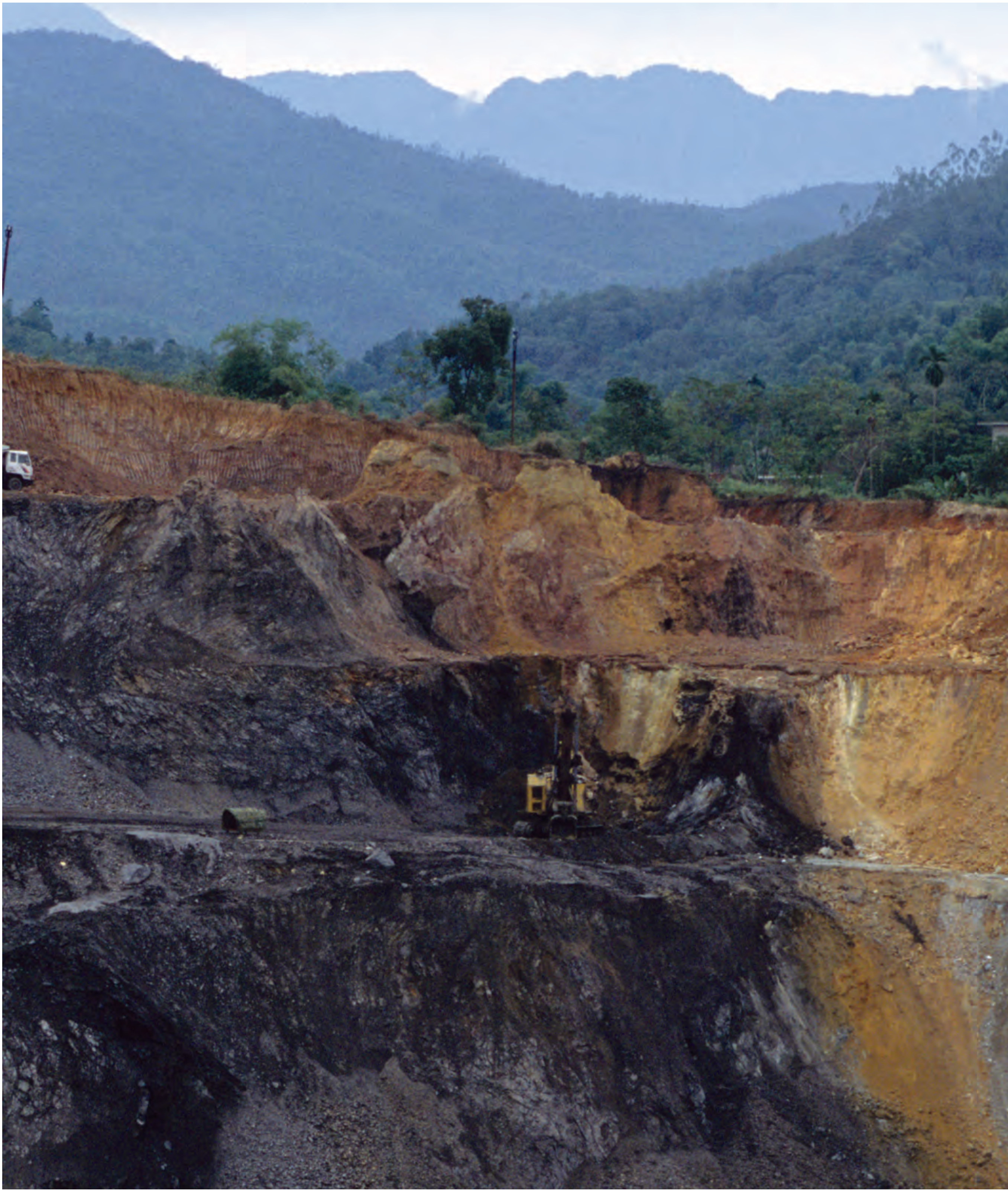


Photo: Extractive industries (mining, and oil and gas) have undergone notable growth in Asian ape states, and now pose a threat to several species. Opencast coal mine in Vietnam. © Terry Whittaker

CHAPTER 5

Mining/oil extraction and ape populations and habitats

Introduction

The extractive industries overlap extensively with ape habitat across Asia and Africa. In both regions, these industries are growing in intensity and scale, with increasing amounts of exploration and development/production in areas of land previously unexploited. Africa, in particular, is experiencing an unprecedented surge in mineral and hydrocarbon development, and the landscape is quite literally being turned upside down in search of the materials and energy that drive the global economy. The significant peak in exploration in the past decade was from 2000–08, with a gradual but significant slowdown over the past 5 years (J. Suter, personal communication, 2013). Although the mineral and hydrocarbon industry directly affects the landscape at a different scale to that of

“Far less is known about the impacts of mining and hydrocarbon project development than about the impacts of logging.”

the forestry industry, broad-scale changes to habitat structure and composition can result from both direct and indirect impacts generated during the project exploration, development, operation, and closeout phases of mineral/hydrocarbon projects.

Far less is known about the impacts of mining and hydrocarbon project development (including exploration, analysis, site selection, construction, operations, closure, and post-closure) than about the impacts of logging. Chapter 4 explores the impacts of logging in greater detail. There are few published studies on the impacts of mining, oil, and gas projects (exploration and development) on African or Asian ape populations (Kormos and Kormos, 2011b). It is evident, however, that mining and hydrocarbon exploration and development processes are impacting the habitats and populations of all taxa of apes both directly and indirectly. Across Africa and Asia, extractive industries are affecting the social, cultural, and ecological fabric of the region. The extractive industries can be an economic engine with valuable local and regional benefits for both local people and national economies. However, mining cannot be done without negative social and environmental impacts in localized areas. The challenge is to find the “best balance” for co-existence.

To fully understand and address the threats to apes, a range-wide analysis of the overlap between ape range and extractive industries is needed. The range of each ape species should be compared with the known areas of potential mineral distribution. Once the oil, gas, and/or mining lease is issued, the land can be exploited. However, if the review is done before leases are issued, so that they avoid the most important conservation areas, then reserves and set-asides can be designated. A review of ape habitat compared with areas designated as exploration and exploitation leases for mining, oil, and gas would help identify what proportion of each species range is in areas designated for industrial activities, and provide information for conservation practitioners on strategies to avoid and mitigate damage. Support for best practices can then be targeted towards concessions of high value for apes.

In conjunction, long-term longitudinal studies are needed to understand more completely the impacts of all extractive industries (logging, mining, and oil and gas) on apes. Such studies would enable mining companies and national governments to be more effective in avoiding negative impacts throughout the project cycle by carefully locating concessions and associated operations. These should start with the establishment of accurate biodiversity baselines before any industrial activities have taken place, and track the impacts on ape populations in the same location over time. Ideally, such studies would be completed before an area is opened to mineral exploitation, and therefore would need to be funded and implemented by a government/nongovernmental organization (NGO) collaborative effort, rather than mining companies. It could be an impact-offsetting action for industry to support future offsite studies such as these, as part of their mitigation commitments. Although these currently happen on a site-specific basis within the mineralized area footprint, they need to happen across a broader landscape, as it is likely that the effects of the project will cover a much larger area. Such studies would provide a more appropriate understanding of the impact of industrial activities, and the effectiveness of mitigation techniques. It is also important, however, to study the broader landscape so that areas that will not be impacted by the project can be enhanced and protected, rather than just the area that will in all likelihood be significantly impacted/destroyed.

As described below, a number of strategies exist to ensure that the negative impact of extractive industries is minimized to the extent practical, and these are described as part of the "mitigation hierarchy." In summary, these are described as prevention, avoidance, minimization, and reduction, and then reparation and restoration. Only finally are biodiversity offset strategies developed to ensure that harm to ape populations in one area is offset by enhanced ape conservation impact in another area. If any biodiversity offsets are established it is essential that research and monitoring are carried out into their effectiveness for ape conservation. A critical research question that remains is whether or not offset strategies actually achieve a net gain. This would most simply be measured as whether population losses at the impact site are more than compensated for by conservation gains at the offset site (Chapter 1).

Based on experience where industry has partnered with conservation agencies to identify and implement best practices, it is recommended that:

- The conservation community works with the private sector to assist responsible and willing companies to implement and share experience of best and leading-edge practices, including but not limited to certification, and appropriate use of the mitigation hierarchy including biodiversity offsets (with reference to the Business and Biodiversity Offset Programme (BBOP) principles).
- Conservationists and the private sector lobby governments to establish a policy environment that at a minimum removes disincentives for best practice, and where possible supports best practice; for example, exemption of land tax on conservation set-asides in mining concessions, clear offset policies, and legislation that supports retiring unallocated land (land that is currently not assigned for exploration or mine development lease or concession) from mining activities.
- All stakeholders support and promote the enforcement of existing laws, particularly in relation to illegal logging, illegal mining, hunting, and agricultural encroachment.
- Independent Environmental and Social Impact Assessments (ESIAs) and Strategic Environmental Assessments (SEAs) should be carried out, which include detailed examination of the direct, and the indirect, impacts of development on people and biodiversity.
- All best practice management systems should include a rigorous monitoring program to evaluate the effectiveness of ape conservation measures. This must be linked to a system of adaptive management whereby lessons are learned and actions improved.
- Conservationists and industries should be more proactive in raising awareness of guidance and management tools which are already available to support best practice, for example the Orangutan Conservation Services Program (OCSP) Best Management Practice (BMP) tools, Business and Biodiversity Offsets Program (BBOP) publications, and the International Council on Mining and Metals (ICMM) guidelines, such as the independent report on biodiversity offsets (ICMM and IUCN, 2012).

Annex III provides a more detailed overview of specific recommendations for the responsible management of apes in the extractive industry sector.

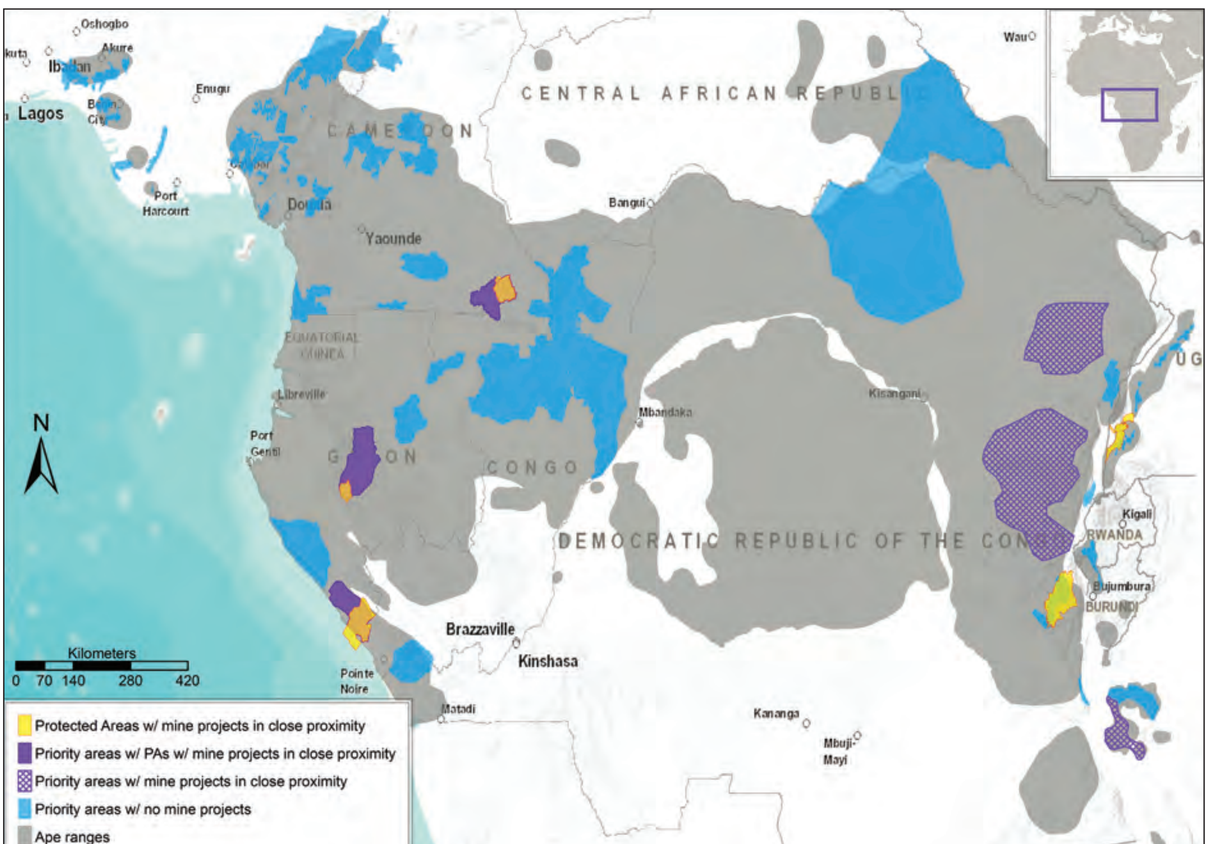
Overview of impact of mining/oil on ape habitats and populations

A global, broad-scale analysis conducted by the UNEP World Conservation Monitoring Center (WCMC) of all apes across their range, including gorillas, chimpanzees, bonobos, orangutans, and gibbons, indicates that only five of the 27 ape taxa analyzed have no mining projects within their range. This survey examined the overlap of ape ranges from the International Union for Conservation of Nature (IUCN) Red List (in some cases refined by more recent, peer reviewed data from the A.P.E.S. Portal[1] and other publications), with mining data from the MineSearch database of the Metals Economic Group.[2] The MineSearch database covers projects with a focus on a set of 37 core commodities, including coal, iron ore, and other minerals and metals. The taxa with no mining projects within their range are also the species with some of the smallest ranges, namely mountain gorillas (*Gorilla beringei beringei*), Cross River gorillas (*Gorilla gorilla diehli*), Nigerian–Cameroon chimpanzees (*Pan troglodytes ellioti*), Hainan black-crested gibbons (*Nomascus hainanus*), and eastern black-crested gibbons (*Nomascus nasutus*).

