity elements; the magnitude of impacts, the significance of impacts, the likely success of proposed mitigation/enhancement measures; any guidelines, methods or techniques used.

Include clear colour coded or annotated maps, showing:
the study areas considered;
biodiversity constraints including designated areas and areas otherwise of importance for biodiversity
the different types and quality of habitats likely to be affected.

In addition:
Reference all sources of background information, e.g.. research papers and existing data
Include or clearly reference all new data collected for the EA (generally put data in appendices or separate reports to limit the size of the text of the actual EA); state collection methods, survey time and duration, limitations; The length and detail of the descriptions of effects should reflect their relative importance; Give as factual description as possible of possible predicted impacts; impacts should be quantified as far as is practicable; any judgements made on the advice of statutory or other expert consultees should be noted. The aim is to provide sufficient data to allow decision-makers to form their own judgements about the significance of impacts.
Cumulative biodiversity impacts can be discussed in a separate section or as an integral part of the analysis of biodiversity impacts;
Explain the proposed mitigation and enhancement measures, give detailed prescriptions for their implementation and assess their likely success.
Summarise the residual impacts on biodiversity after mitigation.
Describe the proposed biodiversity post-project monitoring programme; what will be measured, when, how, by whom.
Explain how and by whom unexpected post-project impacts will be remedied.

(Source: Byron 1999)

3.8 PROMOTION OF GREATER AWARENESS

Detailed guidance on public involvement is provided in *Update* no. 5 *Public Involvement in Environmental Assessment: Requirements, Opportunities and Issues*, which replaces Chapter 7 of the EA Sourcebook. The summary of *Update* no.5 states:

> The Bank's Operational Directive (OD) 4.01 on Environmental Assessment (EA) requires that affected groups and local NGOs be informed and consulted in a meaningful way as a part of EA preparation (para 21). **Information disclosure** is a prerequisite for meaningful consultation. Proper **consultation** is a requirement for EA category A projects but is also useful for other projects as it helps (1) improve understanding of the potential impacts of proposed projects; (2) identify alternative sites or designs, and mitigation measures, to improve environmental and social soundness; (3) clarify values and trade-offs associated with these different alternatives; (4) identify contentious issues; (5) establish transparent procedures for carrying out proposed projects; and (6) create accountability and a sense of local ownership during project implementation. Public **participation** in project preparation, beyond consultation, is not an EA requirement except where a project involves involuntary resettlement or affects indigenous people; but public participation in decision-making strengthens local ownership and accountability.

Figure 3.34 describes activities for information disclosure, consultation and participation in relation to the Bank project cy cle and EA process.

Figure 3.34 Public Involvement in Environmental Assessment

3.8.1 Public involvement during screening

Figure 3.33 indicates that ***information disclosure*** to affected groups and local NGOs first occurs at the scoping stage of the EA process. However, there may be considerable value in information disclosure at the screening stage in terms of identifying key biodiversity impacts. Properly informed, affected groups and local NGOs may be much better placed than Bank and borrower to identify these impacts (see Figures 3.5 and 3.6). As stated in *Update* no.5, the information should be provided in a form that is meaningful for, and accessible to, the groups being consulted. ***Consultation*** (the two-way flow of information) with affected groups and local NGOs at the screening stage, while not *required* under OD 4.01, may therefore be helpful in enabling the more accurate identification of such impacts, with potentially profound significance for the correct categorisation of the project (as category A or B) and so for the entire course of the EA.

3.8.2 Public involvement during scoping

Information disclosure at the scoping stage normally includes a summary of the project description and the potential negative impacts from the proposed project. Again, properly informed, affected groups and local NGOs may at the scoping stage be much better placed than Bank or borrower to identify the potential impacts on biodiversity. Local community groups are frequently owners and/or users of biodiversity resources, and so knowledgeable about biodiversity status and trends, pressures on and uses of biodiversity, and current measures for the conservation and sustainable use of biodiversity. As stated at section 3.3.2, ***consultation*** is critical at this stage to help avoid misunderstandings and costly mistakes. Local affected groups and NGOs can assist in assessing the potential impacts (direct, indirect, cumulative, etc.) on biodiversity against the criteria given in Figures 3.5 and 3.6, in identifying appropriate time and spatial parameters for the study. This in turn may usefully inform the terms of reference and selection of biodiversity expertise for the EA.

