International Association for Impact Assessment

Special Publication Series No. 3
January 2018

International Best Practice Principles

Biodiversity and Ecosystem Services in Impact Assessment

PURPOSE
These Best Practice Principles on Biodiversity and Ecosystem Services in Impact Assessment are intended to guide development and capacity building among practitioners for improving impact assessment outcomes.

BACKGROUND
These Best Practice Principles were first published in 2005. Comments are welcome at any time and should be forwarded to the current chair(s) of IAIA's Biodiversity and Ecology Section.

HOW TO CITE THIS PUBLICATION
Brownlie, S and Treweek, J. (2018) Bidiversity and Ecosystem Services in Impact Assessment. Special Publication Series No. 3. Fargo, USA: International Association for Impact Assessment.

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MANY HUMAN ACTIVITIES DAMAGE ECOSYSTEMS, PLACING BIODIVERSITY, ESSENTIAL ECOSYSTEM SERVICES, AND ULTIMATELY HUMAN WELLBEING AT RISK. IMPACT ASSESSMENT PLAYS A KEY ROLE IN PLANNING DEVELOPMENT THAT IS COMPATIBLE WITH THE CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY AND ECOSYSTEMS.

CURRENT PRACTICES MUST IMPROVE CONSIDERABLY TO ARREST ONGOING GLOBAL DECLINES IN BIODIVERSITY AND ENHANCE THE RESILIENCE OF ECOSYSTEMS SO THAT CONTINUED AVAILABILITY OF ESSENTIAL SERVICES, VALUES, AND BENEFITS CAN BE ASSURED.

Introduction

These Principles[1] apply to all stages and types of impact assessment (IA), whether at project or strategic level, and are intended to underpin efforts to achieve sustainable outcomes for biodiversity, ecosystems, and the services they provide. They promote biodiversity-inclusive IA that is compatible with the aims and objectives of the Convention on Biological Diversity (CBD), the Ramsar Convention, and the Convention on Migratory Species (CMS). These require Signatories ("Parties") to use environmental impact assessment (EIA) for projects and strategic environmental assessment (SEA) for policies, plans, and programs as tools for the conservation and sustainable use of biodiversity and ecosystems and the fair and equitable sharing of the benefits arising from their use.

The Principles are intended to align with the performance standards and requirements of international finance institutions that promote integration of conservation needs with development priorities, to protect and conserve biodiversity and ensure that benefits from ecosystem services are maintained.

They should help practitioners to integrate biodiversity and ecosystem services in IA, decision-makers to commission and review IAs, and other stakeholders to ensure that their biodiversity and ecosystem services interests are addressed in development planning. They should also support efforts by businesses to strengthen their corporate policies and commitments on the environment and natural capital by mainstreaming biodiversity and ecosystems into their procedures for environmental and social planning, assessment and management.

Importantly, these Principles embody the need to go beyond "business as usual" to achieve positive and demonstrable outcomes for biodiversity and ecosystems through rigorous application of the mitigation hierarchy (MH) as part of impact assessment.

Biodiversity and Ecosystem Services in Impact Assessment

Biodiversity: Essential values, benefits, and services

Biodiversity is the variability among living organisms, including diversity within species, between species and of ecosystems. It forms the basis for genetic evolution and is necessary for life to adapt to changing environments and conditions. Biodiversity components and ecological processes and functions also make many direct and indirect contributions to human wellbeing[2]:

1. *Provisioning services:* Goods or products such as food, timber, fresh water, and medicine.
2. *Regulating services:* Contributions to human wellbeing arising from an ecosystem's control of natural processes, such as climate regulation, disease control, erosion prevention, pollination of crops, water flow regulation, and protection from natural hazards.
3. *Cultural services:* The non-material contributions of ecosystems to human wellbeing, such as recreation, spiritual values, and aesthetic enjoyment.
4. *Supporting services*[3]*:* The natural processes needed to maintain the other services, such as primary production by plants, decomposition, recycling of nutrients, and soil formation.

Ecosystems and their biodiversity contribute to human wellbeing in a variety of ways, some of which are difficult to quantify in monetary terms. These include contributions to health, traditional livelihoods and cultural, spiritual, or religious enrichment. In many cultures and societies, components of biodiversity have "intrinsic" or "existence" values that need to be recognized, irrespective of any material contribution they make to human wellbeing. These values and benefits are often overlooked, underestimated, or omitted from the important trade-offs and decisions for which EIA and SEA are used, resulting in failure to internalize significant costs and risks. Replacement or substitution of the services provided by biodiversity (e.g., engineered flood defense to replace coastal protection by dunes or mangroves) often requires large financial investment. Failure to recognize risks to biodiversity can create serious long-term liabilities for developers and failure to recognize critical dependencies of people on biodiversity may result in contravention of human rights, undermine irreplaceable cultural traditions, or elicit major resistance from affected communities.

Principle 1

The Principles

Principle 1: Use IA to maintain and enhance biodiversity, with a goal of no net loss (NNL) outcomes as a minimum and an aspiration for net gain (NG).

