A Guide on Biodiversity and Environmental Assessment

Prepared jointly
with the

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1. INTRODUCTION

The concept of biodiversity is encapsulated in the following description: *"Biological diversity is the variety of species, the genetic composition of species and communities, ecosystems and ecological structures, functions and processes at all levels."*

Biodiversity is decreasing at an alarming rate due to the impact of the growing human population and increasing resource consumption rates. Recognition of the world-wide impact of this decline prompted the global community to negotiate, in 1992, the United Nations Convention on Biological Diversity.

The Biodiversity Convention, as it is commonly known, is a legally binding international treaty. The Convention obliges signatory countries to assess the adequacy of current efforts to conserve biodiversity and to use biological resources in a sustainable manner. Canada was the Convention's first signatory.

In November 1992, federal, provincial and territorial ministers of Parks, Wildlife, Environment and Forestry departments launched a process to follow-up on the Convention which included the development of a Canadian Biodiversity Strategy. The federal Cabinet approved the Strategy in May 1995 and all Canadian jurisdictions are now committed to its implementation to the extent that their resources allow.

Environmental assessment (EA) has been recognized as a key element in meeting the obligations of the Biodiversity Convention and Strategy. Article 14 of the Convention recognizes EA as an important decision-making process toward the protection of biological diversity.

Although current EA processes already consider biodiversity, this guide highlights the importance of biodiversity conservation, especially given Canada's ratification (federal and provincial) of the Strategy. Consideration of biodiversity is a reasonable offshoot of normal practice - not a completely new challenge.

The objectives of this guide are to:

- provide an overview of the legal responsibilities related to biodiversity under the Convention and the Strategy;
- provide general guidance to EA practitioners in considering biodiversity within current EA approaches;
- emphasize what a good EA should include and that biodiversity is a cornerstone of EA.

As the practice of EA evolves, this document will require updating and revision. It should be viewed as an "evolving document" rather than static textual material.

Any suggestions for updates or revisions should be directed to:

Canadian Environmental Assessment Agency
EA Enhancement & International Affairs
200 Sacré-Coeur Blvd., 14th Floor
Hull, Quebec K1 A 0H3

1.1 The Canadian Biodiversity Strategy

The Strategy's fundamental objectives are to:

- conserve biodiversity on a national and global scale;
- promote the sustainable use of biological resources;
- improve resource management capabilities; and
- develop incentives and legislation to support the conservation of biodiversity.

In addition, the Strategy outlines strategic directions for EAs and mitigation to preserve biodiversity. Some of these directions are as follows:

- "*Use EAs to determine the potential effects of development on ecosystems, species and genetic resources and recommend appropriate ways of avoiding or reducing these effects to acceptable levels.*

- *Continue to examine and develop ways of harmonizing EAs nationally and internationally, where appropriate.*

- *Enhance efforts to identify and eliminate, or reduce to acceptable levels, the cumulative environmental effects resulting from human activities on ecosystems, species and genetic diversity. This includes developing early-warning indicators and working towards incorporating cumulative environmental effects into relevant national and international agreements."*

Advice on the Strategy was sought from various stakeholders (i.e., regional and urban governments, private property owners, businesses, industry, local and indigenous communities, conservation organizations, research institutions, foundations and other groups) because of their essential role in conserving biological diversity and using biological resources sustainably.

2. ADDRESSING BIODIVERSITY IN ENVIRONMENTAL ASSESSMENT

EA represents a widely adopted, systematic process for integrating environmental, socio-economic, cultural and health considerations in planning and decision making. A growing recognition of the importance of addressing environmental issues early in project planning was the

main reason why Ontario introduced EA as a formal process in 1973. Since then, EA has been adopted by many Canadian jurisdictions and organizations. Indeed, all Canadian provinces and the

federal government have legislated EA requirements for new development projects. Many municipalities and lands administered by Native peoples have also incorporated formal requirements for the application of EA to development proposals.

While the requirement to assess biodiversity may not be explicit in the EA legislation of all jurisdictions, it is implicit. For example, in the *Canadian Environmental Assessment Act* (the Act), biodiversity is implicit in the Purpose of the Act to promote sustainable development, as shown by the following definition:

> *"environment": the components of the Earth, and includes:*
> *(a) land water and air, including all layers of the atmosphere;*
> *(b) all organic and inorganic matter and living organisms, and*
> *(c) the interacting natural systems that include components referred to in paragraphs (a) and (b) above.*

2.1 General Considerations

Biodiversity is already considered/included in the performance of many EAs through cumulative environmental assessment, consideration of sustainable development, and best practice techniques. It is therefore important to note that assessing biodiversity is not an onerous, new requirement.

Biodiversity is only one aspect of ecosystem integrity. In assessing the environmental effects of a proposal on biodiversity, the EA practitioner should consider the following guiding principles:

- 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 losses;
- 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 change;

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1 Where an activity raises threats or harm to the environment or human health, precautionary measures should be taken even if certain cause and effect relationships are not established scientifically.