Public ***participation*** - which allows local people to come together with project authorities to share, negotiate and control the decision-making process - may also be advisable at the scoping stage if biodiversity resources are critical to local livelihoods and/or of national or global importance. Participation from this early stage of the EA process will help establish local ownership of the EA process, enhance positive impacts on biodiversity and reduce negative impacts. Participatory rural appraisal (PRA) methodologies - in addition to standard methods of checklists, matrices, flow diagrams and networks, and overlay mapping (section 3.3.3) - may usefully be applied for both consultation and participation, to capture local knowledge on biodiversity at the scoping stage and build local ownership of the process. Some key sources of information on PRA (and the use of PRA in biodiversity studies or in EA more generally) are given in Figure 3.35. As mentioned in *Update* no.5, the maintenance of a participation process may require the engagement of qualified social scientists skilled in communications, facilitation, mediation and negotiation.

Figure 3.35 Key sources of information on the use of PRA tools for biodiversity studies

The Resource Centre for Participatory Learning and Action, International Institute for Environment and Development (IIED), 3 Endsleigh Street, London WC1H 0DD, UK. Tel: +44-20-7388-2117, Fax: +44-20-7388-2826. Email: resource.centre@iied.org

PRA Reading Room, Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK. Tel: 44-1273-606261, Fax: +44-1273-621202. Email: qdfe9@sussex.ac.uk

3.8.3 Public involvement in baseline studies

OD 4.01 does not *require* that affected groups and local NGOs are consulted during baseline studies but, as at the scoping stage, ***consultation*** during biodiversity baseline studies may greatly improve the quality of the biodiversity data collected, and so provide a much more robust basis for subsequent prediction of impacts on biodiversity and analysis of impacts of project alternatives on biodiversity. Again, PRA methodologies may be usefully applied during baseline studies as a means of soliciting local knowledge and promoting meaningful dialogue on biodiversity, as well as building local ownership of the EA. While the large toolbox of methods offered by PRA allows to some extent for the cross-checking of local anecdotal information on biodiversity, there may be a need to further cross-check important biodiversity information using more conventional scientific approaches (see also section 3.4.3). Further, careful attention must be paid when designing time-intensive consultations to the opportunity cost to local groups (who are often living in extreme poverty).

3.8.4 Public involvement in the evaluation of significance of impacts, analysis of alternatives, design of the EMP

Consultation or ***participation*** of affected groups and NGOs on biodiversity issues at these stages of the EA process may greatly enhance the evaluation of the significance of impacts on biodiversity, analysis of the impacts of alternatives on biodiversity, and the responsiveness of the EMP to biodiversity concerns. As at the scoping stage, the active ***participation*** of affected groups and NGOs is advisable where biodiversity resources are critical to local livelihoods and/or of national or global importance. A variety of project planning tools exist - such as the goal-oriented project planning (GOPP) - which facilitate the engagement of a broad range of stakeholders and might usefully be applied in design of the EMP (ref.?).

3.8.5 Public involvement in implementation, monitoring and evaluation

As shown in Figure 3.34, the results of consultation and participation should be reflected, as appropriate, in loan agreements - and this should include those results relating to biodiversity. During implementation, consultation of affected groups and local NGOs on the biodiversity aspects of the EMP should be ongoing. Participation of affected groups and local NGOs should be provided for where biodiversity resources remain of significance for local livelihoods and/or of national or international importance. These local groups and NGOs may also have key roles to play in monitoring and evaluation of impacts on biodiversity.

3.8.6 Further guidance on public involvement in EA

Update no.5 gives further guidance on public involvement in EA which is equally applicable to public involvement in the treatment of biodiversity in EA. This includes guidance on who should be involved, on the elements of effective consultation and participation, and on issues and risks.

4.1 INTRODUCTION

The foregoing parts of this report outline the policy imperative for the effective treatment of biodiversity in EA, indicate continuing problems in the effective treatment of biodiversity in EA, and provide guidance for more effective treatment of biodiversity in EA. Some of this guidance may be adopted immediately with little additional investment of staff time or resources, but take-up of other guidance is constrained by a number of constraints or problems which emerged in the course of discussions with Bank staff. These constraints and discussions and potential solutions are outlined here for further discussion.

4.2 PROBLEMS AND RECOMMENDATIONS

4.2.1 Inadequate use of Sectoral and Regional EA

EA at project levels provides at best for the mitigation of project impacts. It is often too late for avoidance through relocation or redesign. There is a need to apply EA tools more frequently at the sectoral and regional EA level. These allow the consideration of cumulative impacts that are missed by stand-alone project-level EAs. A good example of the use of a regional EA is NE Brazil, where 4 dams and a canal were all subjected to a single regional EA. There may also be a good argument for the application of EA to the Bank's Country Assistance Strategies.

