

Good Practices for Biodiversity Inclusive Impact Assessment and Management Planning



Prepared for:
**Multilateral Financing Institutions
Biodiversity Working Group**

Prepared by:
Jared Hardner, MFS
Ted Gullison, PhD
Stuart Anstee
Mike Meyer, PhD

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1 Introduction

This document is produced for project developers and their consultants responsible for preparing Environmental and Social Impact Assessments (ESIAs). It summarizes “good practices” for biodiversity inclusive impact assessment and management planning in ESIA. The document is based on a review and synthesis of various reports and guidance documents from multi-lateral finance institutions (MFIs), government regulators, industry associations, and non-governmental organizations (NGOs). It is not intended to replace ESIA guidance, but rather to supplement it where biodiversity is not adequately covered. This document is a companion to **Good Practices for the Collection of Biodiversity Baseline Data**. Additionally, the Cross-Sector Biodiversity Initiative is developing complementary guidance on impact management tailored specifically for the extractive sectors (CSBI, in preparation).

Biodiversity risks and their respective management requirements will vary according to the project. Project developers should tailor the level of rigor in impact assessment and management planning accordingly. While all projects should adhere to the framework of the mitigation hierarchy (avoid, minimize, restore, and compensate), it is the intention of this document to offer a range of options for good practices, leaving it to the project developer to select the appropriate level of rigor to manage project risks.

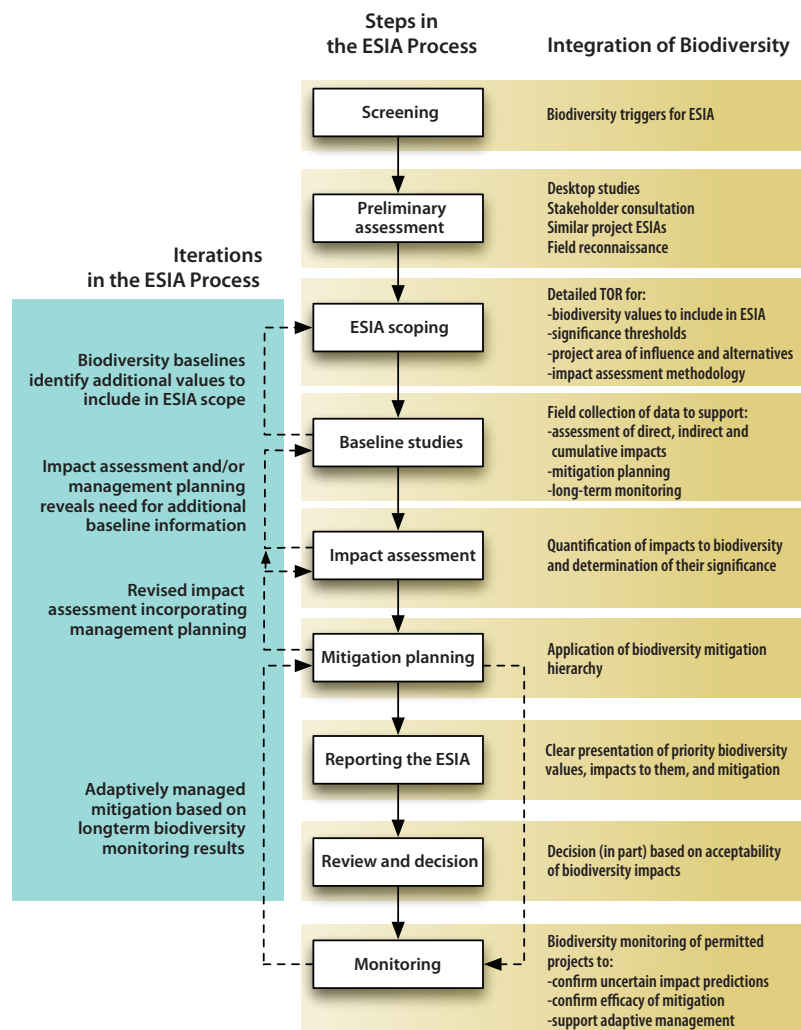
Figure 1.0.1 illustrates how impact assessment and mitigation planning fit within the larger ESIA process. The user of this document should note that generally the ESIA process is not linear and is likely to require iterative loops at many stages. These iterations will be discussed throughout and it is essential that all involved in the ESIA preparation understand the possible impacts to timing, budgeting, and staffing.

Before proceeding further, it is important to flag an important issue related to the preparation of ESIA, especially in the area of biodiversity impact assessment and management planning. Effective impact assessments and management plans largely rely on a solid foundation of:

- a) Information on biodiversity (e.g., taxonomic descriptions of species, conservation status assessments of species, conservation status assessments of ecosystems, distribution maps of species and habitats at a scale that is appropriate for project planning, understanding of sensitivity to stressors);
- b) Understanding of direct, indirect, and where feasible, cumulative impacts (i.e., placing the project in the context of land/resource use trends to ascertain how it contributes to landscape-scale impacts);
- c) Identification of priorities for biodiversity conservation (e.g., existing and planned protected areas, National Biodiversity Strategies and Action Plans); and
- d) Demonstrated methods to manage impacts.

