start here quick sheet
Good Practice Guidance on Mining and Biodiversity

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Prepared by
Lindsay McIvor
Stephanie Bertels
start here quick sheet

Good Practice Guidance on Mining and Biodiversity

This guide was prepared by Lindsay McIvor, MBA, and Dr. Stephanie Bertels, PEng., Beedie School of Business, Simon Fraser University

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This Quick Sheet provides a tailored overview of good industry practice for managing biodiversity around a project site. It is based on the 150-page advisory document released by International Council of Mining and Metals (ICMM), “Good Practice Guidance for Mining and Biodiversity”, and only represents a portion of the information contained in the full document. This is not an official International Council of Mining and Metals document, nor has it been endorsed by ICMM, and the entire contents of this Quick Sheet are credited to ICMM. If you begin to do work in this area, we suggest referring back to the original document, which can be found here:


*The IFC does not have a guide or advisory note on Biodiversity, but instead refers readers to this guide.*
Mining has the potential to affect biodiversity throughout the life cycle of a project, both directly and indirectly. Biodiversity encompasses the variety and variability of life on Earth. Biodiversity sustains human livelihoods and life itself. Biodiversity is also the basis of innumerable environmental services that keep us and the natural environment alive – from the provision of clean water and watershed services to the recycling of nutrients and pollination.

Direct or primary impacts from mining can result from any activity that involves land clearance (such as access road construction, exploration drilling, overburden stripping or tailings impoundment construction) or direct discharges to water bodies (such as riverine tailings disposal or tailings impoundment releases) or the air (such as dusts or smelter emissions). Direct impacts are usually readily identifiable.

Indirect or secondary impacts can result from social or environmental changes induced by mining operations, and are often harder to identify immediately. Cumulative impacts occur where mining projects are developed in environments that are influenced by other projects, both mining and non-mining. Introduction of alien or invasive weeds and feral fauna can have secondary impacts that extend well beyond the mine. These impacts need to be explicitly considered within the Environmental Management System or related action plans.

Proactive management of biodiversity issues leads to:

- Better relationships with regulatory agencies and shorter and less contentious reporting cycles
- Improved community relations
- Strong supportive partnerships with NGOs

Despite the significant potential for negative impacts on biodiversity from mining operations, there is a great deal that companies can do to minimize or prevent such impacts in areas identified as being appropriate for mining.
2. relevance to exploration, development and small producing mining companies

It is important to undertake early screening efforts to determine regulatory restrictions such as protected areas or regulatory requirements in terms of permitting. It is better to flag significant biodiversity (and other environmental or social) risks at an early stage, as those risks may have a bearing on whether a project could realistically be developed.

The absence of protected status for an area or species should not be interpreted as low biodiversity importance – many areas of international importance for biodiversity lie outside of protected areas. The challenge for mining companies is to qualitatively evaluate the importance in the absence of clear protective designations.

Adopting responsible practices in biodiversity management is increasingly viewed as important with respect to:

- **Access to land**, both at the initial stages of project development and for ongoing exploration to extend the lifetime of existing projects;
- **Reputation**, which links to ‘social license to operate’; and
- **Access to capital**, particularly where project finance is to be obtained from one of the investment banks that are signatories to the Equator Principles, which apply the Biodiversity Performance Standard 6 of the International Finance Corporation (IFC) to all investments in excess of $10 million.

The potential for significant impacts is greater when mining occurs in remote, environmentally or socially sensitive areas.
3. getting started

The following primarily desk-based steps can help to initially establish the biodiversity context:

- Obtaining readily available information on biodiversity through review of maps and publications available online;
- Identifying whether the site or surrounding area falls within a protected area – that is, whether it is an area designated for biodiversity protection at a local, national, regional or international level;
- Identifying whether the site or surrounding area is not currently protected but has been identified by governments or other stakeholders as having a high biodiversity conservation priority;
- Identifying whether the site or surrounding area has particular species that may be under threat (although the area may not currently be officially protected);
- Reviewing legal provisions relating to biodiversity; and
- Eliciting stakeholders’ views on whether the site or surrounding area has important traditional or cultural value.

