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IGF CASE STUDY

Biodiversity and Mining Governance:

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INTRODUCTION

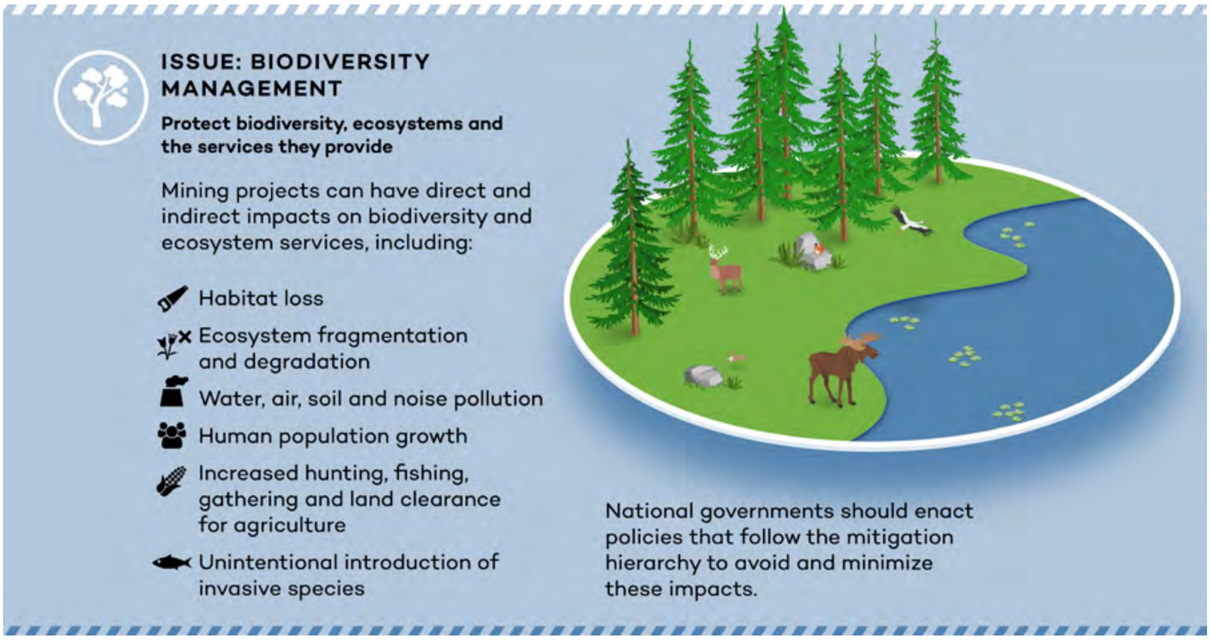
The integration of biodiversity and ecosystem protections into mining policy and legislation has emerged from an increased and expanding understanding—from the public, governments, and corporations—of ecological processes and ecosystem services; the economic importance of nature-based tourism; the close links between environmental health and community support for mining projects; and the operational and reputational risks that can result from destroyed, degraded, or disturbed biodiversity.

When not properly planned, activities across the mine life cycle—from exploration through the post-mining transition—can have significant impacts on the natural world. From land-use change and deforestation to pollution, greenhouse gas emissions, the unintended introduction of invasive species, and other pressures linked to increasing human populations, there are many ways in which mining operations can influence local and national biodiversity and ecosystem services.

Many of these impacts are unavoidable but can be minimized and mitigated with good planning. Because communities, governments, and mine operators now recognize the role that biodiversity plays in supporting local economies and operations and in maintaining the physical and mental well-being of workers and surrounding communities, they have placed greater value on addressing these impacts to conserve and protect biodiversity and ecosystems. Doing so requires that communities and governments balance their development priorities with their conservation needs. Through collaborative planning, implementation, and monitoring and evaluation, stakeholders can work with mining projects to ensure that economic value is generated with no net loss (NNL) of biodiversity. In the best-case scenario, when properly planned and implemented, mining activities can even lead to a net gain for nature over the life of the mine. More support can be found in the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development's (IGF's) 2021 *Guidance for Governments: Environmental Management and Mining Governance*.

BIODIVERSITY AND ECOSYSTEM SERVICES

Biodiversity is the variety of life in all its forms and interactions, including genetic diversity, species diversity, and ecosystem diversity (Convention on Biological Diversity, 2008). Ecosystem services are closely related to biodiversity, though important distinctions should be made between the two. These services include provisioning,



regulating, cultural, and supporting services such as food, clean water, climate regulation, nutrient cycling, aesthetic enjoyment, soil formation, pollination, and carbon sequestration. Biodiversity and ecosystem services are particularly important in many of the areas home to mining operations, where adjacent households and communities are often more dependent on natural resources for their livelihoods and well-being.