However, the reality is that this foundation may be imperfect in many countries. For example, where little is known about biodiversity conservation priorities, their sensitivity to impacts, and methods for restoration and conservation, major research may be required before a detailed management plan can be developed. Where risks to biodiversity are believed to be high, it may be necessary to fill gaps in knowledge before proceeding, or to make cautious assumptions to account for uncertainty (the extent of which may be negotiated with regulators, lenders, and corporate decision makers). Where risks are believed to be lower, it may not be reasonable to delay a project or make overly cautious assumptions. In all cases, it is good practice to document with full transparency what is known and not known, and how uncertainty was addressed.

Figure 1.0.1: Outline of ESIA process, including impact assessment and mitigation planning



2 Impact Assessment

Biodiversity impact assessment is the process of determining the types and significance of effects a project will have. It is the core of the ESIA and can be divided into four general steps:

1. Definition of project alternatives
2. Impact identification
3. Impact characterization
4. Assessment of consequence and risk

The following sections describe each of these steps in detail.

The companion *Good Practices for the Collection of Biodiversity Baseline Data* addresses the steps that occur before Impact Assessment. Those steps will identify the set of biodiversity values that should proceed through the impact assessment process (*Figure 2.0.1*). This will depend on the regulatory, lender, and corporate requirements for which the project proponent is developing the ESIA.

The impact assessment is not purely technical. It is good practice to consult project stakeholders in all steps of the process, especially in the identification of potential impacts at the outset of the assessment (similar advice is given for the identification of biodiversity values of importance in *Good Practices for the Collection of Biodiversity Baseline Data*). In particular, entities that are potentially affected by impacts to biodiversity as well as those that have a knowledge base about local biodiversity, including traditional knowledge, should be consulted about the potential impacts of the project. This process may yield several outcomes. First, local stakeholders may have a greater appreciation than external technical experts of the biodiversity values in the area and their sensitivity to impacts. Second, it is good practice to document perceived impacts, even if they appear technically unfounded. Maintaining a discipline of respectfully acknowledging and analyzing these concerns will contribute towards building trust with stakeholders and ensuring a complete analysis.

CHECKLIST

- Does the impact assessment begin with a clear statement of the biodiversity values requiring analysis; and does this list correspond with regulatory, lender, and corporate requirements?
- Does the impact assessment include a process for stakeholder input?

Figure 2.0.1: Identifying biodiversity values that will proceed through impact assessment



2.1 Alternatives Analysis

It is good practice for impact assessment to include a comparison or analysis of project alternatives. At a minimum, most ESIA include an analysis of a “no project” scenario. Additional comparisons may include different project designs.

A “project” versus “no project” comparison offers the opportunity to distinguish between project impacts and those that might otherwise occur in the absence of the project. Analysis of the “no project” alternative can be uncertain if it requires projections of trends over time, for example changes in land use related to anticipated economic patterns. In these cases, it is important to state clearly all assumptions, methods, and uncertainties associated with the analysis.

A comparison of alternative project designs might include variations in the physical layout of project facilities, routing of roads and transmission lines, or core design elements such as the difference between run-of-river and conventional hydropower generation. As will be discussed in Section 3: Management Planning, choices of project design may be influenced by the desire or necessity to avoid impacting certain biodiversity values, such as irreplaceable habitats.

It is good practice for the ESIA to present the alternatives to be examined and to provide the results of the impact analysis for each. The following sections describe an approach for conducting that analysis – this sequence of steps can be repeated for each alternative.

CHECKLIST

- Does the ESIA present alternatives to be analyzed? Do they include a “no project” alternative and other alternatives that may be relevant for avoiding potentially significant biodiversity impacts?
- Does the ESIA conduct an impact analysis for each alternative? If so, are the results of the analyses presented in a manner that allows for comparison?

2.2 Impact Identification

The purpose of this step is to identify potential project impacts to those biodiversity values identified in the baseline study as requiring impact assessment. This will serve as the starting point for determining the consequence of impacts in subsequent steps.

Impacts can be categorized in terms of:

- **direct impacts** – the physical footprint of project activities (including project infrastructure and the incremental transportation and energy infrastructure required to support it) plus the area affected by emissions and effluents;
- **indirect impacts** – the physical footprint of non-project activities in the surrounding area that are caused or stimulated by the project plus the area affected by their emissions and effluents; and
- **cumulative impacts** – the overall impacts occurring in the project landscape caused by the project and non-project activities (related and unrelated to the project), generally including clusters of projects, land use change trends, and/or foreseeable developments.

It is good practice for the ESIA to analyze both direct and indirect project impacts. It merits special note that the indirect impacts of projects, especially the impacts of new roads or other projects that stimulate human settlement in new areas, can be very large relative to direct impacts. Special care should be taken when identifying indirect impacts as they are often difficult to predict with certainty.

While many guidance documents recommend analysis of cumulative impacts, the information and/or methods required may be unavailable. In these cases, it is important for the project proponents to: a) negotiate the appropriate level of treatment of cumulative impacts with regulators, lenders, and other key stakeholders; and b) provide full transparency with regard to the limits of the analyses performed (for more discussion of this topic see International Finance Corporation, 2012).

