Photo: Forest landscape degraded by artisanal mining. © Micha Hollestelle

CHAPTER 6

Artisanal and small-scale mining and apes

Introduction

The term "artisanal and small scale mining" (ASM) describes the use of manual labor and low-level technologies that characterize the activity (Hruschka and Echavarría, 2011), as opposed to the capital-intensive and high technological input of industrial, large-scale mining (LSM). ASM is often an informal activity and artisanal miners' lack of recognition, formal rights, and support creates a structural inability that can make it difficult for them to move out of poverty. Described as being amongst the poorest members of society, their trade is often fraught with dangerous practices and, in conflict and post-conflict countries, can have serious implications for security (Hayes and Wagner, 2008). At the local level, however,

and in contrast to other subsistence-based livelihoods, artisanal miners are often better off than their neighbors, as their income can enable them to invest in their families' health care and education, buy consumables, and better cope with shocks. But while ASM is an important and increasingly popular livelihood for tens of millions of people around the world, bringing in needed income to rural communities, it is also a serious and growing threat to biodiversity and the integrity of protected areas due to the extraction methods and the livelihood practices that support mining populations (Villegas *et al.*, 2012).

This chapter attempts to integrate the extent of artisanal mining activity within previously identified ape habitats with those mitigation strategies currently in existence, alongside the emerging lessons and knowledge gaps. In the context of conservation, economic activity, and human rights, it illustrates just how dire the environmental impacts of uncontrolled ASM can be, as well as highlighting the importance of this sector as an economic force that requires better regulation and understanding. Critical issues to be addressed include:

- An overview of the structure of ASM activity in protected areas and critical ecosystems (PACE) around the world;
- The policy and regulation of artisanal mining;
- The nature of ASM experiences in ape range states, illustrated through case studies of artisanal mining in ape habitats, focusing primarily on central Africa;
- Mitigation strategies and their challenges.

Key findings:

- The presence of ASM in PACE can have a devastating impact on local biodiversity and thus apes, through obvious, direct activities such as habitat destruction, degradation, and fragmentation, but also no less significantly through a multitude of indirect impacts such as water pollution, soil removal, and the increase in hunting pressure that accompanies migration to mining sites (see Chapter 7).
- ASM activities increase the risk of the spread of diseases to ape populations due to poor sanitation and poor hygiene within mining communities, as well as zoonotic disease transmission from animal to human populations due to increased contact through habitat intrusion (see Chapter 7).
- The role of LSM as a magnet in drawing ASM into these areas (as they are seen as viable for exploitation) is complex and misunderstood, and with current mitigation thinking generally focused at the site level, an analysis of markets at both the supply and demand ends also requires further investigation.

Both political perceptions and attitudes towards the ASM sector are central to progressive policy processes. But while it remains poorly understood, with this knowledge deficit reflected in weak or non-existent legislation, so too have recent management options been few in number and with little analysis as to what extent they have either

NOTE

Protected areas and critical ecosystems

Protected areas have been defined according to the IUCN definition of a "clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008, pp. 8-9). Different notions of how to classify which of the world's ecosystems should be considered "critical" exist, but for the purposes of this chapter, they include Areas of Zero Extinction (of which there are only 587 in the world), in which endangered or critically endangered species of mammals, birds, amphibians, reptiles, plants, and reef-building corals are known to reside, and the Global 200 Priority Ecoregions as described by Olson and Dinerstein (2002).

succeeded or failed. While existing programs are slowly beginning to rectify this situation, the often immature and corrupt governance structures found in many ape range states exacerbate ASM's environmental and social impacts. With increased encroachment on ape habitat, there is now a recognized need amongst conservationists to focus on the opportunities for not only mitigating the environmental impacts of the sector, but also improving the social impacts, through better regulation and the formalization of tenure rights. In areas considered critically important for ape conservation there may also be the need to ban mining altogether, and this will require interventions supported by more robust law enforcement. As long as ASM remains an economically rational choice for often chronically poor individuals, the ultimate aim will be to find ways of navigating these complex conservation and development trade-offs that it produces in sites of high conservation value. Some of the shortfalls apparent in existing management strategies highlight how integrated interventions that include policy and legislative development in traditional spheres of control, coupled with poverty alleviation measures, are more likely to mitigate the impacts of ASM on great apes and gibbons than efforts that focus on any one of these alone.

The structure of artisanal mining

There are four main types of ASM (Hruschka and Echavarría, 2011):

- **Permanent**: refers to ASM as a full time, year round activity. Mining is frequently the primary economic activity and is sometimes accompanied by other activities such as farming, herding, or other localized extractive practices.

BOX 6.1

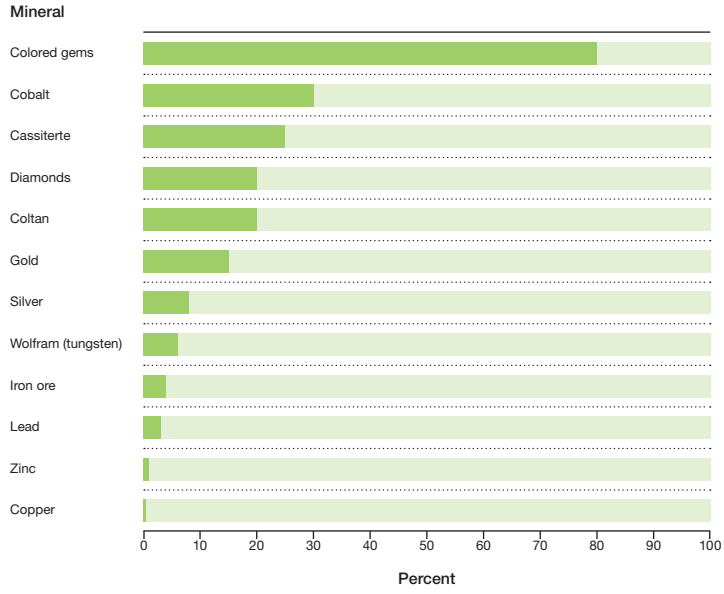
Overview of ASM sites and the key minerals obtained through them

Artisanal mining primarily depends on the most basic tools (hammers, picks, shovels, buckets, wheelbarrows, etc.) and manual labor for excavation. More advanced organization and production methods – such as the use of bulldozers and advanced mechanization – can also be referred to as small-scale mining. The term 'ASM' is thus used to describe a sector that is in fact quite diverse. Different types of ASM include: recovery of alluvial material from river beds or banks; recovery of tailings from old processing plant discharges or rejected material; open-pit mining, with or without benches to stabilize the pit walls; vertical or inclined shafts, of which tunnels or galleries may be excavated; irregular tunnels into hillsides following mineral veins; extraction from abandoned industrial mines, whether open pits or underground mines, which can include removal of ore-bearing pillars and other supports for underground galleries or destabilization of pit walls; and appropriation from large-scale mine stockpiles of rejected or prepared materials (Hayes and Wagner, 2008).

Using data collected by the German Federal Institute for Geosciences and Natural Resources (BGR), Figure 6.1 shows the contribution of ASM to the global production of minerals, including those commonly extracted in or adjacent to protected areas or critical ecosystems (and thus great ape habitats).

Many other minerals are also mined (both artisanally and otherwise). These include bauxite, different gemstones, iron ore, marble, limestone, and other construction materials.

FIGURE 6.1
ASM share of global production (%)



Villegas *et al.*, 2012, p. 9, courtesy of ASM-PACE.

- **Seasonal**: refers to ASM taking place during specific seasons owing to seasonal alternating of activities or seasonal migration of people into artisanal mining areas during idle agricultural periods, for example, to supplement their annual incomes.
- **Rush-type**: massive migration of artisanal miners to an area, based on the perception that the expected income opportunity from recently discovered deposits far exceeds the current actual income of those people who are lured into it.
- **Shock-push**: refers to when ASM is a poverty-driven activity emerging after recent loss of employment in other sectors, often as a result of conflict or natural disasters.

ASM can impact and become a threat to endangered species when initially temporary mining sites become increasingly permanent, in turn bringing affiliated service industries, increasing associated livelihood activities (hunting, forest clearing for mining or agriculture, etc.), or through the mining techniques themselves (use of toxic chemicals, dynamite, forest clearing, diversion or dredging of rivers and streams). However, given that the processes involved in preparing the terrain, and extracting and processing the materials, differ greatly, there are differing degrees of impact on humans, wildlife, and the environment.

Driving factors behind artisanal mining

There are many reasons why people undertake ASM. Often the primary motivation is that, although extremely physically demanding, and physically and financially risky, ASM is an economically rational choice for chronically poor individuals in a context of limited options. People generally undertake ASM because it offers:

Photo: An artisanal miner holding his find of alluvial gold in Buheweju, Uganda. © Estelle Levin

- Immediate cash, which is otherwise difficult to acquire in rural, subsistence-farming contexts (Villegas *et al.*, 2012).
- Potential relief during difficult circumstances in fragile societies that have undergone or are undergoing deepening poverty, natural disasters (e.g. in Mongolia), economic transition or collapse (e.g. in Zimbabwe), or civil conflict or post-conflict reconstruction (e.g. in Sierra Leone and Liberia) (Villegas *et al.*, 2012).
- Opportunity to earn higher income for unskilled or illiterate individuals (Villegas *et al.*, 2012).
- Subsistence for people who are desolate and mine in exchange for food or other basic provisions (Villegas *et al.*, 2012).
- Emancipation from traditional hierarchies and social structures; artisanal mining economies (especially in rush situations) are often highly individualistic and provide scope for young people to organize and discipline themselves as they see fit (King, 1972; Levin, 2010, cited in Villegas *et al.*, 2012).
- Hope that mining will help them break free of poverty and bring them increased dignity and respect from their community (Levin, 2005; Zoellner, 2006, cited in Villegas *et al.*, 2012).

ASM is an economic activity that rises and falls with global mineral prices and shifts production of certain minerals in accordance with local or global demand. For example, Nyame and Grant's (2012) analysis of the recent shift from artisanal diamond production to artisanal gold mining in Ghana emphasizes the fact that artisanal miners would rather adapt their activities to the extraction of other minerals (sometimes at great environmental cost, e.g. the use of mercury) rather than return to traditional activities. In the context of high mineral prices, ASM is a rational economic choice for people seeking to escape absolute poverty or improve their lives. In Uganda, for example, the average miner contributes almost 20 times more to GDP than the average woman or man in farming, forestry, or fishing (Hinton, 2009, p80; Hinton, 2011). In Liberia, the average artisanal digger working north of Sapo National Park has the potential to make 17 to 50 times more than the average Liberian per day (Small and Villegas, 2012).