Principle 2: Integrate biodiversity and ecosystem services in development planning and IA from the earliest possible stages.

Principle 3: Take an ecosystem perspective to framing of IA, allowing the significance of ecological changes to be assessed at appropriate spatial and temporal scales.

Principle 4: Address the rights, values, dependencies, and benefits that people derive from biodiversity and ecosystems in IA, taking a participatory and transparent approach throughout.

Principle 5: Design IA baseline surveys and assessments to generate the information and understanding needed to support evidence-based approaches to assessment of impacts on biodiversity and ecosystems.

Principle 6: Ensure that implications for biodiversity and ecosystem services are fully addressed using transparent, evidence-based approaches and appropriate expertise.

Principle 7: Apply the MH, with emphasis on preventive measures and including offsets for residual impacts on biodiversity, ecosystems and the services they provide.

Principle 8: Use precautionary approaches where the consequences of development for biodiversity and ecosystem services are unclear and there is insufficient information to exclude the possibility of unacceptable, irreversible, or non-offsetable impacts.

Principle 9: Establish robust adaptive management systems to ensure that IA commitments will be met, mitigation measures will be implemented and that no net loss/net gain (NNL/NG) outcomes can be demonstrated through monitoring, auditing and reporting.

Use IA to maintain and enhance biodiversity, with a goal of NNL outcomes as a minimum, and an aspiration for NG

This Principle underpins an outcome-oriented approach to IA, with explicit efforts to maintain biodiversity at current, pre-impact levels or better. It recognizes the need to prevent further biodiversity loss through rigorous application of the MH (Principle 7) and, in some cases, to rectify historic losses to improve chances of achieving long-term sustainable outcomes.

NNL represents the break-even point for losses and gains. NG, sometimes termed net positive impact (NPI) means going beyond break-even to leave an overall positive legacy, enhancing the resilience of biodiversity and ecosystems.

- For biodiversity, IA should be used to identify ways in which diversity within or among species and ecosystems and the ecological and evolutionary processes on which they depend can be safeguarded or enhanced, allowing them to persist in the area or landscape affected by a proposed development.
- For ecosystem services, IA should be used to identify ways in which ecosystem extent, health, and functionality can be safeguarded or enhanced, allowing the values and benefits derived from ecosystem services to be sustained over time.

IA is a key implementation mechanism for policies on NNL or NG because it is endorsed by several international conventions as a tool for mainstreaming biodiversity into planning and decision making, widely promoted as a tool for corporate social responsibility, and seen by financial institutions as a key tool to manage environmental and social risks of the developments in which they invest (IPIECA, 2016; CSBI, 2015). Many countries have policies on NNL or NG of biodiversity, and IA offers a means of implementing them by making losses and gains explicit when development is planned, though there can be significant implementation challenges.

In some circumstances, working towards an NG outcome may be essential for future viability. Some lender and corporate standards therefore require it for biodiversity that is relatively irreplaceable or highly vulnerable. Aiming for NNL/NG does not necessarily mean using complex numerical accounting approaches, but it does demand explicit, transparent, and evidence-based efforts to redress losses, as well as a system of monitoring and follow-up to confirm assumptions.

Principle 2

Integrate consideration of biodiversity and ecosystem services in development planning and IA from the earliest possible stages

Early consideration of development implications for biodiversity and ecosystems is needed to ensure that IA is designed with appropriate spatial, temporal, and technical scopes to:

- Identify risks of irreplaceable or unacceptable losses of biodiversity or ecosystem services in time for avoidance action to be taken and feasible development alternatives to be adopted.
- Recognize critical dependencies of people on ecosystems through appropriate consultation.
- Avoid wasted expenditure on technical designs that cannot be progressed because of unacceptable biodiversity impacts.
- Identify opportunities for enhancement or gain and form any partnerships needed to capitalize on these opportunities.
- Avoid having to take a strongly precautionary approach.

Long lead times are often needed to develop robust baselines and consider probable trends affecting biodiversity (e.g., climate change and foreseeable future development). Without early engagement, it is often impossible to take an appropriate ecosystem approach in accordance with Principles 3 and 5.

Early consideration may be achieved through inclusion of biodiversity issues "upstream" in the planning process (e.g., through SEA) or by "front loading" incorporation of biodiversity in EIA, e.g., through its explicit consideration in scoping.

Principle 3

Take an ecosystem perspective to framing of IA, allowing the significance of ecological changes to be assessed at appropriate spatial and temporal scales

People and biodiversity depend on healthily functioning ecosystems. Taking an ecosystem perspective means conducting IA (whether EIA or SEA) in a manner that allows implications for biodiversity and ecosystem services to be assessed at an ecologically relevant, appropriate, and meaningful scale and over a time frame that allows consideration of the full range of risks and opportunities affecting their viability, i.e., not constrained by artificial boundaries or fixed-distance buffers.