For the majority of taxa, where mining projects in the various phases of their implementation do overlap with the habitat of apes, it is important to note that the spatial scale of ape ranges is significantly different to the footprints of mining operations. Ape ranges generally cover thousands of kilometers, while mining operations are represented in this analysis with a spatial resolution of 1 km^2. As a consequence of these significantly different spatial scales, less than 0.02% of each taxon's range is spatially coincident with points (mining pixels) identified as containing one or more mining projects. However, as well as the possibility

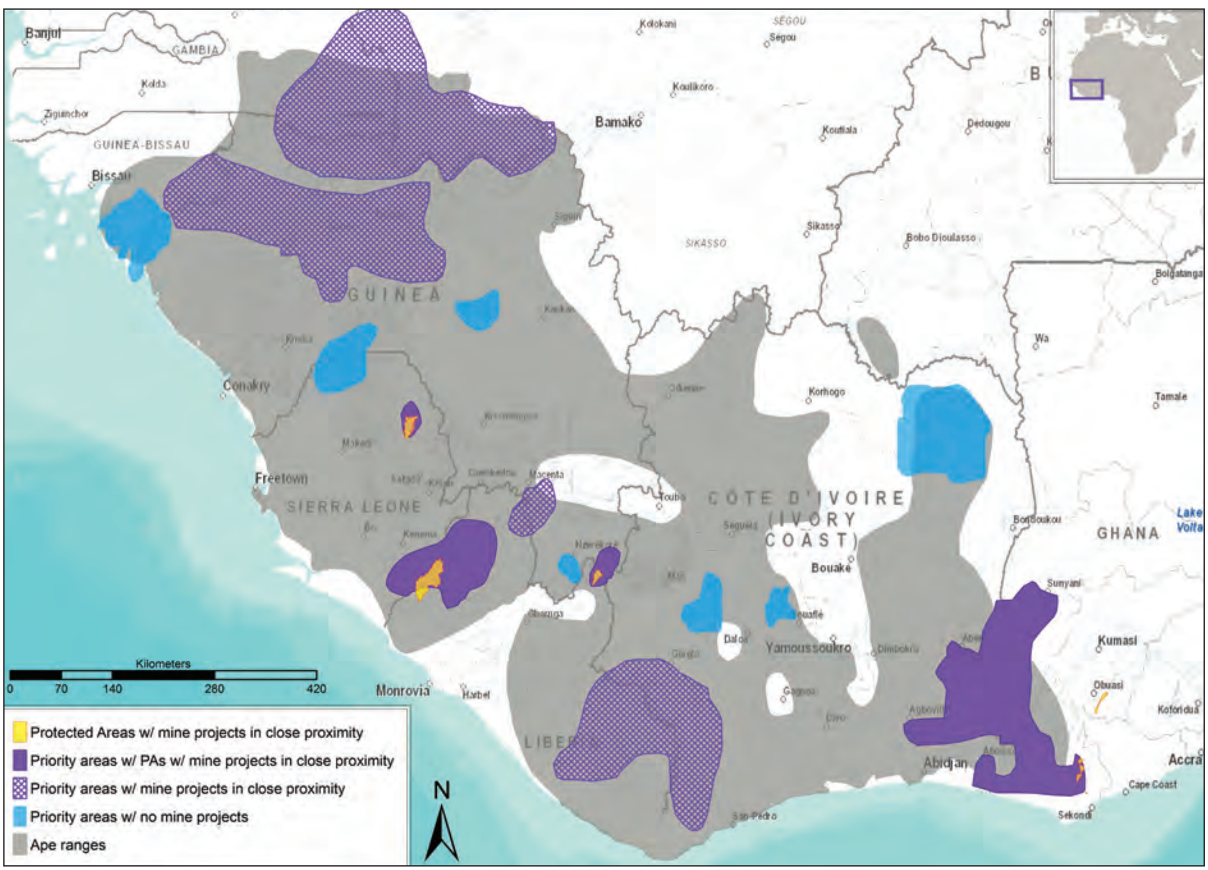
FIGURE 5.1

Great ape action plan sites (priority areas) and their spatial coincidence with mining pixels



of significant localized impacts, the mining pixels that do contain mining projects at one or more stages of their development and operation could potentially have a much more extensive impact on the forest – such as from roads, infrastructure, etc. – than is indicated by the specific point of the operation. Species with only one mining project within their range are the bonobo (*Pan paniscus*), Kloss' gibbon (*Hylobates klossii*) and pileated gibbon (*Hylobates pileatus*). In each of these taxa, a single mining project is currently undertaking development activities. This statistic does not preclude the presence of artisanal operations within the species range but is indicative of no (or a low number of) corporate operations within the range of these taxa.

A key characteristic of all ape taxa analyzed is the predominance of activities that are part of the exploration and evaluation phase of the mining project within their ranges. This identifies the potential future threats from mining operations, and allows these potential threats to be flagged. It should be noted, however, that the number of exploration and evaluation projects is not necessarily indicative of the level of future threat from operational mines. Only a very small proportion of exploration licenses actually develop into commercially profitable mines. However, a concentration of development activities suggests the existence of commodity reserves within ape ranges and the potential for future issues/conflicts in relation to resource exploitation.



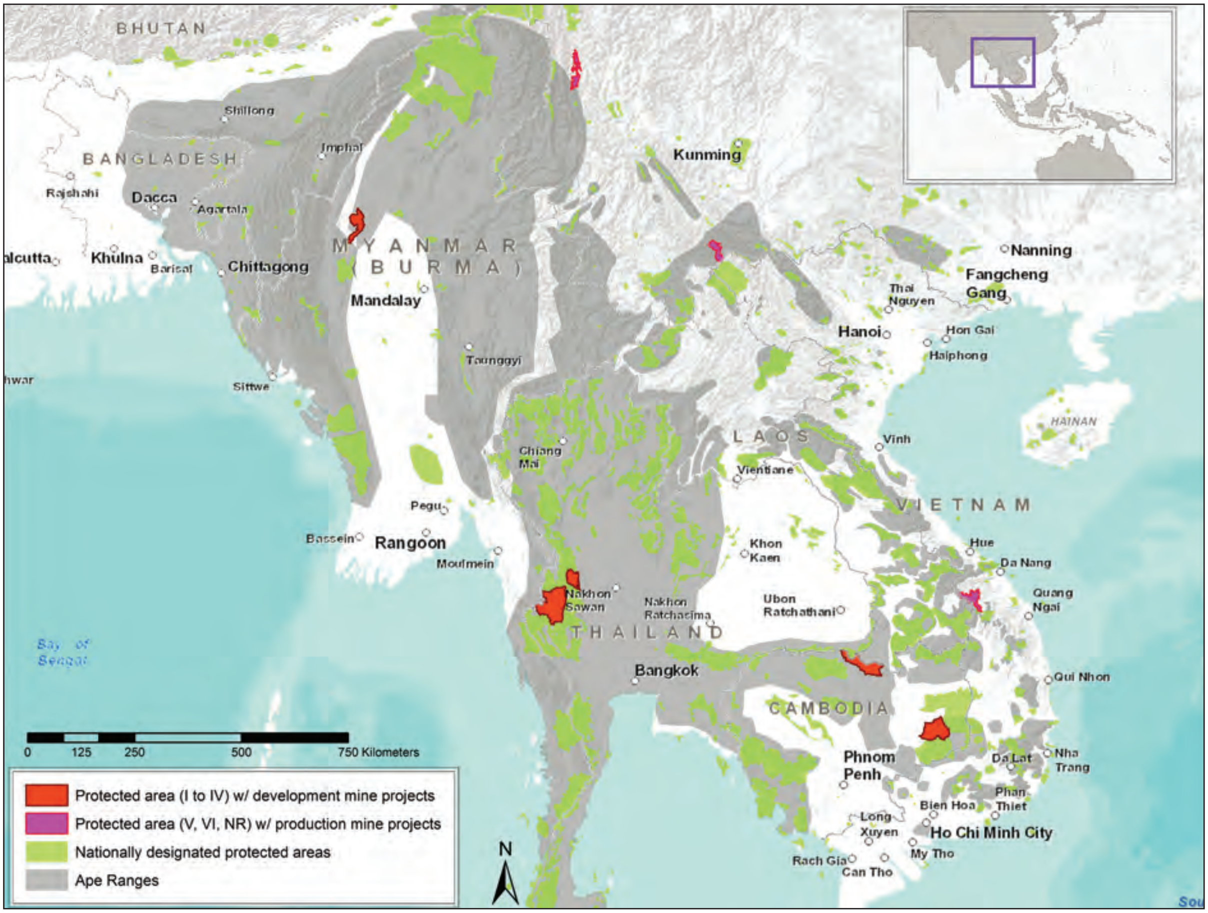
Protected areas: PAs. Apes extent of occurrence: EOO (= ape ranges).

Courtesy of UNEP-WCMC.

Data sources: Kormos and Boesch, 2003; Tutin *et al.*, 2005; Plumptre *et al.*, 2010; Morgan *et al.*, 2011; ESRI, 2012; IUCN, 2012c; IUCN and UNEP-WCMC, 2012; SNL, 2012

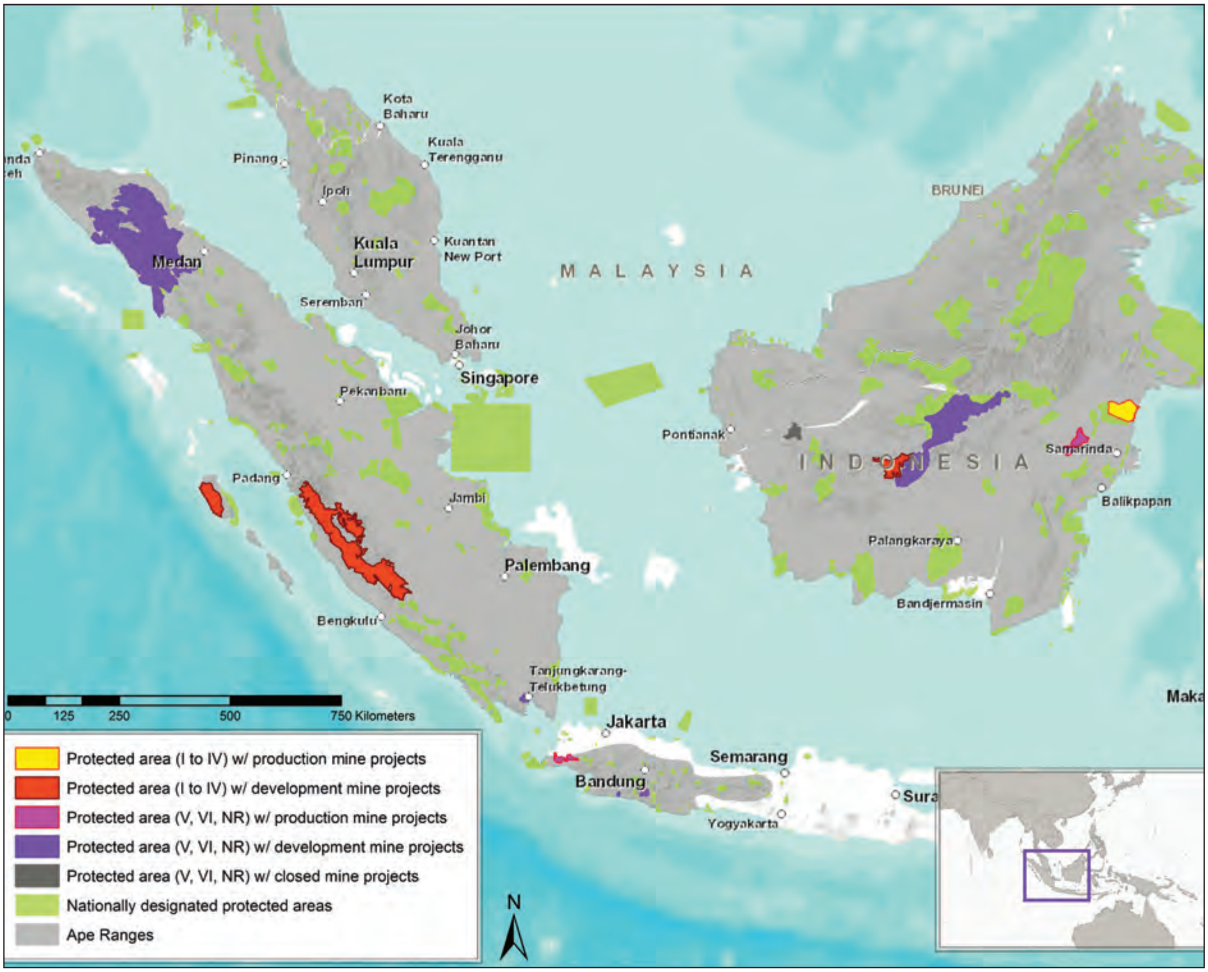
FIGURE 5.2

Asian protected areas which coincide with the range of one or more ape species and contain, or are in close proximity to, mining pixels (split according to their development stage)



The two taxa that have the most notable overlap with mining operations are the Bornean orangutan (*Pongo pygmaeus*) and western chimpanzee (*Pan troglodytes verus*). Five percent of protected areas within the range of *Pongo pygmaeus* contain, or are in close proximity to, mining operations. The range is spatially coincident with 17 mining projects of which four are producing operations and 11 are development activities. Such high spatial coincidence between the refined species range and mining is a strong indication that this species has a high interaction with mining operations. *Pan troglodytes verus* is also identified as having a significantly higher number of mining activities present within its range than other taxa. The range of the Bornean gibbon (*Hylobates muelleri*) overlaps with the largest number of productive mines, a high proportion of which are surface operations, such as open-pit mines.

