



WORKING
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TOWARDS
RESPONSIBLE
ARTISANAL
AND SMALL
SCALE MINING



Estelle Levin Ltd.

REPORT

SEPTEMBER

2012



ARTISANAL AND SMALL-SCALE MINING IN PROTECTED AREAS AND CRITICAL ECOSYSTEMS PROGRAMME (ASM-PACE)

A GLOBAL SOLUTIONS STUDY

SEPTEMBER 2012

By Cristina Villegas, Ruby Weinberg, Estelle Levin, and Kirsten Hund

The aim of **ASM-PACE** is to address the environmental impacts of artisanal and small scale mining (ASM) whilst building on its economic, social, and empowerment potential in some of the world's most important ecosystems. The project uses a scientific foundation of knowledge, participatory methods and rights-based approaches to work with miners and their communities -- rather than in opposition-- to design sustainable, win-win solutions that will last. The project is focused exclusively on ASM occurring in and around protected areas and priority ecosystems. For more information please visit www.asm-pace.org.

Estelle Levin Ltd. is a boutique development consultancy specialising in natural resources governance and sustainable supply chains. Much of its work is in the extractives sector, on behalf of clients like development agencies, NGOs, mining companies, consultancies, industry associations, and end-users like jewellers. Working individually or by bringing in the relevant expertise, we help organisations mobilise natural resources in ways that achieve their development and commercial ambitions whilst ensuring empowerment and ecological protection; development through sustainability & sustainability through development. Contact Estelle Levin at estelle@estellelevin.com.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

ASM-PACE is coordinated through WWF's Central Africa Regional Programme Office (WWF-CARPO), which is the largest program office of WWF International. For more than 20 years, WWF and its partners have been working throughout the Congo Basin region to:

- Create a network of protected areas to conserve biodiversity
- Encourage logging and mining companies to promote good management practices
- Promote the reduction of greenhouse gas emissions from deforestation and degradation of forests
- Support sustainable business practices and financial investments in development and infrastructure projects
- Improve the livelihoods of indigenous and local peoples
- Reduce wildlife poaching and the bushmeat trade
- For more information, please visit www.panda.org

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Mining site in Sierra Leone,
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ACRONYMS

| | |
|-----------------|--|
| AGC | Artisanal Gold Council |
| AMZ | Artisanal Mining Zone |
| ARD | Acid Rock Drainage |
| ARM | Alliance for Responsible Mining |
| ASGM | Artisanal and Small-scale Gold Mining |
| ASM | Artisanal and Small-scale Mining |
| ASM-PACE | Artisanal and Small-scale Mining (ASM) in and around Protected Areas and Critical Ecosystems (PACE) |
| AZE | Area of Zero Extinction |
| BGR | The Federal Institute for Geosciences and Natural Resources / <i>Bundesanstalt für Geowissenschaften und Rohstoffe</i> |
| BNP | Brownsberg National Park |
| CASM | Communities and Small-scale Mining Initiative |
| CIDA | Canadian International Development Agency |
| CN | Cyanide |
| CSO | Civil Society Organization |
| CSSL | Conservation Society of Sierra Leone |
| CTC | Certified Trading Chains |
| DDI | Diamond Development Initiative |
| DDII | Diamond Development Initiative International |
| DRC | Democratic Republic of the Congo |
| EHS | Environmental Health and Safety |
| EIA | Environmental Impact Assessment |
| EU | European Union |
| FDI | Foreign Direct Investment |
| FFI | Fauna and Flora International |
| FI | Financial Institution |
| FLO | Fairtrade International (formerly Fairtrade Labelling Organization) |

| | |
|--------------------|---|
| FPIC | Free, Prior, Informed Consent |
| FT/FM | Fairtrade/Fairmined |
| GFP | Gola Forest Program |
| GGDMA | Guyana Gold and Diamond Mining Association |
| GMP | Global Mercury Project |
| GoCAR | Government of Central African Republic |
| GoDRC | Government of the Democratic Republic of the Congo |
| GoL | Government of Liberia |
| ICGLR | International Conference on the Great Lakes Region |
| ICMM | International Council on Mining and Metals |
| IFC CommDev | The International Finance Corporation's Oil, Gas and Mining Sustainable Community Development Fund |
| ILO | International Labour Organization |
| ITRI | Formerly the International Tin Research Institute, now known only as ITRI |
| iTSCi | ITRI Tin Supply Chain Initiative |
| IUCN | International Union for Conservation of Nature |
| KBNP | Kahuzi-Biéga National Park |
| LBMA | London Bullion Market Association |
| LSM | Large-Scale Mining |
| MDG | Millennium Development Goal |
| MEDMIN | Integrated Management of the Environment in Small Mining Project (<i>Medio Ambiente, Minería e Industria</i>) |
| MOU | Memorandum of Understanding |
| NGO | Non-Governmental Organization |
| PA | Protected Area |
| PRADD | Property Rights and Artisanal Diamond Development programme |
| PRSP | Poverty Reduction and Strategy Paper |
| RSPB | Royal Society for the Protection of Birds |
| SDC | Swiss Agency for Development and Cooperation |
| SIA | Social Impact Assessment |
| SIDA | Swedish International Development Cooperation Agency |

| | |
|------------------|--|
| TNS | Sangha Tri-National Park |
| UN | United Nations |
| UNECA | United Nations Economic Commission for Africa |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| USAID | United States Agency for International Development |
| WWF | World Wide Fund for Nature or World Wildlife Fund |
| WWF-CARPO | WWF's Central Africa Regional Programme Office |

GLOSSARY

| Term | Definition |
|---|---|
| Amalgamation | Mineral processing method which extracts gold from mined ore using mercury to create amalgam which is then decomposed leaving gold. |
| Area of Zero Extinction | A places where 95 per cent or more of the entire, known population of an Endangered or Critically Endangered species (as defined by the IUCN 2004 Red List) occurs. AZE can therefore be described as the “top of the endangerment pyramid” featuring the most threatened species due to their extremely small global ranges and small populations. ¹ |
| Artisanal and Small-scale Mining (ASM) | Mineral extraction characterised by low levels of mechanisation and capitalisation and high labour intensity. It is usually done by local miners for the purpose of creating local livelihoods or subsistence or as small businesses, or at group or individual level. It is often done in the pursuit of creation of (self-)employment and often in conditions of informality. |
| Assurance | An evaluation method that uses a specified set of principles and standards to assess the quality of an organization's performance, the underlying systems, processes and competencies that underpin its performance, and/or the reporting thereof. |
| Concessions | Areas within which mineral exploration or mining companies (concession holder) are granted rights to operate and derive revenues from that operation. |
| Consent | Refers to indigenous/local communities' consent to mineral exploration within their territory/habitation areas. |
| Consultation | Refers to stakeholder consultation, aimed at understanding how key stakeholders perceive the Standards' individual and relative strengths and weaknesses. |
| Critical Ecosystem | The site is not a protected area but it is a WWF Priority Place. OR The site affected is not a protected area or a WWF Priority Place, but it is in one of the Global200 Priority Ecoregions |
| Cyanidation | Mineral processing technology of dissolving gold in a cyanide solution (cyanide leaching) and subsequent recovery of the gold from the solution by precipitation with zinc or through absorption on activated carbon and subsequent desorption. |
| Degazetting | Declassifying a protected area |
| Digger | A type of ASM labourer whose role it is to recover the mineral, clear vegetation and boulders, removing overburden and extracting and transporting gravel. Often confused with the term 'miner' and often also used with a pejoratively. |

¹ Alliance for Zero Extinction (2010)

| | |
|---|--|
| Fairtrade² and Fairmined minerals | Refers to minerals which are mined and traded according to standards set by Fairtrade International (FLO) and the Alliance for Responsible Mining (ARM). At the time of publishing, these standards apply to gold and associated precious metals. The standard ensures that certified artisanal and small-scale mining associations and organizations are democratic and accountable organisations with formalised operations; are using safe working practices including the management of toxic chemicals, such as mercury and cyanide, used in the gold recovery process; are respectful of the environment; recognize the rights of women miners; and do not allow child labour in their operations. Organizations that purchase Fairtrade and Fairmined gold from these certified groups are to establish long term and stable trading relationships, and pay a minimum price and a Fairtrade premium. The premium payment is invested in community projects and improving the mining organisation's operations. The gold in the end product to consumers can be labelled as "Fairtrade and Fairmined". |
| Gazetting | Classifying a place as protected. |
| Gold-washing | Concentrating the gold using water and gravimetric methods, e.g. with a pan or sluice. |
| Industrial Mining | Often termed Medium- or Large-Scale, done by professional, corporate outfits legally and in the pursuit of profit. High level of mechanisation and capitalisation; low labour intensity. |
| Miner | In the context of this report, the term 'miner' refers to any person involved in artisanal and small-scale mining. |
| Ore | Mineral (rock or gravel) which contains gold at an economic concentration (grade) and that is therefore suitable to be processed. |
| Protected Area | A location that receives protection because of its recognized natural, ecological and/or cultural value. There are different kinds of protected areas which vary by the level of protection depending on the enabling laws of each country or the definitions of the international organisations involved. The term 'protected area' also includes Marine Protected Areas. |
| Regulation | A set of laws and rules imposed by a government, backed by the use of penalties or incentives, intended specifically to modify the socio-economic or environmental behaviour of individuals and firms in the private sector. |
| Standard | A set of officially approved principles and criteria designed to measure and safeguard specified social, environmental, and management issues in the industrial gold mining sector. |
| Tailings | Intermediate or final leftover-product from mineral extraction or mineral processing with low concentration of gold. This material is deposited at waste rock dumps (extracted rocks with too low gold content) or tailings dumps /ponds (low content fraction after mineral processing). In some cases tailings can be reprocessed to recover remaining gold. |

²Fairtrade.net, 2009

EXECUTIVE SUMMARY

“Entire hills and valleys have been turned into giant craters, turning the landscape of the region into an expanse of naked and sterile earth.”³

Kevin D'Souza on the impacts of artisanal mining in DRC's Kahuzi-Biéga National Park, a World Heritage Site.

“I work because I need to survive...”

Emmanuel, digging for gold along a stream leading into Liberia's Sapo National Park. July 2011.

Artisanal and small-scale mining (ASM) is an important and increasingly popular livelihood for tens of millions of people around the world. While it brings in needed income for rural communities, ASM is also a serious and growing threat to biodiversity and the integrity of protected areas.⁴ Compounding the environmental impacts of mining methods — clear-cutting forests, river dredging, frequent use of toxic chemicals — are livelihood practices — gathering firewood, hunting for food or trade — that support mining populations.

Artisanal and small-scale miners (ASM) work in more than 80 countries⁵ and on every continent except Antarctica. ASM produces some 10 per cent of the world's mined gold,⁶ 15-20 per cent of mined diamonds,⁷ approximately 20-25 per cent of mined tin and tantalum,⁸ and a staggering 80 per cent of coloured gemstones.^{9,10} In the current context of high mineral prices, ASM is a rational economic choice for people seeking to escape absolute poverty or improve their lives: artisanal miners mine because it brings them more income and faster economic returns than other livelihoods such as agriculture. For example, in Uganda, the average miner contributes almost 20 times more to GDP than the average woman or man in farming, forestry or fishing.¹¹ In Liberia, an artisanal miner working north of Sapo National Park has the opportunity to make 17 to 50 times more than the average Liberian per day.¹²

Often ASM is part of a diverse livelihood strategy at the individual and household level.¹³ It can build resilience. ASM can enable families to better cope with seasonal or unplanned stress or at a time when traditional livelihoods are becoming less viable, due to reasons like climate change.¹⁴ It is therefore not surprising that the increasing price of precious minerals has launched rushes worldwide. These rushes are attracting people to previously untouched places that are important conservation sites: including within protected areas and critical ecosystems (PACE).

Aim

The aim of this report is to summarize the scope and scale of ASM in protected areas and critical ecosystems worldwide, describe its known effects, document and study attempted solutions, and offer an initial set of recommendations. While this report provides background on some of the current issues in the ASM sector, it does not seek to provide a comprehensive overview of ASM around the world.^{15,16} Instead, this report focuses *exclusively* on ASM occurring in and around protected areas and critical ecosystems (defined below).

³ D'Souza, K. 2003

⁴ We are using the term “protected areas” to encompass areas of high biodiversity value and other protected areas established by national, regional or local governments (including RAMSAR sites) for at least partly biodiversity conservation.

⁵ Telmer & Veiga, 2009

⁶ Hruschka, F. and Echavarría C., 2011.

⁷ KPCS, 2008

⁸ Dorner et al, 2012

⁹ GIA, 2011.