Either subsequently or in parallel, a basic survey of ‘natural’ areas should be undertaken, using maps and planning documents, aerial surveys or a site walkover. Biodiversity importance is closely correlated with undisturbed vegetation.

Stakeholder Engagement and Biodiversity

Stakeholders have an important role to play in identifying and establishing priorities regarding threats to areas of importance for biodiversity, as well as in developing and implementing proposals for conservation enhancement. One area of particular relevance to consultation is ‘traditional knowledge’ of Indigenous Peoples. Biodiversity assessments benefit from obtaining knowledge from indigenous and local people on biodiversity, land use and local plants and animals and their uses, including harvesting, breeding and cultivation techniques.

Note: Some Indigenous Peoples do not wish to be categorized as stakeholders.
Basics of Mitigation Measures

The aim is to prevent adverse impacts from occurring or, if this is not possible, to limit their significance to an acceptable level.

- **Avoid** impacts by modifying a proposed mine or existing operation in order to prevent or limit a possible impact. The highest priority should always be afforded to avoidance measures. Changing the location or design of a processing plant is a simple example.
- **Minimize** impacts by implementing decisions or activities that are designed to reduce the undesirable impacts of a proposed activity on biodiversity. For example, installing tertiary treatment to remove phosphates from effluents that could lead to eutrophication of wetlands and changes in species composition, with resultant impacts on aquatic biodiversity.
- **Rectify** impacts by rehabilitating or restoring the affected environment. This would include attempts at habitat re-creation, to restore the original pre-mining land uses and biodiversity values.
- **Compensate** for the impact by replacing or providing substitute resources or environments. Compensatory measures should be used as a last resort and might include so-called offsets, such as purchasing an area of equivalent habitat for longer-term protection.

Examples of biodiversity goals and objectives may include:

- Successful reintroduction to mined areas of key flora or fauna species;
- Non-disruption to migration patterns;
- Protection of designated high-value locations; and
- Control of weeds and other pest species.

Important Considerations:

In identifying and measuring change as a project progresses, it will be necessary to take into account:

- The ability of an ecosystem, habitat or species to recover;
- The local value and role of biodiversity;
- Interactions with natural processes; and
- The global, national or local significance of the biodiversity.

Successful environmental performance involves:

- Forethought and planning before the exploration activity;
- Minimizing impacts during exploration;
- Environmental cleanup **immediately following the programmed exploration**; and
- Rehabilitation **within six months of programmed exploration**.
An Environmental Management System framework helps mining companies address biodiversity by:

- Integrating biodiversity into the environmental policy;
- Documenting and assessing local biodiversity in consultation with appropriate stakeholders;
- Undertaking identification and assessment of biodiversity aspects/risks;
- Maintaining a register of legal and other requirements, including legally designated protected areas;
- Planning and developing preventative and mitigative measures for significant biodiversity aspects;
- Implementing preventative and mitigative responses to identified biodiversity aspects;
- Monitoring, measuring and reporting performance on biodiversity management;
- Managing the review of procedures and outcomes; and
- Adopting a continuous improvement approach.

Accountability for biodiversity management within the organization should be allocated to a senior management role.

In order to take into account of the various aspects of biodiversity, the ESIA should:

- Assess the relevant levels of biodiversity, namely ecosystem, species and, if appropriate, genetic biodiversity;
- Assess the interconnections between the levels of biodiversity by considering the structural and functional relationships and how they will be affected by the proposed project;
- Collect detailed data of key biodiversity indicators;
- Assess the full range of impacts, including primary, secondary, cumulative and induced impacts;
- Assess the importance of community and indigenous knowledge of local biodiversity aspects and stakeholder participation;
- Clarify the criteria used to assess impacts; and
- Consider impacts and mitigation measures for biodiversity.
Building Biodiversity Management into the ESIA

During the screening and scoping stage, it is also important to begin to map the intersection between proposed mining activities and potential impacts, bearing in mind the following:

- **Cast the net wide**: Look beyond the obvious interfaces between biodiversity and mining, such as land clearance. For example, if discharges into watercourses are likely, consider the impacts on migratory fish and downstream wetlands.