Ecological impacts may extend well beyond development footprints, and cumulative effects are often significant drivers of decline in biodiversity and ecosystems. The ecological implications of land use change and their significance cannot be evaluated if IA is based only on information about plan- or project-affected areas, in isolation from their wider ecological context. To predict outcomes for biodiversity and evaluate their significance, it is necessary to consider implications for populations and ecosystems (or the parts thereof) that will remain with planned development in place. Spatial scope may therefore need to extend to the limits of affected ecosystems or the wider areas needed to maintain them in a viable condition. This is clearly recognized in IFC's Performance Standard 6 (2012) and accompanying Guidance Notes, which emphasize the need for a landscape approach to identification of "critical habitat" and assessment of impacts on biodiversity.

Principle 4

Address the rights, values, dependencies, and benefits that people derive from biodiversity and ecosystems in IA, taking a participatory and transparent approach throughout

Development may affect the ability of people to benefit from biodiversity and ecosystem services, sometimes with implications for their fundamental human rights. Failure to recognize critical dependencies on ecosystem services and the values and benefits derived from them may compromise livelihoods and wellbeing of affected people and damage social license to operate. IA should therefore be designed to support full, transparent, well-informed, and open participation from beneficiaries of ecosystem services that may be affected by proposed development. The results of IA should be communicated to or shared with stakeholders and interested and affected parties in a clear, transparent and timely manner.

IA should indicate where planned development could compromise any human rights, health, safety, or livelihoods by damaging ecosystems or biodiversity. It should highlight critical dependencies on biodiversity for which there may be no effective or acceptable substitutes. Needs of future as well as current generations (inter-generational needs) should be considered: efforts should be made to identify alternatives that do not trade in biodiversity "capital" to meet short-term needs where this could jeopardize the ability of future generations to meet their needs.

The involvement of affected communities in mitigation and management actions can help to build a constituency with long-term investment in maintaining biodiversity and ecosystem services. In some it may be necessary to obtain the "free prior and informed consent" of affected people, and this may require targeted efforts to ensure that implications of ecosystem change are considered in IA and communicated effectively.

Principle 5

Design baseline surveys and assessments to generate the information and understanding needed to support an evidence-based approach to assessment of impacts on biodiversity and ecosystems

Baseline surveys should be designed to generate the information needed by ecologists to assess impacts and evaluate their likely significance using transparent, evidence-based approaches. Robust baselines support a more outcome-oriented approach to IA for biodiversity and ecosystems, allowing explicit consideration of how development will affect ability to achieve NNL/NG in accordance with Principle 1.

Ecosystems are dynamic, responding to natural pressures and cycles as well as human-induced changes. To evaluate the significance of impacts associated with planned development, assessment of impacts on biodiversity and ecosystem services must be carried out in relation to their existing, pre-development state and their projected future state without planned development. This requires information on external threats and pressures that might contribute to cumulative effects with the direct, indirect, and induced impacts of the specific proposal and means that biodiversity baseline studies often have long lead times and a wider spatial scope than some other specialist studies in IA.

Principle 6

Ensure that implications for biodiversity and ecosystem services are fully addressed using systematic evidence-based approaches and appropriate expertise

Impacts on biodiversity and ecosystem services should be investigated systematically using the best information and expertise available. IA should consider the consequences of development for all types of biodiversity loss and ecosystem damage, even if these are not all assessed to the same level of detail. Impacts should be assessed at a level of detail proportionate to the risks and probable impacts and the likely importance, vulnerability, and irreplaceability of affected biodiversity, established in accordance with Principle 5. Early consideration of development implications for biodiversity and ecosystem services in scoping plays a key role in enabling this (Principle 2), as does use of appropriate specialist expertise.

Impacts must be evaluated in relation to NNL/ NG outcomes for biodiversity in line with any international conservation obligations, legal requirements, government or corporate policies, and lender standards. Implications of lost or diminished ecosystem services for the rights and values of communities that depend on them also need to be considered.

Assessment of impacts on biodiversity and ecosystem services is complex, often uncertain, and always highly context-specific. The strength of evidence used to underpin predictions and any assumptions made must be clearly explained, so that the need for precautionary approaches can be established in accordance with Principle 8. This is also necessary to justify any "scoping out" of risks and impacts.

IA must consider the role of biodiversity in the socioeconomic system. Biodiversity concerns are not limited to protected areas or highly threatened or charismatic species. Elements of natural systems remain in even the most urbanized cities and play an important part in determining the quality of life in those cities. Implications for "overall biodiversity" need to be considered as part of a comprehensive approach. This Principle therefore requires consideration of the full range of development-related factors affecting biodiversity, including direct and indirect impacts, cumulative effects, and induced impacts arising from socio-economic changes catalyzed by any proposed development.

Principle 7

Apply the MH, with emphasis on preventive measures and including offsets for residual impacts

The MH is an essential "organizing" framework for mainstreaming biodiversity and ecosystems into impact assessment and working systematically towards NNL/NG outcomes through preventive and remediative measures.