¹⁰ Lucas, 2011

¹¹ Hilson, et al, 2007

¹² Small, 2012

¹³ Hilson, et al, 2007

¹⁴ Kramcha, Sandra (2004)

¹⁵ For such analyses, see Hentschel, T., Hruschka, F. and Michael Priester (2002) “Global Report on Artisanal & Small-Scale Mining” for the Mining, Minerals, and Sustainable Development project, available here: <http://pubs.iied.org/pdfs/G00723.pdf>. See also their 2003 report “Artisanal and Small-Scale Mining: Challenges and Opportunities” for IIED. Available here: <http://www.bvsde.paho.org/bvsacd/cd27/artisanal.pdf>. Or see Hruschka, F. and Echavarría, C. (2011) “Rock-Solid Chances: For responsible artisanal mining”. Available here:

This report is issued as a part of the Artisanal and Small Scale Mining in Protected Areas and Critical Ecosystems (ASM-PACE) Programme. A joint initiative by the international conservation organization WWF and specialist development consultancy firm Estelle Levin Ltd, ASM-PACE seeks to identify workable, sustainable solutions that constructively navigate the conservation and development trade-off presented by ASM in protected areas and critical ecosystems.

Key findings

- ASM is occurring in 32 of the 36 countries studied and in or around 96 of the 147 protected areas evaluated¹⁷
- Affected sites include at least seven natural World Heritage Sites. (See Table 3 below)
- ASM is taking place in at least 12 WWF Priority Landscapes
- Minerals mined artisanally in or adjacent to protected areas or critical ecosystems include: gold, silver, diamonds, rubies, sapphires, emeralds, quartz, aquamarine, tourmaline, amethyst, emerald, morganite, rose quartz, copper, phosphates, coal, iron ore, cassiterite (tin), wolfram (tungsten), coltan (columbium-tantalum) and other metallic minerals, gypsum, salt, limestone, marble, stone aggregate, clay and sand
- ASM is impacting a wide range of critical ecosystems including: arctic landscapes (Greenland), tropical rainforests (Brazil and Gabon, among many others) and coral reefs (Philippines)

On a global scale, ASM of gold is the biggest “problem” in terms of negative environmental impacts. However, other minerals have significant localized impacts within specific ecoregions or countries: e.g. tin, tantalum and tungsten in the DRC; coloured gemstones in Madagascar; diamonds in West Africa.

Map: ASM-PACE studied an initial 36 countries to assess ASM activities in protected areas and critical ecosystems



http://communitymining.org/attachments/059_RSC_FINAL_web_low.pdf. Or MMSD Breaking New Ground, Chapter 13, "Artisanal and Small-Scale Mining". Or Sandra Kramcha 's report (2004) "Livelihoods and Policy in the Artisanal and Small-Scale Mining Sector- An Overview". Available here: <http://www.dfid.gov.uk/r4d/pdf/outputs/C391.pdf>.

¹⁶ See Levin, 2005, and Hayes, K. 2008.

¹⁷ Researchers found evidence of active ASM in protected areas and critical ecosystems in 32 of the 36 countries studied. Only one—Nigeria—was found not to have artisanal miners active in PACE areas. In seven countries the data was either not available to desk-based researchers or inconclusive.

Causes, Motivations and Push Factors for ASM

There are many reasons why people undertake ASM. The primary motivation is usually economic and ASM generally offers¹⁸:

- Immediate cash; often difficult to acquire in rural, subsistence-farming areas
- Potential relief; during difficult circumstances in fragile societies which have undergone or are undergoing deepening poverty, natural disasters (e.g. Mongolia), economic transition or collapse (e.g. Zimbabwe), or civil conflict or post-conflict reconstruction (e.g. Sierra Leone and Liberia)
- Opportunity; high incomes are available to unskilled or illiterate individuals
- Subsistence; people are able to mine in exchange for food or other basic provisions
- Emancipation from traditional hierarchies and social structures; artisanal mining economies (especially in rush situations) are often highly individualistic and provide scope for youth to organize and regulate themselves¹⁹
- Hope; mining offers a rare opportunity to break free from poverty and bring increased dignity and respect from the ASM's community²⁰
- Economic Potential; ASM is increasingly profitable owing to rising minerals prices, especially for gold

Why do people mine in protected areas?

The study found that there are many “push” and “pull” factors behind why men and women choose to mine in or around protected areas:

- Protected areas are seen as untouched, virgin areas: they have not been mined in living memory (e.g., Liberia)
- Lack of recognition or knowledge of park borders amongst the local population (e.g. in Sapo National Park in Liberia, the Kahuzi- Biéga National Park in DRC, and Brownsweg National Park in Suriname)
- The protected area is perceived as common land, in which there is no statutory or customary landowner to whom one must pay for access rights. If unguarded, access to the resource is perceived as free money (e.g. in China²¹)
- Gazetting the protected areas limits the land available for agriculture pushing farmers into ASM (e.g. Uganda)
- Land which hosts mining activities is gazetted into a protected area (e.g. the Kahuzi-Biéga National Park in DRC)
- Large-scale corporate miners (LSM) achieved statutory prospecting, exploration and/or mining rights in historically ASM mined areas. ASM must transition to areas not granted to LSM, i.e. protected areas (e.g. in DRC; Ghana; Tanzania; Sierra Leone; Liberia)
- Closure of industrial mining sites can 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, DRC)
- Protected areas offer a variety of livelihood options that complement ASM in a livelihood strategy for individuals or households: timber, bushmeat and other wildlife products (i.e. ivory or rhino horns), charcoal making

¹⁸ See MMSD, 2002. Chapter 13. See also Levin, 2005. Temple et al. 2006; MacConachie & Binns, 2007.

¹⁹ King, 1972; Levin, interviews with artisanal gold miners in CDI, 2010.

²⁰ Sadly, it rarely works this way. In the artisanal diamond fields, one often hears stories of the miner who found ‘the big one’, only to have it stolen or be cheated of its true value by predatory local and national authorities and exploitative diamond dealers. See also Levin, 2005 and Zoellner, 2006.

²¹ Gunson, personal correspondence with Weinberg, June 2011.

Marginalization of ASM and its link with environmental degradation

Environmental degradation associated with artisanal mining is, in part, exacerbated by the political marginalization of the ASM sector. This is coupled with the lack of appropriate incentives to mine in a more environmentally sensitive manner. ASM's marginalization within the mining industry primarily stems from four issues:

1. The persistent belief by many governments that LSM should be prioritized whenever possible over ASM – versus in tandem with ASM
2. As currently practiced, in most contexts ASM does not contribute as much direct tax revenue to the state as industrial mining; its indirect contributions are often not calculated or considered
3. ASM as an informal or illegal activity is seen as foregone conclusion: making reform or formalization economically unattractive and/or politically challenging
4. Local markets for high-value/low volume commodities such as diamonds or precious stones and especially gold often lack transparency and formal trading chains. This provides the ideal setup for extraordinary profits in grey or black markets, such as money laundering or smuggling by unscrupulous middlemen, some of who have direct ties to those with the economic and political means to perpetuate the marginal and informal condition of ASM so crucial for their businesses.

These factors create a situation of minimal political will to address the sector. It follows that few successful education initiatives have addressed artisanal miners' ignorance of how to reduce or mitigate their impacts on the environment, or at a more basic level, educate them in the ways in which what they do is environmentally damaging. This is coupled with a widespread lack of incentives for miners to introduce improved techniques or rehabilitate mining sites.

Is it worth noting that, unlike in large-scale mining where the financial profits and investments are larger than the costs of requisite conservation programmes, in ASM the profits are orders of magnitude smaller, sometimes altogether elusive and usually dispersed amongst a large group of people.

Environmental impacts of ASM in protected areas and critical ecosystems

The most commonly reported environmental impacts of ASM involve the clearance of vegetation (frequently tropical forest) for mining activities. This, in turn, results in degraded and fragmented habitats for wildlife. Other frequently cited environmental impacts of gold and diamond ASM in particular are semi-mechanical techniques that use dredges, water pumps, hoses and vacuums to remove topsoil, riverbed sediments and riverbanks. The use of mercury is a major issue in artisanal gold mining. A summary of the study's findings on environmental problems associated with ASM in and around PACE is found in the table below:

Table 0: Reported Impacts of ASM activities in Protected Areas and Critical Ecosystem (PACE) locations.

| ASM ACTIVITY | OBSERVED or ANTICIPATED ECOLOGICAL IMPACT |
|--|--|
| <p>Clearing vegetation, and harvesting timber and non-timber forest products:</p> <ul style="list-style-type: none"> • Gathering wood for camp or mineshaft construction • Clearing vegetation to expose substrate for mining • Firewood collection for warmth and cooking in camps • Bark removal to make pans for washing minerals • Cutting specific plants to make carrying baskets or for medicinal purposes | <ul style="list-style-type: none"> • Food sources are diminished. E.g., in the case of apes, this includes 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 • Secondary impacts from erosion, including sedimentation and siltation (see below) • Behaviour modification. For example, in Sapo National Park, cleared spaces found to act as sites for congregation of elephants • Extensive use of tracks both on foot and by cars lead to additional habitat loss, migration range disruption and increased vulnerability to commercial bushmeat trade • Important non-timber forest products used in food preparation and house construction |
| <p>Physical removal of soil and rock to access the deposit:</p> <ul style="list-style-type: none"> • Use of high power hoses or medium and large-size backhoes and dredges to remove topsoil or the top layer of sand and clay • Use of spades and other manual tools to remove soil | <ul style="list-style-type: none"> • Increased vulnerability of affected areas to erosion • Reduced capacity of the area for recovery of the native ecosystem • Creation of ecologic niches for non-native vegetation • Release and dispersal of corrosive dusts • Exposure of mineralized rocks, soils and tailings leading to oxidization of sulphide minerals and the subsequent release of toxic metal ions (known as ARD - "acid rock drainage"). ARD can impact groundwater and surface water quality • Air-borne or water-borne toxic substances can detrimentally impact soils, water quality, vegetation and human health • Destruction of riverbanks and riverbeds impact hydrological systems and aquatic ecology. |

| | |
|---|--|
| <p>Mining in or near rivers and streams:</p> <ul style="list-style-type: none"> • Increased release of silt during the washing and panning process • Diversion of waterways to access mineralized deposits on the riverbed or to obtain water needed for washing • Use of pumps to remove water when digging below the water table • Direct dumping of waste, tailings and effluents in waterways • Removal/disruption of riverbeds and riverbanks because of intensive scooping, dredging, or vacuuming • Digging in river banks • Unmanaged release of tailings into waterways through erosion | <ul style="list-style-type: none"> • Siltation reduces light penetration into water bodies, causing reduced photosynthesis in aquatic plants, depleting oxygen levels in the water and clogging of the gills of fish; all consequences kill aquatic life • Increased turbidity due to siltation can reduce water quality by creating favourable conditions for harmful microbes • Direct (tailing, diesel from pumps) and indirect (turbidity) pollution of human and animal drinking water sources • Sedimentation can lead to loss of refuges and spawning grounds for fish • 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 • Reconfiguration of hydrological systems in one area through widening and/or dredging can affect hydrology downstream; e.g. through sedimentation and filling of dam reservoirs, disappearance of marshland and wild bird habitats, increased risk of flash floods • Loss and degradation of aquatic herbaceous vegetation through riverbank impacts |
| <p>Lack of backfilling when digging pits in search of gold or other minerals.</p> | <ul style="list-style-type: none"> • Stagnant pools of water in mining pits are breeding grounds for malaria-carrying mosquitoes and water-borne diseases • Abandoned pits pose a risk of injury and drowning to children and animals, including livestock and endangered species • Previously mined sites are often unusable for agriculture, forcing people into other habitats to serve their needs • Aesthetics are affected by creating 'moonscapes' • Lack of backfilling aggravates the negative effects of erosion by making topsoil reconstruction very difficult • Issues around re-establishment of original vegetation |
| <p>Use of toxic chemicals in gold processing:</p> <ul style="list-style-type: none"> • Use of cyanide • Use of mercury, especially vaporization and release into waterways | <ul style="list-style-type: none"> • Risk of 'dead zones' and localized death of animals (including birds and fish) exposed to unmanaged cyanide releases • Exposure of humans and animal species to mercury emissions into air or water • Bioaccumulation of Hg up the food chain, especially in carnivorous fish consumed by local and distant populations • Pollution of drinking water for humans and animal species |

| Ancillary / support services | |
|--|--|
| <p>Hunting of animals for bushmeat to feed miners and their families, and to sell in local markets:</p> <ul style="list-style-type: none"> • Opportunistic and deliberate poaching of endangered species for trade | <ul style="list-style-type: none"> • Population decline of critically threatened and endangered species due to hunting • Animals maimed or mortally wounded after escaping from snares • 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 • Population decline of poached species, with broad-scale ecological impacts, including the loss or decline in seed dispersing agents like elephants and great apes, leading to forest health decline |
| <p>Establishment of permanent and semi-permanent camps, villages and towns.</p> | <ul style="list-style-type: none"> • Noise may alter animal habitats, migration patterns, or increase resource competition and territorial warfare • Increased human-wildlife conflict (great population density in the park means higher rate of human encounters with animals) • Increased human-wildlife conflict due to higher proximity • Lack of household waste management and other factors leads to ground, soil, water, air pollution • Spread of disease in humans, such as cholera and typhoid • Exposure of gorillas and chimpanzees to human diseases, such as the flu, harmful parasites and other disease stemming from sewage from mining sites • Exposure of humans to zoonotic disease due to increased animal interaction (e.g. Ebola Hemorrhagic Fever, Anthrax) |
| Larger ecosystem impacts | |
| <ul style="list-style-type: none"> • 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 | |

Several specialists have done extensive work to document and address the environmental challenges and management options of ASM.²² The precise problem is not a lack of knowledge of ASM's impacts or how to manage them from a technical standpoint. The problem is how to do so in a way that is politically feasible in a precious ecosystem. This involves hard questions involving policy, engagement, incentives, assigning resources, and which options are logistically feasible and politically palatable. It is not simply about introducing new techniques, but about constructive policies and choosing to engage. Therefore, one of the key questions guiding the research for ASM-PACE is: *What policy responses exist, and specifically, under what circumstances are these responses likely to be desirable, effective and sustainable for a wide range of stakeholders?*

²² For a comprehensive overview of known environmental issues in ASM, see Wotruba, H., Hentschel, T., Livan, K. et.al (1998 & 2002).