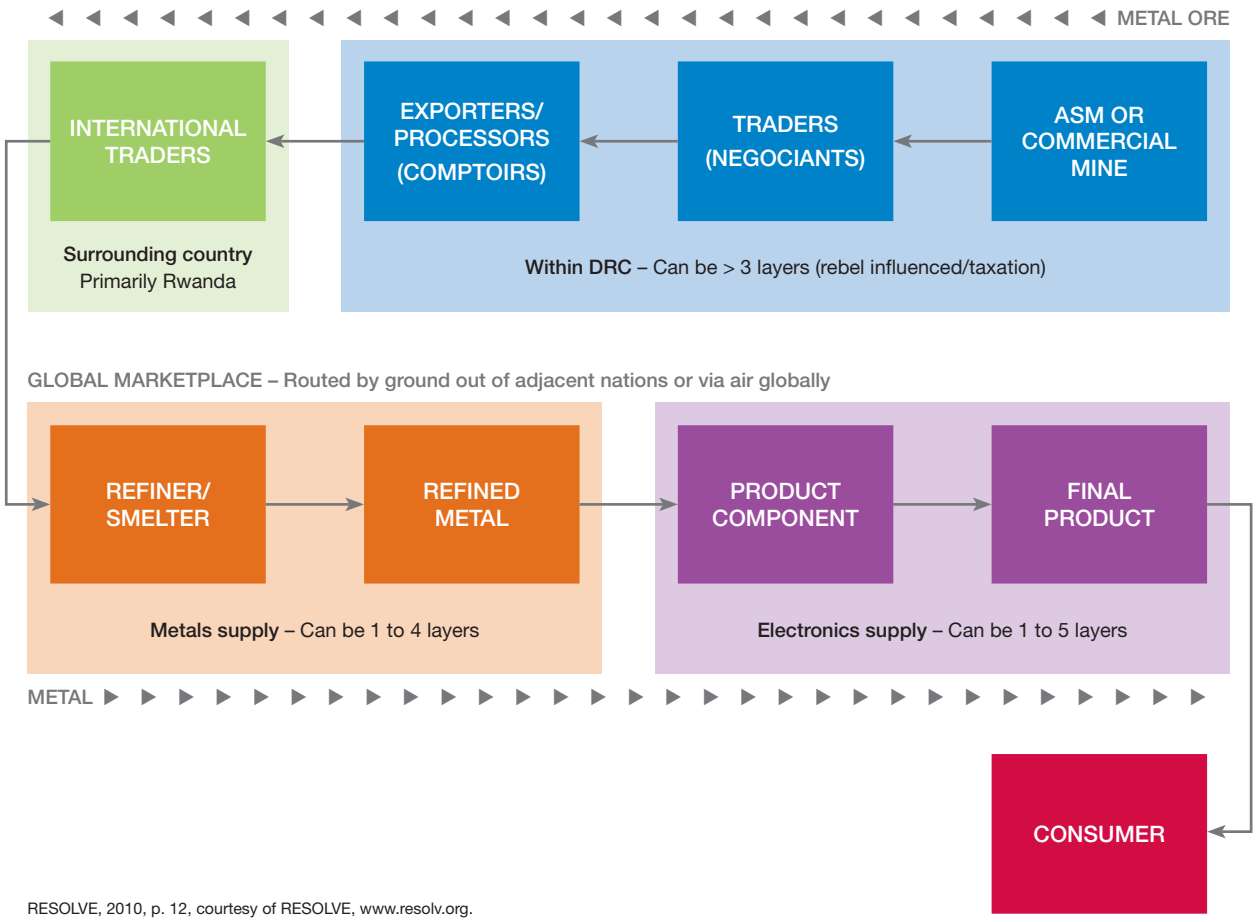
Unfortunately, the increasing price of precious minerals has launched rushes on all continents. More often than not, these rushes are attracting people to relatively undisturbed places that are important conservation sites, including protected areas and other critical ecosystems (Villegas *et al.*, 2012). Furthermore, it is also important to note that if and when miners decide to move to other livelihoods, these might be more damaging to ape populations and their habitat than mining alone (e.g. hunting, charcoal making, slash and burn agriculture, etc.).

The complex, market-based forces that drive ASM can be further exacerbated by the following factors:

- **An increase in Foreign Direct Investment (FDI) in the extractive industries**. While governments can gain needed income from FDI, this may in practice have detrimental impacts on miners, pushing them to mine in ever more remote areas. There is some awareness of this physical and economic displacement phenomenon and pressure on companies to create displacement plans. However, instead of being seen as an economic asset, artisanal miners are often seen as an impediment to development in spite of the fact that ASM can be a force for local economic development (albeit founded on a largely informal activity). There is often a misperception that LSM is more 'developmental' (Villegas *et al.*, 2012).

- **Impact of international legislation aimed at increasing transparency in the "conflict minerals" sector**. In response to the perceived connection between mining and armed rebel activity in the eastern Democratic Republic of Congo (DRC), there have been a series of initiatives aimed at so-called "conflict minerals," including tin, tantalum, tungsten, and gold ("3TG") originating from this or any adjoining country. This has served to further stigmatize and marginalize the sector, in some cases taking away ASM buyers for fear of being the target of conflict-minerals-inspired consumer campaigns. This has the outcome of pushing it further underground without constructive restructuring of legislative environments to be supportive of formalizing existing practices in the sector.
- **Large-scale land-use change**. Commercial or industrial agricultural activities may drive local farmers out of business or deprive them of land, and could then push them towards ASM as an alternative means of business.
- **The effects of climate change** may make traditional livelihood activities less viable, and there is a great deal of uncertainty as to whether and how this might impact future ASM scenarios.

FIGURE 6.2
Sample supply chain of tin, tantalum, or tungsten from a mine in the DRC



RESOLVE, 2010, p. 12, courtesy of RESOLVE, www.resolv.org.

The supply chain

The nature of the commodity chain itself also plays an important role in defining ASM. Much of artisanal mineral trading is informal. There is not usually any type of paper trail during the early stages of the commodity chain, making transactions vulnerable to smuggling, money laundering, or other types of illegal trade. Thus the ability of miners to receive a "fair price" for their mineral varies considerably. In some cases, they do not know the true value of their goods, are innumerate or illiterate, or do not have transparency on where their mineral goes and the costs of getting it to the international trader, so cannot judge if a price is fair or not. In addition, the need for immediate cash to continue living and mining often outweighs the effort of selling the product further up the chain or stockpiling it to sell in larger quantities, even though they would be likely to get a higher price were they to do so. In other cases, however, miners are able to achieve prices that are close to or even above the international reference price. This occurs when a trader is buying gold either to launder money or to use the mineral as a financial instrument to limit costs associated with his/her primary economic activity (e.g. importing food or goods from a neighboring country that works with a different currency).

As is the case with many resource commodity chains, there can be multiple levels or layers of buyers and sellers (see Figure 6.2). These can include locals, residents from urban areas, foreigners, and the military and government agents, with mined products being exchanged for both cash and in trade. It is usually at the point of export (when the international trade occurs) that the paper trail begins and the trade becomes formal or legal. The lack of price transparency, the lack of value addition early on in the chain, the multitude of middlemen, and the convoluted (and often corrupted) path to market leave miners in a vulnerable economic position, whereby miners capture little value of the end product (such as with diamonds), thus fuelling a cycle of poverty.

The relationship between artisanal and large-scale mining

Recent research undertaken for this publication on the spatial overlap between mining activity and 27 ape taxa indicates that only six have no commercial mining projects within their range (see Chapter 5), and that the remaining taxa ranges are characterized by a predominance of development stage mining projects. While these activities are not necessarily a direct indicator of the future threat from mining operations, their concentration is indicative of potential commodity reserves within ape ranges, which may lead to future conflict in relation to resource exploitation at both the large and the artisanal scale.

One of the reasons why ASM is a growing phenomenon in areas of suitable environmental conditions for apes is due in part to the fact that the rush for minerals by large-scale corporate miners may lead to a gradual squeeze of ASM off land where industrial mining companies have achieved statutory prospecting, exploration, and/or mining rights (e.g. in DRC and Sierra Leone), thus potentially pushing artisanal miners towards other more remote sites. While large and small mining actors come into contact with each other extremely frequently, with LSM following ASM (which may have been on site for decades) or ASM following LSM (anticipating the economic boom or hoping for employment generated by the LSM's presence), the nature of this relationship is complex. The presence of alluvial gold or diamond mining, for example, can suggest the presence of a larger subsurface resource that is amenable to LSM, but resources amenable to LSM may be wholly unsuited to

ASM because they occur at depth and/or are low grade and/or are metallurgically complex. LSM may attract ASM where excavations create access to otherwise inaccessible ore (e.g. illegal miners underground at the Obuasi gold mine in Ghana) or where it creates waste dumps that can be picked over by individuals (e.g. coltan/tin in the DRC, diamonds at the Williamson mine in Tanzania). However, given this complexity, and multi-scale patterns in the spatial variability of the potential impacts from mining operations on great ape and gibbon taxa ranges needs to be further investigated.

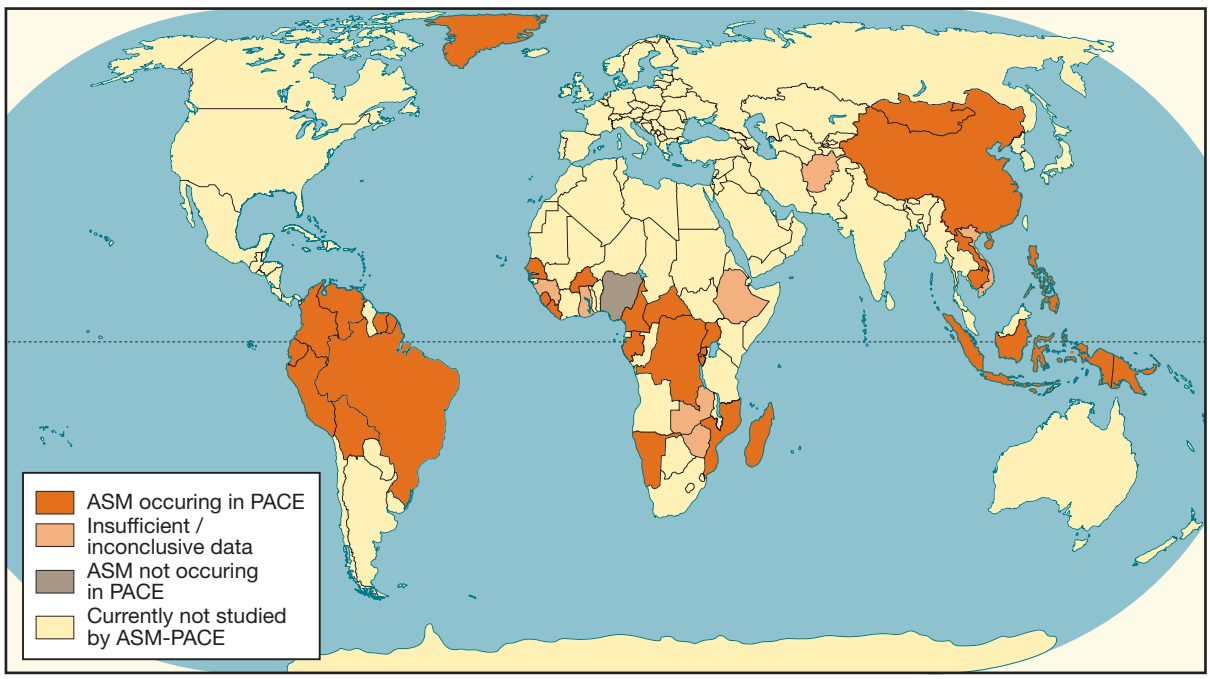
Given that ASM and LSM can often occur side by side, and that there now appears to be increased recognition that large mining companies should engage with artisanal miners and their dependents, the particular sustainable development challenges of ASM – including security, human rights, and relocation programs – need specific consideration. However, the fact that much of ASM occurs outside regulatory frameworks can present significant challenges for companies and regulators. This relationship has also been troubled by a mismatch of expectations between the two sectors, which in some cases can lead to mistrust and conflict. This might include potential competition over the same minerals, impacts on livelihoods if access to resources is limited, and changing social conditions, including between host communities and companies (IFC, unpublished data).