It prioritizes efforts first to avoid and then minimize impacts on biodiversity and ecosystem services before mitigation based on restoration is considered. This is because some biodiversity and ecosystems cannot be

restored with known techniques, making residual losses inevitable if they are destroyed. Offsets are presented as the last step in the MH as they carry more uncertainty, but chances of success are enhanced if the potential need for offsets is identified early in the IA process as designing them is challenging and takes time. The MH should therefore be used iteratively throughout IA, with a focus on NNL/NG outcomes according to Principle 1.

Early identification of potentially irreversible or unacceptable impacts on biodiversity and ecosystem services through the MH allows feasible alternatives to be considered that allow NNL/NG to be achieved before significant resources have been committed to more damaging alternatives.

Principle 8

Use precautionary approaches where the consequences of development for biodiversity and ecosystem services are unclear and there is insufficient information or knowledge to exclude the possibility of irreversible or non-offsetable impacts

This Principle involves taking a precautionary approach to IA in any situation where important biodiversity may be threatened and there is insufficient knowledge or baseline information available, to quantify impacts and risks, implement effective mitigation, or provide assurance that sustainable outcomes are possible. The same Principle should apply where people have high levels of dependence on ecosystem services, without access to viable or acceptable alternatives.

Ecosystems are complex and dynamic. In the absence of complete knowledge or understanding of ecosystem functioning, impacts are frequently difficult to predict with certainty, especially over longer time frames or in landscapes where rapid change is occurring. Where there is insufficient information or understanding to exclude the possibility of irreversible, non-offsetable impacts or unacceptable impacts on biodiversity or ecosystem services, less harmful development alternatives should be sought or development should be delayed until greater assurance of ability to achieve NNL/ NG can be given in accordance with Principle 1.

Principle 9

Establish robust adaptive management systems to ensure that IA commitments will be met, mitigation measures will be implemented, and NNL/NNG outcomes can be demonstrated through monitoring, auditing, and reporting

Monitoring and adaptive management are essential to ensure that intended outcomes of mitigation are achieved in the longer term and that key assumptions used in IA were correct. Given that the penalties for incorrect prediction or assessment of impacts may include loss of irreplaceable biodiversity or priority ecosystem services, and/ or prevent the attainment of NNL/NG objectives, the design and implementation of plans or projects may need to be adapted over time. Ongoing management of biodiversity and ecosystem services must be responsive to "learning-by-doing" or research feedback.

This Principle is embodied in the Performance Standards of the International Finance Corporation (IFC, 2012) which states: "Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle."

Implementing the Principles

This section provides advice on how to implement the Principles in practice. It is not possible to provide comprehensive guidance for the full range of development and impact assessment contexts, so some key considerations are identified. Where possible, links are provided to more detailed relevant guidance.

Principle 1. Use IA to maintain and enhance biodiversity, with a goal of NNL outcomes as a minimum, and an aspiration for NG

- Explicit screening should be undertaken to ensure that impact assessment is used for developments affecting biodiversity and ecosystems. Screening criteria to invoke use of SEA/EIA may include potential impacts on protected areas, other key biodiversity areas, or on species listed as threatened by IUCN. Screening criteria also need to reflect risks of cumulative impacts on areas that are unprotected but are nevertheless important to maintain ecosystems in a viable, functioning state across the landscape, to safeguard biodiversity overall or to maintain populations of species that are under-recorded and may be approaching higher levels of endangerment due to additive, landscape- or seascape-scale impacts. In addition, screening criteria need to reflect risks of unacceptable loss of priority ecosystem services on which local communities depend heavily for their livelihoods, health, safety, and/or wellbeing.

- To demonstrate that NNL (as a minimum) can and will be achieved, the IA process must be designed to account systematically for losses and gains using transparent, evidence-based approaches. This requirement needs to be considered early in the IA process and reflected in scoping.

- Use Principle 3 to ensure that an appropriate landscape or seascape scale is used and that IA recognizes ecological limits: NNL cannot be achieved if the ability of ecosystems or their components to recover from impacts is lost. This means efforts must be made to avoid impacts on areas recognized for their uniqueness, irreplaceability, and vulnerability. In some cases development may not be appropriate in such areas and they should be identified as "no go" areas for development from the perspective of biodiversity.

- IA reports should indicate how positive contributions will be made to the achievement of conservation objectives and targets for biodiversity at international, national, regional, and local levels when development is planned, assessed, designed, implemented, and decommissioned. A statement should be included indicating how NNL or NG will be achieved when the planned development is implemented, based on the MH (Principle 7).
- Ensure that all proposed mitigation measures for impacts on biodiversity and ecosystems are clearly incorporated into a biodiversity action plan, management plan, or offset management plan (as appropriate) with explicit outcomes, program timelines and roles, and responsibilities for implementation.
- Use adaptive management approaches in accordance with Principle 9, based on monitoring and ongoing risk review to ensure that NNL/NG outcomes are assured in the longer term, based on IA commitments.

Principle 2: Integrate consideration of biodiversity and ecosystem services in development planning and IA from the earliest possible stages

Implementing this Principle is a shared responsibility of policy-makers, planners, developers, regulators, and practitioners.