Known policy responses to ASM occurring in PACE

There are eight major responses to ASM in protected areas and critical ecosystems. Six seek to enable artisanal mining as a development opportunity first and take into account conservation aspects second. Two prioritise conservation over development by focusing on slowing or preventing ASM in protected areas altogether. The types of responses are:

To manage ASM in PACE:

1. **Market-based interventions** and sustainable supply chain initiatives centred on specific sites, with permanent oversight, and aimed at achieving positive social and environmental outcomes by capacity building throughout the supply chain and use of standards and certification to assure ethical performance.
2. **Negotiated/conditioned access** and voluntary agreements negotiated between governments or NGO partners and mining camps that specify environmental rules in exchange for authorized access to specific parts of protected area.
3. **Selected de-gazettement** of protected areas to allow existing artisanal mining to continue
4. **Promotion of alternative livelihoods**, via the introduction of new development /employment opportunities outside of protected areas
5. **Introduction of responsible mining methods**
6. **Introduce “Mining Mindful” conservation strategies early on in conservation planning**, such as park border considerations as well as those for specialized staffing and government-provided services.

To stop ASM in protected areas or critical ecosystems:

1. **Eviction** of artisanal miners from a protected area by force or threat of force in response to its illegality
2. **Gazetting artisanal mining sites as new protected areas**, or conferring stricter protected status to mining sites in order to secure the area and prevent future mining

See the full report’s Section 4 and Annex A for additional detail on the strategies listed above.

Key challenges affecting the feasibility of managing ASM in PACE locations

There are unique challenges to investigating and managing the occurrence of ASM in PACE that compound the typical challenges of working within the ASM sector:

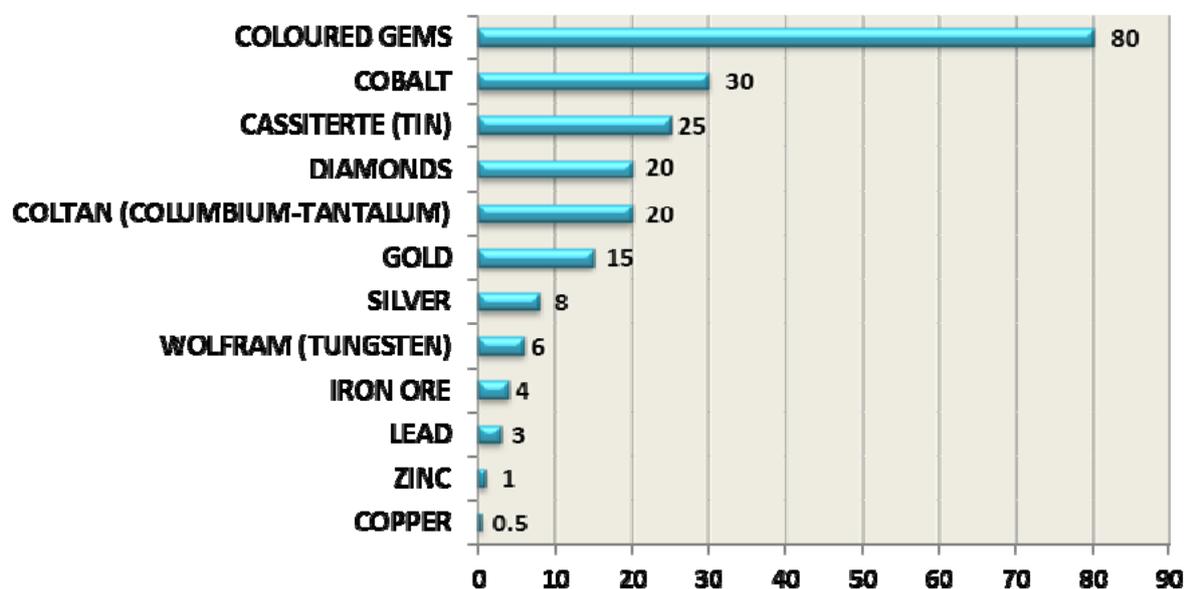
- Convincing governments and other stakeholders that engaging with miners does not signify condoning or accepting their behaviour or presence
- Some solutions might — in fact — not be possible; finding a workable solution then becomes even more challenging or requires clear prioritization backed by budgets, improved capacity and planning
- For reasons of local or national security, protected areas in remote areas and/or along international borders are sometimes perceived as sites where existing insurgents or the disaffected may gather to plan an uprising. Where this is the case, accessing these areas to investigate ASM is difficult owing to the level of politicization of the park and/or the ASM within it
- Sorting problems of conflicting mandates, particularly when mining, conservation and forestry laws directly conflict or where there is no coordination in practice
- Protected areas do not always have clear that are accepted by local communities Protected areas, due to the nature of being created to discourage or prohibit human settlement, are often areas of very little infrastructure, except in cases where the area receives a steady stream of tourists
- In the development-conservation balance, addressing threats to critical ecosystems is not among the top priorities of most governments and consequently, incursions may continue unabated by a government
- Environmental impacts of ASM may be even more severe or complex given the sensitive nature of these areas

If the goal is to preserve the flora, fauna, and ecosystem integrity of protected places, these challenges must be addressed. Without engagement and sustainable responses, uncontrolled mining will continue to chip away at the most important ecosystems on Earth.

1. INTRODUCTION

Artisanal and small-scale mining (ASM) is an important and increasingly popular livelihood for tens of millions of people around the world. Yet, while it brings in needed income for rural communities, ASM is also a serious and growing threat to biodiversity and the integrity of protected areas²³ due to the mining methods (clear-cutting forests, river dredging, frequent use of toxic chemicals) and the livelihood practices (gathering firewood, hunting for food or trade) that support mining populations. Artisanal and small-scale miners (ASM) work in more than 80 countries²⁴ and on every continent except the Antarctic. ASM produces some 10 per cent of the world's mined gold²⁵, some 15-20 per cent of mined diamonds,²⁶ approximately 20-25 per cent of mined tin and tantalum,²⁷ and a staggering 80 per cent of coloured gemstones.^{28,29} Many artisanally-mined minerals are part of developing countries' export economies, bringing in much needed foreign exchange;³⁰ others are used for the local market, for example salt, aggregates and stones. Despite their large numbers, the role artisanal miners play in the global minerals market is not always fully understood.

Figure 1: ASM share of global production (%)³¹



Since the 1990s, ASM has experienced rapid expansion from 13 million³² to at least an estimated 30 million or more miners today.³³ The increasing price of precious minerals, especially gold, has resulted in mineral rushes on every continent except Antarctica. More often than not, these rushes attract people to increasingly remote locations, including protected areas. Some examples are:

²³We are using the term "protected areas" to encompass areas of high biodiversity value and other protected areas established by national, regional or local governments (including RAMSAR sites) for at least partly biodiversity conservation.

²⁴ Telmer & Veiga, 2009

²⁵ Hruschka, F. and Echavarría C., 2011.

²⁶ KPCS, 2008

²⁷ Dorner et al, 2012

²⁸ GIA, 2011.

²⁹ Lucas, 2011

³⁰ Kramcha, 2004

³¹ Data from the German Federal Institute for GeoSciences and Natural Resources (BGR)

³² ILO 1999.

³³ Veiga, M.: Global Mercury Project. GEF/UNDP/UNIDO and in Presentations of 5th CASM ACC 2005.

- In Tanzania, Sakale village — directly upstream from the Amani Nature Reserve, a UNESCO-designated Biosphere Reserve — expanded from a few hundred miners in 2003 to a swelling gold mining hub of more than 40,000 by 2005.^{34,35}
- In Madagascar, alluvial mining for precious stones and gold occurs in and around the country’s national parks.³⁶
- In Indonesia, widespread mercury use in artisanal gold mining is contaminating waterways and causing significant habitat destruction throughout Indonesian Borneo.³⁷
- In the Philippines, thirty of the country’s 128 “key biodiversity areas” as identified by Conservation International, have been impacted by illegal artisanal gold mining.³⁸
- In Suriname, up to ten per cent of the 14,400 hectare Brownsberg Nature Park --part of the pristine Guyana Shield landscape-- has been affected by ASM. The 20,000 small-scale gold miners active in the park access the deep gold-bearing soils by first removing the area’s vegetation and top soil, and then using high pressure water jets and mercury to dislodge and consolidate the gold particles. Consequently, large quantities of mercury and soil are discharged into the environment. What remains is a desolate landscape of highly polluted, water-filled pits where a nature park used to be.³⁹



Despite its role in rural livelihoods and economic potential for rural economies, ASM remains “conspicuously absent” from Poverty Reduction Strategy Papers, likely due to its significant environmental impacts and widespread illegality.⁴⁰
 Photo credit: Estelle Levin.

At the same time, ASM alleviates poverty. In the current context of high mineral prices — especially gold, which has risen from US\$290/oz in October 2001 to US\$1,740/oz in October 2011⁴¹ and fell slightly to US\$1600/oz in

³⁴ WWF 2004

³⁵ Mwanyoka, 2005

³⁶ Cook and Healy (2012); Cushman, T. (2011, July). (R. Weinberg, Interviewer)

³⁷ Sulaiman (2007)

³⁸ Ban Toxics!, unpublished

³⁹ Versol 2007

⁴⁰ Pedro, 2005.

⁴¹ Kitco, 2011

August 2012 - ASM is a rational economic choice for people seeking to escape poverty or improve their lives: artisanal miners mine because it brings them more income and faster economic returns than other livelihoods such as agriculture or because traditional livelihood activities are becoming less viable due to climate change and other reasons. In Uganda, for example, the average miner contributes almost 20 times more to the GDP than farming, forestry or fishing.⁴² In Ecuador, an estimated 80 per cent of income artisanal and small-scale gold mining (AGSM) is retained within the national economy.⁴³ In Liberia, an artisanal digger working north of Sapo National Park has the opportunity to make 17 to 50 times more than the average Liberian per day.⁴⁴ Artisanal mining also employs many more people than industrial mining. Often ASM is part of a diverse livelihood strategy at the individual and household levels, helping build resilience and enabling families to better cope with seasonal and extraordinary stresses.⁴⁵ Of the entire global minerals industry, 90 per cent of the mining labour force is artisanal miners.⁴⁶ Women's participation varies by region but can range from 10 per cent (Asia) to 30 per cent (Latin America) to 50 per cent of miners (Africa).⁴⁷

1.1. ASM and Economic and Social Development

*"ASM is pivotal in alleviating poverty, increasing community capital and diversifying the local economy in many rural regions of the developing world, primarily because it is viable in areas with minimal infrastructure where other industries could not function. ASM can increase local purchasing power, increase demand for locally produced goods, contribute to foreign exchange earnings, reduce rural-urban migration and allow exploitation of mineral deposits unviable for larger operators. It has the potential to be a viable economic sector for developing countries. It also brings diversity into rural economies by stimulating other economic sectors such as the communications and manufacturing sectors." -- Communities and Small-scale Mining Initiative (CASM), the International Finance Corporation's Oil, Gas, and Mining Sustainable Community Development Fund (IFC CommDev) and International Council on Mining and Metals (ICMM), 2010.*⁴⁸

Particularly in light of current mineral prices — especially gold — the Artisanal Gold Council (AGC) comments that "gold can represent an excellent method of transferring wealth to rural communities: small-scale producers often get 70 per cent or more of international prices, even in remote areas. This is much higher than other products such as coffee, bananas, etc."⁴⁹

For years the international community has been commenting on ASM's potential to play an important role in economic and social development in developing and rural contexts. A 2002 UN-organised conference in Yaoundé, Cameroon emphasized through its "Yaoundé Vision"⁵⁰ that — if properly harnessed — ASM and partner institutions can contribute to the UN Millennium Development Goals (MDGs).⁵¹ For instance, strategic support and interventions in ASM could help:

- Alleviate extreme poverty (MDG 1), particularly in rural areas, recognizing that ASM is usually a poverty-driven activity in a context of few viable options
- Achieve universal primary education (MDG 2) by decreasing the involvement of children in the sector through a process of eliminating the economic benefits of child labour, substituting children's jobs with

⁴² Hilson, et al, 2007

⁴³ Sandoval, 2001 in Kramcha, 2004

⁴⁴ Small 2012.