- **Include transport routes and associated infrastructure**: Consider the impacts that a spillage of process chemicals or hazardous wastes en route to or from the mining operation would have on biodiversity. In addition, ensure that ancillary infrastructure such as dedicated power supplies or product export infrastructure is considered.

- **Consider societal interfaces with biodiversity**: Biodiversity may have a variety of important uses or values to local communities or others, ranging from the aesthetic to a strong dependence for subsistence or livelihoods.

Few operations will have the requisite skills in-house to undertake biodiversity surveys (or the other types of fieldwork referred to above). The main options for undertaking fieldwork include:

- Hiring consultants
- Engaging a conservation organization
- Involving a research institution or university
4. Recommended Practices at Various Stages

**Exploration**

Recommended practices at exploration include:

- Limiting land clearing by using technologies and mining practices that minimize habitat disturbance;
- Avoiding road building wherever possible by using helicopters or existing tracks – if roads are to be constructed, use existing corridors and build away from steep slopes or waterways;
- Using lighter and more efficient equipment to reduce impacts on biodiversity;
- Positioning drill holes and trenches away from sensitive areas;
- Capping or plugging of drill holes to prevent small mammals from becoming trapped;
- Removing and reclaiming roads and tracks that are no longer needed; and
- Using native vegetation to re-vegetate land cleared during exploration.

As exploration advances and where biodiversity is identified as being of potentially high value, it is important to ensure that reputable agencies or individuals conduct biodiversity assessments and produce reports that are peer-reviewed.

At Pre-feasibility and feasibility, it will be important to undertake the following:

- Identification of important areas for biodiversity, whether protected or not, and the status of protected areas and species;
- An initial review of possible mining options, processing options and likely waste products, water demands, options for waste rock or tailings storage, as well as an evaluation of the merits of each from a technical, economic, environmental (including biodiversity) and social perspective; and
- A preliminary assessment of potential impacts, taking into consideration possible timeframes for development.
FEASIBILITY

By the end of the feasibility stage, the ESIA work should be in an advanced stage. This should include the following aspects:

- Confirmation of the implications of legal provisions, protected areas and species and any interfaces with the mining project;
- Results of baseline studies, an evaluation of the importance of biodiversity (from a technical perspective and based on in-depth consultations with a range of stakeholders) and a discussion of current threats to biodiversity;
- An assessment of the proposed mining projects' impacts on biodiversity (direct, indirect and induced) and on the users of biodiversity;
- A discussion of mitigation measures (from construction through to closure), the prospects for successful implementation and residual impacts on biodiversity and related stakeholders; and
- A discussion of options for biodiversity conservation or enhancement.

CONSTRUCTION

Construction often represents the period of greatest environmental and social disruption during the mining project cycle. Many stakeholders are often unprepared for the realities of construction.

The construction of access roads and other linear project infrastructure (such as dedicated rail lines, pipelines for transport of slurries or concentrates or power transmission lines) can have a significant impact on biodiversity. Changes to stream and river flows may affect adjacent habitats or riverine ecology, including fisheries on which downstream communities may be dependent.

Land clearance has an obvious and direct impact through habitat destruction. Measures can be taken, however, to ensure the survival of rare plant and animal species. For example, rare plants can be transplanted prior to vegetation removal, and land clearance can be avoided during the nesting season of important bird species. Land clearance may also significantly affect the users of biodiversity, most notably through diminishing the resource base of dependent communities.
Construction-related impacts and infrastructure:

The large numbers of workers involved in the construction of mining projects (sometimes thousands of temporary workers or contractors’ staff), along with the related infrastructure, can have significant impacts on biodiversity. To control the impacts on biodiversity during construction, some companies have adopted policies of no firearms or no hunting or fishing.