- Ensure that regulations and planning procedures encourage biodiversity-inclusive IA and recognize the importance of rigorous screening and scoping to identify potentially significant risks and impacts.
- Promote or seek reliable, up-to-date information on local, regional, or global conservation priorities and on key biodiversity areas for conservation in or close to the area proposed for development.
- Practitioners should work with clients to agree an appropriate spatial scope for ecological studies as early as possible, based on the likely area of influence of proposed development, taking account of all infrastructure and activities inseparably associated with that development, and recognizing Principle 3. This allows baseline studies with an appropriate spatial scope to inform IA (Principle 4) and with sufficient time to obtain information on seasonal variations and trends.
- Consider potential cumulative risks to biodiversity and ecosystem services due to development, environmental, or political trends that might affect the same biodiversity and ecosystem services as the proposed development and compromise its sustainability at an early stage so that they are reflected in scope and inform baseline assessments (Principle 4).
- Seek early and ongoing engagement with affected communities and interested stakeholders in a transparent, respectful, and accountable manner (Principle 4).
- Develop corporate policies, approaches, and procedures that recognize the importance of biodiversity and ecosystem services and allow for timely, early consideration of risks.
- Use Principle 6 to ensure that the MH is rigorously applied throughout the design and planning process from the inception phase to achieve an emphasis on avoidance.

Principle 3: Take an ecosystem perspective to framing of IA, allowing the significance of ecological changes to be assessed at an appropriate spatial and temporal scale

- Spatial and temporal scope should not be determined on the basis of planned development infrastructure and activities alone:
  - The IA spatial scope should reflect the distributions of ecosystems and associated species populations, and incorporate all areas required to maintain the functions and processes that sustain them.
  - The IA timeframe should allow for effective consideration of seasonal differences, the dynamic nature and connectedness or interplay of ecosystems, uncertainty, and the often unpredictable nature of ecosystem functions, behavior and responses.
- This means going beyond the limits of proposed development sites or immediate project-affected areas and may require extensive (or landscape-scale) study areas that allow all levels of biodiversity and key ecological processes to be considered.
- Consider the relationship between biodiversity associated with proposed development areas and that associated with the wider ecosystem, landscape, or seascape.
- On land, IA for development affecting key biodiversity areas, biodiversity hotspots, ecological corridors, intact natural areas, habitat continuums, and priority conservation or protected areas needs to consider implications of planned development for the integrity of such areas and the viability of the species populations they support, taking into account existing threats and pressures affecting them.
- Take into account the role of the development area in supporting seasonal populations or migratory species, providing refuge for species (e.g., in times of drought) or supplying an "emergency resource" for biodiversity and people in times of ecological stress.
- Use time frames appropriate for ecological processes such as migration, restoration of degraded or transformed ecosystems (e.g., some vulnerable species may be dependent for reproduction on old growth trees), or replenishment of depleted ecosystem services (e.g., implications of time lags for affected communities).

Principle 4: Ensure that people's rights, values, dependencies, and benefits associated with biodiversity are recognized and addressed by taking a participatory and transparent approach

- Consult widely, starting early and continuing throughout the IA process, to ensure that all stakeholders have been engaged and that important biodiversity values and dependencies are taken into

account. Valuation of biodiversity can only be done in negotiation with the different groups or individuals in society (stakeholders) who have an interest in biodiversity.

- Use IA to identify, protect, and promote sustainable use of ecosystems and their biodiversity so that valued ecosystem services can be maintained over time.
- Test the findings of the IA, as well as implications and acceptability of potential mitigation options, with stakeholders, taking into account the likely costs of replacing lost or depleted ecosystem services.
- Publicize reports on the findings of the IA in formats and language appropriate to stakeholders. Ensure that there is sufficient time and an appropriate consultation response mechanism to ensure that stakeholders can participate in the IA process fully cognizant of relevant facts and information and that their views and concerns are heard prior to decision making on a proposed development.
- Publish project-related biodiversity and ecosystem services commitments and make the results of performance and/or compliance monitoring and environmental auditing available to stakeholders.
- Consider the likely implications of proposed compensation or offsets (Principle 6) and any changes in access to priority ecosystem services on the sustainability (rights and values) of affected communities and provide appropriate remediation.
- Use traditional and indigenous knowledge wherever appropriate in gathering baseline information, identifying trends and pressures affecting biodiversity and ecosystem services, and formulating optimum mitigation options.
- Seek alternatives that do not trade in biodiversity "capital" to meet short-term needs, where this could jeopardize the ability of future generations to meet their needs.
- Work carefully with indigenous communities to ensure that knowledge of biodiversity is not inappropriately exploited. Where possible, plan mitigation and management measures to allow local stakeholders to participate in their implementation and benefit from positive outcomes.