⁴⁵ Lahiri-Dutt, 2008.

⁴⁶ Artisanal Gold Council (2012); Alliance for Responsible Mining (2010). "Fairtrade and Fairmined Gold: Information for Business and Designers".

⁴⁷ See Hinton et al (2003) and Lahiri-Dutt (2008)

⁴⁸ See "Working Together" by ICMM, CASM, IFC-CommDev, 2010.

⁴⁹ Artisanal Gold Council, 2012

⁵⁰ Marieke, H. 2005, p.82.

⁵¹ The World Bank's Community and Artisanal and Small-scale Mining (CASM) Conference of 2005 also ruminated upon the link between ASM and the MDGs in depth.

technology and making school a viable, affordable and accessible alternative to children living in ASM communities⁵²

- Promote gender equality and empower women (MDG 3) by promoting an industry in which women represent 50 per cent of the workforce, including in rural contexts
- Reduce child mortality (MDG 4) and achieve universal primary education (MDG 2) by addressing — versus ignoring — the reality of child labour on the mine sites
- Improve maternal health (MDG 5) by addressing issues such as safe handling of mercury (which negatively affects foetuses) in processing
- Combat malaria and other diseases (MDG 6) by engaging on environmental practices such as abandoned water-filled pits and poor sanitation practices
- Ensure environmental sustainability (MDG 7), by addressing the significant environmental impacts and improving water and sanitation issues in the ASM sector
- Contribute to Community Driven Development (CCD) (MDG 8) when, through the participation of a given ASM community, a list of “must haves” for development could be constructed; i.e. new technology for miners provided by the private sector; a transparent and accountable governing body and local resources available for the mining community; ASM as productive employment option for youth; etc.⁵³



Female artisanal gold miners in Cote de Ivoire. Photo credit: Estelle Levin.

Links between ASM and the first seven MDGs are strengthened with evidence of the “crucial role [ASM income plays] in the education and health expenditures of many rural communities”⁵⁴ in places like Burkina Faso, Mali and Guinea. Yet, despite international recognition of the development potential of ASM, Antonio M.A. Pedro of the United Nations Economic Commission for Africa (UNECA) notes that ASM remains “conspicuously absent” from Poverty Reduction Strategy Papers (PRSPs). ASM’s commonly cited environmental and social liabilities may explain this, as well as the fact that in the vast majority of countries where ASM occurs, it is somewhat or entirely

⁵² Jennings in CASM, 2005

⁵³ De Regt in CASM, 2005

⁵⁴ Pedro, 2005. For more on this topic, see Hilson, 2002.

illegal.⁵⁵ For an important overview of key social obstacles in ASM, see Hayes and Wagner (2008).⁵⁶ However, ASM's frequent illegality (or in some cases, just informality) and its social and environmental challenges are strongly connected. The Global Mercury Project — a United Nations-backed initiative to address mercury use in the ASM sector — comments:

"Whereas some countries choose to ignore the existence of [artisanal mining] activities, others lack adequate legal frameworks to regulate them. The lack of technical know-how, access to credit facilities, and [government-provided] technical support coupled with poor organizational structures means that miners are unable to invest in technology and hence cannot improve their working methods. This results in negative environmental impacts, low productivity and hence earnings and the vicious circle continues." – Global Mercury Project, 2002.

Thus, while ASM provides numerous economic benefits, its significant negative environmental and social impacts are made worse with a lack of government support to the sector.

Perhaps not surprisingly, many governments have chosen to ignore or even criminalize the ASM sector, or 'industrialize it away', favouring 'large-scale' mining interests (which can have significant environmental impacts too if they are not effectively regulated and monitored).⁵⁷ These policy approaches can further marginalize a sector that in many cases drives significant – albeit frequently informal – development gains for individuals, communities and wider regional economies.⁵⁸ In addition, there are viable ways and opportunities to support both types of mining, such as creating incentives — including the streamlining of procedures — that would lead to private investment in the ASM sector.⁵⁹

Some governments choose to exclusively focus on developing the LSM sector because it is easier to regulate and benefit a small number of larger entities than many small ones. This is particularly true for governments with weak institutional capacity. In addition, LSM produces a more predictable flow of income to governments that are desperately seeking revenue. From an economic perspective, the convincing economic development case for an exclusive focus on LSM has yet to be made, particularly in terms of job creation and comparable local economic development outcomes. Indeed, in a briefing paper⁶⁰ as part of the World Bank's 2004 Extractive Industries Review, Luke Danielson, Former Director of the Mining Minerals and Sustainable Development Project, commented that: "The great majority of the people who earn their livings from the minerals sector do not work for large private multinationals. Many of them work for medium scale local private companies or state owned enterprises. The majority (perhaps 15,000,000 people supporting close to 100,000,000 family members) are in artisanal and small scale mining (ASM)."⁶¹ "When properly funded, real advances can be made. ASM can be transformed into a safe and viable livelihood for communities" states Maria Laura Barreto, chairperson of the Alliance for Responsible Mining.⁶²

This stated, in the vast majority of contexts ASM is a still largely under-realized economic development opportunity. In addition, like its industrial mining counterparts, it is an economic sector that requires regulations, economic incentives, and enforcement. Left ignored or unchecked, the increasing popularity of ASM and its drift into protected areas will further deteriorate and could eventually destroy ecosystems. These same ecosystems play a decisive role in preserving biodiversity, combating climate change, and supporting local and global ecological resilience. Thus, recognizing ASM's potential, a larger question is posed: *How can one harness this economic potential of ASM, whilst achieving social and environmental gains too?*

⁵⁵ CASM, 2005

⁵⁶ Hayes & Wagner, 2008.

⁵⁷ Large-scale mining (LSM) or industrial mining in critical ecosystems is not the focus of this report, however, for a summary of the social and environmental issues relating to LSM operations, see No Dirty Gold (2007). For a report on LSM incursion into protected areas—including World Heritage Sites—see No Dirty Gold's (n.d.) *Mining the Parks*.

⁵⁸ Van Bockstael and Vlassenroot, 2011.

⁵⁹ See also "Working Together" by on how LSM and ASM can be complementary in practice, even on the same sites. ICMM, CASM, IFC-CommDev (n.d.).

⁶⁰ Danielson, Luke. (2004)

⁶¹ He also commented that the downstream parts of the minerals industry is often overlooked yet can "sometimes offer more potential for sustainable development than mining. Refining, fabricating products, and materials recovery and recycling may be overlooked in the focus on mining."

⁶² Remarks by Maria Laura Barreto of the Alliance for Responsible Mining at the ARM-Maplecroft Gold Dialogue, London, UK, December 2011. Quoted with permission.

1.2. ASM-PACE Programme Approach and the Purpose of this Report

While ASM practices are on the rise around the world, most notably within protected areas, up until 2010 no coordinated or systematic effort existed to curb its distressing environmental impacts in critical conservation zones. To fill this void, WWF and Estelle Levin Ltd. have partnered to produce concrete improvements in critical ecosystems by reducing the ecological and social damage caused by ASM, whilst building on its economic, social, and empowerment potential.

The Artisanal and Small-scale Mining in Protected Areas and Critical Ecosystems (ASM-PACE) programme uses a scientific foundation of knowledge and participatory methods to work with — rather than in opposition to — miners and their communities to design sustainable, win-win solutions. To this end, ASM-PACE comprises a four part programme that starts with a Global Solutions Study to understand the scale and scope of the phenomena. In order to determine key opportunities for managing ASM in critical ecosystems, this Study will examine past interventions to manage or eradicate PACE and lessons learned (such as characteristics of successful and failed approaches).

The report authors provide background on the current issues in the ASM sector that are important to consider and that were uncovered as part of the global scoping research. This report does not, however, seek to provide a comprehensive overview of ASM around the world. Such a report would require significantly more resources and such work has capably been done already.⁶³ Instead, this report focuses *exclusively* on the particularities of the threat and opportunity posed by ASM occurring in protected areas and critical ecosystems to people and the environment.

Therefore, the aim of this report is to:

- Briefly introduce the contextual issues (Section 1)
- Report, based on a review of 36 countries, the scope and scale of ASM in protected areas and critical ecosystems worldwide and document a few of its most common environmental impacts (Section 2)
- Document 'push and pull' factors contributing to the problem (Section 3)
- Document and study attempted solutions to address ASM in PACE (Section 4)
- Via the review of attempts to manage ASM in PACE, offer a series of recommendations for action (Section 5)

1.3. Methodology

As a scoping study, the intention was for this report to get a “snapshot” of the global situation by examining 36 out of the (at least) 80 countries⁶⁴ where ASM is known to exist. Based on an initial scoping in 2010, the chosen countries: had existing evidence of ASM in relevant ecosystems; ASM sectors were already well studied or are the subject of a significant donor or NGO programme; and/or offered a unique and important ecosystem that merited consideration (e.g. Greenland). In addition to the countries studied in this phase which merit deeper attention, there are 44 countries where, if funds become available, ASM-PACE wishes to scope for the occurrence of ASM in PACE in order to complete its global scoping study.

⁶³ See Hentschel, T., Hruschka, F. and Michael Priester 2002 and 2004; Hruschka, F. and Echavarría, C. 2011; MMSD (2004) Breaking New Ground, Chapter 13; Kramcha, S. (2004).

⁶⁴ These include Australia, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, CAR, Chad, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Dominican Republic, DRC, Ecuador, Ethiopia, French Guiana (France), Gambia, Gabon, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, India, Indonesia, Kenya, Kyrgyzstan, Laos, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Mongolia, Mozambique, Myanmar, Nicaragua, Niger, Nigeria, Panama, Papua New Guinea, Peru, Philippines, Russia, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Suriname, Tanzania, Tajikistan, Thailand, Togo, Uganda, USA, Uzbekistan, Venezuela, Vietnam, Zambia, Zimbabwe. (Telmer & Veiga, 2009); Also: Afghanistan, Angola, Greenland (Denmark), Iran, Morocco, Namibia, Pakistan, Republic of Congo, South Sudan, Sri Lanka, and Turkey.

Table 1: Countries which were studied in the global scoping.

| | Africa | Americas | Eurasia | Australasia |
|---|--|--------------------|----------------|--------------------|
| Included in this phase of the Global Solutions Study | Burkina Faso | Bolivia | Afghanistan | Cambodia |
| | Burundi | Brazil | Greenland | China |
| | Cameroon | Colombia | | Indonesia |
| | CAR | Ecuador | | Laos |
| | DRC | French Guiana | | Philippines |
| | Ghana | Peru | | Papa New Guinea |
| | Guinea | Suriname | | Vietnam |
| | Liberia | Venezuela | | |
| | Madagascar | | | |
| | Mozambique | | | |
| | Namibia | | | |
| | Nigeria | | | |
| | Rwanda | | | |
| | Senegal | | | |
| | Sierra Leone | | | |
| | Tanzania | | | |
| | Uganda | | | |
| | Zambia | | | |
| | Zimbabwe | | | |
| | Next phase (funding permitting) | Angola | Argentina | India |
| Benin | | Canada | Iran | Malaysia |
| Botswana | | Chile | Kyrgyzstan | Myanmar |
| Chad | | Costa Rica | Pakistan | Nepal |
| Gambia | | Dominican Republic | Russia | Sri Lanka |
| Guinea-Bissau | | Guatemala | Tajikistan | Thailand |
| Ivory Coast | | Guyana | Turkey | |
| Kenya | | Honduras | Uzbekistan | |
| Lesotho | | Mexico | | |
| Malawi | | Nicaragua | | |
| Mali | | Panama | | |
| Mauritania | | USA | | |
| Morocco | | | | |
| Niger | | | | |
| Republic of Congo | | | | |
| South Africa | | | | |
| South Sudan | | | | |
| Sudan | | | | |
| Togo | | | | |

More than half of the countries examined in this study are in Sub-Saharan Africa, in part because over 50 per cent of the countries in the world that engage in ASM are located in Africa.