During the intense construction period, many contractors and subcontractors could be on-site at any given time, and the contractual pressures on contractors to deliver are often intense. In these situations, the responsibilities for mitigation measures committed to in an Environmental Management Plan can become diffused or forgotten. In areas of high importance for biodiversity, it is essential that these practical realities are factored into the design of mitigation measures, into the allocation of responsibilities for implementing these measures and into construction supervision to ensure that adequate protection is afforded to biodiversity and affected stakeholders.

PRODUCTION

The main potential impacts on biodiversity relate to:

- Accidental releases of process chemicals and tailings disposal from hydrometallurgical processing – that is, minerals processing based on the use of solutions or solvents, primarily water combined with other process chemicals;
- Air emissions from pyrometallurgical processes such as roasting and smelting, which include sulphur dioxide, particulates and heavy metals, which may be toxic to flora or fauna;
  - Plume dispersion impact modelling of pyrometallurgical emissions will often consider impacts on human receptors, but need to be refined to address impacts on biodiversity.
- Disposal of slag from pyrometallurgical processes which contains toxic metals; and
- Low-grade stockpiles seeping into surface and groundwaters.
## Appendices

### Appendix 1: Checklist: Ensuring biodiversity is adequately addressed in environmental and social impacts assessments (ESIA)*

<table>
<thead>
<tr>
<th>ISSUES TO CONSIDER</th>
<th>Y/N</th>
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<tbody>
<tr>
<td><strong>Key aspects to be addressed in the ESIA overall (see section 5.2.1 of full document)</strong></td>
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<tr>
<td>Have the relevant levels of biodiversity – i.e. ecosystem, species and, if appropriate, genetic biodiversity – been assessed?</td>
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<tr>
<td>Have the interconnections between the levels of biodiversity been assessed by considering the structural and functional relationships and how they will be affected by the proposed project?</td>
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<tr>
<td>Have sufficiently detailed data been collected for key biodiversity indicators?</td>
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<td>Have the full range of impacts been assessed, including primary, secondary, cumulative and induced impacts?</td>
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<tr>
<td>Has the importance of community and indigenous knowledge of local biodiversity aspects been assessed, and has stakeholder participation been adequate (e.g. during the various stages of the ESIA process from initial screening through to public comment on draft reports)?</td>
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<tr>
<td>Have the criteria that have been used to assess impacts been clearly explained?</td>
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<tr>
<td>Have the range of potential impacts on biodiversity and related mitigation measures been adequately considered?</td>
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<tr>
<td><strong>Screening and scoping of biodiversity issues in ESIA (see section 5.2.2 of full document)</strong></td>
<td></td>
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<tr>
<td>Has readily available information on biodiversity been obtained through a review of maps and publications available online?</td>
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<tr>
<td>Does the site or surrounding area fall within a protected area – i.e. is it an area designated for biodiversity protection at a local, national, regional or international level (see Section D of full document for key sources of information on this and the next two bullet points)?</td>
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<tr>
<td>If the site or surrounding area is not currently protected, has it been identified by governments or other stakeholders as having a high biodiversity conservation priority?</td>
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<td>Does the site or surrounding area have particular species that may be under threat (although the area may not currently be officially protected)?</td>
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<tr>
<td>Have the legal provisions relating to biodiversity been reviewed?</td>
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<tr>
<th>ISSUES TO CONSIDER</th>
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<tr>
<td>Have the views of stakeholders on whether the site or surrounding area has important traditional or cultural value been obtained?</td>
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<tr>
<td>Where the initial screening stage identified areas of potentially high importance for biodiversity, was more detailed consideration given to possible impacts on such areas, both direct and indirect, such as the impacts related to ancillary infrastructure?</td>
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<tr>
<td>Has a basic survey of ‘natural’ areas been undertaken, using maps and planning documents, aerial surveys or a site walkover?</td>
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<tr>
<td>Has initial engagement with stakeholders taken place to help identify the uses that people make of biodiversity and any areas of particular importance?</td>
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**Determining whether baseline studies or additional fieldwork is required (see section 5.2.3 of full document)**