IMPACTS OF MINING ON BIODIVERSITY

Mining projects have the potential to impact biodiversity and ecosystem services throughout their life cycle in a variety of direct, indirect, and cumulative ways.

- **Direct impacts:** Biodiversity impacts directly related to a mining project's footprint, activities, and decision making. They include habitat loss, fragmentation, and degradation, as well as water, air, soil, and noise pollution.
- **Indirect impacts:** Biodiversity impacts associated with project-induced human migration to and around the project area, including hunting, fishing, gathering, and land clearance for agriculture and housing.
- **Cumulative impacts:** The successive, incremental, and combined direct and indirect impacts of a mining project's development and implementation and other surrounding activities.

Biodiversity impacts in forested areas are a prime example. According to the World Bank (2019), mining activities are the fourth-largest driver of forest loss globally. Forest clearance for both the mine's footprint and its supporting infrastructure can result in considerable loss of forest cover, forest biodiversity, and associated ecosystem services; these impacts are then acutely felt by the local communities dependent on these forests for their health and livelihoods (World Bank, 2019). The scale of impacts will depend on the scale of the mining operation and the mineral that is being mined: high-volume, low-value bulk minerals like iron ore will require larger infrastructure than low-volume, high-value minerals like diamonds and gold, and the impacts will differ accordingly (World Bank, 2019).

To properly integrate biodiversity protection into a mine's design and operations, a biodiversity baseline must be established prior to the start of a project. At this early stage, the biodiversity and ecosystem services that are considered priorities from a conservation or community perspective should be identified. With a solid understanding of the starting point, the mining company—working with stakeholders—can then develop, implement, and monitor the progress of mitigation and compensation measures for this priority biodiversity, measuring progress against the baseline over the project's life cycle to ensure that—at the very least—the direct, indirect, and cumulative impacts of a project on biodiversity are addressed. In a best-case scenario, measures are designed and implemented to ensure that biodiversity is strengthened over time.

THE MITIGATION HIERARCHY

The mining industry is increasingly using the mitigation hierarchy (MH) framework to guide mine operators in reducing the significant negative impacts of operations on priority biodiversity and ecosystem services. The MH focuses on measures for avoidance, minimization, rehabilitation, and offsets to reduce development impacts and control any negative effects on the environment. As a matter of priority, impacts on biodiversity and ecosystems should be avoided. When avoidance of impacts is not possible, measures to minimize impacts and rehabilitate biodiversity and ecosystem services should be implemented. Offsets should only be considered as a last resort after appropriate avoidance, minimization, and rehabilitation measures have been applied (IGF, 2021).

1. **Avoidance:** The measures taken to avoid negative impacts on biodiversity from the outset through site design and scheduling. The mine operator must determine: a) whether a deposit is viable to develop, based in part on expected biodiversity impacts, and b) whether mine infrastructure can be designed and located—and activities timed—to avoid these biodiversity impacts. This requires establishing a robust baseline understanding of biodiversity and associated risks across the landscape (or seascape) and designing the site and its infrastructure accordingly. A mining project may, for example, plan access roads to avoid rare habitats or breeding grounds. Certain project activities can also be scheduled around a critical species' breeding or migratory season, for example, or during seasonal changes in the ecosystem. Avoidance can be expensive, but these costs are usually upfront, one-off, and typically cheaper than those associated with rehabilitation/restoration and offsets.
2. **Minimization:** Minimization involves measures taken to reduce the duration, intensity, and extent of any impacts on biodiversity that cannot be completely avoided. When effectively applied, minimization can eliminate some negative impacts. Mining companies should start minimizing their impacts early in the project life cycle and—through risk management, adaptative management, and constant monitoring—continue these efforts throughout the mine life cycle. In Fiji, during the planning phase of an open-pit/underground mine, processing plant, and waste management facility for copper concentrate, it was found that the project could negatively affect endemic species of flora and fauna in an upland rainforest and cloud forest within the project's area of influence. Application of the MH led to the development of a biodiversity management plan, which included key minimization activities such as restricted access to mine access infrastructure, mine site

design around key species to reduce impacts, and buffer zones established around waterways (The Biodiversity Consultancy, 2018).