The ESIA should include a review of all project activities during design, construction, operations, and closure. This should be inclusive of the physical project infrastructure and the incremental transportation and energy infrastructure required to support the project. Based on these project activities, a comprehensive list of potential impacts to biodiversity should be developed. Potential impacts are those that could occur in the absence of management within the project's area of influence, as described in the Biodiversity Baseline Study. Examples of biodiversity impacts (either directly caused by the project or indirectly caused by activities linked to the project) include:

- **Habitat removal and fragmentation**
- **Habitat degradation**
 - Selective physical removal or alteration of habitat components
 - Changes in hydrology (e.g., natural flow regime of rivers, changes in groundwater levels)
 - Reduction in air quality (e.g., dust)
 - Reduction in water quality (e.g., nutrient loading, sedimentation)
 - Changes in water temperature
 - Introduction of invasive species
- **Wildlife mortality and/or population loss**
 - Habitat loss or degradation (see above)
 - Selective harvest or capture
 - Vehicular collisions with wildlife
 - Introduction of animal or plant disease
 - Interference with species movement, including migration
 - Increased light levels
 - Increased noise and vibrations

The specific direct and indirect impacts to biodiversity of various industry sectors are well documented in checklists that can be used for purposes of impact identification. A complete list should include all stages of the project's life cycle. These should, however, only be used as a guide and not a replacement for site-specific assessments.

Notable sources of impact checklists are:

- **Mining** – International Council on Mining and Metals (2006)
- **Oil & Gas** – Energy and Biodiversity Initiative (2003)
- **Forestry** – Food and Agriculture Organization (Zimmerman, 1992)
- **Hydropower** – World Commission on Dams (2000); International Hydropower Association (2012)
- **Roads** – Bissonette (2007); Byron (2000); Spellerberg (2002)

As mentioned earlier, the impact identification process will benefit from stakeholder consultation to ensure complete coverage of potential impacts, including perceived impacts.

CHECKLIST

- Are project stakeholders included in the process of identifying potential project impacts, and are all perceived impacts documented?
- Are biodiversity values evaluated against a comprehensive checklist of potential (and perceived) project impacts specific to the industry sector?
- Does the list of potential direct project impacts consider all associated facilities, transportation (e.g., trucking and roads), and energy infrastructure (e.g., transmission lines)?
- Does the list of potential project impacts include indirect and cumulative impacts (as needed and feasible)?
- Are potential impacts identified throughout all stages of the project cycle?
- Does the geographic scope of potential impacts correspond to the area of direct and indirect influence, as defined in the biodiversity baseline study?

2.3 Impact Characterization

The purpose of this step is to characterize potential project impacts identified in the previous step.

The simplest way to characterize biodiversity impacts is to use habitat as a surrogate for the values it supports. Some of the ways in which impacts to habitats may be measured include change in the gross area of habitat affected, change in area while accounting for the condition or naturalness of the habitats, and fragmentation of habitats at the landscape level.

It is good practice for the ESIA to present a GIS-based spatial analysis of the area of influence of the project, including the physical footprint as well as layers depicting the spatial extent of other impacts such as those related to air and water quality. In some cases, map layers may also be available showing indirect impacts such as areas of human settlement that may expand due to the influence of the project. Map layers depicting natural habitats and their condition, developed in the Biodiversity Baseline Study, can be overlaid on impact layers to quantify the area of each habitat type impacted by the project.

There may be a need for the ESIA to estimate impacts to individual species in those cases where habitats are not an acceptable surrogate (e.g., migratory bird mortality from transmission lines or wind turbines) and/or regulations, lender or corporate standards require species-level analysis. This may prove challenging in many contexts, as populations are very difficult to quantify. To the extent that reliable indices of abundance with sufficient statistical power can be developed, they may be used to measure impacts. A suitable approach should be negotiated with the entity requiring this analysis.

As depicted in Figure 1.0.1, this step will be repeated iteratively once management plans are made (Section 3) to illustrate the benefits achievable with management. The results of both analyses should be presented in the impact assessment.

CHECKLIST

- Is the characterization based on the identified potential project impacts?
- If species-specific assessments are required, are there reliable means to estimate impacts? Where possible, has a practical proxy measure been negotiated?
- Is the assessment repeated to quantify inherent (without management) and residual impacts (with management)?

2.4 Assessment of Impact Consequence and Risk

The objective of this step is to assess the consequence and risk of the potential impacts to biodiversity values described in the previous two steps. Some regulators, lenders, or corporate standards will use the term “significant” to refer to a threshold of consequence and/or risk that requires management or may not be acceptable.

Consequence

Consequence is assessed in terms of how impacts alter the viability of a biodiversity value (in other words, the ability of a biodiversity value to persist over time). The viability of a biodiversity value is a function of its irreplaceability and vulnerability. Irreplaceability relates to the number of sites or the geographic extent where the value is present; if a biodiversity value (for example, a rare habitat type) occurs only at a few sites, then it is highly irreplaceable. Vulnerability relates to the impact and likelihood of existing and future threats; a vulnerable biodiversity value is one that has experienced rapid loss over recent history and/or is faced by current threats that will lead to rapid loss.

Practitioners of impact assessment use a number of different scales to rate the consequence of impacts. There is no general consensus on a single scale. Following are examples of two approaches.