For new projects, have detailed baseline data been collected where:
- initial efforts at mapping the biodiversity context identify areas of potential but uncertain importance for biodiversity, which would benefit from additional study to establish a baseline?
- the land adjoining or affected by the operation is clearly of value for biodiversity but is subject to a range of existing threats (which might or might not include mining), and additional fieldwork could be used to characterize the nature and relative importance of threats?
- areas of importance for biodiversity adjoin a proposed mining operation but patterns of usage are complex and not clearly understood and local communities have a high dependence on biodiversity, so that additional fieldwork could help establish usage patterns and perhaps the related values that people place on access to biodiversity?

For existing projects, has additional fieldwork been undertaken where:
- an existing operation has been active for many years and the original permitting requirements contained few if any provisions relating to biodiversity and there was little or no other information readily available?
- the preferred post-closure land uses included biodiversity conservation or enhancement but there was limited information available on the current status of biodiversity?
- an operation has had unintended and unanticipated adverse consequences on biodiversity?

**Evaluating biodiversity importance (see section 5.2.4 of full document)**

For protected areas and species, is their biodiversity importance clear as part of their designation, or is additional information required?

Outside of protected areas but within areas that are clearly of value for biodiversity, has there been any attempt to qualitatively evaluate biodiversity importance in the absence of clear protective designations?

Has the process of evaluating biodiversity importance considered common criteria including: species/habitat richness; species endemism; keystone species; rarity; size of the habitat; population size; fragility; or the value of ecosystem services?

Has the application of these criteria involved a trained ecologist, particularly in more complex situations – e.g. in some developing countries where there is little information to evaluate biodiversity comparatively, extensive fieldwork may be required to better understand the relative value of operational sites?
**ISSUES TO CONSIDER**

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<th>Impact identification and assessment (see section 5.2.5 of full document)</th>
<th>Y/N</th>
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<tr>
<td>Did the assessment of impacts include an assessment of the level of impact – i.e. on ecosystems (and related services), species or genetic resources?</td>
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<tr>
<td>Did the assessment of impacts include an assessment of the nature of the impact (primary or secondary, long-term or short-term) – primary impacts occur where a proposed activity is directly responsible for that impact, whereas secondary impacts are an indirect consequence of the project?</td>
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<tr>
<td>Did the assessment of impacts include an assessment of whether the impact was positive, negative or had no effect?</td>
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<tr>
<td>Did the assessment of impacts include an assessment of the magnitude of the impact in relation to species or habitat richness, population sizes, habitat sizes, sensitivity of the ecosystem, recurrent natural disturbances, etc.?</td>
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<tr>
<td>Did the BAP provide for management of pest plants and animals to control impacts on local species within and beyond the mine lease area?</td>
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<tr>
<td>Did the assessment of impacts explicitly recognize that the intensity of impacts varies over the life of a project, being typically low at the start, increasing markedly through the construction and operational phases and diminishing as closure is implemented?</td>
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<td>Was the significance of predicted impacts on biodiversity determined by assessing the magnitude (or intensity) of the impact and the sensitivity of the affected ecosystem or species (see section 5.3.2 of full document)?</td>
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<tr>
<td>Were clear distinctions made between impacts that could be assessed quantitatively and those for which only a qualitative assessment could be made?</td>
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| Were cumulative impacts considered in situations where multiple mining projects (or other projects) were being implemented within a broad geographic area (such as a watershed, valley or airshed), with reference to:  
* any existing or proposed activities in the area and the likely effect on biodiversity of those proposals in conjunction with the proposed mining activity?  
* any synergistic effects of individual project impacts when considered in combination?  
* any known biodiversity threats in the area and the likely contribution of the proposed mining activity to increasing or decreasing those stresses? |  |
| Did the assessment of impacts consider adverse affects such as: loss of ecosystems or habitats; habitat fragmentation and increases in the ‘edge effect’; alteration of ecological processes; pollution impacts; and disturbance impacts? |  |