ASM in protected areas and critical ecosystems (PACE) around the world

An appreciation of this complex economic and social context is essential in attempting to understand why ASM is increasing in areas of high biodiversity. The ASM–PACE

FIGURE 6.3

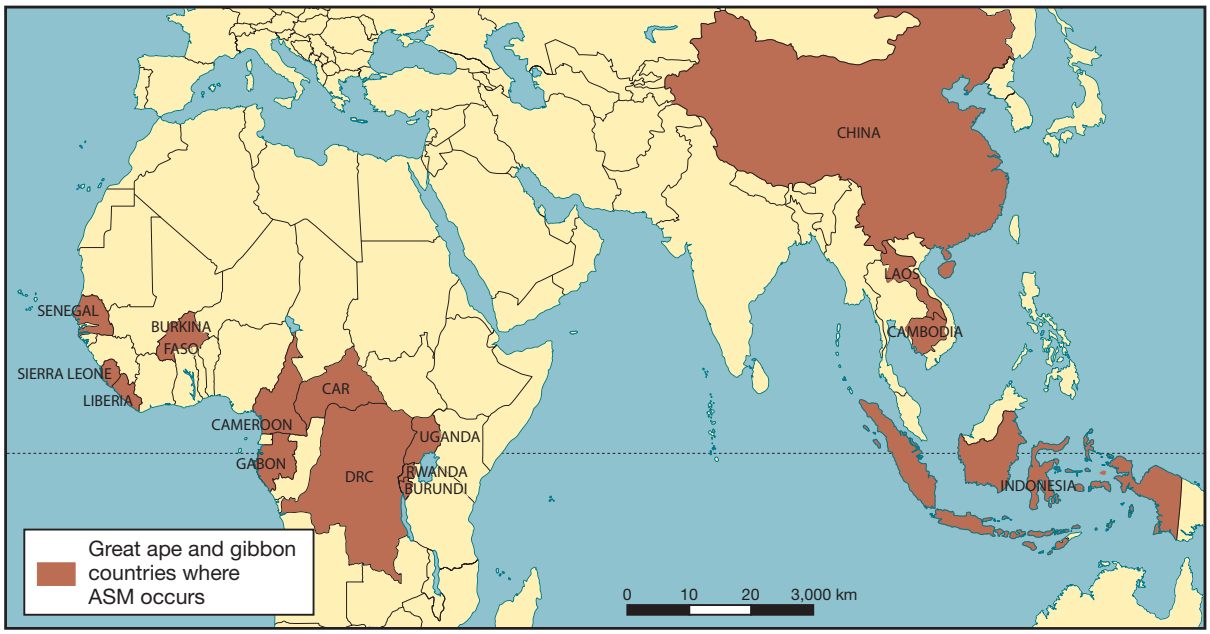
Map of countries with ASM in PACE



Courtesy of ASM–PACE.

FIGURE 6.4

Map showing the overlap of ape countries with ASM



Courtesy of ASM–PACE.

Global Solutions Study (Villegas *et al.*, 2012) provides the following analysis on the scope and scale of ASM encroachment into PACE and thus the habitats of endangered species, including great apes and gibbons.

- ASM is occurring in or around 96 of 147 protected areas evaluated in the Global Solution Study, and in 32 of 36 countries studied (Figure 6.3).
- Affected sites include at least seven natural World Heritage Sites and at least 12 World Wildlife Fund (WWF) Priority Landscapes.
- ASM is occurring in or impacting a wide range of critical ecosystems, not only tropical rainforests in Central Africa and South Asia, which are typical ape habitats (Figure 6.4), but also arctic landscapes (Greenland) and coral reefs (Philippines).
- On a global scale, ASM of gold has the most significant negative environmental impacts; however other minerals have significant localized impacts within specific ecoregions or countries, such as tin, tantalum, and tungsten in the DRC; colored gemstones in Madagascar, and diamonds in West Africa.

There are many "push" and "pull" factors behind why men and women choose to mine in or around protected areas in particular. Often they are seen as untouched, virgin areas, or they have not been mined in living memory (e.g. Liberia). Many colonial governments created forest reserves (which later became protected areas) in places where rich mineral deposits were known to exist, and there may also be a lack of recognition or knowledge of park borders amongst the local population (e.g. in Sapo National Park in Liberia and the Kahuzi-Biéga National Park in DRC). In some parts of the world, protected areas are perceived as common land, in which there is no statutory or customary landowner to whom one must pay for access rights (e.g. mining

TABLE 6.1

Impact and mitigation of ASM

ASM activity	Examples of observed or anticipated ecological impact	Recommended mitigation options
Clearing vegetation, and harvesting timber and non-timber forest products	■ Ape food sources diminished, including fruit trees and terrestrial herbaceous vegetation. ■ Habitat and migration paths are blocked by mining camps. ■ Habitat loss due to deforestation. ■ Increased vulnerability of forest ecosystems to invasive plant and animal species. ■ Erosion of unsecured soil during rains, sometimes resulting in landslides. ■ Soil degradation leading to changes in vegetation, including food sources. ■ Extensive use of tracks both on foot and by cars leads to additional habitat loss, migration range disruption, and increased vulnerability to commercial bushmeat trade (D. Greer, personal communication, 2012), markets for ape infants, and hunting for ivory and animal parts used in traditional medicine. ■ Important non-timber forest products used in food preparation and house construction, like leaves from the Marantaceae (and to a lesser extent, Zingiberaceae), are also staples for lowland gorillas (D. Greer, personal communication, 2012).	■ Only buy local supplies of firewood, timber, or charcoal from certified ASM suppliers, i.e. other areas where wood is grown commercially and sustainably (Cook and Healy, 2012). ■ Restrict access/usage to miners with mining identification cards for the specific site (Cook and Healy, 2012). ■ Strict regulation and enforcement together with sensitization and education campaigns. ■ Foster an environment of close cooperation between ASM, nongovernmental organizations (NGOs), and government experts to understand which plants/animals can or cannot be used, by explaining economic and environmental motivation of so doing (D. Greer, personal communication, 2012).
Physical removal of soil and rock to access the deposit	■ Release and dispersal of corrosive dusts (such as lime dust). ■ Oxidation of soil piles leading to the release of toxic metal ions. ■ Leaching of toxic minerals through erosion or water seepage can impact groundwater and surface water quality. ■ Air-borne or water-borne toxins can detrimentally impact soils, water quality, vegetation, and human and animal health. ■ Destruction of riverbanks and riverbeds impacts hydrological systems and aquatic ecology. Gorillas are known to consume the aquatic herbs *Hydrocharis* and *Scleria*, but it is not known if the impacts of mining methods affect these plants significantly or not (D. Greer, personal communication, 2012).	■ Conduct studies to understand the chemical composition of soil, characterize the risk of contamination, and take appropriate steps for containment (Villegas *et al.*, 2012). ■ Introduce alternative techniques and technologies that target known deposits and impact a less extensive area (Villegas *et al.*, 2012). ■ Do not allow mining in highly sensitive erosion areas, i.e. steep slopes and fragile soils (Cook and Healy, 2012).
Mining in or near rivers and streams	■ Siltation reduces light penetration into water bodies, causing reduced photosynthesis in aquatic plants, depleting oxygen levels in the water.	■ Conduct a thorough evaluation of endemic aquatic biodiversity and identification of potentially important aquatic habitats.

	■ Direct (tailing, diesel from pumps) and indirect (turbidity) pollution of water sources for humans, apes, and other wildlife ■ Smaller streams and waterways can cease to flow due to numerous open pits and clogging of springs. ■ Erosion of unprotected earth during rains leading to landslides, additional sediment release, and riverbank deterioration. ■ Loss and degradation of aquatic herbaceous vegetation through riverbank impacts, some of which can be important seasonal gorilla foods.	■ Conduct statutory environmental studies in PACE sites (Cook and Healy, 2012). ■ Minimize extraction for mine sites and conserve/recycle water (Cook and Healy, 2012). ■ Create dedicated sites for washing/panning with settlement holes or tanks to reduce waste-water flowing into watercourses with high sediment loads (Cook and Healy, 2012).

Use of toxic chemicals in gold processing	■ Risk of "dead zones" and localized death of animals (including birds and fish) exposed to unmanaged cyanide releases.
	■ Aquatic faunal and other animals' health affected by mercury in air or water (including great apes).
		■ UNEP promotes a two-step approach to reduce mercury use in ASM:
		  ■ Step 1: Reduce mercury use and emissions through improved practices, which use less mercury.
		  ■ Step 2: Eliminate mercury use by using alternative mercury-free technologies that increase (or at least maintain) income for miners, and are better for health and the environment (UNEP, 2011b).

Anciliary/support services		
Hunting of animals for bushmeat for personal consumption or sale **Opportunistic and deliberate poaching of endangered species for trade**	■ Population decline of critically threatened and endangered species due to hunting (including great apes). ■ Animals maimed or mortally wounded after escaping from snares (including great apes). ■ Disturbance of wildlife habitats and migration routes due to large number of people resident in and moving through forest, as well as light and sound pollution of mining activities.	■ Ban commercial hunting as part of a mining permit, but allow closely monitored subsistence hunting (Cook and Healy, 2012). Include artisanal miners in the creation of park patrols and ecoguards where possible (Hollestelle, 2012). ■ Restrict access to the ASM site to reduce pressure on the biodiversity and the site's environmental impact (D. Greer, personal communication, 2012).
Establishment of permanent and semi-permanent camps, villages, and towns	■ Enlarged settlements may result in reduced great ape home ranges and increased resource competition, resulting in lower quality of diet and increased great ape interactions (D. Greer, personal communication, 2012). ■ Noise may alter great ape home-range movement. ■ Increased human–wildlife conflict.	■ Population monitoring (pre-, during, and post-mining activity) and habitat quality preservation completed in association with relevant ministries, NGOs, universities, etc. ■ Initiate education programs tailored to ASM to minimize human–wildlife conflict (e.g. what to do or not do when animal approaches, etc.)
Larger ecosystem impacts		
	■ Ecological changes due to loss of keystone species such as elephants and apes. ■ Long-term changes in watershed due to rapid run-off in deforested areas. ■ Downstream hydrological impacts with respect to water quality and flow due to widespread siltation and pollution of rivers and streams.	■ Create a cordon sanitaire or buffer zone (min. 500 m) between ape-critical habitat and the ASM, and clearly mark it. The buffer must be recognized and respected by the miners and the ASM management authorities (Cook and Healy, 2012).

license, surface rent). Gazetting of protected areas can also stimulate ASM activities by making other livelihoods less viable owing to the limited availability of land for farming and other activities (e.g. Uganda).

The closure of industrial mining sites can also create a surge of impoverished and out-of-work miners in rural areas who migrate towards protected areas in order to maintain their livelihoods (e.g. in Ecuador and the DRC). Furthermore, protected areas offer a variety of livelihood options that complement ASM in a logical livelihood strategy for individuals or households, for example timber extraction, bushmeat and other wildlife products, and charcoal making (Villegas *et al.*, 2012).