- where possible, use indicator species or valued ecosystem components to focus the assessment;

- define the spatial parameters that chararacterize ecological processes and components in order to provide a regional context for an impact analysis of the proposed project;

  identify the best practicable option (mitigation) for maintaining biological diversity;

  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.

2.2 Information Sources

- see Appendix 1 for a contact list of federal expert departments;
- municipal, regional, provincial, planning departments;
- geographic information systems (GIS);
- academic and research institutions;
- non-government organizations, local residents, and First Nations;
- previous environmental reports or assessments on projects in the same geographical area.

2.3 Framework for Addressing Biological Diversity in Environmental Assessment

An EA usually has the following generic stages: scoping, analysis, mitigation measures, determining the significance of effects and a monitoring or follow-up program. Jurisdictions may also differ on specific EA requirements. Further, it is recognized that the effort invested in biodiversity considerations should correspond to the environmental effects of the project.

Step 1. Scoping

Scoping an EA includes:

- identify environmental effects, i.e., the specific aspects of biodiversity to be addressed (e.g., population dynamics, interaction between and among communities, cumulative environmental effects, etc.); and

- set the spatial and time parameters of the assessment.

*(a) **Identify** environmental effects*

The objective is to identify the likely effects of the proposed project on the environment. Information on this aspect of scoping can be found in the *Responsible Authority's Guide* (Canadian Environmental Assessment Agency 1994).

At this stage of scoping, practitioners should identify the potential effects which proposed projects are likely to have on biodiversity and on the sustainable use of biological resources in a broad context, and then focus on specific issues.

The characteristics of biodiversity covered in an EA could include:

- the range of interacting natural systems, i.e., ecosystems within a region;
- the interaction of ecosystem functions, between species and components of an ecosystem with other species, or even with the non-living portion of ecosystems;
- the range of diversity of living things;
- the range of genetic characteristics found in a population or species.

For assessing biodiversity, however, genetic diversity requires considerable information and may be impractical to apply.

The list of examples provided below, is not meant to be exhaustive, but rather illustrative, of how potential effects on biodiversity can be stated in understandable terms. With appropriate elaboration, such lists (or question trees) could serve to flag specific, potential problems requiring further examination.

Examples for Biodiversity Considerations

Ecosystem Level:

- Areas of high biological diversity, e.g., estuaries, salt marshes, wetlands, shore lines;
- Critical habitat areas, e.g., breeding grounds, rearing areas, overwintering sites, migration routes;
- Relic ecosystems, e.g., old-growth forests, original grasslands, undisturbed lakes;
- Fragile ecosystems, e.g., arctic tundra, montane meadows.

Species Level:

- Endangered/threatened species, e.g., those listed by COSEWIC, IUCN;
- Populations at low levels in cycle, e.g., salmon stocks on some rivers;
- Populations at outer limits of their range, e.g., beluga whales in St. Lawrence River;
- Species with low reproductive capacity, e.g., most large mammals;
- Species highly sensitive to disturbance, e.g., most birds of prey,

Genetic Level:

- Genomes and genes of social, scientific or economic importance, e.g., agricultural crops, domesticated species.

Some questions that practitioners might consider when scoping for specific aspects of biodiversity:

- What species[2], communities and ecological processes would be impacted by the project? Are any of these species endangered, endemic, sustainably used, new to science or special in some other way?

[2] Proponents can at best evaluate the effects of these proposals on indicator, rare and special species. Indicator species should therefore be carefully chosen to maximaze the protection of all biological diversity.

- How much habitat would be eliminated or degraded, including short-term use areas vital to seasonal, life-history or migratory cycles, e.g., feeding grounds for sandpipers in the Bay of Fundy which provide sustenance for the southern migration?

- Are critical thresholds or levels of capacity being reached, i.e., are the species already in severe decline?

- What values does society attribute to each species, community and ecological process?

(b) Parameters of the assessment

Time and spatial parameters must be relevant to the biological components potentially affected by the proposed project or policy. As well, the parameters must consider the possible cumulative effects of a proposal on biodiversity.

It is important examine the proposal not only for effects at the local level but also for effects at the larger, regional ecosystem level. Evaluating the proposal within a larger landscape-level context will ensure that a variety of local and regional biological diversity concerns are addressed. In general, for any EA, the analysis of effects should cover the largest relevant scale, as well as local scales, based on the affected resources and anticipated environmental effects. It is also acknowledged that assessing for biodiversity on a larger scale may not always be possible.

Some questions that practitioners may ask when determining spatial/time parameters of the EA are:

- Could any migratory species be affected in another portion of their range which would hence cumulatively affect the species/population?

- What time, spatial, or other issues need to be considered for each of the species, communities and ecological processes affected by the project?

- Do major systemic or population changes appear to be taking place?

- What historical trends or cumulative losses of species and habitat are involved?

Step 2. **Analysis of Environmental Effects**

The objective of the analysis is to determine how and to what extent the potential environmental impact of the proposal will affect biological diversity or affect the sustainable use of biological resources. The analysis should consider the factors contributing to a loss of biological diversity, and apply the general principles for conserving biological diversity and the goals and strategic directions of the Canadian Biodiversity Strategy.