**Monitoring and interpreting changes in biodiversity (see section 5.2.6 of full document)**

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<tr>
<th>Monitoring and interpreting changes in biodiversity (see section 5.2.6 of full document)</th>
<th>Y/N</th>
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<tr>
<td>Were indicators monitored to determine progress against agreed biodiversity objectives – for example, to assess the extent of impact on biodiversity, the success of mitigation measures or the outcomes of measures to enhance biodiversity conservation?</td>
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<tr>
<td>Were a set of indicators agreed with key stakeholders to measure and manage impacts on biodiversity?</td>
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<tr>
<td>Was expert assistance sought in selecting and reviewing the most appropriate indicators of biodiversity to be measured?</td>
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<tr>
<td>Where appropriate, was knowledge obtained from indigenous and local people on biodiversity and its uses?</td>
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Appendix 2: Establishing Targets and Objectives

When setting biodiversity objectives and targets, the following factors should always be taken into account:

1. **Relevant regulatory requirements and other guidelines**
2. **Effective consultation with key stakeholders**
3. **Competing interests need to be understood and reconciled**
4. **All available information on biodiversity**
   ◦ Based on the pre-mining biodiversity values, planning (including closure planning) will need to consider whether these can realistically be replaced, using recognized good practice rehabilitation methods with adaptive management. The information needs to be viewed from an ecosystem perspective and to take account of aspects such as floral and faunal communities, habitats, key indicator species, stakeholder aspirations and rare, threatened or uncommon species.

5. **Technical limitations**
   ◦ Mining may result in significant changes to soil characteristics, microclimate, topography and hydrology. Propagation methods for some plant species originally present may be unknown. In addition, the innate characteristics of the site – in terms of nutrient status, slopes, water availability and so on – may also profoundly influence the types of plant and animal communities that may ultimately be supported. These and other technical limitations need to be considered so that the biodiversity objectives set are achievable.

6. **Pre-mining land uses and the extent of biodiversity degradation**
7. **Whether mitigation or enhancement is intended**
   ◦ Where biodiversity may have been degraded prior to mining, the principles of mitigation require mining companies to rehabilitate biodiversity to a comparable extent. But companies committed to excellence will often aim instead for enhancement, as part of a net biodiversity gain.
8. **Post-mining land tenure and land uses**

9. **Integration into whole-of-lease biodiversity management**
   - It is very important to minimize impacts on the floral and faunal communities of surrounding areas over which the mining company has control. Initiatives such as reducing grazing, controlling introduced predators and herbivores, fire management, weed eradication and establishment of nest boxes can be used to enhance conservation values in un-mined areas of the lease and can provide the sources of recruitment over the longer term. Local conservation groups are a good source of information on what initiatives might prove the most cost-effective.

10. **Minimizing secondary impacts**
    - Some rehabilitation objectives should focus on minimizing the secondary impacts of the mining operation – for example, by controlling erosion that could increase downstream sediment loads, affecting aquatic biodiversity.
Appendix 3: Biodiversity Action Plans

A biodiversity action plan (BAP) is a mechanism by which the objectives and targets for biodiversity conservation can be achieved. BAPs can either be stand-alone plans or be incorporated into the EMS. Numerous elements may be covered in a BAP, including:

- **Control of access to areas of importance for biodiversity**
- **Clear demarcation of all protected areas to avoid inadvertent destruction through ignorance or carelessness**
- **Restrictions on how vegetation (and associated fauna) are removed need to be specified:**
  - This helps to maximize the use of seed and other plant propagules, soil nutrients and soil biota, decaying organic matter, logs and other potential fauna habitat that can be valuable for rehabilitation. This will help ensure that clearing operations are fully integrated with the requirements of subsequent rehabilitation operations.
- **Management of pest plants and animals**
- **Management of community biodiversity uses and other ecosystem services:**
  - In areas where communities are directly dependent on biodiversity for ‘provisioning services’, particular attention may be needed to ensure the management and maintenance of the aspects of biodiversity that communities depend on (fisheries, fuelwood, medicinal plants and so on). More generally, other ecosystem services (such as the role of wetlands in the vicinity of the mine in regulating water quality) may need to be explicitly considered within a BAP.
- **Research and development programs:**
  - In the ESIA phase, gaps in knowledge of biodiversity on the site and in adjacent areas may have been identified and addressed to the extent necessary to gain project approval. In the operational phase, that knowledge base can be further developed through ongoing research. This research is usually targeted towards gaining additional knowledge that improves revegetation/rehabilitation.
- **Re-vegetation trials**
Appendix 4: Basics of Biodiversity