3. **Rehabilitation/restoration:** For impacts that cannot be avoided or minimized, rehabilitation and restoration activities are taken on-site to improve degraded ecosystems or re-establish lost ecosystems. Rehabilitation aims only to restore basic ecological functions and/or ecosystem services (e.g., by planting trees to stabilize bare soils or establishing a lake to provide a recreational facility). Restoration, conversely, has specific ecological goals, often aiming to return an area to a state similar to what the ecosystem was before the project activities started. Rehabilitation and restoration are frequently needed toward the end of a project but may be possible in some areas during operations (e.g., progressive rehabilitation after temporary borrow pits have fulfilled their use). Rehabilitation and restoration activities must be designed for the broader landscape with the participation and buy-in of local communities.
4. **Offset:** In offsets, measures are taken away from the mine site to compensate for any residual adverse impacts that remain after all previous steps of the MH have been fully implemented on-site. There are two main types of offsets: "restoration offsets," which aim to rehabilitate or restore degraded habitat, and "averted loss offsets," which aim to reduce or stop biodiversity loss (e.g., future habitat degradation) in areas where this is predicted. Offsets are almost always related to conservation interventions related to land, freshwater, or sea management, and while typically away from the site of the direct project impacts, they should still be undertaken in areas that deliver benefits to affected communities. Not all residual impacts can be offset, particularly if the affected area is unique and irreplaceable in terms of its biodiversity and ecosystems (World Bank, 2017).

INTERNATIONAL BENCHMARKS AND STANDARDS

The MH has increasingly been adopted by multilateral and regional development banks, with biodiversity and ecosystem protection and conservation linked to project financing from lending institutions. These institutions are increasingly converging around similar requirements. Key standards to consider include:

- International Finance Corporation (IFC) Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources (PS6)
- European Bank for Reconstruction and Development (EBRD) Performance Requirement 6 (PR6) on Biodiversity Conservation and the Sustainable Management of Living Natural Resources
- The Equator Principles
- World Bank's Environmental and Social Standard 6
- Inter-American Development Bank Guidance for Assessing and Managing Biodiversity Impacts and Risks

Industry associations and international organizations are similarly providing guidance to mining companies on how to apply the MH to their operations. The International Council on Mining and Metals (ICMM) published good practice guidance for mining and biodiversity as part of its Sustainable Development Framework, which focuses on the integration of biodiversity considerations into all phases of mining; environmental and social impact assessments (ESIAs) and environmental and social management plans (ESMPs); and stakeholder consultation and engagement (ICMM, 2006). The Mining Association of Canada (2015) offers guidance for its members on biodiversity conservation, including a corporate commitment to biodiversity conservation with accountability and communications, facility-level biodiversity conservation planning and implementation, and biodiversity conservation reporting. The International Union for Conservation of Nature's *Policy on Biodiversity Offsets* (2016) provides guidance to help conservation organizations, governments, and companies reach common ground on the associated risks and opportunities regarding offsets. Regarding offsets, the *Global Inventory on Biodiversity Offset Policies* presents an inventory of 198 countries' national laws and legislation on offset provisions.

THE ROLE OF GOVERNMENT

Active collaboration on biodiversity management and protection among governments, mining companies, and local communities is increasingly seen as a win–win–win. For governments, working with mining companies to protect biodiversity and ecosystem services can help them achieve their commitments under multilateral environmental agreements, including Sustainable Development Goals 14 and 15, the Aichi Targets of the Convention of Biological Diversity, the Convention on Migratory Species, the Ramsar Convention on Wetlands, and the United Nations Framework Convention on Climate Change. These biodiversity management activities can also provide jobs for local communities, improve land-use planning, and support both mitigation and adaptation to climate change.

There is no one way to integrate biodiversity and ecosystem services considerations into legal and regulatory frameworks; the approach taken will depend on the national context. Governments can, however, follow certain good practices as they move toward improving the protection of biodiversity and ecosystem services.

DEVELOP AND ADOPT A NATIONAL POLICY ON BIODIVERSITY

The IGF's Mining Policy Framework recommends that governments develop, adopt, and implement laws, policies, and regulations to protect biodiversity and ecosystem services (IGF, 2013). The first step is to set an explicit, realistic policy goal for biodiversity—for example, that the government commits to the MH or that it intends to move from cumulative loss of biodiversity to NNL to net positive impact (NPI) by a set future date. This policy goal can serve as the foundation for the development of a new policy on biodiversity, the improved integration of biodiversity considerations into existing sectoral policies (including mining), or the integration of the MH and NNL/NPI objectives into the ESIA process. The approach taken must be consultative and should align with the country's development path and priorities as well as its international commitments.