Figure 2 and 3: Geographic Foci of the Global Solutions Study (GSS)

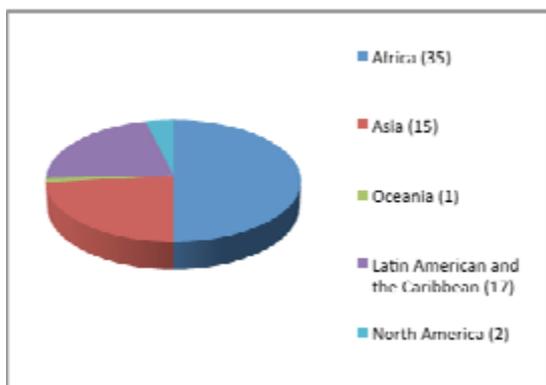


Figure 2: ASM Prevalence world-wide

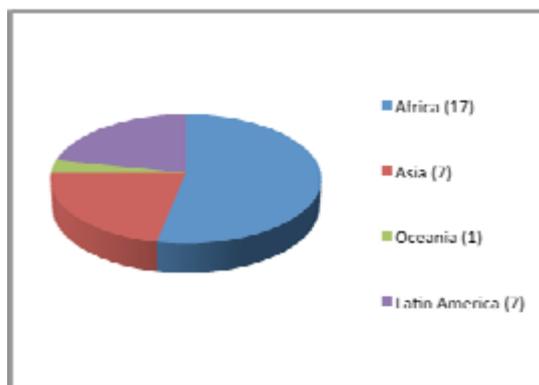


Figure 3: Countries studied in the GSS

The majority of the analysis involved desk-based research using publicly available documents, such as academic articles and books, development agency reports, NGO publications and statistics, news articles, consultancy reports, as well as government statutes and laws. In addition, where relevant ASM experts, country specialists, or organizations operating in the geographic area of interest were identifiable, researchers made every effort to engage them and solicit their expertise.⁶⁵ For the desk-based studies, research was limited by the following factors: (1) A very short period of time (up to 1 day per country) allocated for gathering a wide array of information from various experts who were often away during the summer holidays; (2) Delayed replies from experts for data; general lack of recent or detailed data — particularly with respect to ASM activities within and around protected areas; (3) Data are time-bound (often just a snapshot in time) and therefore lack strong external validity; and (4) ASM activities in protected areas are especially dynamic due to their usually-illegal nature. Given these constraints, much of the research is top-level and indicative.

A few case studies — the Democratic Republic of the Congo (DRC), Gabon, Liberia, Madagascar, and Sierra Leone — utilized in-country researchers, but this was not possible for the majority of the study. In Gabon and Liberia, unexpected evictions of artisanal mining communities by the government were also a significant constraint, creating delays and requiring new field sites to be selected. However, the evictions — and the ensuing controversy— also highlighted the critical need for new strategies to effectively manage ASM within protected areas. In the DRC, internet and telephone network outages further interfered with research, as did the level of politicization of both the minerals and conservation issues in this country, which contributed to stakeholders being tentative and occasionally unwilling to talk about the issues. This is a critical lesson for further work in DRC or in any country with the same level of international attention to these issues. Additional qualitative or quantitative information on specific sites is welcomed by the report authors to help update our database and deepen their understanding of a situation. Please contact ASM-PACE through its website, www.asm-pace.org, to contribute relevant research or data.

1.4. Important Definitions and Distinctions

“Artisanal and Small-scale Mining”

Surprisingly to some, there is a lack of consensus on the precise definition of “Artisanal and Small-scale Mining” (ASM). For the purposes of this study, however, ASM-PACE defines ASM as: Mineral extraction characterised by low levels of mechanisation and capitalisation and high labour intensity. It is usually done by local miners for the purpose of creating local livelihoods or subsistence or as small businesses, or at group or individual level. It is often done in the pursuit of creation of (self-)employment and often in conditions of informality. Within this report, the authors will be specific to note where ASM is occurring with more advanced mechanisation.

⁶⁵ Please see the acknowledgements for people who kindly offered their expertise to aid our investigations.

There are four main types of ASM:

- *Permanent ASM* – This refers to ASM as a full time, year round activity. Mining is frequently the primary economic activity for the community and is sometimes accompanied by other activities like farming or herding.⁶⁶ Example: The mining occurring on the outskirts of Sapu National Park is permanent because it happens year-round and is the primary occupation for the majority of the diggers and miners.
- *Seasonal ASM* – This refers to ASM taking place during specific times of the year due to seasonal alternating of activities or seasonal migration of people into artisanal mining areas.⁶⁷ For example: In some parts of Africa, farmers mine during idle agricultural periods to supplement their annual incomes. Note: It is possible to have a situation of both permanent and seasonal ASM. For example, farmers or students can join permanent ASM sites during specific periods of the year when they are available and/or need income. For students, this might be in their holiday period to make money for tuition payments. For others, this might be to make extra money for the Christmas holiday.
- *Rush-ASM or “rush mining”* – This refers to massive migrations of artisanal and small-scale miners to an ASM site based on the perception that the expected income opportunity from recently discovered deposits far exceed the current actual income of the people who are lured into it.⁶⁸ For example: In Madagascar, migratory rush-mining is common. In this context, tens of thousands of people descend on a specific site at a time based on rumours of a new sapphire or gold discovery.
- *Shock-push ASM* – This refers to when ASM is a poverty driven activity emerging after recent loss of employment in other sectors, conflicts or natural disasters.⁶⁹ For example: In a situation of economic collapse of a state or sudden displacement due to civil war, people may turn to ASM because it gives them immediate cash with very low barriers to entry. ASM offers them income in an otherwise desperate situation with few if any realistic alternatives (e.g. Zimbabwe).

“Miners” and “Diggers”

In the context of this report, the term ‘miner’ refers to any person involved in artisanal and small-scale mining.⁷⁰ However, there is an important distinction between these terms on the ground. Particularly in African contexts, “miner” usually refers to the legal license holder of the artisanal mining concession or the mine manager (foreman), and “digger” typically refers to the person who does the physical labour to recover the mineral and is either employed by the miner or works informally as an individual or in small gangs.

“Critical Ecosystem”

The report authors recognize that some Protected Areas have little conservation value in actual fact whereas other unprotected sites could be judged as having high conservation value. The ultimate aim of ASM-PACE is to consider how to navigate the conservation/development trade-off which is produced by ASM in high-conservation-value sites. For these reasons, researchers limited their research to ASM in protected areas and ecosystems they judged to be “critical.” ASM-PACE defines protected areas as areas of high biodiversity value protected for the sake of biodiversity conservation either under international conventions (e.g. IUCN-designated sites, RAMSAR sites, Areas of Zero Extinction) or by national, regional or local governments at least partly for the purpose of biodiversity conservation (e.g. nature reserves or national parks). Different notions exist of how to decide which of the world’s ecosystems should be considered ‘critical’, but for the purpose of setting reasonable research parameters given the constraints of the study, ASM-PACE defines ecosystems as ‘protected’ or ‘critical’ and therefore eligible for inclusion in this study based on the following criteria:

⁶⁶ Weber-Fahr et al (2002)

⁶⁷ Weber-Fahr et al (2002)

⁶⁸ Weber-Fahr et al (2002)

⁶⁹ Weber-Fahr et al (2002)

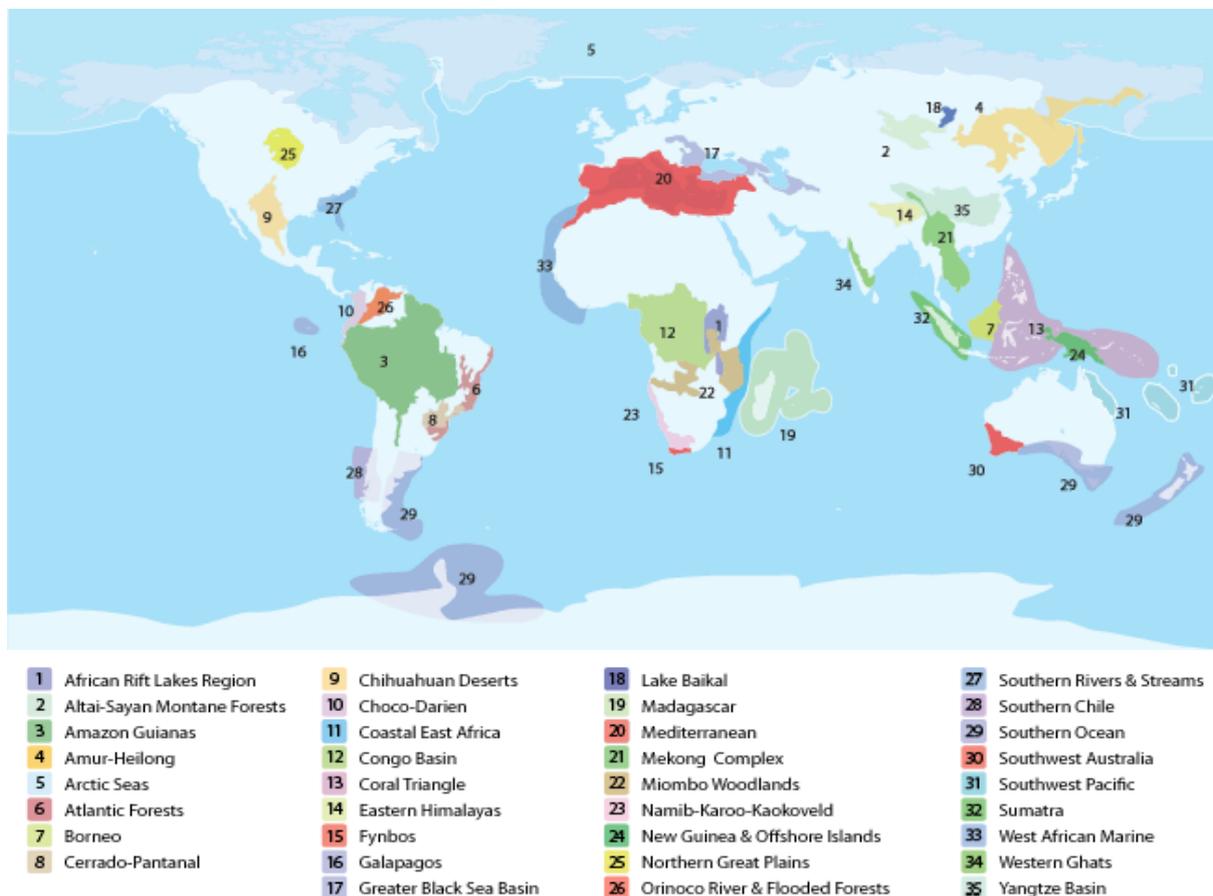
⁷⁰ ARM-FLO definition

Table 2: Priority ecosystems included in this study

| | |
|---|--|
| <p>HIGHEST PRIORITY:</p> <p>Areas of Zero Extinction (AZE)</p> <p><i>and</i></p> <p>World Heritage Sites (WHS)</p> | <p>The ASM is happening in, on the border of, or upstream from, Areas of Zero Extinction (AZE), of which there are only 587 in the world. AZE are the only sites in the world in which an Endangered or Critically Endangered species of mammal, bird, amphibian, reptile, conifer or reef-building coral is known to reside.</p> <p>World Heritage Sites are those nominated by governments and selected by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as “considered to be of outstanding value to humanity.”⁷¹ It may contain the natural habitats of endangered wildlife or possess exceptional natural beauty. When a WHS is under serious threat, it may be listed on the “List of World Heritage Sites in Danger”, which comes with additional international assistance.</p> |
| <p>HIGH PRIORITY</p> <p>International Union for the Conservation of Nature (IUCN) Categories I to IV</p> <p><i>and</i></p> <p>RAMSAR sites</p> | <p>The ASM is happening in, on the border of, or upstream from a protected area which either: falls under Categories I to IV of the definitions set by the International Union for the Conservation of Nature (IUCN) or is listed as a RAMSAR sites due to it being a Wetlands of International Importance.</p> <p>IUCN Categories I to IV:</p> <p>Nature Reserve (IUCN Category Ia): An area devoted primarily to the preservation of conservation, scientific research and monitoring, where human impacts are limited as much as possible.</p> <p>National Park (IUCN Category II): “large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, education, recreational and visitor opportunities.”</p> <p>Natural Monument or Feature (IUCN Category III): “generally centered on a particular natural feature, so that the primary focus of management is on maintaining this feature.”</p> <p>Hunting domains, wildlife reserves, marine parks and integral reserves (IUCN Category IV): “conserving ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.”</p> |

⁷¹ UNESCO (n.d)

| | |
|--|--|
| <p>MID-PRIORITY</p> <p>IUCN Categories V and VI <i>and</i></p> <p>WWF Priority Place not within the boundaries of a protected area:</p> | <p>The ASM is happening in, on the border of, or upstream from a protected area which falls under Categories V to VI of the definitions set by the International Union for the Conservation of Nature (IUCN).</p> <p>Or, the site affected is not within the boundaries of a protected area, but is located within a WWF Priority Place. See Figure 2 for a map of WWF's Priority Places.</p> <p>IUCN Categories V and VI: These are protected landscapes/seascapes and managed resource protected areas, respectively. It may be possible under IUCN guidance to allow mining in these two categories.⁷²</p> |
| <p>PRIORITY</p> <p>Global 200 Priority Ecoregions:</p> | <p>The site affected is neither a protected area nor a WWF Priority Landscape, but is in one of the Global 200 Priority Ecoregions as described by Olson and Dinerstein, 2002.</p> |
| <p>NOT ELIGIBLE:</p> | <p>The ecosystem is not in a protected area, a WWF Priority Landscape nor a Global 200 Priority Ecoregion.</p> |



⁷² At the World Conservation Congress in Amman, Jordan in October 2000, IUCN's members adopted a recommendation pertaining to these categories: "in categories V and VI, exploration and localized extraction would be accepted only where the nature and extent of the proposed activities of the mining project indicate the compatibility of the project activities with the objectives of the protected areas". IUCN (n.d.) The IUCN comments: "This is a recommendation and not in any way binding on governments; some currently do ban mining in categories I-IV protected areas and others do not." Mining in categories I-IV was expressly barred. (IUCN, n.d.)