Consequence based on IUCN Conservation Status Assessment

An example of how to assess the consequence of an impact is to use the IUCN conservation status assessment methodology. The conservation status of a species, as determined by the IUCN Red List methodology, is an assessment of the viability of the species and is determined by measures of irreplaceability and vulnerability. Therefore, a species’ conservation status is a useful starting point in determining the risk that a project poses to a biodiversity value. As the consequence of project impacts increases, the viability of the impacted value declines, and in some cases its conservation status may even change. IUCN has recently begun implementing a similar status assessment method for ecosystems¹, although more work remains to be done in most countries. In the interim, the criteria for performing a conservation status assessment are available from IUCN and may be applied to any ecosystem for purposes of an impact assessment. *Table 2.4.1* demonstrates how this might be used in practice to assess consequence.

¹ <http://www.iucnredlistofecosystems.org> (viewed 12-1-14)

Table 2.4.1: Example definitions of impact consequence based on IUCN conservation status assessment methodology, which considers irreplaceability and vulnerability for species and ecosystems. Conservation status is evaluated with and without the project. The consequence of an impact to a biodiversity value may range from minor (i.e., no net loss) to catastrophic (e.g., loss of the species or habitat). The assessment can be implemented at any geographic scale (i.e., sub-national, regional, national, global).

Consequence	Description
Minor	No net loss in biodiversity value, regardless of conservation status
Moderate	Net loss in value with a status of LC, NT or VU
Serious	Net loss in value with a status of EN, or status of a value changes to EN due to project impacts
Extreme	Net loss in value with a status of CR, or status of a value changes to CR due to project impacts
Catastrophic	Status of value changes to EW (species) or CO (ecosystem) due to project impacts

Note: IUCN conservation status categories for species are: Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX). They are similar for ecosystems, with the exception of Collapse (CO), which is the ecosystem analog of EW/EX.

Consequence based on Regulatory, Lender, or Corporate Standard

Regulators, lenders, or corporate standards may provide specific definitions of impact consequence based on magnitude, type of habitat lost, or other variables. For example, a standard may consider any large-scale clearing of natural habitat as having a serious consequence. Others may provide definitions that distinguish “critical” habitats from others and consider impacts in these habitats to be of greater consequence. *Table 2.4.2* provides an example of how this might be put into practice.

Table 2.4.2: Example definitions of impact consequence based on regulatory, lender, or corporate requirements

These descriptions are not based on a specific standard and should be adjusted according to the relevant standard(s) applied to the project.

Consequence	Description
Minor	Incidental and localized impacts to natural habitat
Moderate	Small-scale loss of natural habitat
Serious	Large-scale loss of natural habitat, or small-scale conversion of “critical” habitat (e.g., known to be occupied by species with EN status)
Extreme	Large-scale loss of “critical” habitat (e.g., known to be occupied by species with a conservation status of EN), or small-scale loss of “critical” habitat (e.g., known to be occupied by species with a conservation status of CR)
Catastrophic	Large-scale loss of “critical” habitat (e.g., known to be occupied by species with a conservation status of CR)

Performing the Consequence Assessment

The technical approach for assessing the consequence of impacts may range from qualitative expert opinion to analysis of quantitative data. The level of rigor should reflect the potential severity of the impact.

There are many locations where information is lacking to support this assessment. For example, where little is known about a given biodiversity value, such as its distribution and vulnerability to cumulative effects, it is very difficult to ascertain the incremental effects of an individual project. In these cases, using a precautionary approach may be desirable (if not required) to ensure that impacts are not underestimated simply due to lack of knowledge. Uncertainty should be documented, and the method and rationale used to develop a consequence rating should be explained in the ESIA.

Risk

Up to this point in the assessment, all potential impacts have been analyzed. Some assessments will limit the scope of analyses to potential impacts that are likely or certain to occur, while other assessments may also include potential impacts of lesser likelihood, assigning probabilities to the occurrence of these impacts. For example, habitat clearing in the physical footprint of a project is certain to occur, but petroleum spills or the accidental introduction of invasive species via vehicular traffic is not. A risk assessment process can reflect this and provide a basis for prioritizing mitigation actions (as will be addressed in the Management Planning section). Risk is a function of the potential consequence and likelihood of an impact, as shown in *Figure 2.4.1*.

Figure 2.4.1: Example risk matrix for biodiversity impact assessment

Risk ratings are generated by finding the intersection of impact consequence and likelihood.

Likelihood	Consequence				
	Minor impact	Moderate impact	Serious impact	Extreme impact	Catastrophic impact
Almost certain: expected to occur in project plan	M	H	C	C	C
Likely: probably will occur in project plan	M	H	H	C	C
Possible: might occur in some circumstances	L	M	H	C	C
Unlikely: may occur at some time	L	L	M	H	C
Rare: only in exceptional circumstances	L	L	M	H	H

Risk levels: L = low, M = moderate, H = high, C = critical

As depicted in *Figure 1.0.1*, this step will be repeated iteratively once management measures are designed (*Section 3*) to illustrate the difference between pre- and post-management. The results of both analyses should be presented in the impact assessment.

CHECKLIST

- Is a measure of consequence assigned to each of the potential impacts that have been characterized?
- Is the assessment transparent about the information needs to make firm determinations of impact significance?
- Is the assessment supported by documentation of the method for generating consequence ratings? Is the rigor of the assessment commensurate with the potential severity of the impact?
- Is the assessment repeated to quantify inherent (without management) and residual (with management) impacts?"

3 Management Planning

The purpose of this section is to describe the process for developing a plan to manage biodiversity impacts. Here management is defined as any actions that correspond to the four elements of the mitigation hierarchy, as described below.