INTEGRATE THE MH INTO NATIONAL LEGISLATION AND REGULATIONS

With a policy in place, the government can develop the necessary laws, rules, regulations, and standards required to implement the policy; establish the institutions required to carry out the policy; secure and allocate the resources needed to implement and enforce the policy; and develop guidelines that spell out the policy and its regulations to relevant stakeholders. Some key considerations include:

- Requiring that mining companies work with affected communities to identify priority ecosystem services for the operations and affected stakeholders.
- Providing guidance on acceptable metrics for measuring biodiversity loss and gain.
- Requiring that mining entities identify potential and actual risks and impacts to biodiversity before, during, and after mining as part of the ESIA process and permit conditions.
- Integrating biodiversity into ESMPs.
- Requiring that mining companies submit performance assessments to government and publish regular public reports.
- Clarifying no-go scenarios, locations, and situations in which negative biodiversity impacts are not permitted.
- Providing guidance on the activities that can deliver the secure and additional long-term gains needed to offset any residual impacts, the rules outlining which types of impacts on biodiversity can be offset by which type of gains (for example, like for like or better), and areas suitable for offsets (and those to be avoided).

ESTABLISH AND MAINTAIN ADEQUATE INSTITUTIONS FOR BIODIVERSITY PROTECTION

Governments must ensure that the institutional arrangements required to implement and enforce their policies and regulations on biodiversity protection are in place to ensure strong and transparent governance of MH-related activities. Assigning a lead department, agency, or task force will help ensure that there is ownership of the policy's implementation and that there is a clear structure in place for communication, monitoring, evaluation, and adaptive management. Building and maintaining high-level, cross-ministerial support for the policy will be important for its successful implementation.

ESTABLISH CLEAR GUIDELINES ON BIODIVERSITY OFFSETS

The government will have to ensure that clear, consistent guidance is developed for the use of biodiversity offsets, that it is available to potential buyers and sellers of offsets, and that these stakeholders are connected. These guidelines should be developed in consultation with mining companies and conservation organizations to ensure that they result in meaningful, effective offsets.

ESTABLISH MECHANISMS, PLATFORMS, AND REQUIREMENTS FOR INFORMATION SHARING AND REPORTING

The government should work with communities and civil society to establish mechanisms that allow them to provide reliable, timely, and robust data, maps, and information on the status of local biodiversity and ecosystem services. This should be provided in an open and accessible way and in a standardized format that is easily understood and can be used by stakeholders. Governments can also provide a platform where mining entities are able to engage with each other on landscape-level biodiversity issues, in part to promote more attention to cumulative impacts of operations and integrated offsets.

ALLOCATE ADEQUATE FUNDING TO SUPPORT IMPLEMENTATION AND ENFORCEMENT

Finally, adequate resources will need to be allocated to the protection and strengthening of biodiversity and ecosystems. This support includes funding to cover the monitoring and enforcement of the biodiversity components of the legal framework for mining, including those activities that take place after mine closure. Support should include sufficient funding for a country's protected areas and ensuring that relevant government staff have the time, skills, and resources needed to work on the implementation of the country's biodiversity policy and enforcement of its regulations. This effort will require adequate training for staff in biodiversity and ecosystem services impacts in the concepts of NNL and NPI, and in the application of the MH.

BIODIVERSITY MANAGEMENT IN TURKEY AND SENEGAL

Managing the impacts of economic activities on biodiversity and ecosystems is difficult across most sectors—and mining is no exception. The two case studies presented here—Senegal and Turkey—reflect examples of how the MH has been implemented on the ground at the outset of a mine's life cycle. Governments can learn from the experiences of these two case studies while keeping in mind that there is a variety of unique ecological factors to consider when developing and improving a country's legal and policy frameworks around biodiversity management and mining. The case studies demonstrate that:

- The use of the MH can reduce the overall impacts of mining operations on biodiversity and ecosystems, improve conservation outcomes for communities, and reduce the long-term costs of rehabilitation and offsets.
- Baseline studies carried out at the outset of a mining project are critical for identifying potential impacts on biodiversity and ecosystems and for establishing monitoring and evaluation systems. Governments should require that mining companies share their biodiversity and ecosystem data, both to help track the mine's performance and—where possible—to use the data to enhance the management of nearby protected areas.
- The biodiversity management plans and actions of a mining company should be designed to support existing government biodiversity and conservation commitments and initiatives, as well as national and subnational protected areas. This is more easily done if a national biodiversity strategy and action plan is in place and is well communicated by the government to those working in the sector.
- Biodiversity offsets, when well designed, can help expand existing national protected areas and reduce habitat fragmentation. Offset targets should exceed expected losses to ensure the success of these programs, and the programs should consider climate change impacts to ensure future viability.