The overview highlights the cross-taxa, cross-regional overlap between ape ranges and the mining sector. Both in Africa and in Asia, mining operations overlap the ranges of apes and indicate significant potential conflict. It is difficult, however, to rank the impacts of mining operations on the different taxa analyzed without more detailed information on taxa-specific sensitivities to different mining activities.



Courtesy of UNEP-WCMC.
Data sources: ESRI, 2012; IUCN, 2012c; IUCN and UNEP-WCMC, 2012; SNL, 2012; Wich *et al.*, 2012b).

Extractive industry processes and potential impacts on habitat and species populations

Extraction of the Earth's mineral resources inherently causes environmental and social impacts. This is an especially sensitive issue when exploration prospects are identified within high-biodiversity areas, or suitable habitat for great apes. The accumulations of the Earth's natural resources often occur in some of its most underdeveloped regions, where people are poor, lack cultivable food sources, and have extensive subsistence cultural practices. Yet when mineral resources are discovered in economic quantities, they represent an extremely significant engine for economic development in the region, and potentially a mechanism to improve people's livelihoods and welfare. Despite significant advances to improve the terms of mining contracts and transparency of benefit/wealth sharing, many challenges still exist that have continued to exclude rural indigenous communities from the economic benefits of mineral development contracts. Considering the current uncertainties about energy supply and the expected rise in future demand for hydrocarbons and other minerals, particularly due to global economic growth and technology development in Asia and Africa, there is an urgent need to develop strategies to ensure that development in this sector can be conducted in a way that does not require a sacrifice of natural and social capital.

Prior to moving forward with conservation responses it is important to recognize where and how extractive industries affect apes and their habitat during each phase of a project development cycle:

- **Phase 1:**
  Exploration and evaluation
- **Phase 2:**
  Preliminary engineering and alternatives analysis
- **Phase 3:**
  Final engineering and site selection
- **Phase 4:**
  Construction and commissioning
- **Phase 5:**
  Operation, closure, and post-closure.[3]

Some of these impacts are a direct consequence of industry actions, while others are the indirect consequences of other subsistence or commercial activities that have been put in place as a result of the work or financial activity generated by extractive industries. Increasingly, these direct and closely linked indirect consequences are further intensified by the cumulative impacts resulting from multiple industries operating within the same landscapes. While it is often difficult to isolate specific impacts as being the sole responsibility of one actor, it is still crucially important to recognize where and how extractive industries may be contributing to threats through their project life cycles. Identifying and acknowledging these contributions becomes the first critical step in formulating truly effective mitigation responses and, ideally, can form the basis for more effective *ex-ante* planning.

While there are few specific studies on the impacts of mining on Asian and African apes, they can be inferred from studies on

Photo: Mining impacts may be relatively localized, but extremely intensive. Aerial shot of a drill pad in cleared forest, Indonesia. © Bardolf Paul other taxa elsewhere. In contrast to forestry, which typically causes extensive degradation over a wide area, mining impacts may be relatively localized, but extremely intensive. Logging operations might take place across almost all of a 2000 km² concession, whereas even a large open-pit mine (and ancillary facilities) might have a footprint of only 30 km². This footprint, however, will involve complete destruction of all ape habitat. The impacts of mining on biodiversity fall into two categories, direct and indirect (ICMM, 2006; TBC, 2012). Direct impacts include: habitat loss from mines, roads, processing facilities, tailings dams, etc.; and potential pollution from fugitive chemicals, noise, and dust. Mines use extensive and costly tankage and liner systems to contain process fluids to the maximum practical extent, and apply a variety of noise and dust mitigation strategies. Environmental assessments evaluate the risk of potential accidents and failures on the various receiving resources. Indirect impacts may include: building of roads allowing access to the forest for hunting, logging, and agricultural encroachment; and hunting and logging by company staff. Chapter 4 describes the impacts of logging on apes, based on extensive and long-term research. The indirect impacts of mining are often comparable to those of logging, leading to very similar effects on ape populations, and are likely to be comparable in significance in terms of ape and habitat loss (for more information on indirect impacts, see Chapter 7).

Potential cumulative impacts of extractive industries during the project life cycle and action to address them

The study of impacts of extractive industries on wildlife is still too incomplete to provide a definitive picture of the consequences of each phase of project development, or of the cumulative impacts that may occur. Observational and conjectural data derived from recent field studies carried out in the vicinity of extractive industry sites do provide some insight into probable risks and threats to apes during the extractive industry life cycle. Chapter 3 outlines some of these impacts on apes.

Most oil and mining projects proceed through a similar set of phases (Figure 5.3) implemented over the course of the project life cycle, which for small projects may only be a few years, but for larger ones, could be many decades. Each stage of the development process can be expected to raise the threat of distinct impacts, whose intensity, scale, and duration will vary, and on occasion accumulate over time.

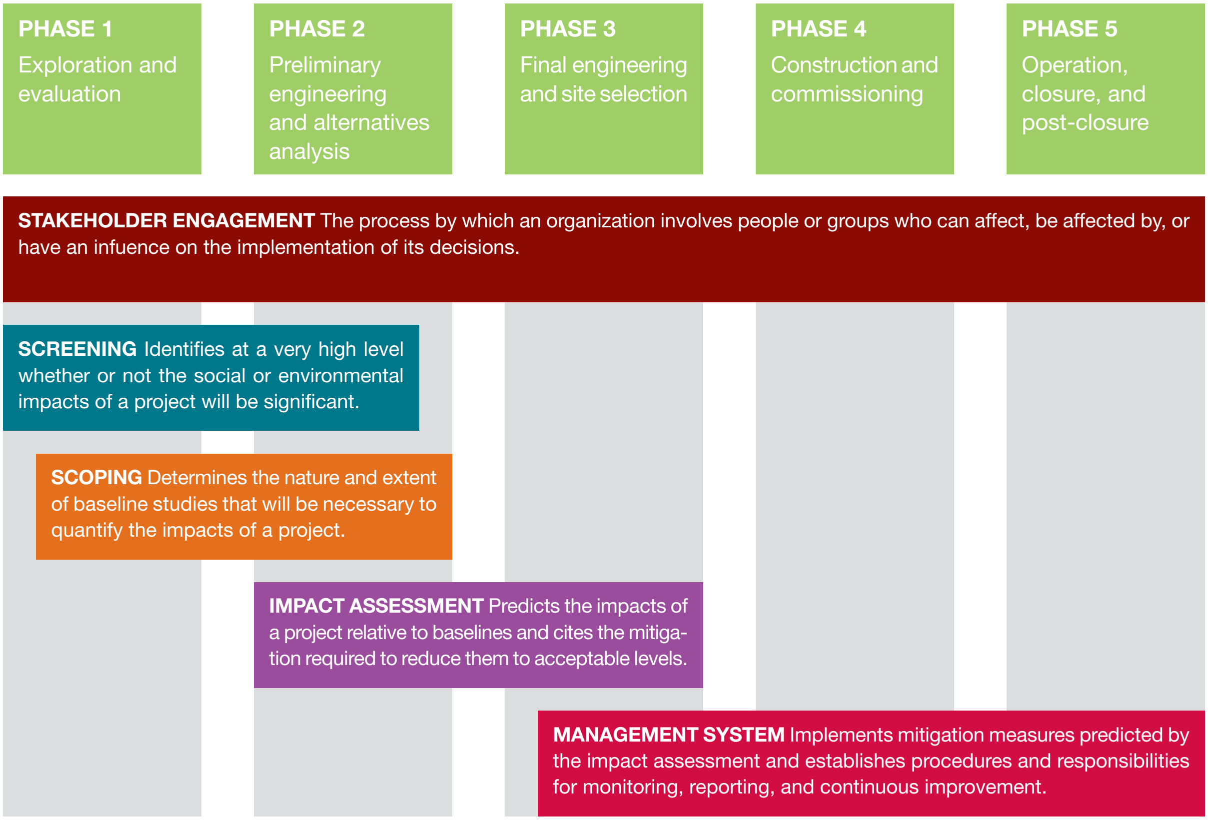
Phase 1

Prospecting

Before committing to the development of a concession, most of the more reputable companies will carry out a series of preliminary studies to evaluate the potential financial, social, and environmental risks, as well as the institutional risks to future company operations and reputation that the project may incur. These studies are generally conducted as desk exercises, but may occasionally include limited field activities. Much exploration is carried out by smaller companies, without the resources or incentive to do this screening, and who may only have the incentive to do this once exploration has demonstrated the presence of a valuable resource that can be sold to a larger company, to recoup the initial exploration investment. Few impacts typically occur during this phase of the project life cycle unless actual field studies are carried out.

FIGURE 5.3

Typical development cycle for a mineral prospect



Courtesy of B. Filas

Exploration and appraisal

A commitment to acquire a concession requires companies to carry out field studies to gain a more thorough understanding of the extent, quality, and marketability of subsurface resources, and of the social and environmental risks that may be associated with their extraction. Seismic surveying and exploratory drilling are likely to be carried out during this phase with the objective of proving or disproving the presence of commercially viable quantities of exploitable metals, minerals, or hydrocarbons. Most survey sites and drill pads will typically be small in area, often requiring the clearing or disruption of only a few hectares of vegetation, or less, in each site. However, there could easily be hundreds of such sites scattered across the landscape with an elaborate network of secondary and tertiary roads and access trails constructed or rehabilitated to service each site. The transport infrastructure may begin to fragment available habitat, and species such as gorillas that are reluctant to stray far from home territories may become isolated. Many ape groups may also be severely disrupted by the significant increase in noise and disturbance of traditional feeding and nesting sites, and of other habitat within their range.

A centralized field station will also likely be established to service prospecting and exploration teams. Such stations frequently cover large areas, and inject significant amounts of capital into local economies.

This new capital can result in a dramatic rise in bushmeat hunting to meet increased demand as locals and industry workers can now afford to buy bushmeat with their salaries. The new influx of human residents also increases the risk of disease transmission to apes and the possible introduction of exotic species, which can reduce or compete for food supplies. In many cases the new human residents have come from far afield in the hope of employment, so that even if the local community has a taboo against eating apes (such as along the southern Congo and Gabon coastline), the new arrivals may not. This can further result in a weakening of local tradition. Finally, new residents are sometimes driven to clear forest in order to cultivate staple food crops, thus further reducing the area available to wildlife and native vegetation. For more information on these indirect impacts, see Chapter 7.

Screening: Once a company receives authorization to conduct exploration activities within a given area by the host country government, a preliminary exploration program is planned. High-level screening (Figure 5.3) is typically initiated prior to the initial field activities to determine if development of the prospect may result in social, environmental, or other impacts that could affect project viability or be a fatal flaw to development. Local and regional stakeholders are identified during this phase and relationship development is evaluated.

Scoping: To understand scoping (Figure 5.3), a definition of common mining development terms may be helpful. "Resource discipline" means areas of expertise in the fields of minerals, air, surface and ground water, land, humans, and flora and fauna. "Project alternatives" means the identification of various methods and/or locations of development investigated and preliminary assessment of potential mitigation and types for each option. Scoping provides the background required to design the impact assessment in detail and to determine the nature and scope of specialist studies that will be required. It is at this stage that site-specific baseline studies are laid out for each of the potentially affected resource disciplines relative to the footprints of the more probable project alternatives. It is also a phase when estimates of the cost of the impact study are compiled.

It is important to keep in mind that screening, and to a lesser extent scoping, activities occur very early in the project cycle, when little or no subsurface exploration has been conducted. The company does not yet know if the geologic indications they have identified on the ground will prove commercially feasible for development.

Phases 2 and 3

Preliminary engineering and alternatives analysis and final engineering and site selection

During these phases, efforts are focused on determining whether or not the mineral resource is worth pursuing further. Hence, land disturbance associated with initial exploration activities will usually be limited. Small excavations, pit digging, and/or drilling activities may unavoidably involve opening up corridors through the forest to access mineralized zones. Early-stage exploration is typically systematically widely spaced to determine the extent of the mineralization. Advanced-stage exploration will then involve infill drilling between the wider-spaced excavations undertaken for those preliminary investigations, to more clearly define the specific nature and extent of the deposit.

Impact assessment: Most companies will typically prepare the comprehensive impact assessment (Figure 5.3) during this phase of the project cycle. The ESIA is the process by which the impacts that project development, operation, and closure will have on the local environment and people are assessed. It includes the collection of detailed site-specific data that characterize potential impacts for all resource disciplines. Ideally, baseline data are collected for at least 1 year in order to adequately characterize the seasonal variation in certain resources, and may require longer periods depending on site-specific circumstances. In particular, surface water and groundwater and flora and fauna species are usually subject to seasonal variation so it is important that the characterization study period is sufficient to adequately document these variations. This is an area, however, where weakness often comes up, as the baseline data are often absent, weak, or of far too short a duration to illustrate the reality (see Chapter 8). The process and methods of the ESIA are often not transparent, and independent, qualified evaluation by an internationally recognized body with ape expertise is recommended (e.g., International Association of Impact Assessment or IUCN Primate Specialist Group/Section on Great Apes (SGA)).