Recommendation

More SEA/Regional EA/EA of CASs

4.2.2 Projects are often referred to the Bank too late in the preparation process

Bank involvement is often too late in the project design process. The client country may initiate or complete a poor EA before the Bank gets involved, and key decisions may already have been taken. (eg. Bolivia-Brazil road: the Bolivian government is doing poor EA work which the Bank will have to re-do later on).

Recommendation

Encourage earlier referral to Bank

4.2.3 EA is often carried out without adequate data on the engineering works proposed

EA should be carried out in tandem with the principal engineering appraisal - not before and not after.

Recommendation

Require that EA is carried out in tandem with engineering appraisals

4.2.4 Environment is not dealt with as a core service - so environment sector staff have no clear authority or accountability

Environment in the World Bank is currently dealt with not as a 'core service' (such as the Bank's Legal Department which drafts and clears contracts), but following the 'modified market' model - the Task Team Leader (TTL) can chose not to spend any money on environment, and has an incentive to cut costs due to budget constraints. Environment sector staff have no clear authority over TTLs, and little accountability. They essentially have two ways to influence EAs.

- as part of a project team (for example, reviewing TORs drafted by borrower, or drafting on behalf of the borrower, advising on the mix of skills needed/hire of expertise, reviewing the draft EA); or
- as part of the Environment Review and Clearance Process under **OP/BP 4.01** which provides for a 'Regional Environmental and Social Unit (RESU) in each region (in LAC, this is called the QAT - Quality Assurance Team) responsible to safeguard Bank policy. (No such unit exists in E Asia?)

If environment was to become a 'core service', this would establish a group of people with full responsibility (and accountability) for environmental work.

Recommendations

- Establish accountable core service with responsibility for treatment of biodiv in EA; or
- Require bank environmental staff on project teams where significant environmental impacts predicted at screening.

4.2.5 Environment Sector staff are usually called in too late in the EA process, and are then given too little time to comment effectively

Env Sector staff often involved too late in the process and are rarely given much time to review EAs. **OP4.01** says that TTLs *should consult* with RESUs on TORs - but is not clear whether RESUs have clearance authority (*should* consult, not *must*) - so, many TTLs go ahead without consulting RESU, hence the occurrence of EAs for which RESU had no input in the TORs. Thus, there is wide interpretation of the intention of the OP. In the Latin

America Division, QAT (that is, the RESU) does not see the EA until the Project Clearance Decision (PCD) - after lots of in-country decisions have already been made - Project Managers are not keen to allow change at this stage.

Recommendation

Establish a clear requirement for early involvement of RESUs - perhaps giving RESUs clearance function at various stages (TORs, screening, scoping, etc.) - would allow for more effective use of tools - there is a need to clear up the ambiguity in the OP.

4.2.6 There are not enough biodiversity specialists in the Bank

There are very few ecologists and environmental engineers in the Bank - and of these, only a few get involved in EA, others prefer to focus on GEF biodiversity projects, etc. EA is an uphill struggle, a thankless task - and the environmental officer is seen as blocking development. Knowledge management (nodes, web sites) is not an alternative to appropriate staffing - one can help the generalist, sensitize him/her to the issues, help him/her recognise issues, but only the technical specialist can decide on sensitivity.

Recommendation

Appoint more ecological specialists.

4.2.7 Borrower ownership of the principle of minimising ecological damage in development, and of the importance of EA in enabling this, is inadequate

The Bank budget for EA preparation is for Bank staff to assist the borrower, eg to scope the EA. The borrower then finances the EA, out of its own resources, or using a small loan from the Bank's project preparation facility, or WB may assist through trust funds. Borrowers may seek to avoid stringent EA, and do not like to borrow to pay for EA. In-country EA law is usually deficient and in practice EAs are poor. Governments may prioritise short-term economic development over environmentally sustainable development. Though the social and environmental aspects of EA are not mainstreamed - adequate treatment is usually found only where the TTL has managed to secure additional trust funds to pay for it - the Bank tends nevertheless to be more stringent on environment that other financing agencies (eg. Japan). If the Bank declines to finance, a project may go ahead anyway with other funding agencies and damage will be worse - governments tend to put most environmentally benign projects to the Bank, and fund the most damaging themselves. Indeed, the Bank sometimes finances on the grounds that if it were left to another agency, it would be worse.