CASE STUDY 1: MAKO GOLD PROJECT, SENEGAL

The Mako gold project is a gold mining development in the Kédougou region of southeast Senegal. Biodiversity is a key consideration for the mine and the broader region. The site is located outside of but adjacent to Niokolo-Koba National Park (NKNP), West Africa's second-largest national park and a UNESCO World Heritage Site that is home to a wide variety of iconic fauna and flora, including elephants, chimpanzees, and lions. Unfortunately, the park is under threat: due to a variety of ecosystem disturbances, it was listed as a World Heritage Site in Danger in 2007 and remains on that list.

The biodiversity goal of the Mako project is to support NNL within the concession and surrounding areas and work to ensure the broader region ultimately benefits from the presence of the mine. The mine operator—Petowal Mining Company (PMC), a 100% subsidiary of Resolute Mining—has pledged to leave the area in as good or better a state than it would have been had the mine never been developed.

The mine operator's commitment to NNL centres on several key factors:

- **The Government of Senegal's institutions, laws, and policies on biodiversity.** Ecology, conservation, and natural resource use are governed in Senegal by the Ministry of Environment and Sustainable Development, which has three primary directorates of relevance to the Mako mine: the National Parks Directorate (DPN), the Environment Directorate, and the Water and Forests Directorate. The primary relevant legislation for the management of biodiversity and ecosystems includes the Hunting Code (1986), the Forest Code (1998), the Environment Code (2001), and the Mining Code (2003). The country also has a National Biodiversity Strategy and Action Plan and a National Committee on Biodiversity.
- **International environmental conventions and treaties.** Senegal is a signatory to several international environmental conventions crucial to the management and conservation of biodiversity. The most relevant for the prevention and mitigation of biodiversity and ecosystem impacts from mining are:

  - The Convention on the Protection of World Cultural and Natural Heritage (1972)
  - The Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention) (1983)
  - The Convention on Biological Diversity (1993)
  - The Ramsar Convention on Wetlands (1977)
  - The Convention on the International Trade in Endangered Species of Wild Fauna and Flora (1977)
  - The Minamata Convention on Mercury (2016).
- **International leading practice.** Leading mining companies and lending institutions are increasingly adopting public commitments to align with international best practices on biodiversity and ecosystem protection (see performance standards from the IFC, the EBRD, and the World Bank). The IFC's PS6 on biodiversity management is viewed as a leading practice by many stakeholders.

To achieve their aim of NNL on biodiversity and to align with lender standards and national legislation, managers of the Mako gold project used the MH to avoid and minimize negative project impacts, rehabilitate and restore affected biodiversity and ecosystems where possible, and offset any residual impacts.

During the initial biodiversity assessment, western chimpanzees were identified as one of the priority species present within the project area. Protection of the chimpanzees and their habitat would have significant positive impacts on other species and the ecosystem more broadly. To limit the potential impact that construction of the mine and related linear infrastructure would have on the species, the mining company implemented the following key preventive and mitigation measures.

AVOIDANCE

Several key avoidance measures were designed and implemented, including:

- **Reducing the mine footprint:** Significant changes were made to the mine design and layout in the feasibility study, resulting in the consolidation and containment of all major mine infrastructure—the open pit, waste rock, tailings, and process plant—within one water catchment area measuring approximately 300 ha—half the size of the originally planned footprint. The new design avoided both the direct loss of chimpanzee habitat and land disturbance within adjacent catchments that drain into core nesting habitats.
- **Rerouting the access road:** Initial planning for the mine's main access road would have impacted the chimpanzees by fragmenting their access to an important dry season water source, gallery forest, and foraging habitat at the eastern extent of their range. The access road was subsequently rerouted to co-align with existing community infrastructure and avoid these impacts on the chimpanzees.