Once the baseline conditions are characterized, discipline-specific resource experts will "superimpose" or model the development, operating, and closure plans onto the resource baseline conditions and predict the impacts associated with the development over the life of the project. Depending on impact significance, experts will identify mitigation measures that can reduce predicted impacts to acceptable levels. That is not to say that project impacts are eliminated; mining results in short- and long-term impacts, both positive (economic development) and negative (affected resources). The impact assessment is the means by which that "best balance" can be found between the positive and negative effects.

Note that mining industry professionals and the consultants involved become keenly aware, through the scoping and impact assessment research they conduct, that not developing a mineral resource can be a negative impact of its own. Ape habitat protection is directly affected by the lack of any type of economic opportunity for local impoverished people with steadily increasing protein food source needs that exacerbate the pressure on the bushmeat trade. The questions are:

1. Can the impact mitigation measures adequately balance the economic development needs so that over the long term ape population numbers and habitat are better protected? and
2. Will the local people develop better protein sources and move away from historical cultural practices that currently have a negative impact on ape populations without development?

The ESIA will often follow national guidelines, if any exist, or those required by lenders or donors, if outside funding has been obtained to advance a project. National requirements in many countries are weak, but Equator Principles, which are embraced by most international lenders financing mining projects, are the main ESIA guidance. The challenge is largely in the interpretation of these guidelines, and the degree of rigor in their application. This has been illustrated in numerous examples, including in the Guinea case study highlighted in Chapter 8. It may therefore be important to include supplemental processes that can support and greatly enhance the ESIA results, as described in Chapter 8.

There is a need for transparency, the sharing of data on impacts and sharing of lessons learned. Studies undertaken as part of the ESIA process result in a wealth of valuable information. However, as previously indicated, this data is generally inaccessible to scientists as it is restricted by confidentiality clauses. Mining companies would contribute significantly to scientific knowledge and understanding and the development of best practice by relaxing or excluding this confidentiality requirement.

Phase 4

Construction and commissioning

If the analysis of appraisal data meets the technical, financial, and corporate policy objectives then the company may decide to develop the resource field, a commitment that may result in the investment of hundreds of millions or billions of dollars over the life of the project, which in some cases may be several decades or more.

This phase of the project typically results in the most dramatic ecological changes and greatest period of disturbance for biodiversity in general and for individual species. Construction and commissioning activities may include more complete development of the transportation network both to move around the extraction area and to connect with regional distribution and shipping centers; construction of drilling and extraction production sites; and construction of facilities, such as pipelines and terminals, processing centers, and lodging and service centers for workers. The ESIA can help anticipate and respond to some of these impacts, although it is unlikely that the prior environmental assessments will take full account of the cumulative impacts likely to occur, or reveal

Photo: Drilling rig core mining for iron ore on Mount Avima in the Republic of Congo. © Pauwel de Wachter/WWF

the actual magnitude of impacts. Predicting the future with 100% accuracy is unrealistic, and for this reason, management systems are developed alongside impact assessments to implement the mitigation and monitoring programs, and as such include reporting, transparency, and continuous improvement commitments as a fundamental element to enable companies to react in a timely manner to any issues that were not accurately predicted in the EIA. For many species, including apes, the responses to increased noise, habitat degradation or destruction, road and vehicle encounters, and increased hunting pressures may not become fully apparent until project implementation begins. Some unverified observations suggest that, when disturbed, a community of chimps or gorillas will generally migrate to adjacent territories, resulting in stress to both immigrant and resident populations. Females might be able to migrate between groups but males may be killed, form male-only groups, or in a few cases be integrated into a new group. For more details on the ecological impact of extractive industries on apes refer to Chapter 3.

> "One challenge for project managers is distinguishing between direct and indirect project impacts and enacting appropriate mitigation measures."

Management systems: Management systems (Figure 5.3) define the specific steps by which the mitigation measures identified in the impact assessment will be implemented on the ground. The management system cites the system philosophy, relevant corporate policies, organization and management responsibilities, and the systems required to identify, organize, manage, and monitor impacts. For some impacted resources, it is necessary to develop discipline-specific management plans to further detail the specific actions and responsibilities for implementing the required mitigation.

The management system also includes provisions for audit, assessment, and continuous improvement of all implementing actions and defines the reporting process and methods for assuring transparency. An important element of the management system is the implementation schedule and budget, which specifically defines the monitoring, additional studies, and future activities to which the company has committed. It includes a capital and operating cost estimate for their implementation throughout the construction, commissioning, operation, closure, and post-closure phases of the project. This allows for all of the environmental and social program costs and the timing of their expenditure to be adequately and accurately factored into the overall project financial evaluation.

Phase 5

Operations

The construction and commissioning phase of an extractive resource development project transitions into the operations phase, and generally results in the continuous day-to-day production of metals, minerals, oil, or gas; maintenance of facilities; and transportation of the exploited materials to market via roads, pipelines, conveyor systems, and export terminals. In some cases, the most dramatic impacts on populations of species such as great apes will already be very apparent, with some individuals lost, groups disrupted or reduced in size, and overall population size and genetics altered.

One challenge for project managers during the operations phase is distinguishing between direct and indirect project impacts and enacting appropriate mitigation measures.

Closure and post-closure

When the commercial life of the extraction project comes to an end, a decommissioning process will typically be implemented to remove facilities and restore project sites to the degree feasible. Restoration work typically includes efforts to reclaim and revegetate the site, usually with the goals of eliminating safety hazards, establishing a stable land form and watershed, and restoring the surface to an acceptable post-mining land use compatible with the surrounding uses. If the surrounding land use is undeveloped forest, the regrading and revegetation programs will strive to enhance the habitat to the maximum practical extent. Industry could benefit from the expertise of ecologists and primatologists to help ensure ape habitat is suitably restored. Mining companies usually have to post a reclamation surety to guarantee that the land will be reclaimed successfully and that surety is not released until after success is demonstrated through post-closure monitoring.

Some infrastructure, such as buildings, conveyors, or railway lines, may also be removed. Open pits or shafts may be filled in and land surfaces recontoured. Industrial wastes (e.g. lubricating oils, hydraulic fluids, coolants, solvents, and cleaning agents) will need to be treated similarly to wastes generated during mining activities, for example by placing them in containers for temporary storage or transport by a licensed hauler to an off-site disposal area.

Direct impacts to great apes from the decommissioning and close-out work may be similar to those experienced throughout the life of the project, as site disturbance levels from noise and physical disruptions are likely to be very high, but they diminish substantially during the closure phase.

Strategies to reduce the impact of mining, oil, and gas extraction on apes and biodiversity

Measures to reduce conflict between apes and industry

This section looks at three key approaches that are rapidly becoming central components in the requirements and practices being adopted by governments, lenders–donors, and companies to protect biodiversity: the preparation of SEAs to provide a cumulative overview of potential impacts across landscapes; the use of spatial planning tools to guide the practical implementation of mitigation hierarchy principles; and the application of the "mitigation hierarchy" as articulated by BBOP and the International Finance Corporation (IFC). In general practice, these three approaches are best combined to generate the data, analysis, and stakeholder response that permits a clear delineation of conservation threats, action targets, and response scenarios.

"SEAs are high-level decision-making procedures used to promote sustainable development."

Strategic environmental assessments

As mentioned previously, most industries prepare a comprehensive ESIA during the exploration and appraisal phase of project development. Unfortunately, there are numerous examples of ESIAs that inadequately analyze the threats to biodiversity and are based on insufficient data and baselines. ESIAs are often prepared for isolated and specific development projects and do not take cumulative impacts into account, including the cumulative impacts from other economic sectors operating in the same landscape. As a consequence, the value of the ESIA is limited and provides poor guidance for mitigating, avoiding, and reducing harm/threats to populations. Another challenge is the enforcement of the actions included in the ESIA to mitigate identified adverse impacts.

One option for strengthening the outputs and use of the ESIA is to provide a broader framework for viewing all industry developments proposed or taking place across a landscape, and include more specific guidelines and requirements for the ESIA process. Increasingly, governments, lenders–donors, and civil society groups are employing an SEA process to build this framework. SEAs are high-level decision-making procedures used to promote sustainable development. These assessments take place before decisions about individual extractive industry projects are made, and they generally include entire landscapes or regions as their frame of reference. The SEA can also serve as the mechanism to establish the key questions, criteria, and actions that should be included in a project-specific ESIA.

An SEA should be conducted at the very earliest stages of decision-making to help formulate broad-scale policies, plans, and programs and to assess their potential development effectiveness and sustainability. This distinguishes the SEA from more traditional environmental assessment tools. EIAs and ESIAs certainly have a proven track record in addressing the environmental threats and opportunities of specific projects. However, they are less easily applied to policies, plans, and any broader program. In this way the SEA serves to complement and provide the gateway and guidance for the EIA or ESIA and other assessment approaches and tools.

SEAs require extensive scoping among all groups who may be affected by direct or indirect impacts from regional development scenarios. Scoping sessions generally aim to identify when, how, and where it is best to develop extractive industry projects within the landscape or region in question, involving all the relevant stakeholders. SEAs usually place a great deal of emphasis on identifying information gaps in advance of individual project developments, and in this sense they can result in ESIAs that ultimately fill these gaps through the required research and field studies. SEAs also typically place a strong emphasis on identifying specific geographic areas likely to be highly sensitive to extractive industry projects, and the SEA will frequently include identification of opportunities to strengthen or establish protected areas and no-go zones, along with recommendations for protocols and standards to guide individual project developments (Kloff, Wicks, and Siegal, 2010).

Much of the emphasis in the development of the SEA is on assessing risk and predicting social and environmental effects over broad geographic areas from the potential mix of development actions. Thus scenario analysis and multi-criteria assessments, risk analysis, and the identification of mitigation opportunities become important components of the final SEA product. In this way the SEA provides an important initial step to support the use of more advanced spatial planning tools and the mitigation hierarchy.

The success of SEAs requires stakeholder consensus that absolutely needs to include buy-in by government. Private sector companies can work with technical experts, including NGOs, to explore and develop mutually acceptable solutions. As stated previously, these studies would ideally be carried out before industry comes in and would help identify areas for exploration and for conservation. In-country industry associations are the most likely opportunity for funding these studies.

In Cameroon, for example, there is both an established and active petrochemical industry association and a newly formed mining association. It would be in their interest to contribute to cumulative impact studies like SEAs, as it would contribute data, share costs, and demonstrate good corporate citizenship. Ideally, they would not just look at site-specific cumulative impact evaluations, but also look at it on a regional basis.

Although the IFC's Performance Standard (PS) 6 places the emphasis on site/project impacts (see Chapter 1), there would be significant benefit in examining broader scale impacts to understand how the site/project contributes to them. In the absence of a government-led planning process, a consortium of private sector companies may find it advantageous to engage in broad analysis of this type as a way to anticipate impacts and reduce overall risk.

Spatial data analysis and long-term conservation planning and monitoring

Spatial planning uses existing data to provide an integrated perspective on conditions, threats, and opportunities for improved biodiversity conservation across a specific geographic area, and helps to understand trade-offs in decision-making. The use of spatial planning tools typically includes measures to coordinate the spatial impacts of sectoral policies in order to achieve a more even distribution of economic development across a region or between regions than would otherwise be created by market forces, and to regulate the conversion of land and property uses (Economic Commission for Europe, 2008; Moilanen, Wilson, and Possingham, 2009).

Some of the decisions and actions that spatial planning typically seeks to support include:

- More socially and economically balanced development within regions, and improved competitiveness;
- Enhanced transportation and communication networks;
- Greater access to information and knowledge by affected stakeholders;
- Reduced environmental damage from all infrastructure as well as extractive development;
- Enhanced protection for biodiversity, ecosystem services, and natural heritage;
- Enhancement of cultural heritage as a factor for development;
- Development of energy resources while maintaining safety; and
- Limits to the impact of natural disasters.

Since most of these issues are cross-sectoral in nature, effective spatial planning should help to avoid duplication of effort by

Photo: Mine employee testing stream water, Indonesia. © Bardolf Paul

all actors engaged in development across a region or landscape, including governments, industry, civil society, communities, and individuals (Economic Commission for Europe, 2008).

Spatial planning processes thus become a potentially valuable tool for anticipating and responding to threats (in this case to great apes) by understanding trade-offs, and may incorporate a variety of methods and outputs. Its ultimate goal in this context would be to identify the optimal scenarios, decisions, and actions to reduce risks and maximize benefits for apes and their habitat in the face of impending extractive development proposals. The planning tool currently under development by the Wildlife Conservation Society (WCS) offers one perspective of how the spatial planning process can contribute to reducing threats from extractive industry developments.

Spatial planning processes, like the tool being developed by WCS, can provide an opportunity for government, industry, lender–donors, NGOs, and civil society to anticipate and prepare for potential adverse impacts early in the project life cycle. Like the SEA, they can provide a broader and richer understanding of direct and indirect cumulative impacts across a larger area than the project development site. Other tools that are used by the mining industry include the ICMM Sustainable Development Framework,[4] Good Practice Guidance for Mining and Biodiversity (ICMM, 2006), and Good Practice Guide for Indigenous Peoples and Mining (ICMM, 2010a), the IPIECA (global oil and gas industry association for environmental and social issues) Good Practice Standards and guidance documents,[5] and the International Association for Impact Assessment.[6] See Chapter 7 for information on how some of these voluntary guidelines address the indirect impacts of extractive industries.