⁷³ WWF, 2011

2. THE STATE OF ASM IN PACE

2.1. Scope and Scale of ASM in Protected Areas and Critical Ecosystems Worldwide

In 2011 and 2012, the ASM-PACE programme completed a rapid scoping study of 36 countries to examine the issue of ASM in protected areas and critical ecosystems (PACE) contexts. Research revealed the following:

- ASM is occurring in 32 of 36 countries studied and in or around 96 of 147 protected areas evaluated⁷⁴
- Affected sites include at least seven natural World Heritage Sites. (See Table 3 below)
- ASM is taking place in at least 12 WWF Priority Landscapes
- Gold, silver, diamonds, rubies, sapphires, emeralds, quartz, aquamarine, tourmaline, amethyst, emerald, morganite, rose quartz, copper, phosphates, coal, iron ore, cassiterite (tin), wolfram (tungsten), coltan (columbium-tantalum) and other metallic minerals, gypsum, salt, limestone, marble, stone aggregate, clay and sand, are all amongst the minerals being mined artisanally in or adjacent to protected areas or critical ecosystems
- ASM is occurring in or impacting a wide range of critical ecosystems, including arctic landscapes (Greenland), tropical rainforests (Brazil and Gabon, among many others), coral reefs (Philippines)

On a global scale, ASM of gold is the biggest “problem” in terms of negative environmental impacts; however other minerals have significant localized impacts within specific ecoregions or countries: e.g. tin, tantalum and tungsten in the DRC; coloured gemstones in Madagascar; and diamonds in West Africa.

Table 3: A selection of just a few of the internationally-recognised conservation sites found to be affected by ASM

| Total # | Type of site affected | Location |
|---------|-----------------------|---|
| 7 [10] | World Heritage Sites | <ul style="list-style-type: none"> • Kahuzi-Biega National Park (DRC) • Okapi Wildlife Reserve (DRC) • Virunga National Park (DRC) • Garamba National Park (DRC) • Salonga National Park (DRC) • Lorentz National Park (Indonesia) • Niokolo-Koba National Park (Senegal) <p><i>Possible (more research required):</i></p> <ul style="list-style-type: none"> • Manú National Park (Peru) • Serengeti National Park (Tanzania) • Selous Game Reserve (Tanzania) |

⁷⁴ Researchers found evidence of active ASM in protected areas and critical ecosystems in 32 of the 40 countries studied. Only one—Nigeria—was found not to have artisanal miners active in PACE areas. In seven countries the data was either not available to desk-based researchers or inconclusive.

| | | |
|----|---|---|
| 8 | RAMSAR sites | <ul style="list-style-type: none"> • Pantanal Matogrossense (Brazil) • Niassa National Reserve (Mozambique) • Lago Titicaca (Peru) • Sango Bay-Musambwa Island-Kagera (Uganda) • Albertine Rift Valley/Lake George (Uganda) • Lutembe Bay (Uganda) • Mabamba Bay Wetland System (Uganda) • Heden (Greenland) |
| 12 | WWF Priority Landscapes and Eco-regions 12 [13] | <ul style="list-style-type: none"> • Amazon-Guianas • African Rift Lakes Region • Borneo (Indonesian) • Cerrado-Pantanal • Choco-Darien • Congo Basin • Coral Triangle • Madagascar • Mekong Complex • Namib-Karoo-Kaokoveld • New Guinea and offshore islands • Orinoco River and Flooded forests • <i>Yagtze Basin [more information required]</i> |
| 22 | Global 200 Priority Landscapes | <ul style="list-style-type: none"> • Nuristan National Park (Afghanistan) • Southwest Amazon moist forests (Bolivia) • Madeira-Tapajós moist forests • Pantanal Flooded Savannas (Bolivia) • High Andean Lakes (Bolivia) • Shield Amazonian Rivers & Streams (Bolivia) • Rio Negro-Jurua Moist Forests (Brazil) • Amazon River & Flooded Forests (Brazil) • Southwestern Amazonian Moist Forests (Brazil) • Upper Amazon Rivers & Streams (Brazil) • Brazilian Shield Amazonian Rivers & Streams (Brazil) • Guianan Freshwater (Brazil) • Pantanal (Brazil) • Upper Parana Rivers & Streams (Brazil) • Cerrado woodlands and savannas (Brazil) • Eastern Cordillera real montane forest (Ecuador) • Gulf of Guayaquil-Tumbes mangroves (Ecuador) • Sapo National Park (Liberia) • Gola [proposed] National Park (Liberia) • Gola National Forest (Sierra Leone) • Outamba Kilimi National Park (Sierra Leone) • Brownsberg Nature Park (Suriname) |

2.2. Critical Ecological Impacts

The most common environmental impacts associated with artisanal mining can be organized as follows in Table 4.



As pictured above: Deforested area due to an artisanal rush for green garnet/demantoids in Antetazambato, Madagascar.
Photo credit: R. Cook and T. Healy.

Table 4: Reported Impacts of ASM activities in Protected Areas and Critical Ecosystem (PACE) locations.

| ASM ACTIVITY | OBSERVED or ANTICIPATED ECOLOGICAL IMPACT |
|--|--|
| <p>Clearing vegetation, and harvesting timber and non-timber forest products:</p> <ul style="list-style-type: none"> • Gathering wood for camp or mineshaft construction • Clearing vegetation to expose substrate for mining • Firewood collection for warmth and cooking in camps • Bark removal to make pans for washing minerals • Cutting specific plants to make carrying baskets or for medicinal purposes | <p>Food sources are diminished. E.g., in the case of apes, this includes fruit trees and terrestrial herbaceous vegetation</p> <ul style="list-style-type: none"> • 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 • Secondary impacts from erosion, including sedimentation and siltation (see below) • Behaviour modification. For example, in Sapo National Park, cleared spaces found to act as sites for congregation of elephants • Extensive use of tracks both on foot and by cars lead to additional habitat loss, migration range disruption and increased vulnerability to commercial bushmeat trade • Important non-timber forest products used in food preparation and house construction |
| <p>Physical removal of soil and rock to access the deposit:</p> <ul style="list-style-type: none"> • Use of high power hoses or medium and large-size backhoes and dredges to remove topsoil or the top layer of sand and clay • Use of spades and other manual tools to remove soil | <ul style="list-style-type: none"> • Increased vulnerability of affected areas to erosion • Reduced capacity of the area for recovery of the native ecosystem • Creation of ecologic niches for non-native vegetation • Release and dispersal of corrosive dusts • Exposure of mineralized rocks, soils and tailings leading to oxidization of sulphide minerals and the subsequent release of toxic metal ions (known as ARD - “acid rock drainage”). ARD can impact groundwater and surface water quality • Air-borne or water-borne toxic substances can detrimentally impact soils, water quality, vegetation and human health • Destruction of riverbanks and riverbeds impact hydrological systems and aquatic ecology. |
| <p>Mining in or near rivers and streams:</p> <ul style="list-style-type: none"> • Increased release of silt during the washing and panning process • Diversion of waterways to access mineralized deposits on the riverbed or to obtain water needed for washing • Use of pumps to remove water when digging below the water table • Direct dumping of waste, tailings and effluents in waterways | <ul style="list-style-type: none"> • Siltation reduces light penetration into water bodies, causing reduced photosynthesis in aquatic plants, depleting oxygen levels in the water and clogging of the gills of fish; all consequences kill aquatic life • Increased turbidity due to siltation can reduce water quality by creating favourable conditions for harmful microbes • Direct (tailing, diesel from pumps) and indirect (turbidity) pollution of human and animal drinking water sources • Sedimentation can lead to loss of refuges and spawning grounds for fish |

| | |
|--|--|
| <ul style="list-style-type: none"> • Removal/disruption of riverbeds and riverbanks because of intensive scooping, dredging, or vacuuming • Digging in river banks • Unmanaged release of tailings into waterways through erosion | <ul style="list-style-type: none"> • 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 • Reconfiguration of hydrological systems in one area through widening and/or dredging can affect hydrology downstream; e.g. through sedimentation and filling of dam reservoirs, disappearance of marshland and wild bird habitats, increased risk of flash floods • Loss and degradation of aquatic herbaceous vegetation through riverbank impacts |
| <p>Lack of backfilling when digging pits in search of gold or other minerals.</p> | <ul style="list-style-type: none"> • Stagnant pools of water in mining pits are breeding grounds for malaria-carrying mosquitoes and water-borne diseases • Abandoned pits pose a risk of injury and drowning to children and animals, including livestock and endangered species • Previously mined sites are often unusable for agriculture, forcing people into other habitats to serve their needs • Aesthetics are affected by creating 'moonscapes' • Lack of backfilling aggravates the negative effects of erosion by making topsoil reconstruction very difficult • Issues around re-establishment of original vegetation |
| <p>Use of toxic chemicals in gold processing:</p> <ul style="list-style-type: none"> • Use of cyanide • Use of mercury, especially vaporization and release into waterways | <ul style="list-style-type: none"> • Risk of 'dead zones' and localized death of animals (including birds and fish) exposed to unmanaged cyanide releases • Exposure of humans and animal species to mercury emissions into air or water • Bioaccumulation of Hg up the food chain, especially in carnivorous fish consumed by local and distant populations • Pollution of drinking water for humans and animal species |
| Ancillary / support services | |
| <p>Hunting of animals for bushmeat to feed miners and their families, and to sell in local markets:</p> <ul style="list-style-type: none"> • Opportunistic and deliberate poaching of endangered species for trade | <ul style="list-style-type: none"> • Population decline of critically threatened and endangered species due to hunting • Animals maimed or mortally wounded after escaping from snares • 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 • Population decline of poached species, with broad-scale ecological impacts, including the loss or decline in seed dispersing agents like elephants and great apes, leading to forest health decline |
| <p>Establishment of permanent and semi-permanent camps, villages and towns.</p> | <ul style="list-style-type: none"> • Noise may alter animal habitats, migration patterns, or increase resource competition and territorial warfare • Increased human-wildlife conflict (great population density |

| | |
|--|---|
| | <p>in the park means higher rate of human encounters with animals)</p> <ul style="list-style-type: none"> • Increased human-wildlife conflict due to higher proximity • Lack of household waste management and other factors leads to ground, soil, water, air pollution • Spread of disease in humans, such as cholera and typhoid • Exposure of gorillas and chimpanzees to human diseases, such as the flu, harmful parasites and other disease stemming from sewage from mining sites • Exposure of humans to zoonotic disease due to increased animal interaction (e.g. Ebola Hemorrhagic Fever, Anthrax) |
| Larger ecosystem impacts | |
| <ul style="list-style-type: none"> • 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 | |

The most commonly-reported environmental impact of ASM involves the clearance of vegetation (frequently tropical forest) to enable access to the mineral deposits. For example, in alluvial gold mining, diggers clear trees before they create pits by removing the overburden to reach the gold-bearing sand beneath. The effects of deforestation during this process can be major: shrinking or materially changing habitats for threatened species; changing migration patterns; topsoil destabilization and destruction; interrupting natural hydrology causing increased flooding, erosion, and landslides. Shrinking habitat can have a profound impact upon animal species. For example, in the case of great apes, reduced habitat from deforestation or human incursion via 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. In this case, this can result in increased chances of infanticide among eastern gorillas and territorial warfare in chimpanzees.⁷⁵ It can also lead to increased human-wildlife conflict, exposure of gorillas and chimpanzees to human diseases, such as the flu, harmful parasites and other disease stemming from sewage from mining sites,⁷⁶ and exposure of humans to zoonotic diseases due to increased animal interaction (e.g. Ebola Hemorrhagic Fever or Anthrax).⁷⁷

⁷⁵ Personal communication between A Awolowo and T. DeJong in July 2012

⁷⁶ Personal communication between A. Awolowo and D. Greer, WWF Apes specialist in August 2012.