MINIMIZATION

Further mitigation measures were implemented to minimize the negative impacts of the mine on the chimpanzees and their habitats:

- The mine operator ensured that the footprint during vegetation clearance minimized negative impacts on natural habitats, particularly for key chimpanzee populations.
- The mine operator also minimized sound and vibration disturbances to the chimpanzee population by instructing staff and contractors to adhere to standard operating procedures, managing blasting

during construction and operation, and restricting the use of certain machinery and vehicles from dusk until dawn. Where possible, natural barriers (such as stands of trees and mounds) are used to buffer noise and vibrations, especially near sensitive areas.

- Another risk to the chimpanzees is accidental injury and mortality from collisions with vehicles and machinery. The mining company minimizes this risk by reducing and strictly enforcing speed limits and prohibiting driving at night outside of the project area, except with special permission or in an emergency. In the event of an accident, staff and contractors follow the injured wildlife protocol. The associated mandatory reporting system includes an assessment of the incident and analyzes if further mitigation measures are needed.

REHABILITATION/ RESTORATION

The mining company also developed a framework that provides a methodology for progressive site rehabilitation and a plan for decommissioning and closure of the Mako gold project, all in alignment with legislative requirements, including Senegal's Forest Code. The overall objective is to prevent or minimize adverse long-term environmental, physical, social, and economic impacts and to create stable landforms that provide self-sustaining natural ecosystems within the project area. This framework will be refined throughout the life of the mine, and the rehabilitation and closure period will extend for approximately 5 years following the mine's decommissioning. Monitoring during the five-year closure period will determine whether defined closure completion criteria have been met, allowing for formal closure, or whether additional remedial measures are required to meet the plan's closure objectives (potentially extending the closure period).

OFFSETTING

The Maiko mine's biodiversity diversity offset program mitigates the residual impacts of the mine on chimpanzees within and adjacent to NKNP. The goal of the program is to protect species and their habitats and ultimately to achieve an overall net gain in biodiversity (Toro Gold, 2017). Using integrated and participatory approaches to land-use planning, the program is implemented by a team composed of the mine operator, protected area authorities, communities, and non-governmental organizations that is advised by a panel of both national and international conservation and resource management experts.

Senegal's national parks department and the non-governmental organization Panthera have partnered with the mine operator to develop a conservation program that covers an 1,800 km^2 intervention zone in the southeast section of NKNP. Since June 2017, the program has worked to enhance security, monitoring, and conservation management within the area.

In a 2018 feasibility study, The Biodiversity Consultancy determined that the mine operators could extend their biodiversity offsetting outside the NKNP to achieve a net gain for all priority biodiversity in the broader landscape of the Tomboronkoto Commune (Toro Gold, 2017). To leave the landscape in a better ecological condition than before the mine, the mine operators need to develop both medium- and long-term conservation strategies that extend through at least the 8-year lifespan of the mine. Progress on delivering these strategies is continuing and includes:

- Land-use planning and land management
- Livelihood development
- Development of legal and policy frameworks
- Community awareness
- Community-based enforcement.

CONCLUSIONS FOR SENEGAL

Biodiversity management at the Mako gold project in Senegal provides an example of good practice that other jurisdictions could consider when working to balance support for mining with meeting biodiversity conservation commitments. Protecting critical habitats and species will be a crucial factor in whether a mine's development can proceed. Since production began at the mine in 2018, wildlife observations have increased in the offset areas of NKNP, though it remains early to report on the ultimate success of the biodiversity protection and conservation measures (Resolute, 2021). Nevertheless, the case study in Senegal demonstrates how:

- Following the MH can help reduce the overall impacts of mining on biodiversity and ecosystems and minimize offset costs for mining companies. Application of the MH must extend beyond the mine's footprint to include its supporting infrastructure, as well as considerations about how this infrastructure will impact species and their habitats.
- A mining company's biodiversity management plans and actions can support existing government biodiversity conservation initiatives if a national biodiversity strategy and action plan is in place. Governments must not only develop and adopt such plans but must also effectively communicate them to the general public and private sector.
- Mining company biodiversity offsets can help expand existing national protected areas and reduce habitat fragmentation. In addition, the enforcement of national protected areas can be supported by the presence of mines in remote areas.
- Biodiversity and ecosystem conservation can be strengthened if governments recognize and support a mining company's commitments to their financiers to quantify, document, and track the success of biodiversity actions and offsets.