BOX 5.1

What are "biodiversity offsets"?

Biodiversity offsets are measurable conservation actions designed to respond to significant residual adverse impacts to biodiversity from project development. Offset actions are proposed and implemented after appropriate prevention and mitigation measures have already been applied. The goal of biodiversity offsets is to achieve **no net loss** (NNL) and preferably a net gain of biodiversity on the ground, with respect to species composition, habitat structure, ecosystem function, and people's use and cultural values associated with biodiversity.

While biodiversity offsets are defined here in terms of specific development projects (such as a road, mine, or well field), they can also be used to compensate for the broader effects of programs and plans.

The mitigation hierarchy: biodiversity offsets and compensation

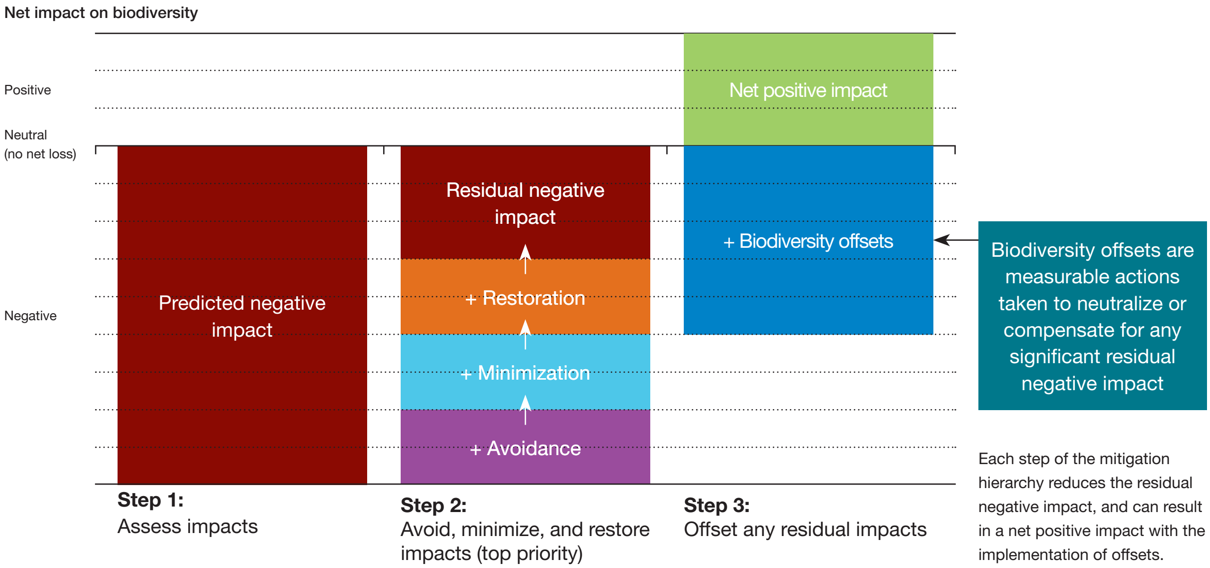
The mitigation hierarchy is a best practice approach to managing biodiversity risk. The approach advocates applying efforts early in the development process to prevent or avoid adverse impacts to biodiversity wherever possible; then minimize and reduce impacts that cannot be avoided; and then repair or restore impacts that cannot be avoided, minimized, or reduced. Only after these initial actions to avoid, minimize or reduce, and repair or restore adverse impacts have been completed do project developers respond to any remaining residual effects. This is achieved through compensation measures for those residual impacts, or ideally and where feasible, creating a "biodiversity offset" through the process of the mitigation hierarchy. If an offset is not possible, some other form of compensation may be needed (see Figure 5.4).

The mitigation hierarchy forms a part of the IFC's Performance Standards and, for some industry representatives, it is the language of PS6 that states "the goal of biodiversity offsets is to achieve no net loss[7]" that presents a real challenge (B. Filas, personal communication, May 2013). The area

Courtesy of WCS

FIGURE 5.4

The mitigation hierarchy and biodiversity impact



Each step of the mitigation hierarchy reduces the residual negative impact, and can result in a net positive impact with the implementation of offsets.

of impact identified by the IFC's PS6 is typically considered the area within which the company has control, which by definition is the mineralized area. Offsite areas can be of equal value, or even preferred habitat for species being offset, but the "no net loss" circle is typically drawn around the area under company control. Industry, government, and stakeholders need to work together here to identify the best offset areas and come up with accurate means to demonstrate no net loss.

The mitigation hierarchy process distinguishes between actions to "compensate" for residual impacts, and those to "offset" residual impacts. Compensation for residual impacts can take a variety of forms, including financial payments or funds established and managed over the life of a project to cover recurrent costs for conservation management. Offsets typically involve specific actions designed to ensure that an equal or greater area of identical habitat is protected or improved to compensate for an area destroyed or degraded as a result of residual project damage (Figure 5.5). It can also refer to individuals of a population, as well as habitat.

Examples of possible offset activities that may be included as a form of compensation include:

- Strengthening ineffective protected areas by investing in capacity building and other management activities for staff;
- Establishing new protected areas or no-go zones in collaboration with communities and government in order to conserve particular species and increase available habitat;
- Establish movement and dispersal corridors for wildlife;
- Establish or strengthen buffer zones adjacent to protected areas;
- Work with communities to develop alternative livelihoods that can reduce or eliminate unsustainable activities and hunting pressures.

Biodiversity offsets and other compensatory projects hold great potential to significantly reduce the impact of extensive commercial activities such as those inherent in large-scale extractive industry projects.

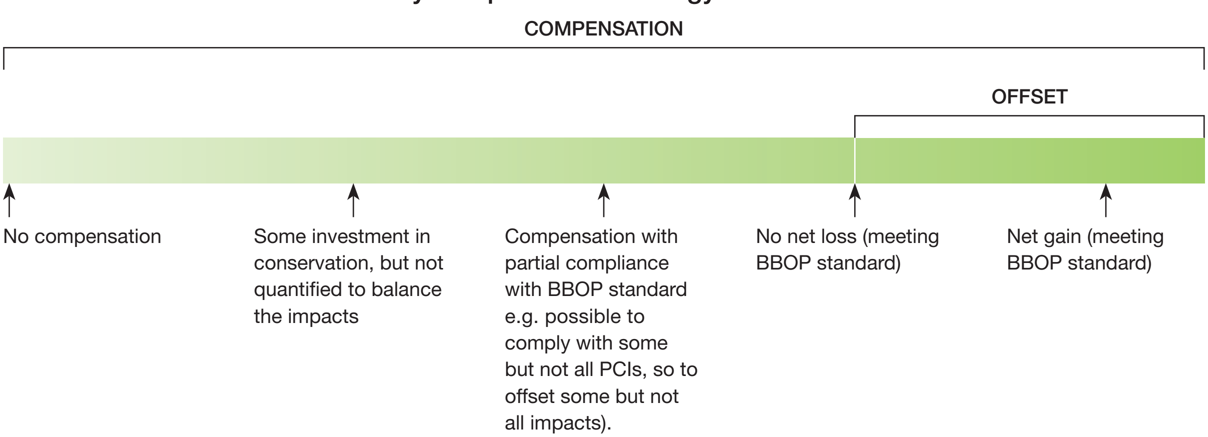
They are not a panacea, however, and must be designed to take into consideration the cumulative threats across the landscape or region to be effective. Offset projects that are designed for individual projects or in isolation from other planned or active developments in a region could result in an incomplete response to risks and threats that accumulate from multiple projects and industries across large geographic areas. In some cases, individual offset proposals will be too small to affect the landscape scale impacts facing a species at risk. There is also a risk that poorly coordinated offset projects omit to account for other regional or national conservation strategies, and thereby negate or fail to support conservation priorities, and represent a lost opportunity for greater conservation impact (Kormos and Kormos, 2011b). There are significant methodological challenges, costs, and time associated with NNL and *net positive impact* (NPI) for great apes. Generating population estimates within relevant geographic areas is difficult and time consuming, and should include both directly affected areas as well as surrounding areas into which the apes may migrate, or potential offset areas. These challenges are described in greater detail in Chapter 8.

Ideally, offsets should be designed and implemented as part of a national planning effort taking into account the cumulative impacts of development in the country, and contributing to and nested in existing national conservation strategies, including recovery plans for IUCN-recognized threatened and endangered species and protected area strategies (Kormos and Kormos, 2011a, 2011b). It is very likely that government-endorsed national offset and compensation strategies would be more effective if supported and overseen by transparent institutions (including conservation trust funds), to ensure permanent funding to deliver conservation outcomes over the long term.

A key factor in the development of any compensation or offset strategy is the assurance that investments in conservation or offset activities do not simply provide a mechanism to allow inappropriate developments to move forward. This is particularly true in areas of rare, unique, or highly threatened species and ecosystems, and it may be distinctly true in the last areas harboring the world's great apes. Thus all compensation and offset strategies proposed in great ape habitat must ensure that appropriate monitoring, planning, and management mechanisms are in place and secure over the

FIGURE 5.5

The role of offsets in a biodiversity compensation strategy



Courtesy of WCS

long term to guarantee that the compensation objectives are achieved (Carroll, Fox, and Bayon, 2009).

Optimally, the collective process of avoiding, minimizing, repairing, and compensating or offsetting will produce NNL of biodiversity. The concept of NNL and NPI for biodiversity is a central principle in the mitigation hierarchy process, and often raises concerns as a risky or impractical goal for extractives. There is an implicit assumption that the implementation of an extractives project always results in some biodiversity loss. Changes in populations, composition or structure of biodiversity could very well occur, particularly in the immediate site of a mining, oil, or gas development project. In some cases, such as in the immediate vicinity of a large, open-pit mine, these changes are unavoidable; however, the NNL principle requires industry to identify actions that can lead to a situation where targeted conservation actions can result in gains in population, composition, and structure for species and ecosystems that will match (NNL), or in the case of NPI, exceed any losses incurred. To accomplish this it is necessary to establish a wide enough geographic sphere of influence to permit populations to disperse or relocate, and a time frame of reference that will permit the recovery or expansion of disturbed groups. This requires collaboration between the company, with limited land under its control, and the government, which manages the extended lands. When this point is achieved, field assessments are necessary to confirm that the "quantity" and "quality" of biodiversity present in the defined affected area remain relatively constant over space and time.

There will unquestionably be instances where NNL may be extraordinarily difficult, if not impossible to attain. In such cases a like-for-like offset of the residual impacts

Photo: All compensation and offset strategies proposed in great ape habitat must ensure that appropriate monitoring, planning, and management mechanisms are in place and secure over the long term. www.jabruson.photoshelter.com on biodiversity may be beyond reach and a project would be restricted to implementing compensation actions that strive to incur the least amount of biodiversity loss possible, while accepting that some loss will occur. It is essential for projects employing the mitigation hierarchy to acknowledge these risks and possibilities at the outset. This may be particularly important in situations where great apes occur, since the potential impacts of extractive industries on apes can be severe and long lasting.

The aim of achieving NNL is based on two important concepts: first is that the entity causing the impacts is responsible for paying for that compensation, and second, that the compensation financing will be put in place for at least as long as the impacts last, or ideally in perpetuity, to ensure the permanence of conservation outcomes. If an SEA has been completed in advance of a company obtaining a mineral concession, they have the information needed to make informed decisions and estimates on the level of effort and cost of compensation before major investment in a project is made, which can then be factored into the feasibility analysis. Although some companies may be concerned with the costs, they will be able to assess them up front, allowing them to make important informed decisions before making significant investments. Ideally this should lead to increased additional financing for conservation of key habitat and species. Further, it is essential to demonstrate that mitigation actions are additional to already planned conservation actions, and that proposed conservation measures are not duplicative or redundant. Mitigation is generally far more expensive than avoidance. As a consequence, industry and ape experts must work together from the outset, rather than after the fact. Ape "experts" must also be credible and have real expertise. It is challenging for industry to distinguish between the real experts and less qualified scientists just looking for income. An international certification scheme, set up by the IUCN SGA, for example, could provide credible recommendations of ape experts to industry.

Integrating SEA, spatial planning, and mitigation hierarchy into broad conservation planning

As mentioned earlier, the application of the SEA, spatial planning, and mitigation hierarchy tools at a program or project scale can typically become a closely integrated process that produces the data, analysis, and stakeholder response that permits a clear delineation of conservation threats, action targets, and response scenarios. These steps are proving to be essential to achieve realistic and long-term conservation outcomes. Even in those cases where it is not possible to achieve NNL or NPI, there exists the ability to explore compensation actions that deliver the best possible conservation results on the ground. Table 5.1 provides a concise overview of how these approaches can be seamlessly integrated.