⁷⁷ Personal communication between A. Awolowo and D. Greer, WWF Apes specialist in August 2012.



As pictured: Terracing in small-scale gold mining in the buffer zone of Minkebe National Park in Gabon. Pit depths of over 40 metres have been recorded in Minkébé mining area. Photo credit: Koumbi, 2009

The second most frequently-cited environmental impact of ASM in critical ecosystems are particularly associated with semi-mechanical techniques in gold and diamond ASM that involve the use of dredges, high-pressure water monitors and suction gravel pumps to remove top-soil and overburden or dislodge sediments from riverbeds and riverbanks. For example:

- In Brazil's Tapajos Garimpo, in the state of Para, miners use small balsa dredges or larger industrial dredges (dragas) to extract the gravel at the bottom of riverbeds or in artificial ponds by suction pumps. At hillside locations, riverbanks or at any gold-bearing gravel layer above groundwater level (barrancos), soil and sub-soil are literally "hosed away" using high-pressure water nozzles.
- In Indonesia's Tanjung Puting National Park in central Kalimantan (Indonesian Borneo), most of the rivers in the park are gold bearing and are constantly being dredged. There are four or five major rivers in the park where this dredging takes place, each with 100-500 dredgers. The dredging results in a widening of the rivers' edges and siltation, which deteriorates the water quality. The siltation causes the water to be depleted of oxygen, which in turn kills much of the aquatic life.⁷⁸ In the surrounding area and broader region of central Kalimantan, any given river can have up to 2,000 dredgers.⁷⁹

⁷⁸ Agrawal, personal communication with Weinberg, July 2011

⁷⁹ Agrawal, personal communication with Weinberg, July 2011



As pictured: Artisanal rush site for gold in 2012 in Soamahamanina, Madagascar. WWF considers the entirety of Madagascar a WWF Priority Place. It is one of twelve known to be impacted by ASM.

A third frequently-cited major environmental impact of ASM in PACE comes from mercury use in artisanal and small-scale gold mining (ASGM). At many ASGM sites, mercury is used to process the gold ore by amalgamation: gold bearing sand, gravel or milled rocks are mixed with mercury, whereby the liquid metal mercury captures the gold particles in form of an amalgam (a mercury-metal alloy). Subsequently, the amalgam and any residual mercury are separated from the sands. In a last step the amalgam is decomposed (e.g. by heat to evaporate the mercury) and the final product gold is ready. Until its replacement by cyanide leaching at the beginning of the 20th century, amalgamation was the “state of the art” technology for industrial processing of gold and silver ores. Today, amalgamation is still widely in use by artisanal gold miners worldwide, due to its efficiency, short operation cycle, low investment requirements and low operating costs; without this process many miners would not be able to extract the gold and make a living from ASGM.⁸⁰ Mercury use in ASGM has been recorded in seventy countries.⁸¹ Mercury poisoning can have devastating consequences on human health⁸² and the environment, including on critical ecosystems.

While it depends on the context and methods in place, generally for every one gram of gold produced, approximately one to three grams of mercury is released into the environment; the ratio depends on the

⁸⁰ Hruschka F., Echavarría C., 2011

⁸¹ The top mercury-emitting countries are China, Indonesia and Colombia and global ASGM emissions are estimated at 1000 tonnes. (See Blacksmith Institute/ Green Cross Switzerland). On a per capita basis, a 2010 study lists Colombia as the top mercury polluter in the world per capita from artisanal gold mining. See Veiga 2010.

⁸² With regard to human health, mercury enters the human body in a number of ways, the most common of which for miners are by inhaling mercury (Hg) vapours during the amalgam decomposition process. For people living in adjacent and even distant communities, ingestion of mercury contaminated food (particularly food subject to bioaccumulation of methylmercury, such as fish) represents the main health risk. Known impacts on human health by chronic mercury poisoning include the development of neurological problems, damage central and peripheral nervous systems, behavioural disorders, tremors, and damage to developing foetuses, among many other serious problems. Similar impacts affect all mammals; “Minamata disease” by methylmercury intoxication can be diagnosed in humans and in animals alike. Even in low doses, methylmercury (MeHg) exposure through dietary sources can have dangerous and significant health effects for women of child-bearing age and children. Source: Personal communication between C. Villegas with F. Hruschka. See also UNEP 2008a and UNEP 2008b.

processing techniques and economic factors.⁸³ Mercury losses occur as emissions into waterbodies during the phase of amalgam composition (bringing the mineral in contact with liquid mercury) and as emissions into the atmosphere during amalgam de-composition (separating mercury from the gold, e.g. by burning off the mercury). Aerial emissions from amalgam burning affect in the first instance the miners themselves; when amalgam burning is done in homes, the entire family; and when amalgam burning is done extensively in gold shops, the entire village. However, through condensation of mercury vapour soils become contaminated and rain can transport the condensed mercury into water bodies.

Mercury in water bodies (where it often ends up) represents a particularly outstanding risk. Under appropriate circumstances bacteria will convert metallic mercury into the organic chemical compound “methylmercury”, which is even more toxic than metallic mercury. Tropic climates are particularly susceptible for this biochemical process. Methylmercury is then bio-accumulated in the aquatic food chain, from bacteria, to micro-organisms, and to carnivorous fish — and further to humans and animals feeding from fish.^{84, 85}

Why do artisanal gold miners use mercury?

According to the Artisanal Gold Council, artisanal gold miners use mercury for the following reasons:⁸⁶

- Quick and easy
- Independent - it can be used by one person independently
- Extracts gold in most field conditions
- Cheaper than most alternative techniques
- Facilitates precise transactions and divides profits – between labourers and owners for example
- Miners are not aware of the risks; those who are aware often do not have access to the capacity or capital required for alternatives
- No choice (boss’s instructions)
- It is one method that permits custom processing of small individual ore batches — often an important socioeconomic structure.

In terms of ecosystem health, the Global Mercury Project comments that “the key concerns here are the direct release of mercury into water bodies, its accumulation and subsequent methylation to organomercury and hence transfer into the food chain through the aquatic ecosystem.”⁸⁷ A 2008 United Nations Environment Programme (UNEP) report outlines the known issues of mercury accumulation in remote ecosystems. These include:

- High levels of mercury in the flesh of fish and marine mammals; is increasingly worrisome if the occurrence of bioaccumulation is widespread⁸⁸
- The use of water resources by remote communities⁸⁹ who are vulnerable given their difficulty in accessing health and monitoring services as well as lack of understanding of the issue and potential human impacts
- Even if mercury use is reduced, the health and environmental impacts may continue in the mid and long terms;⁹⁰ ecosystem contamination can last for decades, even after mining activities in the area have stopped⁹¹

⁸³ Telmer K. , 2006

⁸⁴ UNEP, 2008.

⁸⁵ It is important to note that mercury is not always in use in artisanal and small-scale gold mining. It depends on the geologic characteristics of the deposit and the ore, local availability and price of mercury, miners’ knowledge of the technology, efficacy of intervention measures, and market-demands, among other factors.

⁸⁶ Extracted from Telmer, K. and Stapper D. 2012.

⁸⁷ Global Mercury Project, 2002

⁸⁸ Canuel, R., Lucotte M., and Boucher de Grosbois, S. 2009.

⁸⁹ Canuel, R., Lucotte M., and Boucher de Grosbois, S. 2009.

⁹⁰ Canuel, R., Lucotte M., and Boucher de Grosbois, S. 2009.

⁹¹ United Nations Environmental Programme, 2008.

In focus: Mercury in ASGM

The Philippines

In the Philippines, home to at least 10 per cent of annual global artisanal gold production,⁹² pollution from artisanal mining has been found to be negatively affecting the Coral Triangle,⁹³ but is also directly impacting the nation's fishing industry. The draft National Strategic Plan on ASM in Gold reflects this problem. It reports that in Honda Bay and Palawan Bay, near an abandoned artisanal gold mine, "four (4) fish species had exceeded the recommended total mercury and methylmercury levels in fish while two (2) fish species namely saging and kanuping had exceeded the permissible levels for methylmercury."⁹⁴ Results of mercury pollution visible in the country, according to Ban Toxics!, include higher than permissible levels of mercury in drinking water and marine creatures such as molluscs and fishes; loss of biodiversity; deforestation and siltation; and intoxication among miners and their families. Miners in the Philippines using ore amalgamation are estimated to use 10-25 grams of mercury for every gram of gold produced.⁹⁵

Colombia

In Colombia, the already-major problems caused by ASM's widespread use of mercury are being exacerbated by the country's continued insecurity in rural areas due to rebel activities or bandits. As a result, gold processing is now taking place in urban settings, exacerbating ill-health effects. For example, in Segovia, neurological tests performed on local children — ages 7 to 13 — revealed that 96 per cent displayed at least one measure of intoxication in attention, memory, language, or executive functions. "There is no other case in the world like this where an urban population of 150,000 people is exposed to such high levels of mercury vapor," states Marcello Veiga, the former director of the United Nations Global Mercury Project.⁹⁶

Indonesia

Within just one region of Indonesia — Central Kalimantan — mercury is so widespread that the region is responsible for some fifty tonnes of mercury released into the environment each year. Despite the vast environmental impacts in Indonesia's precious archipelago, the income people earn from this activity is incredibly low; Indonesian miners usually only produce about two grams of gold per day.⁹⁷ As of the time of this report's writing, this is an estimated income of approximately US\$36 per day.⁹⁸

It is important to note that artisanal miners are not always the culprits for mercury's presence in an ecosystem. Mercury is a naturally occurring chemical element and — in forested contexts — deforestation may also play an important role in elevating the amount of mercury in an ecosystem.⁹⁹ Specifically, extensive deforestation — for mining, agriculture, timbering, or other purposes — can cause erosion and lixiviation of land-deposited mercury into tropical rivers and streams, which can result in observable and wide-scale mercury contamination in fish.¹⁰⁰ Thus, while miners may be responsible for upticks in measurable mercury presence, it is a complex issue and there may be other contributing factors for elevated mercury levels in a certain context.

Due to the scale of the issue, a number of experts and donors have focused their attention on the artisanal gold sector's use of mercury and have made several technical advancements in this field.¹⁰¹ This includes the

⁹² Ban Toxics!, 2010

⁹³ Uychiaoco, Arceo, Green, Cruz, Gaité, & Alino, 2005

⁹⁴ Department of Environment and Natural Resources, Government of the Philippines, 2011

⁹⁵ Ban Toxics!, 2010

⁹⁶ As quoted in Siegel, S., 2011

⁹⁷ Agrawal, personal communication with Weinberg, July 2011

⁹⁸ This is assuming miners produce two grams of gold per day and receive 70 per cent of the global gold price, which is approximately US\$1600 per ounce as of August 2012. On average in the 1990s, gold prices were in the range of US\$300 per ounce and one gram per day was the global average. With today's prices, income has gone up (hence the increase in people engaging in ASGM) but miners also work lower-grade deposits. ASGM expert Felix Hruschka estimates the global average production per miner is likely now at below 0.5 gram per day. 'Low income' in ASGM would be producing 0.1 to 0.2 grams per day. Source: Personal communication between C. Villegas and F. Hruschka (August 2012).

⁹⁹ See René Canuel, Marc Lucotte and Sylvie Boucher de Grosbois (2009).

¹⁰⁰ Canuel, R., Lucotte M., and Boucher de Grosbois, S. 2009.

¹⁰¹ Perhaps the most common intervention to reduce mercury use and improve safety has been the introduction of the retort, which is used to catch mercury vapour and recycle it. The retort not only reduces people's exposure to mercury vapours and helps prevent haphazard disposal, but it is also a more efficient processing technology thereby reducing the production cost over time. The GMP has produced several documents on

continuous involvement of the Swiss Agency for Development and Cooperation (SDC) over the last twenty years¹⁰² and the projects under the umbrella of the Global Mercury Project (GMP). A number of factors need to be carefully considered regarding which type of technological intervention is most appropriate and how it should be done; see this report's Section 4's sub-section on 'Introducing Responsible Mining Techniques'. However, despite the availability of mercury management techniques, mercury contamination persists due largely to the marginalization of the sector in many countries. Artisanal miners usually do not receive technical assistance, they face financial barriers preventing them from adopting these techniques and tools, and many do not understand the real risks that using mercury poses to themselves and their communities.¹⁰³ At the time of this report's writing, a global mercury treaty is being negotiated by governments. ASM-PACE encourages a debate on how to incentivize responsible use of mercury in a way that does not undermine the artisanal gold mining sector or its current and potential contributions to rural development.