CASE STUDY 2: ÖKSÜT GOLD MINE, TURKEY

Öksüt gold mine lies in the mountainous Develi region of Kayseri province, in the deciduous tree-steppe ecoregion of southcentral Turkey. The mine, which began production in 2020 and is expected to have a life of 8 years, lies in an ecologically important region at the confluence of Europe, Asia, and Africa. The nearby Sultan Marshes National Park (NP) is a crucial feeding, breeding, and staging area for both resident and migratory birds passing between the three continents. The park has been identified as a Key Biodiversity Area, Important Bird Area, and Important Plant Area. It has also been designated a Ramsar Wetland of International Importance. Minimizing the impacts of the mine on both the park and the surrounding area—a region already under existing threats from grazing, pollution, overfishing, and poor water management—was a key early concern for Centerra Gold, the mine's operator, and a requirement for the EBRD, one of the mine's main lenders.

As part of the mine's ESIA, and in accordance with the EBRD's PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, the mine operator produced several key documents around biodiversity management prior to production: a biodiversity management plan, a biodiversity action plan, a biodiversity offset strategy, and a biodiversity offset management plan (BOMP). These covered not only biodiversity impacts at the mine site but also those that occur because of its supporting infrastructure: the mine's access road, pipeline, and powerline. Taken together, these plans and strategies worked toward the overall biodiversity objective of the project, as noted in the BOMP:

> *To ensure that the biodiversity of the Develi region ultimately benefits from the Project's presence in the region. [The] goal is to have a net positive impact on biodiversity of the Develi region. [The mining company] aims to reach this goal during the mine closure but will seek opportunities to achieve net positive impact as early as practicable in the project life. (Centerra Gold, 2020)*

The plans and strategies developed to protect biodiversity and ecosystems were designed according to national standards and international good practices. An early step in the process was to produce background studies of the local environment that would identify the priority species of flora and fauna and critical habitats that could be negatively impacted by the construction and operation of the mine. The mining company also analyzed where residual impacts would remain after efforts to avoid and minimize these impacts and rehabilitate the area were taken. How these residual impacts would be addressed was the subject of the mine's BOMP.

ESTABLISHING A BIODIVERSITY BASELINE

Due to the proximity of the mine to an Important Bird Area and Ramsar site (Sultan Marshes NP), there was a need for the mining company to better understand the potential impacts of the operation's impacts on local and migrating birdlife. To accomplish this, the mining company undertook vantage point surveys during both the spring and autumn migrations, when large numbers of birds move through the area. These surveys focused on the mine's proposed powerline, which was the piece of mine infrastructure closest to the NP and wetland and areas where potential negative impacts (such as collision, electrocution, and habitat loss and fragmentation) had been identified in the mine's ESIA (Can, 2020).

The goal of the surveys was to establish whether preferential migration paths crossed the powerline, particularly for target species of conservation concern, and to better understand the flight behaviour, flight direction, height of travel, and the number of individuals associated with this migration during the two key seasons of movement. Six surveys were undertaken from vantage points within 2 km of the proposed powerline route. The surveys focused on species identified in the mine's ESIA as being of conservation concern, including saker and red-footed falcons, ruddy shelducks, and western marsh harriers—species that are either threatened or that congregate in globally significant numbers in the area during migration (Can, 2020).

The surveys revealed that the proposed powerline did not intersect and nor will it be in a migration bottleneck for birds that live or pass through the area. It also found that most migration flights take place at an elevation higher than the planned powerlines. Despite this finding, the mining company has committed to continued monitoring of the powerline—including monthly bird mortality surveys—to ensure that negative impacts do not arise over the course of the mine's life. It also installed diverters every 10 m along the mine's powerline to discourage birds from flying near or landing on the cables. Monitoring efforts will be publicly reported annually in both the mine's *Annual Biodiversity Report* and its *Ornithological Monitoring Report*. In addition, survey data and other research are shared with protected area authorities to strengthen the management of the NP (Can, 2020).

APPLICATION OF THE MH

In addition to the mine operator's work on birds, it undertook a series of conservation actions prior to the mine's construction to avoid, minimize, and offset any potential direct and indirect impacts the mine may have on local flora (or priority biodiversity features) and habitats (Centerra Gold, 2020a, 2020b; Duman, 2020). These actions are designed and implemented in line with the mine's biodiversity management plan, biodiversity action plan, and BOMP, as well as EBRD's PR6. The mine's ESIA identified the following impacts:

- Direct impacts: Vegetation clearing, disturbance of terrestrial topsoil, habitat loss due to new infrastructure, negative interactions between birdlife and mine infrastructure (collision, electrocution).
- Indirect impacts: Emissions from gaseous pollutants, dust, changes in morphology and hydrology, the unintended introduction of invasive species.