The impact of ASM activities in ape habitats

While the scale of ASM will impact ape populations in different ways, as with timber extraction, it can disrupt behavior, alter habitat, reduce food resources, disperse populations, and increase exposure to hunting pressures (see Chapters 3 and 7). According to Hruschka and Echavarría (2011):

> [M]ost artisanal miners have little knowledge or awareness about the environmental impact of their activity; their main concern is the subsistence of their family [. . .] The economic situation of artisanal miners forces environmental protection issues to be secondary concerns as expenditure on environmental protection remains a lesser priority as long as basic needs are not satisfied.

A number of these impacts are given as examples in Table 6.1, alongside potential mitigation options. It is necessary to bear in mind, however, that limited research has been done on both the direct and indirect impacts of ASM on ape populations, especially in Asia. Thus some of the following assumptions about anticipated outcomes warrant further investigation.

Policy and regulation of artisanal mining

The recognition of ASM as a potentially important part of the economy and an engine for poverty alleviation has led many countries to draft specific laws for its management. However, often these mining laws and policies do not adequately define and give recognition to the sector. In the Tapajos River Basin of the Brazilian Amazon, for example, assessments indicate that around 99% of miners operate without the environmental and mining permits required by law (Sousa *et al.*, 2011). This is a result of a combination of unrealistic and/or ineffectual policies and regulations, lack of political will, lack of infrastructure to enforce the existing regulations, and lack of incentives to miners to comply with legal requirements. Artisanal miners operate in vast and remote areas and the government lacks the resources (personnel, vehicles, information, and materials) to enforce the laws. Furthermore, idiosyncrasies in the regulation of over 20 laws, decrees, and resolutions relating to ASM reveal massive gaps between policy and reality (Sousa *et al.*, 2011). The slow evolution of appropriate and effective policy tools has been hindered by a number of more general, contextual issues that often reoccur in the regulation and formalization of ASM in ape range states.

Land-rights issues

Mineral resources are often owned by the state, which then issues permits or licenses to private entities to start the process of exploration and exploitation of these sub-surface resources. But while in many countries the

law defines how artisanal miners can acquire rights to exploit the resource, the majority of artisanal mining is either conducted *a-legally* (outside of the law) or *illegally* (in violation of the law). A-legal mining means that the law either does not provide for artisanal mining or the state does not put in place the structures necessary for miners to comply with the law, so it is not possible for miners to be legal. This is commonly known as informality, which must be understood as being distinct from illegality.

In some cases, there may also be an ethnic dimension to ASM, with certain ethnic groups traditionally being artisanal miners, with the activity now a part of their heritage, and not just a source of revenue (Lahm, 2002). Furthermore, ASM is often conducted in line with customary practices around land tenure, which may have been in place for many decades or more (see Chapter 2). This means that the miners follow regulations and customs set by traditional authorities including paying taxes, following site rules, and so on, even where they are not compliant with what is required in national law. In these circumstances, miners view their practices as *formal* to some degree as they are compliant with local regulations, even where they may be in violation of national ones. This is especially common in places where the state has limited reach and influence in rural areas.

Photo: While the scale of ASM will impact ape populations in different ways, as with timber extraction, it can disrupt behavior, alter habitat, reduce food resources, disperse populations, and increase exposure to hunting pressures.
© Gustave Mbaza/WWF

In these settings, conflict between miners and the state and between local authorities and the state can occur where the state chooses to clamp down on what it judges to be illegal activities but what locals consider to be legitimate. For example, miners may be mining illegally within a protected area whilst respecting the rules and regulations of the traditional landowners who held ownership rights before the land was gazetted. Conflict may also occur when the local authorities and/or communities and/or miners specifically see park boundaries as illegitimate, or where the precedence of national over local regulations is not accepted, or when massive rush-type migrations take place (Villegas *et al.*, 2012).

Institutional or structural discrimination

Artisanal miners are often not capable of meeting legal requirements set by governments and other governmental agencies (Hruschka and Echavarría, 2011). This is due to various factors: for example, miners are often illiterate and unaware of their rights and responsibilities under the national mining law and policies; often legislation is designed with large-scale industrial mining in mind and miners are therefore structurally unable to fulfill the requirements (e.g. South African mining law). In other cases, miners are institutionally prevented from formalizing due to the stigma and negative connotation of the activity. In some countries, like Gabon, artisanal mining is not a nationally recognized "profession" (although miners do have some status in the government's Mining Code), therefore miners lie about their real profession, obscuring the scale and scope of the activity, and the need for developmental, legal, and financial support (Hollestelle, 2012).

Such structural issues can bind ASM activities to its informal and illegal status, making it vulnerable to violence, corruption, exploitation, and also exacerbating its negative environmental and social impacts due to a lack of state support or services that could otherwise mitigate some of its impacts (Hruschka and Echavarría, 2011). It can also leave ASM camps vulnerable to influence by persons engaged in illegal activities such as hunting elephants for ivory, with ASM camps used to disguise activities. There is thus a key need to be clear about stakeholder roles and responsibilities among actors and ensure a coherence of policy and governance across sectors in order to create structures that facilitate this.

Lack of good governance and conflict among government agencies

The institutions, polices, and processes that influence livelihoods in the ASM sector vary significantly both from country to country and within different regional contexts. Even in countries where ASM is a formalized activity, there might still be discrepancies and conflict over who can and cannot get rights to use a resource or carry out an economic activity. In many countries where ASM occurs, contradictions between mining, forestry, and/or environmental laws and/or poor coordination across the various agencies responsible for enforcing these creates confusion and unpredictability in how the law should be applied. Likewise, at the local level, a range of different public institutions (often tiers of institutions) influence or are influenced by ASM policy. Local government-district assemblies (Ghana, Guinea, Gabon) also influence land use and local development policy, although evidence suggests that grassroots tiers of government are under-resourced and have different priorities to those of central government (Lahm, 2002; Centre for Development Studies, 2004).

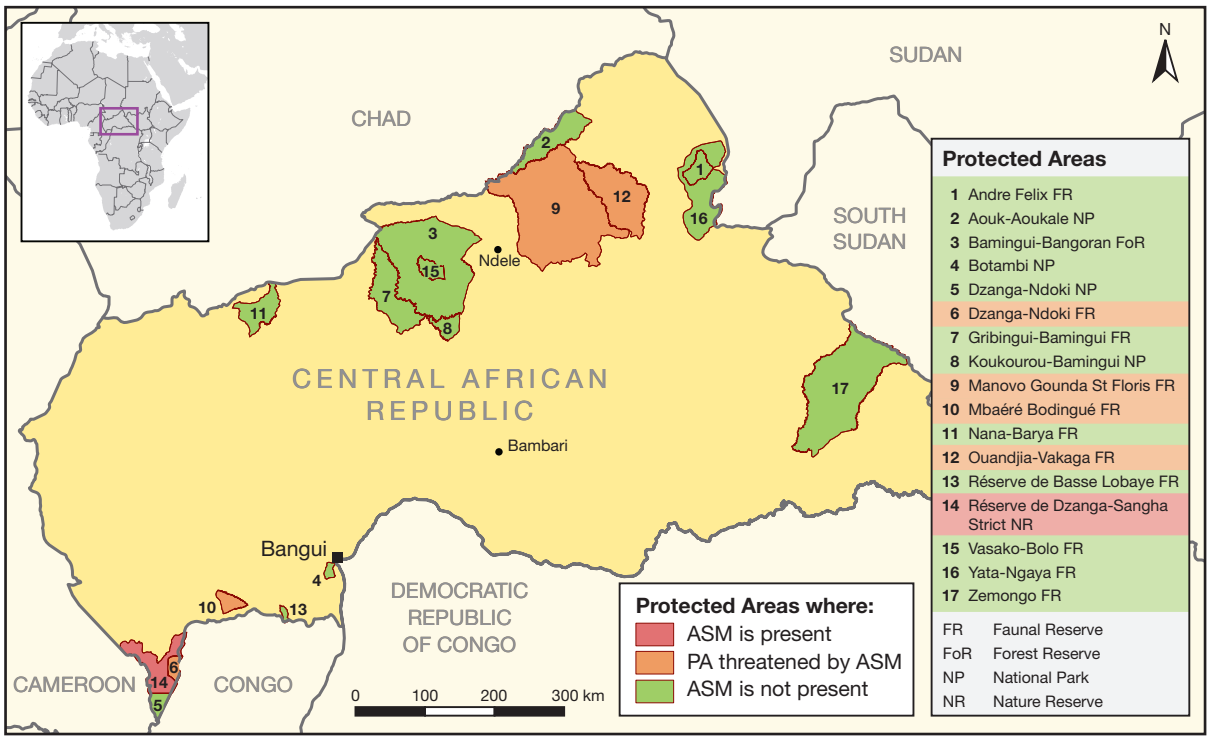
Case studies

The following are a set of case studies examining the specifics of ASM in ape habitats, focusing primarily on central Africa. For each there is a brief situational summary, a discussion of ASM's known or presumptive impacts on ape populations, and a summary of previous intervention attempts to manage ASM's environmental impacts.

Central African Republic (CAR)

Spanning the northern edge of the Congo Basin rainforest in the south all the way up to the Sahel, CAR has a wealth of natural resources and biodiversity, including significant populations of western lowland gorilla (*Gorilla gorilla gorilla*), central chimpanzee (*Pan troglodytes troglodytes*), and the eastern chimpanzee (*Pan troglodytes schweinfurthii*). ASM, primarily in diamonds, represents a key threat to CAR's great apes. Addressing ASM's impact is complicated by the extreme poverty in the country; it ranks 180 out of 187 on the Human Development Index (UNDP, 2012) and exploitation of resources like diamonds offers a critical opportunity not only for national income, accounting for 40–50% of all export revenue, but also constitutes a fundamental livelihood strategy for over 10% of the country's population of 5.2 million people. Indeed, ASM is both poverty-driven and poverty-alleviating, and taking this into account is both challenging and essential to protecting its wildlife (Tieguhong, Ingram, and Schure, 2009).

FIGURE 6.5
ASM in CAR



Using data provided by PRADD/WWF-CARPO/GTZ (Chantiers d'exploitation miniere (diamants) dans la Reserve Speciale de Dzanga-Sangha) the CAR map shows where known ASM occurs. By cross-referencing known diamond deposits with protected areas, a list of protected areas threatened by ASM has been produced.

Courtesy of ASM–PACE.

Overview of the ASM sector and its impact on critical protected areas

The ASM sector dominates the CAR extractive industry, particularly in the diamond field, and brings with it a host of social issues. As in other countries, exploitative labor relationships, smuggling, and links to armed groups have been documented (ICG, 2010). Despite ASM being a fundamental livelihood activity for thousands of people, most are unable to escape poverty. In addition, ASM activity in a number of protected areas, including Mbaére-Bodingué National Park, Manovo-Gounda-Saint-Floris National Park, and near Dzanga-Sangha National Park, poses an environmental threat and negatively impacts apes (Figure 6.5).