Recommendation

Provide for better resources/incentives to borrower for treatment of biodiversity in EA

build borrower ownership and capacity - eg. training of env specialists in transport departments (at level of technical decision-makers, not ministers)

coordinate sectoral and/or regional EA with other lending/donor agencies to establish common position on which projects should or should not be funded.

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Annex 1

Criteria for Selection of EAs for Review

Criteria for Selection of Case Studies for Review of Biodiversity in Environmental Assessments

1. Example of Good practice (such as NT2) and not so good practice
2. Category A and Category B projects
3. Representative of a range of sectors: transport (Halsima hwy project in Philippines, several in China); water resources including hydropower (Nam Theun 2) and large-scale irrigation; power (Thailand, Nepal); mining (Zatar gold in Mongolia), agriculture
4. Representing a variety of ecosystems, both terrestrial and aquatic (Vietnam coastal forests).

Annex 2

SBSTTA Recommendations for a Core Set of Biodiversity Indicators

Recommendations for a core set of indicators of biological diversity.
The following summarises material published in a Background Paper prepared by the Liaison Group on Indicators of Biological Diversity for the Third Meeting of the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) to the CBD, held in Montreal, Canada, 1 to 5 September 1997. The paper proposes a series of four sets of universal indicators, based on the CBD framework (Box 1).

Box 1 Universal indicators for biodiversity assessment and monitoring

Universal Indicators of State: these are indicators of the current status of and trends in biodiversity, and might involve assessment of: ecosystem quantity; ecosystem quality; and threatened and extinct species and habitat types.

Universal Indicators of Pressure: these are indicators of the socio-economic factors or driving forces affecting biodiversity, including: habitat loss; overharvesting; species introduction; pollution; and potential climate change.

Universal Indicators of Use: these are indicators of the utility values of biodiversity, including both goods and services;

Universal Indicators of Response: these are indicators of measures being taken in order to change the current or projected state, including programmes and projects, human resources, legislation, institutional arrangements, and financial provisions.

(Source: SBSTTA 1997)

Such universal indicators, if available, would provide a useful menu from which biodiversity specialists working on environmental assessment may select those most relevant to the project type and location in question. The value of indicators for baseline studies in EA is that they can provide a cost-effective and relatively rapid means of assessing biodiversity status and trends, the causes of change and current measures for the conservation and sustainable use of biodiversity.

Biological indicators are most effective if measured against a *baseline*. In environmental assessment, the baseline is frequently taken to be the pre-project situation. SBSTTA (1997) recognises a number of relevant options exist for setting the baseline: at the time of the CBS's final agreement (1993); before any human interference; before major interference by industrial society; or as an agreed set of characteristics representing a similar cultural landscape with high biodiversity. The use of the pre-project situation as the baseline in environmental assessment raises the question of how any anticipated impact may be judged positive or negative without a theoretical optimal baseline. The effective treatment of biodiversity in EA requires at least some consideration of this theoretical optimal baseline. For practical purposes, a postulated baseline, set in pre-industrial times, appears to be most appropriate.

These universal indicators are described in some detail below, as they provide an indication of the range of data that should be considered for the effective treatment of biodiversity in EA.

Data on status and trends of biodiversity
SBSTTA (1997) propose a core set of 3 complimentary, universal indicators to assess status and trends of biodiversity:

- ecosystem quantity;
- ecosystem quality;

- the relative number of threatened and extinct species.

Ecosystem quantity

Indicators of ecosystem quantity are used to provide an impression of losses or gains at the ecosystem level as a result of major causes. Examples are: self-regenerating (ie. natural) and man-made area as a percentage of total area; self-regenerating area per habitat type (see Box 4.8) as a percentage of the 1993 level and of postulated baseline set in pre-industrial times; and remaining self-regenerating area by size class category (100-1000 hectares, 1000-10,000 ha, 10,000-100,000 ha, 100,000 - 1 million ha, > 1 million ha). However, indicators of ecosystem *quantity* do not provide an impression of the state of the biodiversity within an area: this is provided by measures of ecosystem *quality.*

Box 2 Principle world habitat types as identified by the CBD

- Marine and coastal regions
- Forests
  - temperate mixed and broadleaf forests
  - tropical wet forests
  - tropical dry forests
  - temperate needle leaf forests and boreal forests
- freshwater
- tundra
- desert and semi-desert
- grassland
- agricultural land

Note: much more specific habitat types may be identified within each of these.