Principle 5: Design IA baseline surveys and assessments to generate the information and understanding needed to support evidence-based approaches to assessment of impacts on biodiversity and ecosystems

- Select frames of reference for assessing impacts on biodiversity and ecosystem services to take into account their current status and condition, and the likely future "without development" scenario, recognizing existing and predicted trends. Current and predicted trends, both natural and human-induced, and including climate change, must be factored into the "without development" counterfactual.
- Select time and spatial scales for the frame of reference that accommodate the area of influence of the proposed development and associated activities or infrastructure, wider ecological considerations (Principle 3) and the timeframes for probable impacts.
- Design baseline surveys and any supplementary studies in the most efficient way possible to generate sufficient data and information for use by specialists in their assessment and evaluation of impacts, by reference to any industry-standard guidance on methods where this exists.
- Design baseline surveys to capture key biodiversity components of intrinsic value, and the components that underpin the delivery of priority ecosystem services. Also consider ecological processes and functions needed to sustain viable ecosystems and biodiversity. Pay particular attention to components that are likely to be most vulnerable to the spectrum of direct, indirect and induced impacts associated with proposed development, and to the cumulative effects of external pressures and trends superimposed on those impacts.
- Where baseline studies to capture necessary information are not possible for whatever reason, a precautionary position should be adopted when assessing the significance of impacts and designing mitigation strategies in accordance with Principle 8.

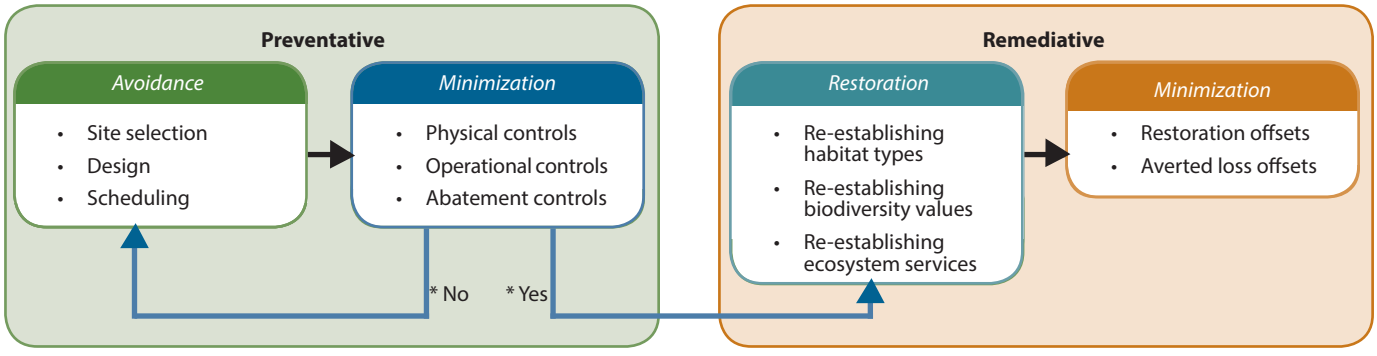
Principle 6: Ensure that implications for biodiversity and ecosystem services are fully addressed using transparent, evidence-based approaches and appropriate expertise

- Necessary skillsets are likely to be context-specific, but it is always good practice to draw on the knowledge and expertise of local (including indigenous) or regional specialists and biologists with specific knowledge of affected ecosystems, taxa, or species. Various specialist inputs may be needed to develop a comprehensive mitigation strategy for biodiversity and ecosystem services assessment generally requires collaboration between social specialists and ecologists as well as other technical specialists, depending on the services in question. Any uncertainties in the ecological information on which IA is based, challenges in accessing specialist input, and other limitations affecting the IA must be acknowledged. Key assumptions about the strength of evidence used to predict ecological outcomes should be explained. A precautionary approach must be taken where information gaps, uncertainties, or constraints on gathering required baseline data may prevent reliable IA (Principle 8).
- While IA must be evidence-based, evidence may be qualitative, based on professional judgement and/or value-based, so long as this is clearly stated in reports. Biodiversity specialists alone may not be sufficiently equipped to identify and assess values of, and impacts and risks to, ecosystem services, necessitating collaboration with other specialists. Appropriate social and economic expertise must be used in conjunction with biodiversity specialist input to address potential effects on ecosystem services.
- Apply Principle 2 and, through rigorous scoping, identify the particular values and benefits associated with affected biodiversity and ecosystems.