This network of protected areas in the CAR together makes up more than 10% of the national territory (World Bank, 2010). However, one-third of these areas have been deemed 'paper parks', in the sense that they afford little protection owing to a lack of resources and enforcement (Blom, Yamindou, and Prins, 2004). The parks in the southwest are the only ones located in dense closed Guineo-Congolian rainforest, which makes up about 15% of the country's environment (de Wasseige *et al.*, 2009). This northern part of the Congo basin is great ape habitat, and Dzanga-Sangha in particular has important populations of western lowland gorillas and chimpanzees, among a total of 16 species of primates (Tieguhong *et al.*, 2009). Gorilla concentrations in the Dzanga sector of the park were estimated at 1.6 km^{-2} in 1996–97 (CARPE, 2010), and even higher in the Ndoki section. A more recent study from 2005 estimated concentrations in the park at around 1 km^{-2} (MIKE, 2005). Another important attribute of the area is its inclusion in the transboundary Sangha Trinational Landscape (TNS), one of 12 priority ecological landscapes identified in 2000 by the Congo Basin Partnership Facility. Overall, TNS has some of the healthiest populations of great apes in Central Africa, making this accord particularly important, as it enables cross-border patrols and harmonization of laws and regulations. Indeed, the principal threats to the TNS landscape include hunting and commercial bushmeat trade, but also unsustainable commercial logging, the ivory trade, the capture of grey parrots, and uncontrolled ASM (de Wasseige *et al.*, 2009).

Mining activity was first observed in the Dzanga-Sangha area during a patrol in 1997 (CARPE, 2009). While most of the activity is located in the special reserve, surveys conducted in 2002 and 2006 show a steady movement towards the Dzanga sector of the park, in some places coming within 2 km of the boundary (Tieguhong *et al.*, 2009). Characterizing the ecological impact of ASM, however, requires looking at the specific impact, and its geographical as well as temporal scale (DeJong, 2012a). While a single miner may destroy plenty of vegetation, the severity of an impact cannot be assessed without looking at the cumulative effect of many miners, as well as to what extent regenerative capacity naturally reverses the effects through time (World Bank, 2008).

The most significant impacts on protected areas, however, are indirect. The worst impact is from poaching (as opposed to legal, but often excessive hunting), which often accompanies mining (World Bank, 2010) and increases as miners penetrate or set up camps in or near protected areas (CARPE, 2010). There is at least one mining camp that has become a town in the special reserve (DeJong, 2012a) and the associated human pressures that result from this development are perhaps more significant than the direct impacts of digging holes. However, the only study to look specifically at mining in the TNS landscape concluded that despite these impacts, the cumulative effect represents a

Photo: Since mining is the most important source of revenue for many people, working in unexploited areas known to have deposits is worth the risk of some harassment and the hardship of living for weeks or months as far as 50 km from home.
© Micha Hollestelle

minimal negative impact on the environment, given the small geographical scale and the fact that many of the effects, such as forest degradation, are reversible (Tieguhong *et al.*, 2009). Nevertheless, the largest direct threats to great apes besides habitat loss, including disease outbreak and poaching, are exacerbated by their proximity to humans, and ASM brings hunters and disease-carriers closer to gorillas and chimpanzees (see Chapter 7).

Motivations of miners

While CAR's mining communities are often refugees and have come from elsewhere (Freudenberger and Mogba, 1998), diamond mining near Dzanga-Sangha is not a "rush" situation, but instead has a long and gradual history of advancement. Indeed, socio-economic studies reveal that diamonds have been the primary livelihood for the majority of people for many years (DeJong, 2012a). In this sense, pull factors appear to be less prominent. Instead, push factors seem to be at work, including the fact that many of the best claims near villages are either already mined out or belong to someone else, which pushes people towards new territory (DeJong, 2012a). However, there is also evidence that people have customary claims in areas in the special reserve that go back many years, perhaps pre-dating the park's creation (DeJong, 2012a) . However, most are aware that they are operating in or near the park, suggesting that poorly understood limits are not an issue. In addition, miners report on confrontations with state authorities, including ecoguards (Tieguhong *et al.*, 2009), which

suggests that enforcement is not enough to deter people from working. At a most basic level, since mining is the most important source of revenue for many people, working in unexploited areas known to have deposits is worth the risk of some harassment and the hardship of living for weeks or months as far as 50 km from home.

Attempts to mitigate the impact of ASM in the CAR

A number of mitigation techniques to reduce the impact of ASM on protected areas have been suggested in the case of the CAR.

Enforcement

Effective enforcement requires sensitization, establishing a clear and accepted understanding of park boundaries, and building positive relationships with surrounding communities. These have all been important cornerstones of the strategy in Dzanga-Sangha (CARPE, 2010). However, perceptions by miners of unwarranted harassment by guards (DeJong, 2012a) and the fact that guards continue to confiscate mining material (DeJong, 2012b) show that this tactic may be too narrow in scope.

Alternative livelihoods

Understanding how mining fits into an overall livelihood picture is needed for any "alternative" livelihood to succeed. According to WWF, the problem of mining in Dzanga-Sangha will not be resolved unless the would-be miners can make a decent living outside the park doing other activities (J. Yarissem, personal communication, 2012). However, it is difficult to find activities that can provide better financial prospects than artisanal mining (Tschakert, 2009).

The Property Rights and Artisanal Diamond Development (PRADD) program is a joint US State Department and USAID initiative aimed at increasing the amount of diamonds entering the legal chain of custody. Its objectives are to:

- Clarify and formalize rights to land and natural resources;
- Improve monitoring of the production and sale of diamonds;
- Increase the benefits accruing to mining communities;
- Strengthen capacity to mitigate environmental damage; and
- Improve stakeholders' access to crucial information.

While new mines are continually being established, others are inherited, purchased, or given as gifts. Through the clarification of these customary means of acquisition, and by focusing specifically on claimant identity, land transactions, and mining documentation PRADD has been able to take advantage of opportunities present in the current Mining Code for registering legitimate claims. The environmental rehabilitation program includes the provision of technical assistance to miners to convert mined-out pits into fishponds, agroforestry plots, and vegetable gardens. The program is a unique attempt to meld together livelihood diversification with environmental rehabilitation, and stands out from other regulatory-driven attempts which have had limited success (DeJong, 2012a). It has also proved popular, with at least 381 rehabilitated sites being counted in under a year (DeJong, 2012a).

While this approach is not directly relevant to protected areas, since both mining and agriculture are illegal in most of them, there is some evidence that for a number of small-scale miners, revenue from fish farming has surpassed revenue from diamonds. This raises the possibility of finding activities that might provide sufficient incentives to keep miners closer to home and away from protected areas, although PRADD's

aim was never to foster alternative livelihoods, but rather to promote complementary ones while strengthening the legal and fiscal regimes that underlie ASM.

Sustainable development policies

It is possible that a sustainable development of the diamond economy could in fact have a positive long-term effect on great ape conservation, provided it leads to economic growth, stronger institutions, and greater respect for the rule of law. CAR is still far from reaching this point, considering its extreme poverty, lack of institutional coordination, limited capacity, and the recent uptick in industrial mining deals. However, the holistic approaches being piloted, like land-use planning and property rights clarification (e.g. PRADD), offer a glimpse of strategies that stand a good chance of enabling both people and primates to thrive.

The Democratic Republic of Congo (DRC)

Environmental impacts of ASM and associated threats to apes

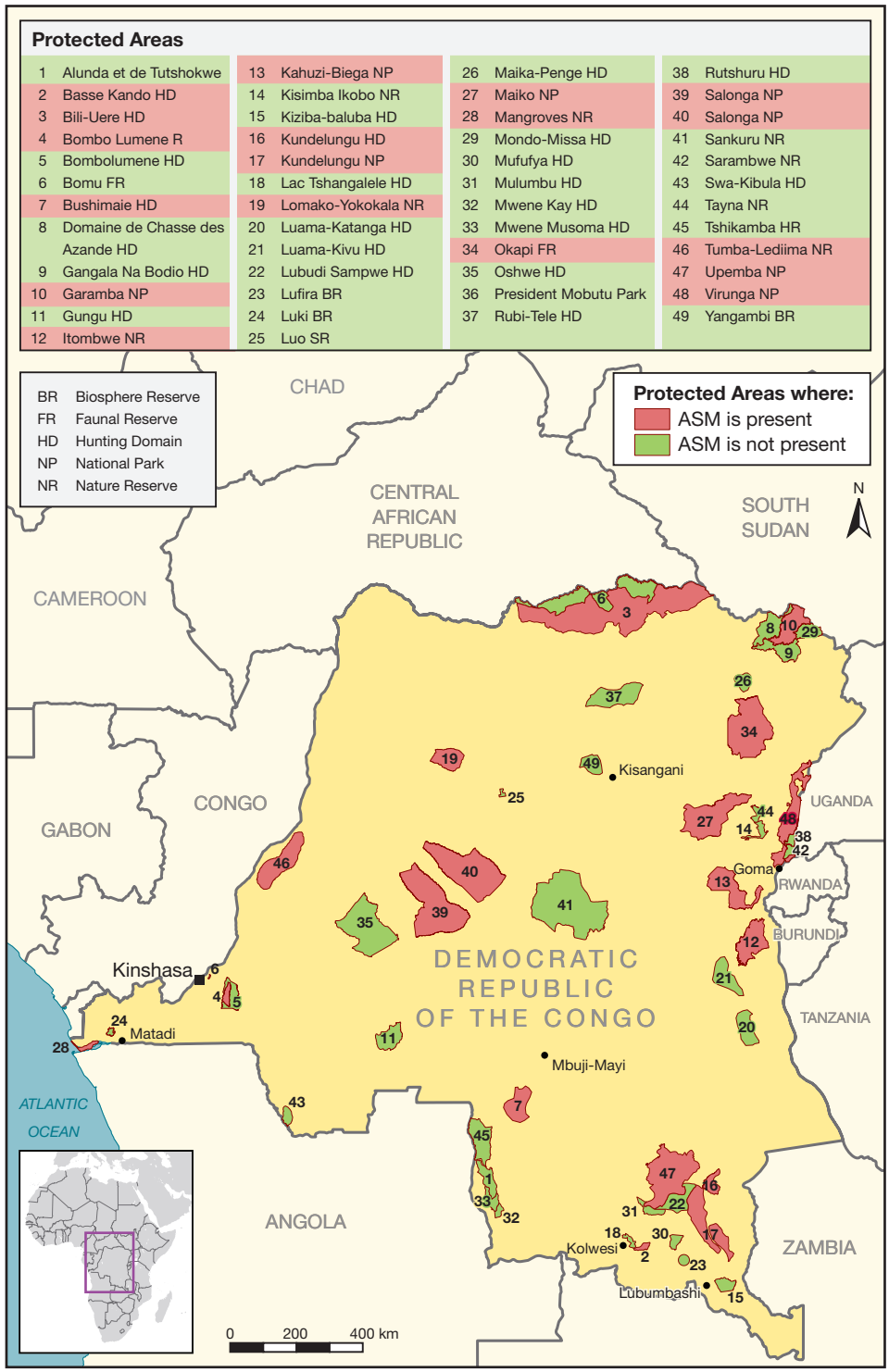
The DRC is a unique region for biodiversity in Africa and the only country on earth to have three species of great ape (Draulens and Van Krunkelsven, 2002), the mountain gorilla (*Gorilla beringei beringei*), Grauer's gorilla (*Gorilla beringei graueri*), bonobo (*Pan paniscus*), central chimpanzee (*Pan troglodytes troglodytes*), and eastern chimpanzee (*Pan troglodytes schweinfurthii*). ASM and associated activities such as wildlife hunting and the bushmeat trade are known to occur in many of the DRC's protected areas and critical ecosystems (Figure 6.6). However, judging the relative significance of ASM as a threat to protected areas and apes against other activities is not a simple task because they often occur in tandem, rather than being independent of one another. Moreover, many of the threats are less obvious as they relate to habitat destruction or reduction. Major threats include: logging (legally and illegally), large-scale extractive projects, the presence of refugees and/or armed groups, and the site-specific particularities of mining, charcoal making, agricultural conversion, and bushmeat hunting and other illegal wildlife trade. An additional ring of environmental degradation is created by the construction of access routes for miners allowing other people to penetrate further into remote areas well beyond the time frame of direct mining activity.