Ecosystem quality

Indicators of ecosystem quality measure the state of biodiversity within an area relative to the expected state (postulate baseline). These may include one or more variable that measure:

- species abundance and/or distribution (evenness)
- species richness; and
- ecosystem structure and complexity.

Species abundance and/or distribution may be assessed by studying an ecologically-meaningful subset of species, including not only dominant but also rare species, and to consider the abundance of the species included relative to the postulated baseline. Increases or decreases in comparison with the baseline are significant, and are sensitive measures for changes in the status of biodiversity.

Species richness may be indicated by compiling an extended list of species in selected taxonomic groups, or assessing the distribution and abundance of a few selected species as a percentage of the postulated baseline for the project area, or assessing the number of indigenous species of one or more selected taxa. However, simple species lists alone, indicating presence or absence, are not sufficient for the purposes of EA. It is important to identify key species (rarities, endemics, other species of particular interest for scientific, cultural, economic or other reasons) and to know their relative, if not absolute, abundance and status of threat.

Ecosystem structure variables are most promising because they can offer a lot of information on the state of the ecosystem over large areas for relatively low effort (SBSTTA 1997). Many aspects of quality can be captured by identifying key-ecosystem structure variables which can indicate if the ecosystem is functioning correctly or not. For example, a crude measure might be the total number of well-specified habitat types observed in a sample area relative to the postulated baseline number. Remote sensing techniques can play a major role in facilitating this process. Examples of variables that might be measured are given in Box 4.9.

Box 3 Possible variables for the assessment of ecosystem structure, complexity, heterogeneity

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

(source: SBSTTA 1997)

Threatened and extinct species and habitat types

The assessment of species and ecosystems threatened according to definitions relevant to the CBD will indicate a trend in biodiversity degradation and loss. The IUCN Red List of Threatened Species provides useful definitions of specific categories of threat. It also provides an important set of data concerning species falling under the specific categories of threat. However, this is not exhaustive for all taxa, and contains significant gaps. For example, while the list of birds is relatively thorough, invertebrate and plant species listings are currently much less comprehensive.

Other useful sources include national Red Lists, though these do not always conform to the categories of threat defined by IUCN, and have not always been compiled with the same degree of rigour.

Data on pressures affecting biodiversity

SBSSTA (1997) proposed five types of indicators to monitor and assess pressures on biodiversity:

- habitat loss;
- overharvesting;
- species introduction;
- pollution;
- potential climate change.

Habitat Loss

SBSTTA (1997) proposes the following indicators (direct or surrogate) of habitat loss, which may be adapted for use in EA:

- annual conversion of self-regenerating area and by habitat type as the percentage of the remaining area in the project area and surrounding region;
- annual land use change from self-regenerating area into agriculture, permanent pasture and built-up land in hectares, in the project area and surrounding region;
- share of riverbeds dammed or channelized as the percent of the whole river in the study area;

· percent of coastal zone with a population density exceeding 100 inhabitants/km2;
· percent of coastal zone within 30 km of a town or city >100,000 inhabitants.

Harvesting

SBSTTA (1997) proposes the following indicators which aim to show the relationship between current harvest levels and long-term sustainability of the resource:

· Total amount harvested per unit effort;
· Total amount harvested relative to estimate of sustainable off-take levels;
· Average size/weight/age per unit of off-take of a given species relative to baseline year;
· Amount of agricultural land lost in 10 years due to erosion as percentage of agricultural area brought into agriculture in the same period, within study area.

Species introduction

SBSSTA (1997) proposes the following indicators which aim to track both introductions and spread of non-indigenous species as well as the relative abundance of populations of these species relative to native flora and fauna:

· Total number of non-indigenous species as a percentage of a particular group;
· Relative abundance/biomass of non-indigenous species, as well as the relative abundance of populations of these species to native flora and fauna.

Pollution

SBSSTA (1997) proposes as an indicator the average exceedance of soil, water and air standards of a particular group of substances. The most relevant groups of chemicals relate to eutrophication, acidification and dispersion of toxic substances. In water, turbidity is also important.

Climate change

SBSSTA (1997) proposes the following indicators:

· Change in mean temperature per gridcell of 50 by 50 km, averaged per study area within a 20-year period;
· Change in maximum temperature, minimum temperature and precipitation per gridcell of 50 by 50 km, averaged per study area within a 20-year period.

Data on the uses of biodiversity

SBSTTA (1997) proposes the following indicators of the use of biodiversity, which may be adapted for application in EA: indicators measuring ecosystem goods; and indicators measuring ecosystem services.