The mitigation hierarchy is endorsed by an increasingly wide body of business, government, lenders, donors, NGOs, and civil society groups, and can provide important principles and protocols to guide the application of these actions on the ground. However, the mitigation hierarchy differs from the SEA and spatial planning in one very important respect – it can be applied on a site-specific level. A company or producer can decide to apply the mitigation hierarchy as part of a voluntary determination to apply best practice and reduce its biodiversity risk. Thus the mitigation hierarchy could be relegated to project- or site-specific concerns, which could prevent the recognition and mitiga-

TABLE 5.1

Applying an integrated process of SEA, mitigation hierarchy, and spatial planning

At a landscape or project scale:
Government commissions an SEA *to review policies and programs* that will influence extractive industry development strategies across a landscape or region.
Spatial planning tools applied to *reveal impact threats and identify mitigation solutions.*
Develop baseline data and ongoing monitoring programs to *quantify biodiversity values* at the site and landscape level.
Use species distribution models and systematic conservation planning tools to *produce best practice mitigation measures and biodiversity offset plans.*
Build the technical and management expertise to *implement offsets.*
Ensure the permanence of implemented offsets by establishing resilient legal and financial mechanisms for offset management.
At a global, regional, and national scale:
Ensure the availability of technical support to lenders, companies, and governments to *establish regulatory and voluntary standards and policies for the development and delivery of NNL of biodiversity or NPI.*
Generate lessons learned from *a portfolio of site-based biodiversity offset and compensation projects and distribute them to all stakeholders.*

Courtesy of WCS

tion of critical indirect or cumulative impacts. It therefore becomes essential to determine where, in the planning and management process, tools such as the SEA, spatial planning, and the principles of the mitigation hierarchy are best applied.

SEA and spatial planning have such strong political dimensions that, in most circumstances, government must play a key role in initiating, steering, and validating the process, although there is also an important role for lenders and donors to play in supporting this process. Both sectors have a great deal to gain from the results provided from the SEA and spatial planning tools. The data- and stakeholder-verified scenarios and objectives which can ensue from these processes provide a valuable framework from which to adapt policies and standards for industry development across a landscape. The business sector also gains immensely from this process as the outputs can help to define the rules under which they will operate. Thus, industries would do well to be engaged throughout the spatial planning and SEA process since their readiness to respond to predicted impacts and preferred scenarios can provide them with a competitive advantage in eventual concession awards and project development. Establishing such a level playing field between extractive industries is of paramount importance to companies seeking to address their biodiversity impacts responsibly. The SEA is a tool to enable that and as such is fundamental to improving the extractive industry's environmental and social performance. However, in places where the political will or understanding is absent, it may only be possible to increase the application of SEA and spatial planning tools once the government has understood their importance and adopted them. Capacity building is a critical tool for donor governments, the private sector, and NGOs, to assist in developing these skills. Wider adoption and use of SEAs, spatial planning tools, and more cumulative benefits from the guidance of the mitigation hierarchy will likely depend on provision of this capacity building and the subsequent dialog necessary to mainstream and institutionalize it.

Despite these constraints and concerns, the number of extractive industry development projects benefiting from increased use of an integrated approach to SEA, spatial planning, and mitigation and compensation processes continues to grow worldwide. Mining and oil and gas associations can play a significant role.

Changing rules of the game: regulating and incentivizing industry for conservation gain

> "The dramatic growth in investments in the energy and minerals sector is resulting in ever-growing threats to biodiversity, ecosystem services, and communities that depend on natural resources."

The dramatic growth in investments in the energy and minerals sector is resulting in ever-growing threats to biodiversity, ecosystem services, and communities that depend on natural resources for their livelihoods. This growth is encouraging a unique four-pronged response by governments, lenders, conservation experts, and the companies themselves. Cumulatively, these actors could produce a set of policies, standards, requirements, and practices to incentivize all extractive industries to do much more than just account for their adverse impacts. If enacted, enforced, and applied, these measures could result in extractive processes that significantly reduce impacts on biodiversity.

National policies and standards

Governments are slowly starting to respond and, together with civil society, are looking for solutions to these threats to ecosystem services and biodiversity. Requiring companies to follow strict mitigation requirements and then offset their impacts may provide one of the most immediate and effective options. Practical applications of these changes in ape range states are still few and far between. Some initiatives are starting to be seen, however. The government of Gabon is exploring measures to mitigate and offset the negative impacts of extractive industries, which is discussed in greater detail in Chapter 8, and initial conversations have also taken place in Uganda. The policy paths being pursued by these and other countries have the potential to create a momentum that can grow substantially as a result of cumulative exchanges and the growing pressures to respond to the pace of investment. Many of the challenges, however, in Gabon, Guinea, the Democratic Republic of Congo and other parts of Africa, as well as Indonesia and much of Asia, occur because the enforcement of existing regulations is weak, and the capacity of organizations to assess and develop integrated approaches is also very weak. This can lead to the agreement of policies, but inadequate implementation and control, leading to the loss of habitats and species, as well as marginalization of communities.

Funding sources and lender policies and standards

Government changes are being further enhanced by increasing pressure from lenders and donors to mitigate and offset adverse impacts to biodiversity. A mining project is capital intensive to build and start up. Most companies do not have the financial resources available from investor proceeds to fund the development of a project internally. Typically they turn to lending institutions to invest in the project, and/or in project development financing. Companies often build their projects on borrowed money until such time as the mine is producing saleable products. This then allows the company to re-pay the bank loans from the proceeds from product sales before and/or concurrent with providing returns to the stockholding investors.

Most of the lending institutions that are big enough to finance a mining project are signatories to the Equator Principles (www.equator-principles.com). Equator Principles are a credit risk management framework that cross-reference and incorporate the environmental and social PSs of the IFC (www.ifc.org). The IFC is the private investment arm of the World Bank Group. Financial institutions signatory to the Equator Principles apply the principles to all transactions exceeding US$10 million. Because nearly all mining projects exceed US$10 million in capital investment and require external financing, mining companies will typically conform to both Equator Principles and IFC PSs as an inherent part of their project planning. This conformance obliges rigorous social and environmental impact assessment and the implementation of detailed management systems to reduce project impacts to acceptable levels.

The most significant influence from lender policies is the IFC's PS6 that has now been adopted by 76 Equator Bank financial institutions responsible for more than 70% of project financing in developing countries. The IFC's PS6 requires funding recipients to demonstrate NNL for impacts in natural habitat and NPI for biodiversity as a result of project implementation activities in critical habitat. PS6 recognizes that protecting and conserving biodiversity, as defined in the Convention on Biological Diversity (CBD), is fundamental to sustainable development and to all of its investments. The applicability of this Performance Standard is established during the ESIA process, while implementation of the actions necessary to meet the requirements of PS6 is managed through the client's Social and Environmental Management System (SEMS) (see Chapter 1).

Unfortunately, few lenders have biodiversity specialists working within their organization, and a recent study has identified that most bankers are not equipped to identify biodiversity risks. There is now a pressing need to help financial institutions to develop this technical capacity or ensure that they have easy access to it. In addition, most Chinese banks that lend to mining projects (China Development Bank (CDB), Export–Import Bank of China (China EX–IM), Industrial and Commercial Bank of China (ICBC)) are not Equator Principle signatories. China has become a leading developer of extractive projects in Africa. Many Chinese investors do not even seek project finance, as it is not generally their preferred funding option. So the Equator Principles are becoming increasingly marginalized for many Chinese-led investments in Africa.

> “The IFC's PS6 recognizes that protecting and conserving biodiversity is fundamental to sustainable development and to all of its investments.”

Internal corporate policies and standards

The emerging government and lender–donor trends are further complemented by a growing corporate interest in adopting environmental and social best practices to manage project risk and highlight corporate social responsibility (CSR). More and more natural resource extraction companies are creating voluntary internal responses to environmental and social risks through policies and protocols designed to avoid adverse impacts wherever possible, and otherwise minimize, mitigate, restore, or offset them in all other cases.

The incentives driving this behavior are largely market-based and institutional. Companies with a proactive vision of future markets realize that their readiness to comply with government, lender, or shareholder mandated requirements gives them a leading edge in obtaining and following through on the development of concessions. Companies without this readiness may be poorly positioned to participate in the growing natural resource development markets.

CASE STUDY 1

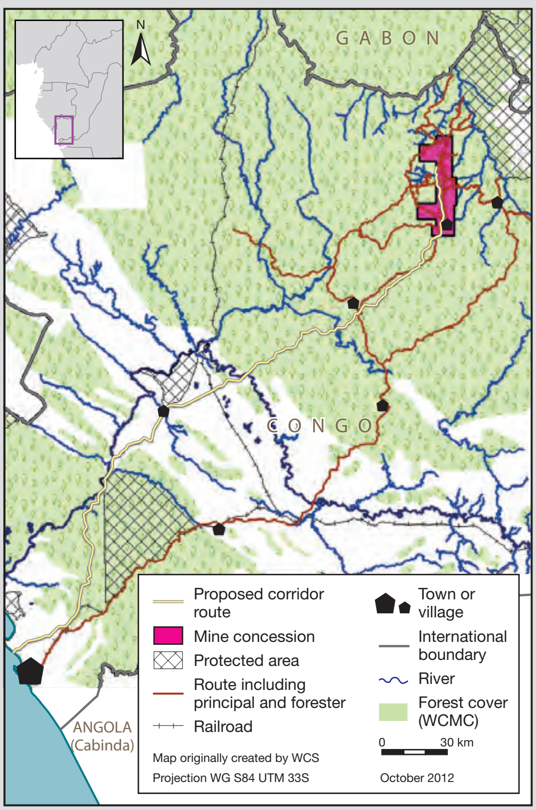
The XYZ iron ore mine in Central Africa

In 2012, a major international mining company embarked on the early stages of planning the development of a proposed iron ore mine ("the XYZ project") in central Africa (Figure 5.6).[8]

The proposed XYZ mine will be located in a core area of the Guineo-Congolian Forest in an area known to contain biodiversity of global significance, including significant populations of lowland gorillas and chimpanzees. The source of a major river situated adjacent to the mine site has been identified by the IUCN as critical for the conservation of forest ecosystems in this basin. The national government recognizes the conservation importance and ecological sensitivity of this region, and established an operating national park immediately adjacent to the proposed mine site in the 1990s. The government has now also proposed the establishment of a protected area contiguous to the existing national park, to further ensure the long-term ecological viability of this area. The two parks will form an

FIGURE 5.6

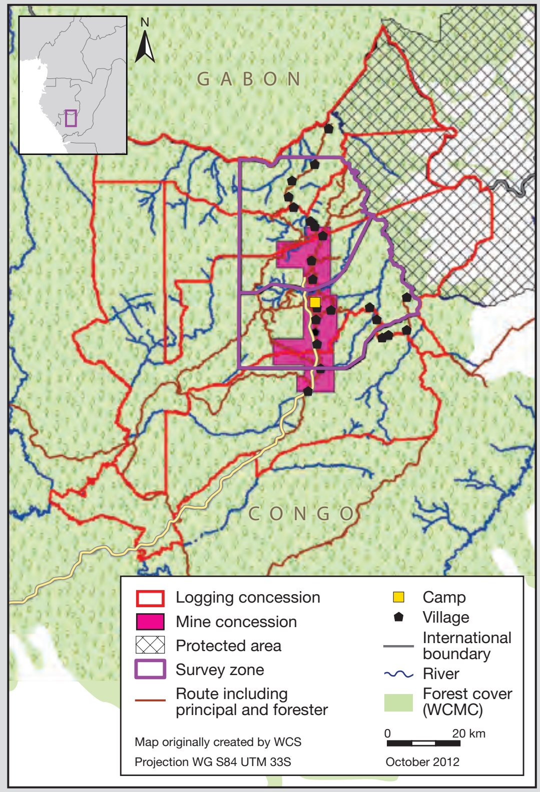
Location of the XYZ mine project and a proposed resource transport corridor route



Courtesy of WCS

FIGURE 5.7

Location of XYZ mine concession and proposed protected area in relation to logging concessions



Courtesy of WCS

important contiguous transboundary protected area of over 5000 km^2 once protected area establishment and development is complete.

The current mine concession overlaps with part of the western section of the proposed new protected area by an estimated 125 km^2 (although the ore body itself is located outside the boundary). The subsurface rights granted to the mine concession further overlap with surface rights granted in three forest concessions, all of which are being actively logged (Figure 5.7).

Following earlier reconnaissance work, XYZ was awarded exploration rights for approximately 1000 km^2 after submitting a research permission application. The extracted ore will be transported via a buried slurry pipe network that travels southwest from the mine site more than 400 km to a coastal port facility.

An Order of Magnitude (OoM) work program as part of pre-feasibility studies indicated that the XYZ mine had the potential to become a world-class iron ore operation and, when fully operational, could be capable of exporting 45–50 million tons of iron ore per year for approximately 25–30 years.

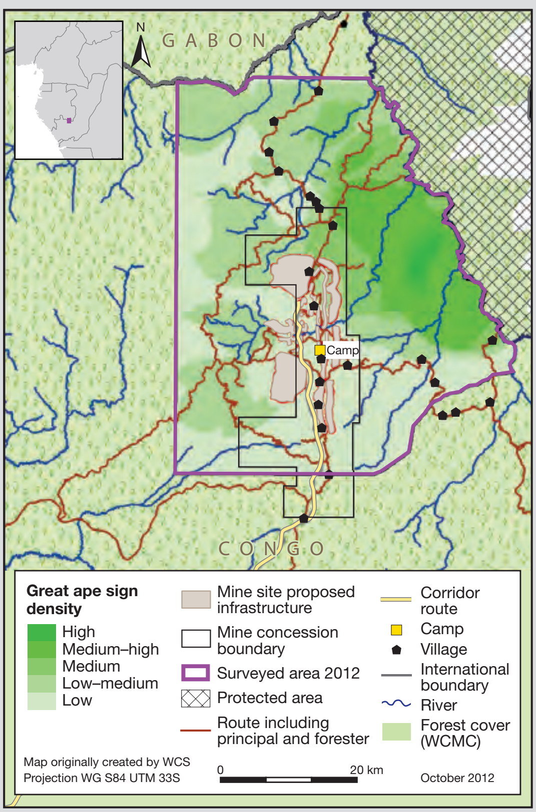
As part of its ongoing pre-feasibility work, the mining company has undertaken detailed investigations to determine the engineering feasibility and economic viability of exploiting the iron ore resource. An ESIA is on-going. More specific studies to establish biodiversity baselines and carry out monitoring of biodiversity in the mine site area and along key sections of the transport corridor have also been on-going since 2009.