Bushmeat hunting and the illegal wildlife trade is a case in point of ASM occurring in conjunction with, and often inciting, other human activities that have a detrimental impact on the environment. Hunting for ivory, and the capture of birds and baby chimpanzees, often takes place at artisanal mining sites, as the buyers of minerals are likely to engage in other lucrative activities as well. In the southern Congo alone, 300 gorillas were estimated to have been killed in 2009 to supply the local bushmeat markets (Endangered Species International, 2009). Concurrent with the invasion of the Bili–Uéré Domaine de Chasse by approximately 3000 gold miners in June 2007, a five-year survey documented expansion of the bushmeat trade to the south of the Uélé River, linked to the artisanal diamond and gold mining industries and centered on Buta (Hicks *et al.*, 2010). By contrast, in areas where there was no ASM, they found no snares and limited evidence of bushmeat and related trades (e.g. skins) in nearby forest zones. While researchers found that the miners consumed primate bushmeat, and that a higher proportion of miners admitted to hunting and eating chimpanzees than did villagers (Darby, Gillespie, and Hicks, 2010; L. L. Darby, unpublished data), it should be noted that a 2012 ASM–PACE study

"Judging the relative significance of ASM as a threat to protected areas and apes against other activities is not a simple task because they often occur in tandem."

FIGURE 6.6

ASM occurring in DRC



Courtesy of ASM–PACE.

found this not to be the case in the eastern part of the Itombwe Reserve where cultural beliefs kept people from consuming apes (Weinberg *et al.*, 2012, 2013).

Kahuzi-Biéga National Park (KBNP): co-existence and conflict between conservation and the ASM sector

Located in South Kivu, near the DRC's border with Rwanda, the Kahuzi-Biéga National Park (KBNP) was founded in 1970 and became a World Heritage Site in 1980 (Walker Painemilla *et al.*, 2010). Its status was upgraded to World Heritage Site in Danger in 1997 (Plumptre *et al.*, 2009), and it is now managed by the Congolese Wildlife Authority (ICCN – *Institut Congolais pour la Conservation de la Nature*), with support from a host of international organizations. The park forms a part of the Congo Basin ecosystem as well as the Albertine Rift. With an area of 6000 km², it boasts a wide array of dense primary tropical forests, montane forests, and bamboo galleries. The high mountains in the east, including the non-active volcanoes Mount Kahuzi (3308 m) and Mount Biéga (2790 m), are connected by a corridor to the lower altitude tropical forests of the west (D'Souza, 2003). This critical ecological corridor is one of the most conflicted parts of the park, with tensions especially high between local communities and park authorities as those communities which were originally located within park boundaries seek to regain access to the land.

The high and low altitudes serve as the habitat for 136 species of mammals, including 13 species of primates: the endangered Grauer's gorilla, chimpanzees, baboons, three different colobus species, and five different guenon species (D'Souza, 2003). Studies at the end of the twentieth century estimated eastern lowland gorilla populations to be at 17 000 (plus or minus 8000 gorillas) with 86% of the populations living in KBNP and the adjacent Kasese Forest (Hall *et al.*, 1998). The population has seen a significant decline in the last decade, and in 2010 UNEP reported that the surviving population is likely to be below 5000; yet regional insecurity makes accurate surveying difficult (UNEP, 2011b).

ASM has been occurring in KBNP since the 1970s (Steinhauer-Burkatt, Muhlenberg, and Stowik, 1995); the dramatic population movement and the global coltan boom only enhanced an already existing phenomenon. As of March 2011, people were mining gold, tantalum, and tin on the outskirts of the KBNP and occasionally within the park as well (Debroux *et al.*, 2007), especially in the lowland sector (UNEP and McGinley, 2009). As of 2006, there were an estimated 9000 to 12 000 miners living in the park, although this number will have fluctuated since (Durban Process, 2006). This population has been connected with hunting, deforestation, and clearing for subsistence agriculture, as well as poaching for ivory, wood for cooking fires, human waste, and many more pressures to the park (UNEP and McGinley, 2009; Conservation International, 2010). The Ministry of Mines also found that artisanal gold miners in the park were using mercury to wash the gold they extracted (Mazina and Masumbuko, 2004). Likewise, coltan miners use a great deal of water to wash the mineral (D'Souza, 2003). Some of the silt enters the rivers and streams and ends up polluting entire water supplies and causing long-term changes in the watershed, especially since run-off can be considerably fast in deforested areas (D'Souza, 2003). Heavy mining adjacent to rivers and streams has also led to soil erosion and landslides (D'Souza, 2003).

One of the reasons why the KBNP is a contested conservation space is a result of its recent history of changing boundaries and the subsequent (and controversial) resettlement of different groups of people living in its conservation zones. In 1975, the ICCN

and then *Deutsche Gesellschaft für Technische Zusammenarbeit* (GTZ, German Technical Cooperation enterprise) increased the lowland area of the park's boundaries from 750 km² (UNEP-WCMC, 2011) to 6000 km², culminating in an official extension of the park (UNEP-WCMC, 2011). The 13 000 people of the Shi, Tembo, and Rega tribes who were living in the extension zone were told to move outside of the new conservation zone (Barume, 2000). These tribes had practiced agriculture, cattle grazing, and mining on the land years before these lands became protected.

As the population was unwilling to move after the decision to extend the national park, authorities used force and destroyed farms and cattle that remained in the extension zone. People retaliated by setting fire to hundreds of hectares of the park (Barume, 2000). By 1995, there were still 15 000 people living inside, despite the ICCN's efforts to negotiate compensation for their cooperation in resettlement. It was not until 2007 that the KBNP, with support from partners, engaged with these communities in a lengthy negotiation over the demarcation.

Programs offering an alternative way forward in dealing with ASM in the DRC's conservation areas

There are a number of examples of on-going programs and initiatives in the DRC that engage with ASM on environmental concerns. Some of these include:

Central African Regional Program for the Environment (CARPE)

CARPE began operation in 1997 and is currently under consideration for extension into 2016 (CARPE, 2011). It is a USAID-funded consortium focusing primarily on "reducing the rate of forest degradation and loss of biodiversity [in the Congo Basin forest of which the DRC forms a large part of the landscape] by supporting increased local, national, and regional natural resource management capacity" (IUCN, 2011). Through CARPE funding NGOs such as WWF have been able to engage with ASM.

Growth with Governance in the Mineral Sector Project (PROMINES)

PROMINES is an integrated, multi-sectorial and multi-component program initiated by the Government of the DRC, the World Bank, and the UK Department for International Development (DFID) to provide technical assistance to the mining sector, as well as improve its governance, efficiency, and future growth. The objective of the artisanal mining component of PROMINES is to improve the legal status, working practices, and economic return of artisanal mining in the DRC whilst establishing mechanisms to sustainably reduce its negative impacts on society, security, and the environment. This project has a multi-million dollar component to tackle some of the key issues in the DRC's ASM sector, including:

- Improving environmental and social management aspects of ASM and mining sector legislation as a whole;
- Helping to ensure that the revenues from ASM contribute to local and regional development;
- Recommending an extensive environmental impact assessment of the mining sector.

Mining and mindful conservation planning in the Itombwe Nature Reserve

This is premised on the observation that many of the difficulties in addressing ASM in

PACE are being neglected or underestimated early in planning processes. ASM–PACE, a joint program founded by Estelle Levin Ltd. and global conservation organization WWF, is working with WWF DRC and other conservation stakeholders focused on the Itombwe Nature Reserve (RNI), where final demarcation is still awaiting approval by the State (Weinberg *et al.*, 2012, 2013). Conservation and local CSOs (civil society organizations) have proposed the RNI be split into three zones: a human habitation zone, a resource-use zone, and a core protected zone. While it is in its early stages, this process aims to take into account existing mining activities in the proposed protected area and plan conservation strategies accordingly.

Gabon

Looking for a green future and balancing conservation and development

ASM in Gabon (Figure 6.7) is currently regulated by the Mining Code (Law N° 5/2000 of 12 October 2000), two additional texts, and a Presidential Decree fixing the conditions of application of law. Permission to engage in artisanal mining is granted by the Ministry of Mines in the form of a card for artisanal exploitation, the *Carte d'Exploitation Artisanale* (Hollestelle, 2012). By law, the Ministry of Mines can support small-scale operators in improving existing technologies or introducing new techniques with regard to artisanal mining, but there remain several weaknesses in the law. For example (Hollestelle, 2012):

- Legal artisanal miners are not bound by environmental or health regulations. The only mention of health is in an article that states that the Ministry of Mines needs to inform relevant local authorities of concentrations of human beings in artisanal mining camps as a means of preventing epidemics such as cholera, AIDS, and Ebola.
- Neither the Code nor the Decree mentions any environmental obligation with respect to the practice of artisanal mining other than the aforementioned support to technology improvement.
- Technically the government requires artisanal miners to sell mined gold at fixed prices that may be uncompetitive with the black market rates available. This requirement – if and when enforced – may have the unintended consequence of exacerbating smuggling operations in the country.
- There are also currently problematic definitions in the government's classification of "artisanal" and "small-scale" mining. Owing to imprecise language, there is a legal 'gray' area for certain types of ASM, specifically those artisanal sites that employ fewer than 70 people.
- There is currently very little incentive to formalize activities. Indeed, artisanal miners gain little with the purchase of a Carte d'Exploitation. If anything, it puts them on the radar of the government when they are already in a weak negotiating position, even if legal.

Minkébé National Park – Government interest in finding "common ground": using ASM as a force for conservation

The environmental stakes are particularly high in Gabon. It has the highest forest cover as a proportion of national surface area in any African country, its pristine forests have brought attention from global conservation organizations, and it has been dubbed the "Green Heart of Africa." Indeed, Gabon is home to five of the world's 200 Global ecoregions, which together cover the entirety of the country, and its national parks contain important populations of western lowland gorillas and western chimpanzees. Thus far,

"The environmental stakes are particularly high in Gabon. It has the highest forest cover as a proportion of national surface area in any African country."

low population density, government stewardship, and a case of 'Dutch disease' (due to its large dependence on the petroleum industry and mainly offshore wells) has meant that Gabon's precious forests are largely intact.