Examples of indicators measuring ecosystem goods include: total amount harvested per species and grand total over time; total recreational revenues derived from ecotourism in the project area and surrounding region; and percent of wild species with known or potential medicinal values and potential revenue in dollars. However, these measures do not capture all potential values of biological resources, nor their sustainability, and the EA may need to give further consideration to these issues.

Examples of indicators measuring ecosystem services include: total and per km2 carbon stored within forests in the project area; percent of watershed area assessed as under “low risk of erosion“.

Data on the conservation and sustainable use of biodiversity (response/ capacity)

SBSTTA (1997) does not elaborate indicators for assessing activity for the conservation and sustainable use of biodiversity, but proposes a series of key questions to be addressed. These key questions are equally applicable in the context of EA:

· how much capacity (human resources, expertise and institutional, legal and financial means) is available in-country to implement the CBD and in particular to implement the CBD within the project area?;

· how much financial support and incentives are currently being provided to implement commitments under the CBD, within the country and targeted at the specific project area or at the habitat types or species represented in the project area?;
· how much new and additional financial resources is currently being provided by developed countries and what proportion of these is targeted at the project area or at the habitat types and species represented in the project area?

Related indicators to be assessed in EA might include: the proportion of threatened species and habitats protected by law; the number of qualified biodiversity staff per unit area per habitat type; the existence and quality of management plans for protected areas; the financial and human resources committed to existing initiatives for biodiversity conservation and sustainable use; etc.

Annex 6

Glossary of acronyms

AIBS >>> American Institute of Biological Sciences
AquaRAP>>> Aquatic Rapid Assessment Program
BCIS >>> British Conservation Information System
BDT >>> Tropical Data Base (Andre Tosello Foundation, Brazil)
Bionet >>> The Biodiversity Information Network
BIN21 >> > Biodiversity Information Network 21
CAS >>> Country Assistance Strategies
CBD >>> Convention on Biological Diversity
CBIN >>> Canadian Biodiversity Information Network
CD >>> Country Director (World Bank)
CEAA >>> Canadian Environmental Assessment Agency
CHM >>> Clearing House Mechanism
CITES >>> Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRES >>> Centre for Resources and Environmental Studies (Australia)
CSIRO >>> Commonwealth Scientific and Industrial Research Organisation (Australia)
DETR >>> UK Government Department for Environment, Transport and the Regions
EA >>> Environmental Assessment
EIA >>> Environmental Impact Assessment
EMP >>> Environmental Management Plan
ENGIS >> > Environment and Geographical Information Systems Team (World Bank)

ENV >>> Environment Department (World Bank)
ERIN >>> Environmental Resources Information Network
GEF >>> Global Environment Facility
GIS >>> Geographical Information System
GBRMPA >>>Great Barrier Reef Marine Park Authority (Australia)
IAB >>>International Association of Bryologists
IABIN >>> Inter-American Biodiversity Information Network
IAIA >>> International Association for Impact Assessment
IEEM >>> Institute of Ecology and Environmental Management
IEMA >>>Institute of Environmental Management and Assessment
IIED >>> International Institute for Environment and Development
ISEE >>> International Society for Ecological Economics
IUCN >>>The World Conservation Union
IPR >Intellectual Property Rights
LEAP >>>Local Environmental Action Plan
LEG >>>Legal Department (World Bank)
NFP >>>National Forestry Programme
NEAP>>> National Environmental Action Plan
NGO >>> Non-Governmental Organization
OD >>> Operational Document
OP >>> Operational Policy
PID >>> Project Information Document (World Bank)
PAD >>> Staff Appraisal Report (World Bank)
PFTs >>> Plant Functional Types
QAT >>> Quality Assurance Team (World Bank)
RAP >>> Rapid Assessment Program
RBA >>> Rapid Biodiversity Assessment
REAP>Regional Environmental Action Plan
REG >>> Regional Environment Division (World Bank)
REMIB>>> Red Mexicana de Información sobre Biodiversidad (Mexico)
RESU >>>Regional Environmental and Social Unit (World Bank)
RVP >Regional Vice President (World Bank)
SBSTTA>> >The Subsidiary Body for Scientific, Technical and Technological Advice
TM >>> Task Manager (World Bank)
TOR >>> Terms of Reference
TTL >>> Task Team Leaders (World Bank)
UNEP >>>United Nations Environment Programme
US-OBI >>>United States Organisation for Biodiversity Information
WCMC >>>World Conservation Monitoring Centre
WWF >>>World Wide Fund for Nature