Direct and indirect threats to great apes

Particular attention has been placed by the mining company on potential impacts to great apes and their habitat. Although exact population numbers are unknown for the mine site or the transport corridor, it is evident that western lowland gorilla (*Gorilla gorilla gorilla*) and western chimpanzee (*Pan troglodytes troglodytes*) do occur in the project area, although in lower numbers than are found elsewhere in the region (Figure 5.8).

FIGURE 5.8

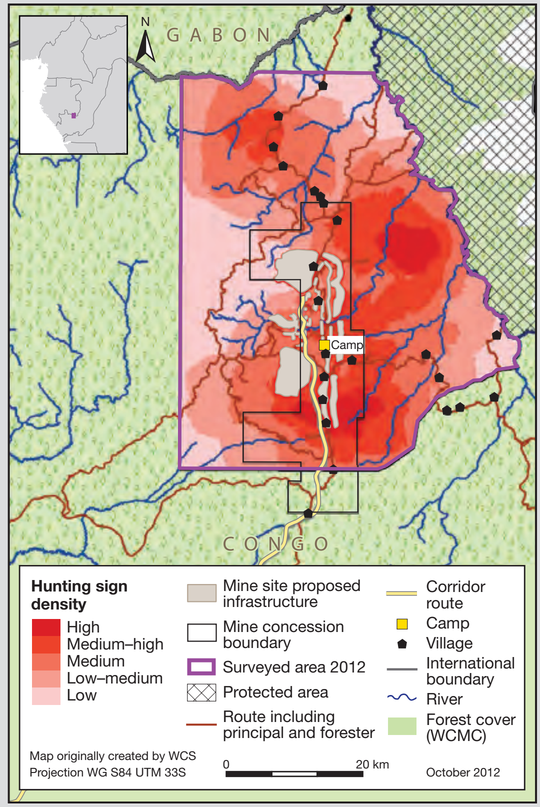
Great ape sign density in the area of the proposed XYZ mine project, 2012 surveys



Courtesy of WCS

FIGURE 5.9

Hunting sign density in the vicinity of the proposed XYZ mine project, 2012 surveys



Courtesy of WCS

Field surveys to estimate great ape relative abundance indicated an estimate of 75.7 (45.35–126.33) nests per km^2, which suggests an approximate number of 900 individuals in the mine site area. While this reveals the presence of a reasonably healthy population, it is noticeably lower than similar areas surveyed elsewhere in the country with a density estimate of 234 (185–299) nests per km^2, suggesting an estimate of 68 000 great apes across 27 000 km^2 of rainforest.

Ecologically, great apes and the habitat they depend on appear to be experiencing a two-fold threat in both the mine site and transport corridor. On the one hand commercial and artisanal loggers are quickly degrading and eliminating habitat. They are also greatly increasing access opportunities for hunters through new road and trail construction. At the same time, the new employment opportunities available from the logging companies and at the mine site have significantly increased some local incomes and available revenue, which, in turn, is increasing hunting incentives as hunters seek to take advantage of the increased demand and purchasing power for bushmeat.

Surveys carried out in 2012 show a significant increase in hunting across a large part of the mine site and transport corridor areas compared to previous surveys carried out in 2009–10 (Figures 5.8 and 5.9). Hunting signs were recorded over almost all of the surveyed area in 2012. There also appears to be a strong correlation between the increased hunting pressures and a dramatic increase in logging operations in the mine site area. Field observations indicate that the loggers consume significant quantities of bushmeat, and do not restrict access to the logging roads or trails to enter the forest. This suggests a strong correlation between expanded logging operations and increased hunting pressures, and this can be expected to further intensify as previously inaccessible areas are opened to new logging operations.

Thus the increasing threats to great apes in this area appear to be principally indirect ones related to the proposed mine project. The rehabilitation or construction of new roads and access routes in the forest is certainly assisting increased hunting, both subsistence and commercial. However, the logging companies have contributed to this growing transport infrastructure and disposable income for the local population, and thus hold significant responsibility for this impact. Separating out the sources and responsibilities for responding to these growing impacts thus becomes a highly complicated task.

Commitment to the mitigation hierarchy: the future for great apes in the vicinity of the XYZ mine

The XYZ mine is sensitive to these overlapping responsibilities and recognizes that the threats to wildlife being experienced in the mine site area and transport corridor are severe, possibly some of the most intense in the country. However, the mine is also committed to contributing what it can to try to mitigate its share of the impacts through improved natural resource management practices, with a particular attention to monitoring of wildlife populations and enforcement of laws and codes to protect them.

The mining company has expressed a voluntary commitment to follow the guidelines of the IFC's PS6, and the XYZ project is now completing its comprehensive ESIA process. More detail on these guidelines is provided in Chapter 8. However, the spatial planning has been limited to the distinct boundaries of the mine site in the concession area, and a narrow width of the proposed pipeline transport corridor extending to a coastal port. No assessment of possible indirect impacts outside of these mine site areas or of adjacent developments has been considered in these spatial analyses.

The ESIA and spatial planning work completed to date has suggested several possible measures that can be implemented to mitigate and offset direct and indirect adverse impacts from further mine development, including support for the establishment of new protected areas, improved management of existing ones, and more effective land-use practices outside of protected areas. Some of the initial actions being considered by the mine project that could benefit great apes include:

- **Carry out semi-annual monitoring of large mammals, including great apes, in the wet and dry seasons** to verify on-going changes in the relative abundance and distribution of mammal, avifauna, reptile and amphibian, and selected aquatic species now known to inhabit the mine site area.
- **Develop education and public awareness campaigns** to ensure that local residents have the information necessary to make responsible decisions on land and resource uses. It will be particularly important for residents to understand the benefits from the ecological services provided by mammals, birds, bats, and invertebrates, including such roles as insect control, pollination, and seed dispersal.
- **Continue assessments of the frequency, intensity, and duration of hunting expeditions**, and development/enforcement of mechanisms to halt or reduce access for hunters, including more detailed analyses of the drivers of bushmeat hunting.
- **Implement a hunter education program** to empower local communities to reduce their take to scientifically determined sustainable levels, and to assist in the enforcement and prosecution of non-sustainable and illegal hunting practices. Hunter education programs can inform hunters of BMPs to reduce harvests during important reproductive and migratory periods, control the number of species taken, and result in more responsible game management.
- **Provide support to government and NGO groups to enforce existing wildlife conservation laws** through trained and equipped teams that are empowered by local community councils and government agencies. Enforcement would also include monitoring of hunters and harvests, and the sale of meat in markets.
- **Fund and implement existing draft natural resource management and economic development plans.** Preliminary community-endorsed plans have been prepared for several communities in the area of the proposed mine, and include a wide range of activities that could help reduce bushmeat demand.
- **Increasing the availability of domestic meat supplies** could reduce the severe price difference that now exists in local markets. Supplies of domestic meat are often sold at logging concession markets, but the market price is often higher for domestic meat than for wild caught/bushmeat.
- **Design a biodiversity offset and compensation plan.** The tentative options for a compensation plan include the possibility of providing the financial and technical support for the establishment and management of the proposed new protected area contiguous to the existing national park. Consideration is also being given to providing long-term financial and technical support to another existing protected area located adjacent to

parts of the proposed transport corridor. While the results from the proposed offset mechanism at the mine will not necessarily resolve all impending risks and threats to biodiversity, the implementation of the mitigation hierarchy for a project of this type would constitute significant progress in the efforts to reconcile extractive exploitation projects in Africa with significantly improved safeguards for biodiversity and the ecosystem services upon which local human populations depend.

If applied, these actions could collectively result in greatly reduced impacts to great apes, in particular, and local biodiversity, in general. Some gorilla and chimpanzee groups should benefit from the establishment of new protected areas and connecting corridors, and improved management in existing ones.

The proposed mitigation and compensation actions are, however, unfortunately limited in geographic and institutional scope. They will principally respond to the voluntary commitments of the mining company, and are designed to reduce or compensate for direct impacts expected from the mining activities. Other indirect and cumulative impacts are not likely to be fully resolved by this mitigation and compensation process, including the dramatic impacts being incurred by intensified logging and hunting throughout the affected environment, and the limited capacity and weak political will of national and local government agencies to enforce existing policies, or forge and implement much needed new ones. Without immediate action to control logging and commercial hunting outside of the mine site the end result over time is likely to be a continued decline in the size, integrity, and health of great ape populations in the immediate mine site and surrounding areas.

CASE STUDY 2

Indonesia

Mining and orangutan distribution

Mining concessions overlap with orangutan habitat in both Kalimantan and Sumatra (Figure 5.10, and Figure 4.2 on page 113). In Sarawak and Sabah, the situation is less clear because no data on official mine concessions could be obtained for this study. On the basis of the presence of coal and mineral deposits, the threat of mining to orangutans in these Malaysian states appears limited. Mining concessions in Borneo overlap with other concessions, thus this chapter focuses on the extent of orangutan distribution shared with mining concessions. The results of these analyses show that 15% of orangutan distribution overlaps with mining concessions (Figure 5.10). For Sumatra the same analysis showed that 9% of orangutan distribution overlaps with mining concessions (Figure 4.2, page 113).

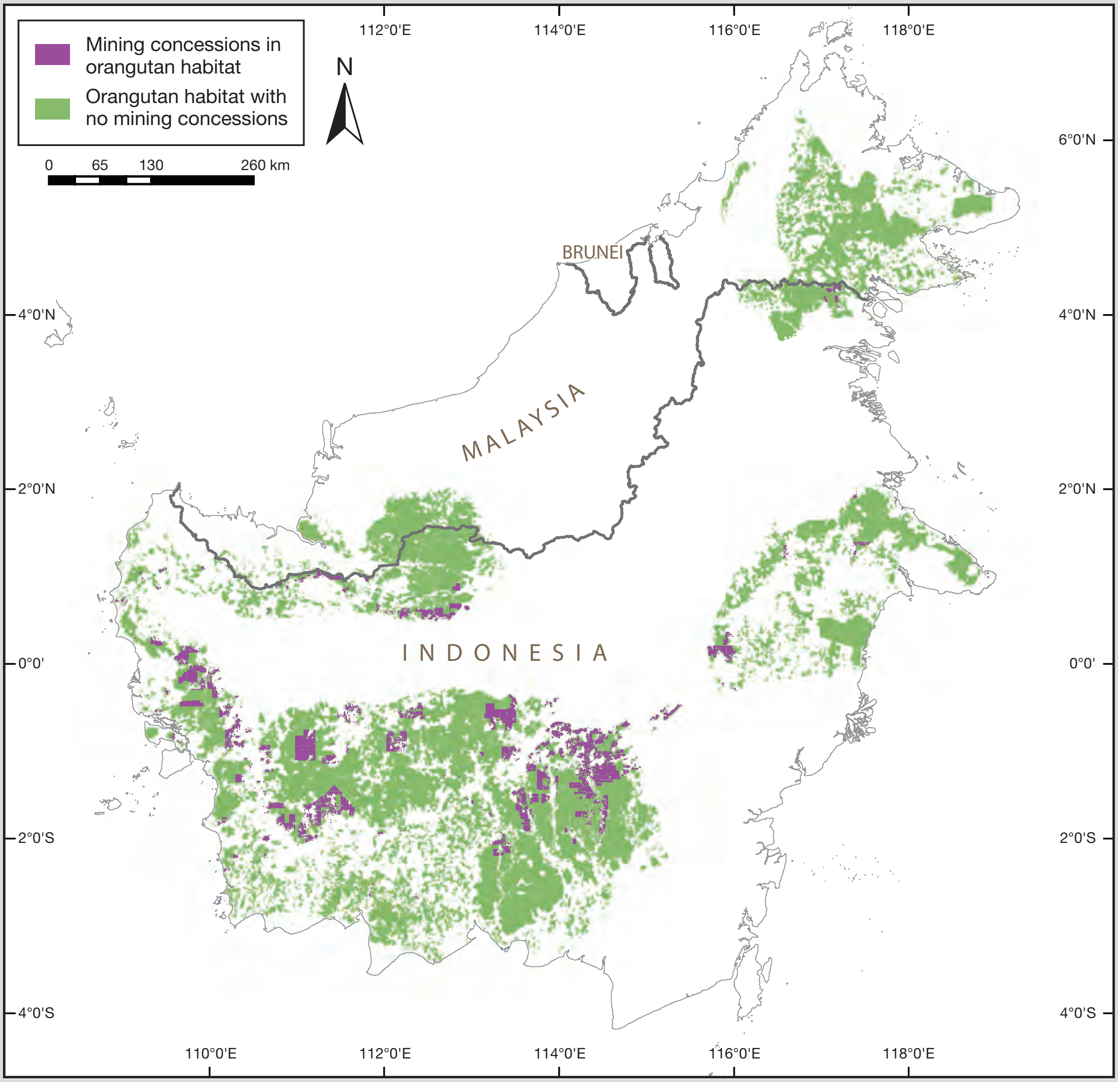
Mining concessions often cover large areas that may include either prime orangutan habitat such as natural forest or more marginal habitat such as degraded forest and agricultural mosaics. The impact of mining on orangutans and their habitat is both direct and indirect (see Chapters 3 and 7 for more information).