At mine closure, the mine operator has pledged to re-establish the site's natural morphology and hydrology and bring most of the threatened habitat back to its original state.

Not all direct and indirect impacts could be addressed through avoidance, minimization, and reclamation. Initial studies indicated that the mine's construction and operation would have unavoidable and residual impacts on two vulnerable flora species (*Campanula stricta var. aladagensis* and *Verbascum luridiflorum*) and one threatened habitat (the Irano-Anatolian steppe). These impacts would therefore require offset activities to ensure that the mine operator achieved its overall biodiversity objective.

Offset targets were established for each of the impacted flora species. To account for potential losses during the offset activities, offset targets were set at 120% of the expected net loss to the species due to the project, creating a safety buffer to ensure the project's success. Pilot projects were taken in the field to test various offset options, and in the end, three main activities were chosen (Centerra Gold, 2020a, 2020b; Duman, 2020):

1. **On-site protection of existing populations:** Where possible, the mine operator would protect those populations of threatened flora species within the mine's concession but outside of the main construction and operation zone. This would include the construction of fencing around threatened populations to halt further degradation from grazing by area livestock, a strategy that would be repeated for reintroduced populations as well. It is hoped that the fencing will help promote improvements in grassland health and biodiversity by reducing overgrazing, soil compaction by livestock, and the continued introduction of more palatable—but not necessarily endemic—fodder.
2. **Reinforcement of existing populations:** The mining company will work to reinforce existing populations of the threatened flora that exist in the mine concession. To increase the survival chances of these rare plant species, efforts would be made to increase their population size, densities, and genetic diversity in those areas well suited to their continued existence but outside of the immediate footprint of the mine and its supporting infrastructure. This would be accomplished through seed cultivation and planting programs, the use of cuttings, and the replanting of salvaged individuals carefully removed from the mine site during construction.
3. **Creation of new populations:** The mine operator will work with local experts to identify suitable areas within the concession for the creation of new, protected populations of the three threatened flora species. Specimens will be translocated from the mine site and other stable populations to the planting site, with tests conducted in advance to help ensure the new site's viability. These translocated plants will be supported by the strategies employed above: new sites will be fenced to protect them from grazing livestock; translocated populations will be complemented by seedlings and transplants from other populations to increase density and genetic diversity; and the sites will be actively managed.

In addition to the priority biodiversity features addressed above, the mine operator needs to offset losses to the critical habitat of the Irano-Anatolian steppe that will result from the mine's construction and operation. Oak forests are a key component of this critical habitat, and expected net losses to the habitat from the mine's construction were assessed at 5.66 ha. The mining company set an offset target of 6.79 ha. Within these lands, the mining company plans to support the protection and enriched planting of existing forested areas, as well as the reforestation of additional suitable habitats without compromising local access to pasturelands. As with the threatened flora species, the offset critical habitat would be supported by fencing to promote faster regeneration, and the oak seedlings used for the regeneration of existing forest stands would in part be transplanted from the mine pits prior to excavation.

Across these offset activities, the mining company plans to use techniques that consider rising global temperatures, and each activity has been assigned resources, timelines, and key performance indicators to measure success over time. Offset activities will also be carried out in accordance with the mine's Stakeholder Engagement Plan, which includes requirements for open communications and consultation with affected stakeholders, as well as grievance reporting and resolution mechanisms.

CONCLUSIONS FOR TURKEY

Biodiversity management at the Öksüt gold project in Turkey provides another example of good practice that other jurisdictions could consider using for supporting both biodiversity conservation and economic development. The mine's development and the actions of the mine operator and its partners early in the mine life cycle demonstrate that:

- Potential biodiversity and ecosystem impacts to be considered and acted upon should extend beyond the mine's footprint to include all associated infrastructure (such as access roads and powerlines).
- Baseline studies are critical for identifying potential impacts of the mine's construction, operation, and closure on biodiversity and ecosystems and for establishing the indicators required to monitor these impacts over time. Survey programs should therefore be designed to ensure they include the development of biodiversity and ecosystem metrics that can track the success of biodiversity protection actions over time.
- Governments should require that mining companies share their biodiversity data. The data can be used not only to track the mine's performance but also to enhance the management of nearby protected areas, where applicable.
- Offset targets should exceed expected losses to ensure the success of the program. This kind of safety buffer helps ensure that, should some of the offsets fail, additional offsets (and associated planning) will not be required. The targets should also consider climate change impacts and the realistic timelines needed for offset programs to prove successful.

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