Avoidance: actions taken to fully prevent impacts to biodiversity values, such as changing the spatial design of a project to prevent impacts in specific locations

Minimization: actions taken to reduce the duration, intensity and/or extent of impacts that cannot be completely avoided

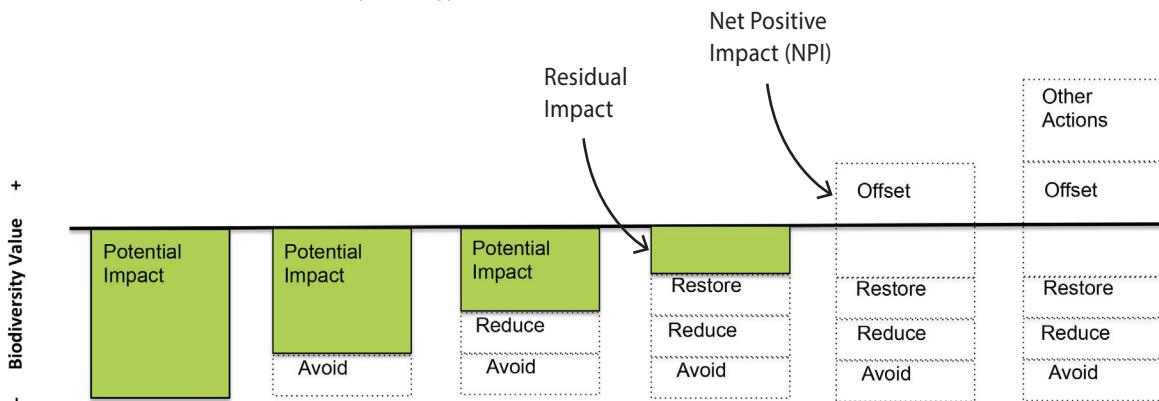
Rehabilitation/Restoration: actions taken to return areas to beneficial use and if possible assist in the recovery of the ecosystem that has been degraded, damaged, or destroyed

Biodiversity Offset: measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people’s use and cultural values associated with biodiversity².

Figure 3.0.1: Graphical depiction of the mitigation hierarchy, the x-axis does not represent time in the project lifecycle, but rather the sequence in which categories of mitigation are considered when planning management. The metric used to measure change in a biodiversity value (e.g., hectares of habitat) is shown on the y-axis.

Biodiversity Mitigation Hierarchy

(Adapted from Rio Tinto Biodiversity Strategy)

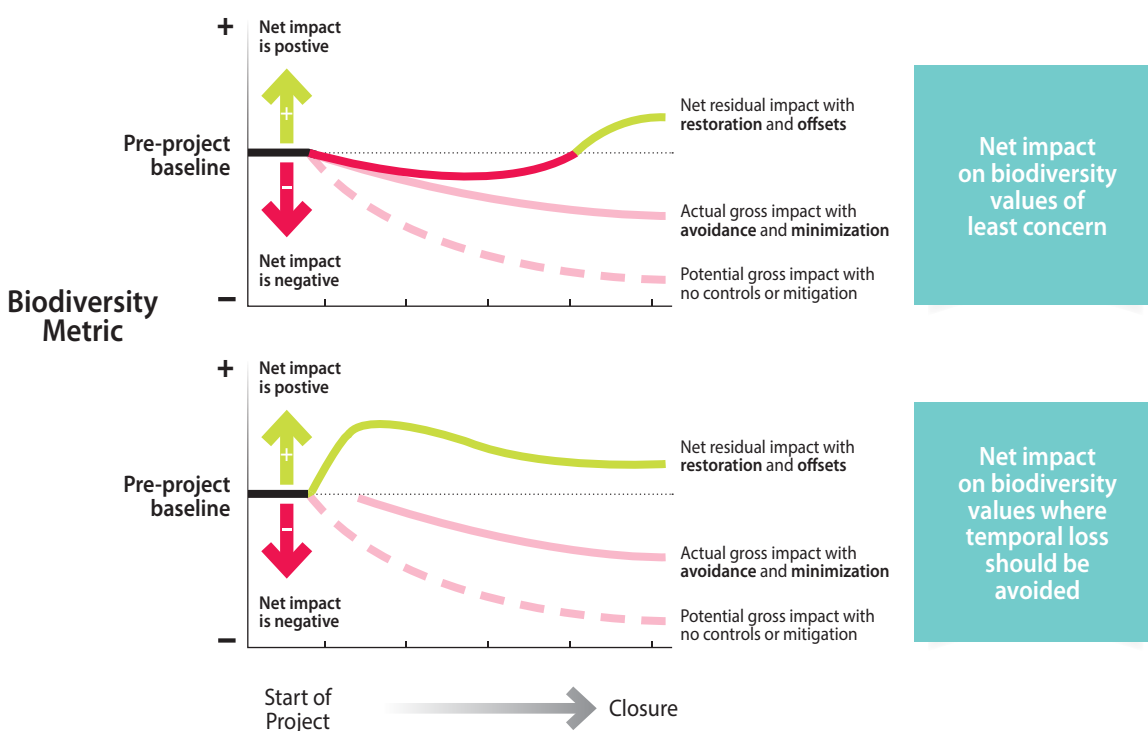


² http://bbop.forest-trends.org/documents/files/bbop_principles.pdf (viewed 9-2-14)

The mitigation hierarchy can be viewed as a prioritized set of possible management responses to anticipated impacts. Where feasible, avoidance and minimization are preferable to relying on rehabilitation/restoration and offsets because they maintain biodiversity values that may be difficult or costly to replace, or in some cases cannot withstand impacts and remain viable in the project area of influence or beyond. Avoiding or minimizing an impact may reduce biological, social, and financial liabilities.