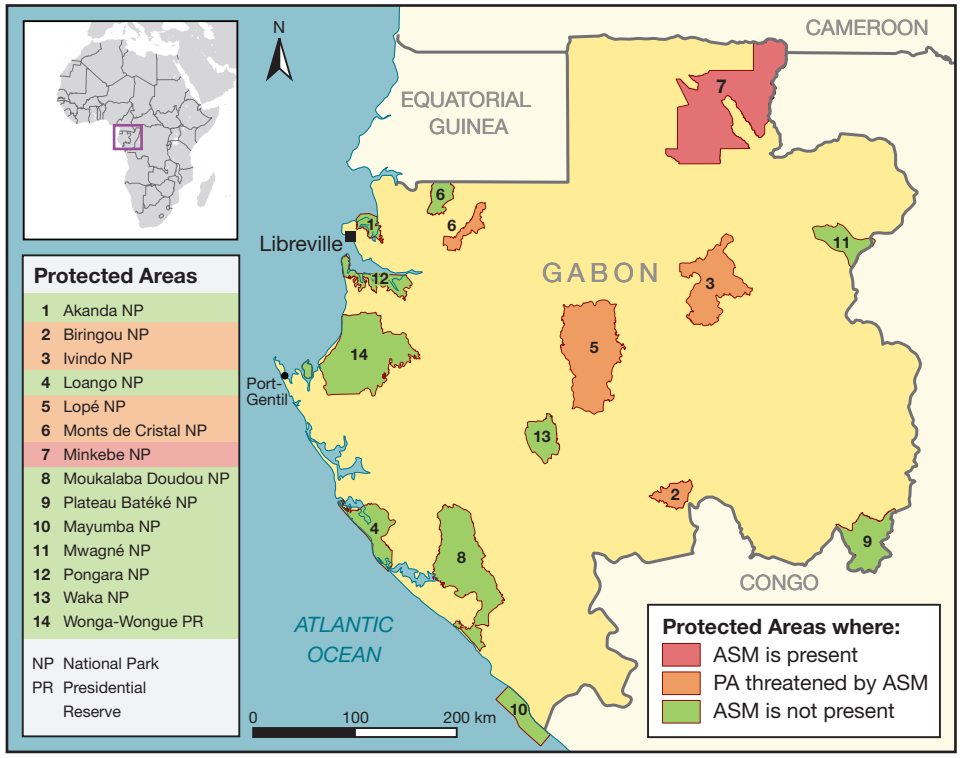
"Dutch Disease implies declining competitiveness and structural change across sectors, normally triggering 'deindustrialisation' in developed countries and 'de-agriculturisation' in developing countries. Yet, this de-agriculturisation also tends to significantly reduce pressures to convert land for agricultural uses, which globally is the principal direct cause of deforestation" (Hollestelle, 2012).

However, since oil production "peaked" in the late 1990s in Gabon, there have been few major oil discoveries, and logging and mining have steadily increased in importance as sources of revenue (Lahm, 2002). A series of oil palm plantations is currently under development in the country as a means of further diversifying the economy and several large mining projects have commenced or are planned, including in neighboring areas of Cameroon and Republic of Congo, with associated regional infrastructure projects.

For years, ASM was a relatively overlooked sector at the national level, although gold panning has been a major source of

FIGURE 6.7

ASM in Gabon



Minkébé National Park is the only protected area in Gabon where ASM is known to be occurring with a significant numbers of miners, and thus where it is likely to have significant impacts on apes. ASM is also known to have taken place in Moukalaba Doudou National Park and Monts de Cristal National Park; however those in Moukalaba Doudou areas were inactive at the time of writing, and the ASM within Monts de Cristal is deemed manageable due to the low number of miners present. The map derives from a sketch map of Gabonese Greenstone belts and major banded iron formations (Hollestelle, 2012). Where these formations overlap PAs, they are considered at risk of ASM activities. Indeed, Ivindo National Park is known to have ASM activity on its outskirts.

Courtesy of ASM–PACE.

revenue for many families in northeastern Gabon since the 1940s (Lahm, 2002). While artisanal and small-scale gold mining in the buffer zone of Minkébé National Park has long been a source of tension, in 2008 the situation became significantly worse in terms of the large number of miners present in the Minkébé camps following the climb in global gold prices. This was facilitated by the sparse presence of national park guards and monitoring teams in the park. A combination of local discontentment with the view that foreigners were financially benefitting from uncontrolled illegal ASM, concern by the State as to the illegality and lack of revenues from the gold sector in Minkébé, and concerns that poaching for bushmeat, ivory and other illegal activities were increasing at an alarming rate, led the government to evict all miners from Minkébé in June 2011 (Koumbi, 2009; Mbaza, 2011). The purge led to between 2000 and 5000 mainly Cameroonian illegal immigrants leaving the Minkébé ASM zone. The Gabonese military personnel have remained in the area, also evicting illegal fishing and hunting camps, and they still occupy these camps to prevent the miners from returning (Hollestelle, 2012).

However, there is now significant government and local interest in re-opening the Minkébé camps to local Gabonese miners. The forced exit of illegal Cameroonian miners has apparently been welcomed by local miners, but they too lost their livelihoods and personal property as a result of the mass eviction. Though outnumbered in recent years, the Minkébé zone was historically populated with Gabonese miners, pit owners, and predominantly foreign traders, while most Gabonese traders were ambulant (Lahm, 2002). Gabonese miners who engaged with the different conservation initiatives have often been keen for the government to step in, a sentiment likely to have been shared by other miners. As a matter of fact, throughout the last decade reports on Minkébé and other mining camps consistently show a desire of Gabonese miners for their trade to be formalized and for the government to address the influx of foreigners. Combined with the government's desire to control the gold trade and coupled with the Park Authorities' desire to safeguard the park for conservation purposes, the notion of economically and socially responsible artisanal and small-scale mining (ESER-ASM) gold seems appealing to all parties as a viable solution. The government has received support from donors to do a national scoping of ASM in PACE locations as a first step to this larger vision of having ASM develop in line with the government's vision of a "Green Gabon." When examples of "best practice" are few and far between, signals of pragmatism in solutions, constructive attention to the sector, and a desire to capitalize on its potential benefits and minimize its environmental impacts are a welcome change.

Management options for mitigating the impacts of ASM in protected areas

While ASM practices are on the rise around the world, including within protected areas, there has been little coordinated or systematic effort to curb their environmental impacts until quite recently (Villegas *et al.*, 2012). Furthermore, recent attempts to incorporate the critically important social impacts of ASM in management practices have been hindered by the fact that the extent of ASM as both an economic and developmental force is not well understood and thus requires further investigation at a variety of different scales. What is evident, however, is that one of the major constraints is the lack of adequate enforcement

Photo: ASM terracing, Minkébé, Gabon.
© Gustave Mbaza/WWF

of existing national laws, due to low human capacity, insufficient budgets and equipment, corruption, and inadequate training or technical knowledge; something that is particularly relevant for many ape range states. Whether or not all of the stakeholders involved (miners, government agencies, international NGOs and governmental organizations) work together on a long-term strategy and have enough funding to finance the longevity of the strategy also has a major influence on policy success (Tranquilli *et al.*, 2012). Whatever the extent of such collaboration, population increases and pressures associated with greater development will likely increase over time, thus paying attention to the mining sector now will likely yield more fruit than paying attention when the threat becomes more severe. The following list of the most widely adopted policy strategies to contain ASM in PACE provides a limited overview of their successes and constraints.

Eviction

To clear miners from a specified area by use of force, or threat of force

This appears to be the most commonly used strategy, although it is more likely to be successful if coupled with alternative livelihood programs and improved park security. The risks with taking this approach include:

- worsening relations with forest-adjacent communities;
- the interruption of mining-dependent rural economies;
- the potential for human rights abuse if eviction is done by undisciplined military (or risk of military involvement in mining sector), and
- pushing miners into increasingly remote and sensitive ecosystems, which has significant and deleterious effects for biodiversity.

Furthermore, a long-term security strategy must be in place in order to prevent miners from re-entering the area in question. Without a robust program offering them an economic stake in respecting the border areas of the park, eviction is likely to fail and ultimately, perhaps, be a waste of time and resources.

Recent examples in ape range states include Sapo National Park in Liberia and Gola Forest Reserve in Sierra Leone. In Gola, the reason for eviction was given as the need to establish both the rule of law and the primacy of conservation priorities in the contested national park. In Liberia, the official rationale for the 2011 "voluntary departure" was for conservation. Other reasons suggested included an upcoming presidential election, the park's remote location near an international border yet with access to roads leading to the capital city, and the profile of miners as ex-combatants. In the short-to-near term, the "voluntary departure" process seemingly left people economically worse off than before because of the disruption of the local economy and livelihoods, and alleged actions by the enforcement agencies to maintain the eviction of all persons from the national park. Furthermore, LSM in the south of the park was due to begin soon after, and the potential for displacing ASM participants back towards the national park was high. It was likely that due to insufficient government monitoring, LSM push factors, and poor knowledge of park boundaries by ASM participants that miners/diggers would soon once again be active in the park (Villegas *et al.*, 2012).

Negotiated access

To allow conditioned access to protected areas where limited ASM is permitted under agreed conditions

The aim of this is to regulate and limit ASM in PACE, and is more likely to be successful in long-established mining sites with strong local community connections and the potential for collaborative efforts to fulfill the agreement. In Brownsberg National Park in Suriname, a 2010–11 agreement was negotiated between park authorities, a facilitating NGO, and local gold miners. In exchange for legal access, the miners would help maintain the road leading up to the tourist lodges in the park. This agreement mutually broke down, however, when authorities failed to clearly delineate the park boundaries and the miners did not fix the road within the desired time frame. Ultimately, the dialog appears to have stopped and the miners continue to work as before. While the potential for this to either be reinitiated in Brownsberg National Park or replicated elsewhere is currently unclear, it is evident that without the necessary trust-building, accountability, and arbitration methods, conditions for negotiated access are unlikely to be met. Indeed, since 2011, the government has returned to a policy of no artisanal gold mining in protected areas.

Geographically based multi-stakeholder supply chain initiatives

To use a participatory method to engage all stakeholders in developing a sustainable supply chain

In areas where there is sustained interest and investment by stakeholders, this may be an effective means of addressing ASM's environmental impacts. An excellent example of an attempt at conservation engagement with ASM is the Gorilla Organization's Durban Process in the Kahuzi-Biéga National Park. The Durban Process was driven by an alarming number of deaths of eastern lowland gorillas in the KBNP, caused in part by the spike in global prices for coltan – and the ensuing increase in ASM – and the on-going

conflict in Eastern DRC. The Durban Process was launched in 2003 at a multi-stakeholder meeting in Durban, South Africa, organized by the Dian Fossey Gorilla Fund (Europe) to address the issue of coltan mining in the KBNP. The majority of the people working on the Durban Process were Congolese and the aim was to make it as participatory as possible, managed by the stakeholders through a monitoring committee – the *Comité de suivi du processus de Durban* (CSPD). Chosen according to their role in the KBNP coltan supply chain, the stakeholders included miners, indigenous people, customary authorities, members of the various militias occupying the park, mining officials, and politicians.

> "Even small adjustments to mining techniques can vastly ameliorate negative impacts."

Members compiled a list of objectives that would come to be known as the central strategies through which the Durban Process would reduce the environmental, social, economic, and political ramifications of ASM in the KBNP. While utilizing many best practices, by 2009, the Durban Process began to wind down, likely due to several factors, namely donor fatigue, a decrease in funding available generally due to the global economic downturn that began in 2008, and the shifting priorities of the Gorilla Organization. While the Durban Process ended prematurely, with a slow return to a "business-as-usual" scenario, the experience revealed much about the challenges of attempting to address the issue of ASM in PACE in this part of the world.