Some of the following tools might be helpful: check lists, matrices, mathematical models and cartographic displays can be used for evaluating ecological effects. Some of these methods may, however, lead the reviewer to carry out a *"mechanical"* as opposed to scientific review. Creative discussion and thoughtful analyses are important in issues as complex as biological diversity impact studies.

Some questions for practitioners to consider when analyzing effects on biodiversity are:

- What impact will the project have on the genetic composition of each species? Are different genotypes of the same species likely to be isolated from each other? To what extent will habitat or populations be fragmented?
- **How** will the proposal affect ecosystem processes? Is this proposal likely to make the ecosystem more vulnerable or susceptible to change?
- What abiotic effects will devolve - change in seasonal flows, temperature regime, soil oss, turbidity, nutrients, oxygen balance, etc.?
- Does the proposal contribute to or undermine the sustainable use of biological resources?
- Does it set a precedent for conversion to a more intensive level of use of the area?
- Is diversity measured at the species, community and ecosystem level?
- Have exotics been included in measures of diversity?
- Have standardized protocols for diversity measurement been applied when available?
- Is the biological resource in question at the limit of its range?
- Does the species demonstrate adaptability?
- Have sustainable yield calculations, including population dynamic parameters, been determined (e.g., lake capacities, population thresholds)?
- Is the data dependable? What are the sources used?
- Is the assessment based on long-term ecological monitoring, baseline surveys, reconnaissance level field observations and primary research?
- Is sampling planned on a suitably spaced geographic grid pattern, two-dimensional for land, three-dimensional for lakes and oceans, etc.?
- Does the sampling cover more than one or two years in order to assess annual variations and all the seasons studied?

- Does the assessment include a check for gaps in the sampling data?
- Are plans made throughout the assessment for meaningful input from the public, non-government organizations and other stakeholders?
- What level of confidence or uncertainty can be assigned to interpretations of the effects?

Step 3. **Mitigation**

The objective of mitigation is to eliminate or reduce potential adverse effects which the projects may have on the environment, in this case, specifically with respect to biological diversity. Another objective of mitigation is to protect and enhance the environment, where possible, over the long and short term. Guiding principles to protect biodiversity, for example, must follow the precautionary principle: where the level of uncertainty of a project is high, precaution for implementation of a project must be considered.

Mitigation measures identified in response to potential environmental effects on biological diversity should be developed within the ecosystem framework and should consider the possible effects of the mitigation itself

It is responsible to assume that some of these guiding principles may not apply under certain circumstances. However, there is flexibility in applying the most appropriate options under specific conditions.

Step 4. Determining the Significance of Adverse Effects

Most EAs are likely to consider the significance of a proposal's potential effects on the environment and whether the effects are adverse. For further reference on significance, consult the RA Guide (Canadian Environmental Assessment Agency 1994).

Step 5. **Follow-up Program**

The follow-up program must clearly define the desired state sought for the project and its mitigation. Without it, no measurements or trends can be analyzed.

Monitoring is essential to understanding the effects of a project and to evaluating the degree of implementation and the success or failure of mitigation efforts. The elements necessary for adequate monitoring are developed during the project planning and environmental analysis stage, including:

- identify the planning area and time frame for data gathering;

- plan what data are to be gathered (taxonomic, ecological, genetic and abiotic);
- gather data;
- establish baseline conditions;
- identify ecological elements at risk;
- select ecological and taxonomic goals and objectives for the area.

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

- select indicator species, communities, ecological processes;
- identify control areas or treatments;
- design and implement monitoring;
- confirm relationships between indicators and goals and objectives;
- analyze trends and recommend changes to the responsible authority.

The breadth and specificity of the monitoring program will be determined by the biological diversity goals and objectives established during the project planning and environmental analysis[3] stage.

[3] Incorporating Biodiversity Considerations into Environmental Impact Analysis under the National Environmental Policy Act. Council on Environmental Quality - January 1993

3. GLOSSARY

Biological diversity or **biodiversity:** 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.

Biological resources: includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.

Indicator species: a plant or animal that indicates, by its presence in a given area, the existence of certain environmental conditions.

No **net loss:** maintain habitats at current levels of productivity.

Sustainable use: the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

4. FURTHER READING

4.1 General References

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Global Biodiversity. An illustrated quarterly bulletin. Subscribe to: Canadian Centre for Biodiversity, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, ON K1P 6P4, Canada, telephone (613) 990-6595, fax (613) 990-03 18. (= *La biodiversité mondiale*). Scientific and traditional knowledge about biodiversity, its conservation and sustainable use.

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4.2 References on Methods to Assess Environmental Effects on Biodiversity

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APPENDIX I

SOURCES OF INFORMATION ON BIOLOGICAL DIVERSITY IN THE FEDERAL GOVERNMENT

Biodiversity Convention Office
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Ottawa, Ontario K1P 6P4
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