The combination of mitigation actions and their timing will vary according to the specifics of the project and the biodiversity values that will be affected. For example, it may be important to consider whether a biodiversity value can withstand temporal loss without a large reduction in its viability, such as the loss of habitat for a Critically Endangered species. In those cases where temporal loss may result in the long-term loss of viability or function of a biodiversity value, more attention can be placed early in the project cycle on avoidance, offsets, and progressive restoration. *Figure 3.0.2* illustrates the difference in timing of mitigation actions between sites having values that can withstand temporal loss, and those having values that cannot.

Figure 3.0.2: Sites that have biodiversity values that cannot withstand temporal loss may choose to prioritize avoidance and accelerate implementation of rehabilitation/restoration and offsets. The x-axis represents timing. The metric used to measure change in a biodiversity value (e.g., hectares of habitat) is shown on the y-axis.



Effective management plans should reduce the consequence and/or risks of impacts. Management plans should be iteratively improved until impact consequence and/or risk ratings achieve acceptable levels, as determined by regulators, lenders, or corporate standards.

Some lender and voluntary corporate standards require projects to forecast the net impact to specific biodiversity values (primarily habitat) in order to demonstrate that management targets (i.e., no net loss or net gain of biodiversity values) will be met. A recommended approach is to calculate the gains from each element of the mitigation hierarchy separately, as the management plan is developed, in order to provide an accounting of what measures are providing the desired gains.

Following is a description of each element of the mitigation hierarchy with general guidance on its inclusion in a project's management plan. In some cases, the design of mitigation measures will require a fair amount of technical analysis. This analysis must be captured in supporting documentation to the ESIA.

As with the impact assessment, management planning is not a purely technical process. It is good practice to consult project stakeholders in all steps of planning. In particular, entities that are potentially affected by impacts to biodiversity as well as those that have a knowledge base about local biodiversity, including traditional knowledge, should be consulted about plans to manage biodiversity impacts. Furthermore, where management includes off-site offsets, stakeholders may be affected positively by enhancing biodiversity values, or negatively by altering land use practices and/or restricting use of biodiversity values. Targeted stakeholder consultation will be very important to ensure the success of offsets. Finally, as stated earlier, management planning should acknowledge perceived impacts and the necessity to recognize them respectfully and appropriately in the management planning process.

CHECKLIST

- Does the management plan follow a structured treatment of the mitigation hierarchy?
- Has it made use of preventative measures before reliance on rehabilitation/restoration and offsets?
- Does the management plan successfully mitigate risks and impacts to all biodiversity values?
- Did the management planning process involve appropriate stakeholder input?

3.1 Avoidance

“Avoidance” prevents damaging actions before they take place. Avoidance often involves a decision to deviate from the business-as-usual project development path. The clearest examples of avoidance are altering the footprint of a project to avoid destruction of natural habitat on the site and/or establishing set-asides where priority biodiversity values are present and will be conserved. The rationale for employing avoidance may include ecological, economic, regulatory and reputational reasons. At a minimum, avoidance should be considered where there are biodiversity values that are: especially vulnerable and irreplaceable, of particular concern to stakeholders, or where a cautious approach is warranted due to uncertainty in impact assessment or the efficacy of management measures.

There are three major types of avoidance (CSBI, in preparation):

Avoidance through Site Selection:

Locate the entire project away from areas recognized for important biodiversity values.

Avoidance through Project Design:

Configure infrastructure to preserve areas at the project site with important biodiversity values.

Avoidance through Scheduling:

Time project activities to account for patterns of species behavior (e.g., breeding, migration) or ecosystem functions (e.g., river dynamics).

Examples from different industry sectors of actions that can be taken to avoid impacting ecologically sensitive areas could include:

- **Mining** – changing the location of certain large-footprint components (e.g., waste rock storage, tailings storage, heap leach pads) to preserve ecologically sensitive habitats;
- **Oil & Gas** – directional drilling, helicopter access instead of road access, pipeline routing to avoid surface impacts to areas considered a priority for conservation;
- **Forestry** – use of set asides to protect areas of habitat important for wildlife;
- **Hydropower** – run-of-river design to decrease the footprint of a reservoir and the consequent loss of terrestrial habitat; and
- **Roads** – roadway routing to avoid wetlands or protected areas.

CHECKLIST

- Is the business case for avoidance analyzed?
- Does the management plan consider avoidance of impacts that have severe or catastrophic consequences?
- Do proposed avoidance measures accommodate uncertainty regarding impact assessment or the efficacy of other management measures?

3.2 Minimization

“Minimization” reduces the extent, intensity, and duration of impacts on biodiversity that are not prevented by avoidance. Examples of minimization actions include practices such as implementing procedures for reducing the occurrence of environmental contamination from hydrocarbon spills, installing wildlife crossings to reduce mortality on roadways, and maintaining environmental flows at dams. Minimization may require significant project investment if avoidance options are overlooked or not possible.