The complexity of resource governance in a context of state fragility is particularly relevant for ape conservation in the DRC. Informal mining and the illicit trading of minerals has long been associated with violent conflicts in the Kivu provinces of eastern Congo, for example, with the DRC military involved in at least some of the mining as well as the systematic elimination of regional elephant populations, and remains a significant hindrance to conservation interventions in the area. While the situation does not lend itself to quick and easy recommendations, the fact that miners receive little state support, while economic operators invest little in their social needs, suggests that the creation of formal structures for coordination between provincial governments and the mining sector is required. The formation of artisanal and trader representation groups (whether cooperatives, associations, or others) would be an important contribution to the engagement of stakeholders and thus the evolution of better governance of the sector (Spittaels, 2010).

The incentivization of responsible mining in PACE

To use a toolbox of political, financial, and social incentives to encourage positive change in the mining sector

This approach recognizes that even small adjustments to mining techniques can vastly ameliorate negative impacts. It is more likely to succeed in areas where eviction is inappropriate, and where miners are unlikely to transition into alternative livelihoods, or where de-gazettement is to be carried out but ASM is still occurring in a critical ecosystem. Examples include the Sustainable Management of Mineral Resources Project funded by the World Bank in Uganda (2003–11) to improve ASM areas and sector governance, and the Global Mercury Project, which worked to encourage mercury management and elimination in eight countries around the world.

The Oro Verde (Green Gold) Project, which was launched in 2000 in the Chocó Bioregion of Colombia, and uses ASM to benefit Afro-Colombian communities through sustainable, environmentally friendly mining and the utilization of social, economic, environmental, and labor standards, also inspired the creation of the Alliance for

Responsible Mining (ARM) in 2004. ARM's mission is to set standards for responsible ASM and to support and enable producers to deliver fair-mined certified metals and minerals through economically just supply chains to markets. As it continues to evolve, it aims to develop a diversified strategy combining communications, applied research, capacity building, networking, partnership, and lobbying activities, involving stakeholders from all sections of the metals and minerals supply chain.

ARM also previously partnered with Fairtrade International under a joint "Fairtrade/Fairmined" program. In April 2013, the partnership ended and both initiatives have continued independently. The new standards, due to be finalized by the end of 2013, incorporate a more nuanced consideration of how to manage ASM in protected areas, with provisions for allowing it under certain circumstances (E. Levin, email communication, August 5, 2013). The Fairtrade and Fairmined programs are considered to be moderate and pragmatic in their approach to help transform ASM into a more socially and environmentally responsible activity, with improvements in the quality of life of marginalized artisanal miners, their families, and communities. However, the pragmatism of their approaches means, inevitably, that there are trade-offs between environmental protection and economic benefit. For example, both allow for the managed use of mercury and cyanide, which can have long-term impacts on the health of human communities, wildlife, and the environment, but whose exclusion would lead to lower adoption of Fairtrade and Fairmined standards by miners around the world, thereby sacrificing the other environmental benefits they garner (e.g. tailings management and rehabilitation).

More generally, there is also a need for programs that educate miners on their environment, the ecosystem, its ecology, and ecosystem services, as a means of potentially engendering a sense of stewardship. If advocated, this approach might stimulate engagement *with* miners rather than reinforcing the traditional paradigm of pitting them *against* environmental protection.

Alternative livelihoods programs

To incentivize participants away from ASM by offering jobs with fewer negative impacts

ASM is often a highly dangerous practice with a variety of health risks for those involved, and raising awareness of these could encourage a change in income generating activity. There may be more potential to introduce new livelihoods when miners are from the local area and have permanent settlements. In Sierra Leone, for example, an international consortium has had apparent success bringing ASM within the Gola Forest National Park under control. ASM was banned from the park and this has been enforced with robust security using locally-recruited forest guards. The Gola Forest Program has been paying compensation packages to land-owning families, the paramount chiefs of the seven chiefdoms constituting the area, and undertaking infrastructural developments like building schools and health centers, as well as giving scholarships to local school and college students.

Following the aforementioned eviction of miners from Sapo National Park in Liberia in 2005, it was found that in practice the alternative livelihoods offered were simply not robust enough, so that those with the requisite equipment, skills, and desire recommenced mining in the Park, suggesting that ASM is an integral part of the local economy. In areas comprising large numbers of economic migrant miners, be they from the same country or foreigners, this model has proven less effective owing to

"There is a need for programs that educate miners on their environment, the ecosystem, its ecology, and ecosystem services, to potentially engender a sense of stewardship."

the population's impermanent status, lack of cohesive social capital, and disinterest in long-term collective enterprises. In many areas ASM's main appeal is how lucrative it is with minimal prerequisite skills. As was seen in Sapo, matching the economic weight with alternative livelihoods can be difficult and might even require unsustainable subsidization, a significant hindrance in the more impoverished ape range states.

Selected de-gazettement

To strategically exempt certain parts of an area from PA status during the gazetting process

If established communities are willing to work with the government and respect the established boundaries, then this method can be an effective way of taking into consideration historic mining sites and local community livelihoods. In Uganda, artisanal salt mining has been taking place for hundreds of years on the Katwe Crater Lake surrounded by the Queen Elizabeth National Park. When the Park was being gazetted, Katwe and 12 other towns – mainly fishing villages – were demarcated to protect existing industry and livelihoods. Thanks to that strategic demarcation, Katwe's artisanal salt mining was allowed to continue even though it was physically in the park area.

However, communication and commitment with the relevant communities must be strong in case they are tempted to move into the protected areas. Likewise, when the mining in the exempt portion runs out, the same thing may happen. There is also the possibility that environmental impacts of

Photo: Artisanal miners pan for diamonds in Sierra Leone. © Estelle Levin, 2007

mining may not be contained in the exempt area and could have negative impacts on the neighboring PA. The reconfiguration of hydrological systems, for example, and the loss of spawning grounds for fish through increased sedimentation, can threaten both the human communities that rely on these resources, and the wildlife that they share them with.

Conversion to a protected area

To obtain or strengthen significant government protection

The ultimate aim of ceasing all mining in a given area is only likely to work in places with strong rule of law, political will, and sufficient resources. In Colombia, protected areas have heightened constitutional protection, enjoy a complete ban on mining, and are managed by the Colombian Park Service. The actual (versus theoretical) legal protection is so strong that some indigenous communities are voluntarily converting their lands into protected areas in order to stop encroachment by both industrial and artisanal mining. For such a move to be effective, sufficient trust must exist that the government will not steal or redistribute the land nor exploit it for its own benefit. Unfortunately, few of the most vulnerable protected areas are in countries able to maintain this level of protection.

"Mining mindful" conservation strategies

To consider on-going and potential ASM when planning or discussing protected areas

Many of the difficulties in addressing ASM in PACE are neglected or underestimated early in planning processes. In areas that are candidates for protected area status, and have on-going ASM or substantial exploitation potential, there may be the possibility of initiating such a strategy. Although it is still awaiting final approval by the state, the Itombwe Nature Reserve in the DRC could become a good example of this, if mindful management strategies succeed in taking into account existing mining activities in the proposed protected area and thus plan conservation projects accordingly. However, it takes considerable forethought and cooperation between government, conservation stakeholders, and mining stakeholders to reach consensus. Mining and critical wildlife habitat might overlap in inconvenient but real ways, resulting in a choice having to be made between conservation and mining activity, and significant enforcement resources deployed if the former is chosen. In Itombwe, for example, a major constraint to successful implementation has been rebel activity within the reserve.

Conclusion

As illustrated, current strategies for mitigation of ASM's impact on PACE and great apes include better enforcement of park boundaries, the promotion of alternative livelihoods, the adoption of land-use planning frameworks, clarification of property rights, the formalization of the ASM economy, and the adoption of larger sustainable development initiatives. However, one of the key difficulties with engaging the sector is its huge diversity (e.g. between and within countries, type of mineral, modes of extraction and processing, marketing arrangements, political economy, socio-economic organization, etc.). Thus strategies to reduce vulnerability and improve livelihood security for artisanal and small-scale miners need to be context-specific at both the country and local levels if they are to have a positive impact on biodiversity conservation.

Some of the management options presented in this chapter suggest that, in order to maximize the chances of sustainability, processes should be:

- **Locally owned and driven**. Projects have a much better chance of survival if local stakeholders are committed to their aims and are involved in all stages of design and implementation. Participation encourages ownership and, with it, a sense of accountability for project outcomes.
- **Informed on robust research data**. In order to both tailor and legitimize policy, any change needs to be based on transparent research data, thus ensuring that a link can be made between micro realities and macro policy. While research can play a valuable role in articulating some of the social aspirations of ASM operators, in the past it has failed to put these needs in the context of the relevant environmental legislation. Building trust between ASM operators and the policy process (of which robust research is a crucial part) is essential to navigating the complex trade-offs that exist between the sector and the landscapes in which it works.
- **Strategic, and link to other key policy initiatives/sectors.** Isolated initiatives rarely have impact on deep and complex environmental and economic issues.

> "The complex nature of environmental factors, limited legislation involved, and lack of knowledge on the interface of these with ape conservation require further investigation."

However, the situation in areas of high conservation value is not likely to improve unless there is a global drop in mineral prices or miners are incentivized either financially or by increased protected area security not to mine there or – if allowed – to be incentivized to do so in a responsible manner. This is also the case for areas outside of protected areas. Indeed, recent research on the overlap between orangutan distribution and a variety of land-use categories in Kalimantan suggests that while 22% of this distribution lies in protected areas, 29% lies in natural forest concessions (Wich *et al.*, 2012b). One of the key dilemmas from a conservation point of view concerns areas that might be considered so precious that perhaps mining should not be permitted in them at all. While the direct environmental effects of artisanal mining may be limited in themselves (as seen in the CAR), the sheer size of the sector and its related activities scale up the environmental impacts to alarming proportions. Furthermore, implying that people ought to be compensated financially for leaving an area that they should not have been in, in the first place raises a number of complex ethical questions. This might be the case where miners were present before a protected area was proclaimed, but would certainly not apply in most rush situations like those in DRC or Madagascar. In a context such as this, where mining is opportunistic and out of control, strong enforcement of the law is also needed.

The complex nature of environmental factors, the limited legislation involved, and the lack of knowledge on the interface of these with ape conservation require further investigation. Ultimately, whether or not great apes manage to survive within these human-modified landscapes depends on whether protected areas are large enough and, more importantly, adequately protected (Tranquilli *et al.*, 2012). Given that diverse interests, goals, and agendas for each stakeholder converge when considering ASM in protected areas and critical ecosystems, accompanying policy changes may also be necessary to support their conservation, and these require political will and, ideally, enthusiasm. While ASM needs to be integrated with institutional change, with legislators, governments, multilateral organizations and industry collaborating, there is no global solution to the problem. Consequently, the need to formalize the sector and protect PACE must be reconciled in a way that brings

all stakeholders together. ASM goes beyond individual livelihoods, and while vast deposits of mineral wealth remain undiscovered and unexploited, and markets continue to fluctuate, there needs to be a recognition that this is not just an economic issue, but also a social, ethical, political, ethnic, and environmental one, too.

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