**Species/habitat richness:** In general, the greater the diversity of habitats or species in an area, the more valuable the area is. Habitat diversity within an ecosystem can also be very valuable. Habitat mosaics are extremely valuable, as some species that depend on different types of habitat may live in the transition zone between the habitats.

**Species endemism:** Endemic species typically exist in areas where populations of a given species have been isolated for sufficiently long to evolve distinctive species-specific characteristics, which prevent out-breeding with other species.

**Keystone species:** A keystone species is one that exerts great influence on an ecosystem relative to its abundance or total biomass. For example, a keystone predator may prevent its prey from overrunning an ecosystem. Other keystone species act as ‘ecosystem engineers’ and transfer nutrients between ecosystems (in the United States, for instance, bears capture salmon and disperse nutrient rich faeces and partially eaten carcasses on land).

**Rarity:** The concept of rarity can apply to ecosystems and habitats as well as to species. Rarity is regarded as a measure of susceptibility to extinction, and the concept is expressed in a variety of terms such as vulnerable, rare, threatened or endangered.

**Size of the habitat:** The size of a natural area is generally considered as important. It must be big enough to be viable, which relates to the resistance of ecosystems and habitats to activities at the margins, loss of species and colonization of unwanted species. Habitat connectivity is also of related importance and refers to the extent of linkages between areas of natural habitat – high levels of connectivity between different habitats or patches of the same habitat are desirable.

**Population size:** In international bird conservation, it has become established practice to regard 1 per cent of a species’ total population as significant in terms of protective requirements. For some large predators, it is important to know whether an area is large enough to encompass the home range of several individuals and allow them to breed and be sustained.

**Fragility:** This refers to the sensitivity of a particular ecosystem or habitat to human-induced or natural environmental changes and its resilience to such changes.

**Value of ecosystem services:** The critical importance of ecosystem services (as highlighted in Chapter 1) is now widely appreciated. While assessment techniques are still being developed, a determined effort should be made to address this aspect.

*The application of the above evaluation criteria is a matter of professional judgement and requires the involvement of a trained ecologist.*
acknowledgements

To improve the practical relevance of this guide, we have enlisted a review panel composed of industry, academic and social sector professionals. We thank each of these individuals for their contributions and guidance. Any errors or omissions remain our own.

Christie Stephenson, Manager, Environmental, Social and Governance Evaluations and Research, NEI Investments
Rick Killam, Independent Mining and Metals Professional (former Director, Environment and Social Responsibility, New Gold Inc.)
David Barrett, Manager, Climate Change and Sustainability Services, Ernst & Young LLP

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about NBS

A Canadian non-profit established in 2005, the Network for Business Sustainability produces authoritative resources on important sustainability issues – with the goal of changing management practice. We unite thousands of researchers and professionals worldwide who believe passionately in research-based practice and practice-based research.

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about SFU Beedie

Since the creation of Canada’s first Executive MBA in 1968, the Beedie School of Business has championed lifelong learning, productive change and the need to be innovative as it delivers research and teaching that make an impact. In particular, it has been recognized for its contributions to knowledge creation in the areas of globalization and emerging markets; innovation and technology; sustainability and governance; and capital and risk management. The school’s goal is to produce broadly educated, enterprising and socially responsible managers capable of making lasting contributions to their communities.

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Asanko Gold

Beedie School of Business, Simon Fraser University

Mitacs Accelerate Program

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