In general, “good environmental management practices” for operations in most sectors can be categorized as minimization actions. As such, numerous resources on good practices in each sector exist, and undoubtedly will grow in number over time. Notable sources are:

- **Extractives** – CSBI (in preparation); International Council on Mining and Metals (2006); Energy and Biodiversity Initiative (2003)
- **Forestry** – Food and Agriculture Organization (Zimmerman, 1992)
- **Hydropower** – World Commission on Dams (2000); International Hydropower Association (2012)
- **Roads** – Bissonette (2007); Spellerberg (2002); Byron (2000)

Minimization measures adopted as “good practice” in a given sector may not be readily transferable across projects. One example is fish passages for dams – a common design element in new hydropower projects but one that has not necessarily been proven for the range of species and conditions encountered at all sites (Brown et al., 2013). An example of a broadly misused management measure is “rescue and relocation” of flora and fauna that are found in harm’s way. There is growing scientific evidence that this practice is not as effective as once believed, and is potentially harmful. As a general rule, translocation should only be conducted as part of a structured program that includes specialized design and ongoing verification of its effectiveness (IUCN and SSC, 2013). In all cases, minimization measures that are transferred to a new context should be technically justified and accompanied by monitoring to ensure their effectiveness.

CHECKLIST

- Does the management plan include minimization of impacts where needed and possible, including widely accepted “good practices” for the industry sector?
- Are proposed minimization measures technically justified for the project and accompanied by monitoring for effectiveness?
- Is the management plan transparent about the information needs to design effective minimization measures?
- Is the management plan provided in a form that is appropriate for others (e.g., construction engineers) to carry out minimization measures?

3.3 Rehabilitation and Restoration

In cases where a project's activities occur for only a specific period of time, such as mining or oil and gas production, there may be an opportunity to rehabilitate or even restore biodiversity values on the impacted site.

Rehabilitation typically re-establishes a "beneficial use" in the impacted area. This fulfills the basic criteria of mitigating soil contamination that may have human health or ecological impacts, ensuring that slopes are stabilized and erosion is controlled via adequate drainage patterns, and that vegetation is re-established. In most cases the metrics of success are safety; visual appeal; and where possible, future human use of the area. Re-establishing a beneficial use of the area may be the most practical and realistic alternative for many sites. However, it does not necessarily address the conservation needs of many biodiversity values. For example, when replanting an area where vegetation has been removed, the vegetation that is established (often for very practical reasons) may be quite different from the natural habitat that initially was removed to develop the project.

Restoration is a more technically ambitious undertaking. The *Society for Ecological Restoration (2004)* states:

An ecosystem has recovered - and is restored - when it contains sufficient biotic and abiotic resources to continue its development without further assistance or subsidy. It will sustain itself structurally and functionally. It will demonstrate resilience to normal ranges of environmental stress and disturbance. It will interact with contiguous ecosystems in terms of biotic and abiotic flows and cultural interactions.

They provide a detailed set of attributes of restored ecosystems including:

The restored ecosystem contains a characteristic assemblage of the species that occur in the reference ecosystem and that provide appropriate community structure.

The requirement to perform rehabilitation and restoration will vary across regulators, lenders, and corporate standards, and may be tightly related to the desired outcome of biodiversity management (e.g., no net loss, net gain). In either case, both rehabilitation and restoration programs should consider several important guidelines:

1. The biodiversity baseline should provide information on the vegetation types at the site and their condition. In the best-case scenario, baseline information will include species composition and density estimates, vegetation structure, and any information possible about ecological function (see the companion *Good Practice for Biodiversity Baseline Data*). The baseline can serve as a reference against which restoration plans are developed. A more expansive baseline study may also include information about the ecosystem in different successional stages (if observable in the landscape) – useful for gauging the progress of restoration of an impacted site.
2. Topography and hydrology of the site should be documented, and to the extent possible, vegetation associations with slope, aspect, and drainage should be recorded for use in the rehabilitation/restoration program.

3. A rehabilitation/restoration program will require a stock of germplasm (seeds, cuttings, seedlings), preferably collected from the site prior to impact, although this may not be necessary in cases where other local sources are available. Collection from site may require advance study of the phenology of certain plants to ensure that seeds can be collected at the appropriate time.
4. A facility will be required to store seeds and propagate plants in a nursery, eventually to be replanted in the area.
5. Organic soil material must be collected and stored properly for future use in the site rehabilitation/restoration.
6. Experimental trials should be started as soon as possible. In those cases where the conservation of biodiversity values at the site depends significantly on restoration, the project proponent should demonstrate that it can successfully perform the necessary restoration prior to impacting the ecosystem.
7. Where possible, rehabilitation/restoration should be progressive, as areas at a site become available for rehabilitation.

A thorough study of the rehabilitation/restoration potential of a site should be conducted as a part of management planning. The restoration potential will be zero if the project results in permanent land use change (e.g., creation of a hydropower reservoir), and may be severely limited where major impacts have occurred (e.g., open pit mine). Where restoration is considered, the costs and benefits should be compared with alternative investments in priority biodiversity values via offsets (as discussed below), as site restoration may be disproportionately costly relative to the ecological benefits achieved.