Typically, an exploration lease covers a much larger area than the area that will ultimately be mined. Following a set timeline, the original lease area is relinquished back to the government and can be re-issued as a new lease to another company. In reality, mining companies therefore only have management rights over a relatively small area (typically a few thousand hectares), which is known as the borrow-use area. These borrow-use areas, especially those on state forest land, are usually much smaller than the operational areas of pulp and paper and oil palm plantations, or timber concessions. It is thus important to understand that many of the mining exploration leases that overlap with orangutan habitat may not actually be mined. Mining exploration leases are therefore not a good indicator for the potential impact mining activities will have on orangutans for the following reasons: (1) many areas leased for exploration will have low economic potential and will not be developed; (2) only a section of an exploration lease area will ultimately be used for mining.

Kaltim Prima Coal (KPC) in Kalimantan has worked with ecologists to identify ways to enhance its reclaimed mine sites with local tree species and species that provide food for orangutans. Some of these older rehabilitated sites now provide habitat for orangutans (KPC, 2010). The key now is to ensure these areas are linked through habitat corridors to the wider forested landscape so that orangutans can move away from operational areas without becoming cut off or isolated from suitable habitat.

FIGURE 5.10

Mining concessions in Kalimantan* in relation to orangutan habitat



* No data available for Malaysian Borneo

Courtesy of E. Meijaard and S. Wich

Mining laws and their implications for orangutan habitat

Indonesia's forests are split into the following categories: (1) Conservation Forest including National Parks; (2) Protection Forest; and (3) Production Forest. All mining activities are forbidden in Conservation Forest. Forestry Law no. 41/1999 strictly prohibits open-pit mining in Protection Forest, but the development of underground mines is still permitted under this law. Presidential Decree no. 41/2004 and Ministry of Forestry Regulation no. 14/2006 give legal exemption to 13 companies, because their mining concessions within Protection Forest were awarded before the regulation came into force. Among these are two coal-mining companies, namely PT Indominco Mandiri with an area of 251.2 km² (25 121 ha) in East Kalimantan, and PT Interex Sacra Raya, which has 156.5 km² (15 650 ha) of coal-mining concessions in East and South Kalimantan. As mentioned above, the former company operates in orangutan habitat.

Investors can apply for a Forest Land Borrow and Use Permit (*Izin Pinjam Pakai Kawasan Hutan* – IPPKH) for the development of mining activities in forest that is officially classified as a Production Forest. This permit provides the right to use the designated forest area for non-forestry development interests, without changing the status and designation of the land as being forest (Ministry of Forestry Regulation no. 43/2008). Depending on whether the total forest area in the province concerned is more or less than 30% of the total land area, either Non-Tax State Revenue (*Penerimaan Negara Bukan Pajak* – PNBP) is paid or the company compensates by reforesting another area of land. Moreover, Forest Resource Provision (*Provisi Sumber Daya Hutan* – PSDH) and a reforestation fund (*Dana Reboisasi* – DR) have to be paid. Mining within forest land without the obligatory IPPKH is considered illegal under the Forestry Law. However, the Ministry of Forestry does not have the authority to revoke licenses in the case of non-compliance.

According to the IPPKH, the land should be returned to the same state as it was when the permit was issued. Ministerial Decree 43/2008 suggests this can be achieved through reclamation and the planting of forest species in 4 m × 4 m spacing. In the third year after planting, at least 80% of the plants should be in a healthy state. However, the ease of issuance of permits for forests protected under such permits, and the rudimentary state of reclamation plans and their implementation, challenge the credibility of large tracts of land actually being returned to their original forested state (McMahon *et al.*, 2000).

The impacts of mining operations on Asian apes, and particularly the gibbons, have been much less widely studied than the impacts of forestry. Why this is so is not clear, but could be due to a perception that other activities (e.g. plantations, forestry) are much more widespread and therefore have a more significant impact on ape populations. Historically, this may have been the case, but in recent years the extractive industries (mining, and oil and gas) have undergone notable growth in Asian ape states, and now pose a threat to several species (IUCN, 2012b, 2012c). What is important to note is that the impacts of logging (as described in Chapter 4) are likely to be similar in terms of disturbance and certainly in terms of indirect threats associated with the activity.

Market incentives for low impact methods such as those of the Forest Stewardship Council (FSC) have driven best practice in forestry for many years. Very few similar incentives exist in the mining industry and implementation of leading edge practices in biodiversity management has lagged behind forestry. In recent years, however, some companies and operations have begun to implement voluntary commitments to improve practices and reduce their impacts on biodiversity and specifically on endangered species like great apes. This is being driven by several factors including: CSR, regulatory pressure, and investor pressure.

Leading edge practices in the mining industry

Lao People's Democratic Republic (Lao PDR) still retains approximately 68% of its forest cover (FAO, 2011b), which is habitat for six species of gibbon (Duckworth, 2008; MAF, 2011). All of these gibbon species are under threat, principally from high levels of hunting for food and trade, and the conversion and degradation of their forest habitat. The 2011 Gibbon Conservation Action Plan for Lao (MAF, 2011) identifies mining as a development activity that can cause major impacts on biodiversity, including gibbons. Mining is central to the economy of Lao PDR however. A 2011 report (ICMM, 2011) concluded that mining contributed 45% of all exports, 12% of government revenue, and 10% of GDP. Almost all of this derives from only two mines, the PBM Phu Kham mine, and the Sepon gold and copper mine. Funds from mining operations could be used to support gibbon conservation elsewhere in the country, as proposed by the Gibbon Action Plan (MAF, 2011).

The Sepon mine is located in northern Savannakhet Province, in central Lao (Figure 5.11). The mine was originally developed as an open-pit copper and gold mine by the Australian company Oxiana. Gold production started in 2002, and copper in 2005 (MMG, 2012). After a series of mergers most of what was then known as OZ Minerals was bought by the Chinese company Minmetals Resources

FIGURE 5.11
Location of Sepon mine in Lao PDR

Developed from IUCN and UNEP-WCMC, 2013

Ltd in 2009, which operates mines through its subsidiary Minerals and Metals Group (MMG). Since taking over, MMG have expanded operations and extended the estimated life of the mine. They now predict that gold extraction will continue until at least 2013 and copper until at least 2020.

MMG controls a lease area, known as a Mineral Exploration and Production Agreement (MEPA), of approximately 1300 km^2. The mine is located in the central Annamite mountains, an area renowned for its high levels of endemism and the relatively recent scientific discovery of several new mammals, including the critically endangered saola (*Pseudoryx nghetinhensis*), and annamite striped rabbit (*Nesolagus timminsi*) (IUCN, 2012b, 2012c). Gibbons are known to occur within the lease area, but it is still not known how many, and which species are present. The lease is located in the area thought to be at the possible boundary between two species, the endangered southern white-cheeked gibbon (*Nomascus siki*) (IUCN, 2012b, 2012c) and the newly described northern yellow-cheeked gibbon (*N. annamensis*) (Thinh *et al.*, 2010; MAF, 2011). It is possible that both species are found in the lease area, and that it could be a zone of hybridization (C. Hallam, personal communication, July 2012).

MMG is now attempting to implement leading edge practice in the management of biodiversity at the Sepon mine. Leading companies in the mining sector aim to follow the mitigation hierarchy to manage impacts on biodiversity (BBOP, 2012). As stated earlier in this chapter, this approach places emphasis on first implementing measures to avoid, then minimize, then restore, and only as a last resort to offset impacts with conservation actions leading to biodiversity gains elsewhere (BBOP, 2012). MMG is collaborating with the WCS Lao Program to implement a biodiversity strategy that follows the mitigation hierarchy. The key elements of this strategy are:

- **Avoidance:** WCS and MMG have mapped and modeled biodiversity features, and threats across the wider landscape. From this they have identified areas of higher biodiversity value. To date the mine has not cleared any forest holding extant gibbon populations. As the mine expands, high biodiversity forest areas, including those with gibbon populations, will be avoided where possible.
- **Minimization:** MMG has strict bans on hunting, and collection of forest resources by staff and contractors. This program is supported by training and awareness raising in environmental issues. Where possible, road widths are kept to a minimum, minimizing forest loss and barriers to gibbon movement.
- **Reinstatement:** Pits are back-filled where possible and native flora re-established. Rehabilitation also occurs in other disturbed areas, for example along roadsides.

Photo: Tin mining tailings ponds in Vietnam. The residual ore and water from the processing plant is dumped into large ponds. The contaminated water drains into the environment. Thai Nguyen province. © Terry Whittaker

- **Offsets:** The mine ESIA includes a program of "Partnerships with wildlife conservation groups and government authorities to develop offset programs outside the project area" (C. Hallam, personal communication, July 2012). MMG is working with WCS to quantify the biodiversity losses from future work, and develop an offset for residual losses leading to a net gain for biodiversity, including improving the conservation status of gibbons. To compensate for existing operations MMG supports a variety of other conservation efforts in Lao including those for Asian elephants (*Elephas maximus*) and Siamese crocodiles (*Crocodylus siamensis*).

The approach taken by MMG stands in clear contrast to practices by many other operations that pay little regard to the management of biodiversity impacts. This is particularly clear with illegal or artisanal mining, which occurs in many parts of Asian as well as African ape ranges (Global Witness, 2003; Laurence, 2008). This is described in greater detail in Chapter 6 of this volume. Phnom Prich Wildlife Sanctuary (PPWS) in eastern Cambodia, for example, is home to a population of approximately 150 groups of southern yellow-cheeked gibbons (*Nomascus gabriellae*) (Channa and Gray, 2009). These gibbons are part of a much larger metapopulation including around 1000 individuals in the neighboring Seima Protected Forest (Pollard *et al.*, 2007). Despite its protected status, exploration for gold has been allowed in PPWS and illegal mining for gold is occurring in several locations. Illegal mining has led to clearance of forest within gibbon home ranges, and illegal miners are known to be hunting in the forest (Channa and Gray, 2009). Gibbons are threatened from this through habitat loss and degradation, and hunting. The continued spread of illegal mining in this area could threaten an important population of this globally endangered gibbon (IUCN, 2012b, 2012c).

Conclusion

The impacts of mining on ape populations and their habitats have not been studied extensively. They can be understood, however, in terms of the direct and indirect effects of operations throughout all stages of project development. Significant gaps still exist in the information and analysis required for both policy-makers and practitioners to determine if it is truly possible to achieve profitable extractive projects together with NNL/effective ape conservation, which is also respectful of social and environmental priorities. Efforts to follow the mitigation hierarchy (avoid, minimize, restore, and compensate) have, to date, shown partial success with respect to biodiversity targets, but they insufficiently address the cumulative impacts of human land use and economic activities. It is likely that leadership from governments at national and regional levels, as well as commitment from leaders in industry, based on strong conservation science and input from civil society (including marginalized, indigenous communities) is required for the extractive industries to be compatible with environmental and social objectives. The case studies show that this is patchy, and specifically for apes, too little data exists to accurately assess and predict the impact of mining on ape survival.

> “Leadership from governments and commitment from leaders in industry, based on conservation science and input from civil society is required for extractive industries to be compatible with environmental and social objectives.”

Clearly, there is much work to be done to help mainstream the application of the measures and methods outlined in this chapter, which are now being considered by governments, lenders–donors, and companies as part of the broader solutions toolbox. A pressing task for decision-makers in the next decade will be to lead the work that can demonstrate where and how these new practices can be best applied, and to create the lessons learned that will lead to more and better conservation, with sustainable financing provided directly by the private sector. Essentially, industry can and should work with national governments to ensure that SEAs are carried out over a large enough area, and that measures put in place to avoid, mitigate, and compensate for impacts are effective. Industry associations are probably better than individual companies to take on these possibilities, as well as other mechanisms, such as land disturbance taxes.

It will also be essential for practitioners to ensure that the two key prerequisites for achieving NNL of biodiversity are included in the growing corporate, government, and donor policies, namely that the funds for compensation actions come from the entity causing the impacts, and that the compensation financing is ensured for at least as long as the impacts last, or ideally in perpetuity to ensure the permanence of conservation outcomes. Compensation funding must be sufficient to finance the management of offsets and dedicated to sustain conservation areas and actions that are not already financed. Certification schemes could certainly filter some of that cost to the growing urban middle classes that are driving much of the consumption.

As these demonstrations and lessons grow it will become possible to provide a tangible response to one of the key constraints affecting great ape and broader biodiversity conservation: the lack of sufficient financing to ensure long-term support for areas identified for conservation and/or sustainable management of working landscapes, including protected areas.

At the present time these methods are frequently applied in a piecemeal manner with little integration or coordination across regions or landscapes. More significantly, the institutional support for the use of these methods, and their ability to enforce and monitor them, is also inconsistent and incomplete. Most applications of spatial planning and the protocol of the mitigation hierarchy occur through voluntary conditions established by companies in collaboration with NGOs or civil society. In those instances where government standards are in place or in process, there are significant questions remaining about the long-term enforcement, and thus the effectiveness, of these standards. The end result for great apes and other associated biodiversity is uncertain in all of these cases, but certainly not encouraging.

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Endnotes

1 http://mapper.eva.mpg.de/

2 http://www.metalseconomics.com

3 B. Filas, 2013

4 For more information go to http://www.icmm.com/our-work/sustainable-development-framework

5 For more information go to http://www.ipieca.org/focus-area/biodiversity

6 For more information go to http://www.iaia.org/

7 Taken from "a biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity" PS6 page 2 footnotes (IFC 2012)

8 The XYZ project is an actual project in development. However, the name and location of this project have been changed to respect the privacy of the implementing company