- Consider the full range of development-related factors affecting biodiversity, including direct and indirect impacts, cumulative effects, and induced impacts arising from socioeconomic changes catalyzed by the proposed development. The latter changes are harder to quantify but may ultimately have greater adverse impacts on biodiversity and ecosystem services.
- Use professionally-registered specialists who are bound by a professional code of conduct, and who preferably have good local knowledge and experience.
- Involve biodiversity and social, cultural heritage, water, and other relevant specialists in IA to ensure that cross-cutting concerns about ecosystem services are reliably and responsibly identified, addressed, and integrated.
- Draw on scientific information from reputable sources, and consider local traditional and indigenous knowledge and values (Principle 5) to predict, assess, and evaluate likely impacts.
- Consider impacts on ecosystem services at a level of detail commensurate with the level of dependence of affected communities on services that will be lost or degraded and based on their ability to obtain alternative sources of benefits from those services.
- Clearly explain the expected consequences of any biodiversity loss or ecosystem degradation associated with the proposed development. These must be evaluated in relation to NNL/NG outcomes for biodiversity and ecosystem services in accordance with Principle 1, taking account of government policies, corporate commitments and any legal or international conservation obligations, as well as the sustainability (rights and values) of communities that are heavily dependent on affected ecosystem services.
- It is good practice to seek peer and/or independent review of environmental reports or statements with involvement of appropriate biodiversity specialist expertise, particularly for cases where biodiversity impacts are significant or complex, or where a proposed development is unprecedented.
- Design baseline surveys and any supplementary studies in the most efficient way possible to generate sufficient data and information for use by specialists in their assessment and evaluation of impacts, referring to industry-standard guidance on methods where this exists.
- Design baseline surveys to capture the key biodiversity components of intrinsic value, and the components that underpin the delivery of priority ecosystem services. Pay particular attention to gathering information on components that are likely to be most vulnerable to the spectrum of direct, indirect, and induced impacts associated with the proposed development, and to the cumulative effects of external pressures and trends superimposed on those impacts.

Principle 7: Apply the MH with emphasis on preventive measures and including offsets for residual impacts

- Apply Principle 1 to ensure that the combination of mitigation measures achieves NNL/NG.
- Recognize that compensation or offsetting of negative impacts on biodiversity of high irreplaceability or vulnerability would be highly unlikely or impossible to achieve due to the unacceptable risk of irreversible loss of biodiversity or irreplaceable loss of priority ecosystem services. In such situations, avoidance or prevention of impacts through seeking more appropriate alternatives must be pursued.
- Continually seek reasonable and feasible alternatives that optimize outcomes for biodiversity and ecosystems.
- Use the MH as a conceptual framework for structuring biodiversity aspects of the IA process from the outset, and apply it iteratively to support adaptive approaches to the development of mitigation strategies. Opportunities to avoid impacts may arise at any stage of design, implementation, or assessment and therefore efforts should be made to identify them from the outset of the IA process. The MH should form part of the design process, from inception to post-closure. The figure below is taken from recent guidance issued by the Cross Sector Biodiversity Initiative (Figure 1, CSBI 2015).



* Can potential impacts be managed adequately through remediative measures?

Principle 8: Use precautionary approaches where the consequences of development for biodiversity and ecosystem services are unclear

Any important gaps in information, assumptions made, or limitations in knowledge or understanding that may have influenced the reliability of impact predictions or effectiveness of mitigation recommendations, and pose significant risks of irreversible or unacceptable impacts on biodiversity or ecosystem services, must be explicitly stated in the IA.

Where important biodiversity may be threatened and there is insufficient knowledge or baseline information either to quantify impacts and risks, evaluate their likely significance or implement effective mitigation:

- Incorporate additional safeguards into the design of a proposed development based on a "worst case" scenario to give assurance that impacts and risks would be acceptable.
- Undertake additional research, studies, or monitoring to improve the levels of certainty and confidence in the IA before decisions can be taken to pursue the proposed development.
- Incorporate additional research, data gathering, and/or monitoring in biodiversity action plans where risks and impacts are deemed acceptable to address key information or knowledge gaps, reduce uncertainty, and improve management outcomes.

In situations where the risks of losing irreplaceable biodiversity or priority ecosystem services are unacceptably high, alternative projects or plans should be prepared.

Principle 9: Establish robust systems to ensure that IA commitments will be met, mitigation measures will be implemented, and NNL/NG outcomes can be demonstrated through monitoring, auditing, and reporting

- Ensure that mitigation measures for impacts on biodiversity and ecosystem services are clearly and comprehensively incorporated into a biodiversity action plan[4], biodiversity management plan, or biodiversity offset management plan (as appropriate) with explicit targeted outcomes, programme timelines, and roles and responsibilities for implementation. The outcome of the combined mitigation measures must clearly be shown to achieve NNL/NG (Principle 1).
- Performance Standard 6 of the International Finance Corporation (IFC 2012) and its accompanying Guidance Note provides advice on incorporation of biodiversity commitments in environmental and social management systems, allowing the flexibility needed for mitigation and management responses to be adapted based on new findings and to support a culture of continuing improvement.
- Incorporate additional research or studies into biodiversity action plans where appropriate, designed to close information gaps, reduce uncertainties, and improve mitigation outcomes.
- Ensure that the adequate financial provision is made to cover predicted costs of implementing all planned measures to mitigate impacts on biodiversity and ecosystem services, excluding costs of measures that have been embedded in the proposed project design. Provide assurance of sufficient financial provision and/ or financial guarantees in this respect as input to decision making.
- Provide for regular monitoring, using sensitive indicators, as well as periodic audits of performance, to inform the need for adaptive or corrective changes to biodiversity action plans, management, or offset management plans, introduction of additional mitigation actions, to "keep performance on track" to meet NNL/ NG outcomes and/ or to verify the achievement of these outcomes.
- Provide for key stakeholder involvement in monitoring the implementation of planned mitigation measures. Make the results of performance and/ or compliance monitoring and environmental auditing available to stakeholders, to enable their oversight of implementation of required mitigation measures and ensure that biodiversity and ecosystem services commitments are met (Principle 5).
- Report transparently and publicly on biodiversity and ecosystem services performance in languages and media appropriate for the specific context.