CHECKLIST

- Is rehabilitation/restoration the appropriate action given the significance of the impact? Have the contributions to avoidance and/or minimization been optimized first?
- Have realistic goals been set for rehabilitation/restoration based on knowledge of the ecosystem, past experience, cost, stakeholder input, and other practical considerations?
- Is the proposed rehabilitation/restoration method tested and proven for the project setting? If not, are uncertainties in method clearly stated and accommodated with appropriate precaution?

3.4 Biodiversity Offsets

Biodiversity offsets are defined as measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity³.

Biodiversity offsets are regulated in some countries (e.g., United States, Australia, Peru), but are largely voluntary at present in most countries. The project developer will need to comply with local regulations and determine whether additional voluntary actions are needed to reach the mitigation targets established by lenders or corporate standards (e.g., no significant negative residual impacts, no net loss or net gain of biodiversity). Recalling Figure 3.0.1, an estimate of residual impact to biodiversity values will be needed once avoidance, minimization, and restoration actions have been designed. Offsets should be designed to make up for that residual loss if it represents a significant shortfall relative to mitigation targets.

The international community of practice generally accepts two types of offsets:

- **Averted-loss** – conservation projects that conserve threatened biodiversity values, which may include creating new protected areas and in some cases supporting existing but highly threatened protected areas; and,
- **Restoration** – conservation projects that restore biodiversity values, and in some cases enhance or create new habitat.

Following are a set of generally accepted principles for offset design.

1. **Follow the mitigation hierarchy** – Offsets are not intended to relieve project developers of performing other types of mitigation.
2. **Offsets should support landscape-level conservation** – Offsets should be designed considering the ecological processes and functions of the landscape.
3. **Offsets must provide additionality** – Only the gains in biodiversity that would not have occurred in the absence of a conservation project qualify as a “biodiversity offset”. The offset must not duplicate or replace an existing and adequately functioning restoration or conservation project.
4. **Achieving no net loss or net gain requires adequate scale** – Offsets should generate biodiversity gains (additionality) commensurate with the impacts of the project. In some cases, the scale

³http://bbop.forest-trends.org/documents/files/bbop_principles.pdf (viewed 9-2-14)

of the offset may be expanded in size to accommodate uncertainties in design and expected effectiveness.

5. In-kind (like-for-like) vs. out-of-kind (trading up) – An offset typically seeks to generate benefits for the biodiversity value(s) impacted by a project. Offsets with these characteristics are known as “in-kind” or “like-for-like” offsets. Sometimes, however, it may be desirable to implement an offset that restores or conserves a biodiversity value of greater conservation value than that which is to be impacted by the project. For example, if a project impacts very common natural habitat in the landscape, it may be desirable to “trade up” to an offset that conserves a more rare and/or threatened habitat that has been identified as a priority for conservation. Such an “out-of-kind” offset should only be implemented after appropriate consultation with conservation stakeholders to ensure both its technical validity – that the offset is genuinely of greater conservation value, and its public acceptance – that stakeholders view the offset as greater in perceived value.

6. Stakeholder participation fortifies offset design – Entities with responsibilities and interests related to biodiversity conservation and the human welfare impacts (both positive and negative) of land use decisions should be engaged in the biodiversity offset planning process. A sample list of stakeholders might include: environmental regulators; conservation organizations operating in the area; and local communities that may be affected by either losses of biodiversity that the offset seeks to replace, or loss of land or resources due to the implementation of the offset.

7. Offsets' benefits should endure as long as project impacts – Offsets require sustained management to ensure that the benefits endure over time. To achieve such continuity, it is recommended to ensure legal protection of offset areas and secure funding to manage the offset for its entire design life.

Offset design should be integral to conservation planning and other land use planning in the project landscape. This may mean that in locations where the public sector has prioritized areas for conservation through a robust scientific and consultative process, “trading up” may be the most logical and preferable option, as it should in theory assist in achieving the most important objectives of the region’s conservation plan. In jurisdictions where offsets are regulated or becoming common due to lender and corporate standards, the concept of “aggregated offsets” may be used to achieve large-scale conservation goals by joining the offset obligations of multiple companies into a single large conservation project. In locations where conservation planning is less developed, there is a weaker context both for “trading up” as well as determining the optimal design for the offset in other regards. In these cases, consultation with experts and organizations with experience in the area may play a valuable role in assisting with the offset’s design.

Project proponents are advised to contract specialists with experience in designing offsets that meet international standards and to work with government and local conservation organizations that have

sufficient local knowledge and the ability to set up and manage successful conservation projects that will serve as an offset.

CHECKLIST

- Is an offset appropriate given the significance of the impact? Are avoidance, minimization, or restoration measures practicable and more appropriate?
- Are the biodiversity values that will benefit from an offset clearly stated, with an estimate of the magnitude of potential benefit? Are those benefits commensurate with the residual impacts of the project?
- If a biodiversity offset is used, is it designed according to generally accepted principles of good practice?
- Is the management plan transparent about the information needed to design an effective offset?
- Does the proposed offset plan accommodate uncertainty through monitoring and adaptive management?

3.5 Plan Documentation

Given the diversity of preferences for management plan documentation across regulators, lenders, and corporations, it is best to consult the relevant entities for direction on how best to document the management plan.

In general, it is good practice to think of biodiversity management no differently than other types of environmental management and to integrate it into the project's Environmental and Social Management Plan. The one exception may be a separate, stand-alone plan for a biodiversity offset because its management may be distinct from the project's on-site environmental management.

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