Notes

1 The Principles were first published in 2005 and reissued in 2018. Comments are welcome at any time and should be forwarded to the current chair(s) of IAIA's Biodiversity and Ecology Section.

2 Adapted from MEA, 2003.

3 The Common International Classification of Ecosystem Services (2011) refers to three main ecosystem services categories, namely provisioning, regulating/maintenance, and cultural services. Supporting services are treated as part of the underlying structures, processes, and functions that characterize ecosystems. www.cices.eu

4 All of these plans incorporate monitoring and evaluation components as well as periodic audits.

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Glossary

Adaptive management: Management that is corrected or adjusted to ensure that intended results are achieved, primarily by taking results of monitoring and evaluation of the effectiveness of past actions into consideration. Lessons learned from past practice are thus taken into account.

Additionality: Conservation outcomes which are achieved over and above results that would have occurred without the particular intervention.

Area of influence: The area in which impacts on biodiversity or ecosystems occur and can be attributed to plan or project activities/facilities and/or associated facilities as well as predictable cumulative effects from existing, planned, and/or reasonably defined developments affecting the same resources. Development area of influence may or may not coincide with development footprint.

Audit: Check performance against a standard or management plan to evaluate whether objectives have been attained and outcomes have met expectations.

Baseline surveys or studies: A description of pre-development biodiversity and ecosystems and future trends in the absence of planned development providing a starting point against which comparisons of post-development conditions can be made, allowing them to be quantified.

Biodiversity offset: Biodiversity offsets are 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 and ecosystem function and people's use and cultural values associated with biodiversity.

Compensation: Making due reparation for loss of biodiversity or ecosystem service caused by a project. Compensation is distinguished from a biodiversity offset when reparation will not—or is not intended to—achieve no net loss.

Counterfactual: A description of what would have happened in the absence of a proposed development or action (e.g., offset). This term is often used as the basis for comparing project impacts and the net effect of offsets.

Cumulative impact: Effect resulting from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions on the same resource, combined with effects of other threats and pressures in the environment.

Direct impact: Impacts directly attributable to a defined action or project.

Ecosystem services: The benefits people obtain from ecosystems and biodiversity. They include provisioning services (e.g., food, water, timber, and fiber); regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling.

Endemic: Confined to, or indigenous in, a certain area or region.

Indirect impact: Impacts resulting from the project that may occur beyond or downstream of the boundaries of the project site and/or some time after the project activity has ceased.

Induced impact: Impacts that are not directly attributable to the project, but are anticipated to occur because of likely socioeconomic changes (and thus patterns in biodiversity and resource use) catalyzed by the presence of the project.

Intrinsic value: The inherent worth of something, independent of its value to anyone or anything else.

Irreplaceability: The extent to which the options for achieving biodiversity targets are reduced if the area is unavailable for conservation (i.e., an impact would cause irreplaceable loss if conservation goals for that biodiversity component cannot be achieved without it), OR the extent to which habitat provides an important resource (food, fuel, etc.) to local communities that cannot be replaced from elsewhere.

Irreversibility: The extent to which impacts can be reversed over time.

Key biodiversity components: Components of biodiversity considered to be particularly significant in a given area for conservation because they are valued "in their own right" or because they are important in a utilitarian or in a cultural sense.

Mitigation hierarchy (MH): The sequential use of impact avoidance/prevention, then minimization, restoration of damage, and offsets or compensation, to ensure no adverse effects.

No net loss (NNL): A situation where negative impacts on biodiversity caused by the project are counter-balanced by mitigation measures so that ultimately there is no loss of biodiversity.

Non-offsetable impact: A negative impact that could not be fully compensated because of the irreplaceability or vulnerability of the affected biodiversity or ecosystem services; it would result in irreversible loss.

Net gain (NG): A situation where the biodiversity gains from mitigation measures exceed the negative impacts on biodiversity caused by the project.

Precautionary approach: Action to avert risks of serious or irreversible harm to the environment where there is uncertainty about the consequences of actions, recognizing that delaying action until there is compelling evidence of harm will often mean that it is then too costly or impossible to avert the threat.

Residual impact: Impact that remains after steps to avoid/prevent, minimise and restore damage have been exhausted.

Resilience: The ability of an ecosystem to recover and maintain diversity, integrity, and ecological processes following disturbance.

Vulnerability: The risk of imminent loss, reflecting irreplaceability over time. Measures of vulnerability are based on features that indicate risk of impending loss, e.g., IUCN Red List or threat status.

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