2.3. Other chemicals in use

The ASM-PACE researchers observed that, while mercury receives much attention, it is not the only problematic toxic substance in use by artisanal miners that affects critical ecosystems. Due to policy and structural reasons such as pricing or, ironically, environmental interventions that ban one substance and inadvertently promote a similarly-dangerous substitute,¹⁰⁴ other dangerous chemicals are also used and affecting PACE sites. For example, when mercury was not in use in some countries, nitric acid often was and was found to be leaching into the surrounding environment.¹⁰⁵ In some places, technological advancement is leading to the adoption of cyanide being used in place of mercury or in tandem. In Ecuador, cyanidation overtook amalgamation as the most common processing technique in ASM. While cyanidation is common, mercury is still in use and used in tandem in some sites, with amalgamation done first, followed by cyanidation of the remaining amalgamated and un-amalgamated tailings.¹⁰⁶ This is a particularly dangerous practice because the mercury present in the amalgamated tailings is also leached by the cyanide solution; bioavailability of mercury increases as dissolved mercury is more likely to be absorbed by plants and animals than metallic mercury.^{107,108}

Cyanide's effects are potentially deadly to its users and the surrounding ecosystems in which they work. As UNIDO describes:

*"All water bodies containing cyanide are hazardous to wildlife. Therefore, if cyanide wastes are not properly managed, they can result in tremendous damage to animals, crops, and humans. Accidental spills of cyanide solutions into rivers and streams have produced massive kills of fish and other aquatic biota."*¹⁰⁹

However, the main difference between mercury and cyanide is the long-term persistence in the environment. Cyanide is a chemical composite (NaCN) and decomposes over time (even quite rapidly if exposed to sunlight and oxygen),¹¹⁰ but mercury is a chemical element and as such persists at the emission site indefinitely or is mobilized contaminating other sites.

ASM and mercury; a particularly useful guidance document for suggested protocols in mercury management can be found in its draft U.N. International Guidelines on Mercury Management in Artisanal and Small-Scale Gold Mining (2007).

¹⁰² Hruschka, F., 2011.

¹⁰³ Telmer K., 2006

¹⁰⁴ For example, if a government effectively enacts a tax regime or ban, the price of mercury may be prohibitively high for miners to use on their own unless an investor fronts them that input. An example of this in practice is in Guinea, where a 2006 Global Mercury Project report noted that mercury was not in use by artisanal miners in the regions where they conducted fieldwork because the penalty for its use by the local government proved a deterrent to miners and other affordable sources were not available (Veiga et al, 2006). However, this trend might well have changed in the past five years

¹⁰⁵ Veiga et al, 2006.

¹⁰⁶ Veiga & Velasquez L., 2007

¹⁰⁷ Veiga & Velasquez L., 2007

¹⁰⁸ Personal communication between C. Villegas and F. Hruschka (August 2012).

¹⁰⁹ Veiga & Velasquez L., 2007

¹¹⁰ Smith A., Mudder T.; 1991

3. CORE ISSUES AFFECTING OF FURTHER PROBLEMATIZING ASM IN PACE

There are many reasons why people undertake ASM. Often the primary motivation is that — although extremely physically demanding and both physically and financially risky — ASM is an economically rational choice for chronically poor populations in a context of limited options. People generally undertake ASM because it offers:¹¹¹

- Immediate cash, which is otherwise difficult to acquire in rural contexts where subsistence farming prevails
- Potential relief during difficult circumstances in fragile societies which have undergone or are undergoing deepening poverty, natural disasters or environmental change (e.g. in Mongolia),¹¹² economic transition or collapse (e.g. in Zimbabwe), or civil conflict (e.g. in Sierra Leone and Liberia)
- Opportunity to earn higher income for unskilled or illiterate individuals
- Subsistence for people who are desolate: people participate in mining in exchange for food or other basic provisions
- Emancipation from traditional hierarchies and social structures — artisanal mining economies (especially in rush situations) are often highly individualistic and provide space for youth to organise and discipline themselves as they see fit¹¹³
- Hope that mining will help them break free of poverty and bring them increased dignity and respect from their community¹¹⁴
- Increasing profitability owing to rising minerals prices, especially for gold

3.1. Why do people mine in protected areas?

This study found that there are many “push” and “pull” factors behind why men and women choose to mine in or around protected areas in particular:

- Protected areas are seen as untouched, virgin areas: they have not been mined in living memory (e.g., Liberia)
- Lack of recognition or knowledge of park borders amongst the local population (e.g. in Sapo National Park in Liberia, the Kahuzi- Biéga National Park in DRC, and Brownsberg National Park in Suriname)
- 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 license, surface rent). If unguarded, access to the resource is perceived as free money (e.g. in China¹¹⁵)
- Gazetting of protected areas can stimulate ASM activities by making other livelihoods less viable owing to the limited availability of land for farming, and other activities (e.g. Uganda)
- Land which previously hosted mining activities is gazetted as a protected area (e.g. the Kahuzi-Biéga National Park in DRC¹¹⁶)

¹¹¹ See MMSD, 2002. Chapter 13. See also Levin, 2005. Temple et al. 2006; MacConachie & Binns, 2007.

¹¹² Kramcha, Sandra (2004)

¹¹³ King, 1972; Levin, interviews with artisanal gold miners in CDI, 2010.

¹¹⁴ Sadly, it rarely works this way. In the artisanal diamond fields, one often hears stories of the miner who found ‘the big one’, only to have it stolen or be cheated of its true value by predatory local and national authorities and exploitative diamond dealers. See also Levin, 2005 and Zoellner, 2006.

¹¹⁵ Gunson, personal correspondence with Weinberg, June 2011.

¹¹⁶ The KBNP was gazetted in 1970 in order to protect the gorillas within it, however “Fifteen existing villages of shifting cultivators, and mining settlements for gold, cassiterite and coltan were located in the west section of the Park, though neither they nor the indigenous Bakwa pygmies were consulted when it was created; and several villages in the buffer zone, where the boundary had never been defined, were sources of conflict. (Hart & Hall, 1996; Steinhauer-Burkart, et al., 1995). Although expelled from the Park in 1970 and 1980, the Bakwa received no compensation and continue to hunt in the Park; most are camped wretchedly on the shore of Lake Kivu.” From UNEP & WCMC (2011).

- The rush for minerals by large-scale corporate miners (LSM) is leading to a gradual squeeze of ASM off land where industrial mining companies may have achieved statutory prospecting, exploration and/or mining rights (e.g. in Ghana)
- Closure of industrial mining sites can 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, DRC)
- Protected areas offer a variety of livelihood options that complement ASM in a logical livelihood strategy for individuals or households, for example timber, bushmeat, charcoal making

In Uganda, there is a long list of reasons — geoclimatic, environmental and economic — that have attracted growing numbers of Ugandans into ASM near protected areas. These include: high mineral commodity prices coupled with rising land pressures; compromised food security with increasing unpredictability and severity of climatic variations; and, in north-eastern Uganda, a combination of prolonged droughts and tribal conflicts that have led to loss of traditional pastoral livelihoods.¹¹⁷ In Uganda's Albertine Rift Valley, the gazettement of protected areas has reduced the amount of arable land available and may therefore be partly responsible for stimulating ASM activities in the region. The problem is further compounded by a resurgence of wildlife in the post-Amin/Obote era — particularly grazing elephant, buffalo and hippos that wander beyond the borders of the park, which constrains people's ability to grow food crops.¹¹⁸

In the area including Liberia's Sapu National Park, there are few if any alternatives to make a living; artisanal mining is one of the only opportunities available to gain cash for consumables or investments. Researchers interviewed trained plumbers and construction workers who were not able to find work elsewhere and consequently were mining gold on the northern border of the Park. "I work because I need to survive ... when I spend the money, I feel the pain (that it took to earn it)," said Emmanuel, a father of four who said he was the family's sole breadwinner. One group of diggers interviewed acknowledged that many of the diggers on the site were former combatants. One stated, "We were all involved in the war; we are just doing this to survive. There are no jobs!" "We are all here for just one thing; no trouble," said another digger, who also doubled as the camp's nurse. Other diggers on the same site said they use the money they make in the gold pits to pay their children's school fees. A few stated that the money has helped their wives start businesses in a nearby trading centre. Some of the diggers on the site were students — many of whose education was interrupted by successive civil wars — who were mining to earn enough money for their university tuition.

In Madagascar, a significant issue for national parks management is that artisanal mining is truly income generating. In this resource-rich but economically poor country, ASM in protected areas like Ankarana National Park provides a rare opportunity for people to engage in an entrepreneurial and independent profession without having to worry about the property holder.¹¹⁹

Finally, in Suriname, when asked about their mining activities within the park, miners and village leaders mentioned the following arguments for mining in the park [*paraphrased*]:

- We have been here before the Brownsberg National Park was established. We should have been consulted about the establishment of the Park, which never happened. The area is part of our usufruct area and hence we have a right to mine there.
- The young men from our village need a place to work. There are no jobs here; the government does not help us with job creation or vocational training. And now we create our own space for working, and they want to stop us. That is unfair.
- The mining occurs far enough from the places where tourists go; the tourists cannot see or hear the miners. They are not bothered by the miners' activities.

It is critically important to understand the motivations of miners. Management options are dictated by the miner's motivations for choosing mining as his/her livelihood and why especially to be mining at all and in that place.

¹¹⁷ Hinton, 2011.

¹¹⁸ Hinton, 2011

¹¹⁹ Walsh, personal communication with Weinberg, July 2011

3.2. Lack of incentives for environmental stewardship

At the heart of the environment and ASM issue — no matter the context — are incentives. According to Hayes and Bawa (2010): “for social and environmental interventions to gain support, in the majority of situations they will need to be part of initiatives which primarily focus on economic and technical issues if players in the trade are to be motivated to implement and sustain improved social and environmental practices.”¹²⁰ While Hayes and Bawa were commenting on the DRC context, their observations are more widely applicable. They argue that miners are generally more concerned about economic factors relating to ASM, such as yield and productivity, certainty of returns, managing upfront costs and avoiding or amortizing debts, spending time actually mining rather than preparing to mine or selling the proceeds and so on. Consequently, environmental factors are understandably often a second consideration.¹²¹ People require tangible benefits before changing their behaviour and they need to feel that they have played a role in determining how that change will take place.¹²²

Similarly, in a study of artisanal mining in Sierra Leone in 2004, Temple et al. (2005) observed that there is little-to-no economic incentive for environmental reclamation of mined-out pits. Further contributing to the problem were the facts that¹²³:

- Without clear secure and communally recognized tenure rights, artisanal miners had little incentive to rehabilitate mining pits, or engage in other long-term decision making.
- Chiefdom authorities made land-use decisions and gained an income stream from mining that usually far exceeded other uses, but they were not in a strong position to insist on reclamation
- The government of Sierra Leone was so woefully understaffed that constant monitoring was simply not administratively possible. “[I]t is not a priority of the government, and there are no personal incentives for staff to ensure that land is reclaimed.”
- Finally, “[t]hose who have most interest in long term reclamation of the land — women¹²⁴, youth and the unborn — are frequently not represented in most of the entities that could encourage reclamation.”

The lesson gleaned from these case studies is that any effective, sustainable intervention in artisanal mining must provide economic or other incentives in order to effect any long term changes in behaviour.

3.3. Marginalization of ASM and its link with environmental degradation

Environmental degradation associated with artisanal mining is, in part, exacerbated by the political marginalization of the ASM sector. This is coupled with the lack of appropriate incentives to mine in a more environmentally sensitive manner. ASM’s marginalization within the mining industry primarily stems from four issues:

1. The persistent belief by many governments that LSM should be prioritized wherever possible over ASM — versus in tandem with ASM. From this position, the political environment determines the scale of extraction, rather than what is geologically optimal in terms of the nature of the deposit. This favouring of large over small-scale mining lead to a potentially hostile relationship between the two sectors and a diminution of land where they can viably and/or legally operate. This policy position prevents government services or capacity building activities designed to help artisanal miners professionalise and mine in ways that are less environmentally damaging and developmentally optimal.
2. As currently practiced, in most contexts ASM does not contribute as much direct tax revenue to the state as industrial mining, and its indirect contributions (derived from the goods and services it demands as inputs and the investment in consumables and services it generates through the miners’ disposal of earnings) are often not calculated or considered.
3. Often in tandem with points 1 and 2, ASM is treated as an informal or illegal activity due to a variety of reasons, including laws/regulations that make reform or formalization of the sector economically unattractive and/or politically challenging.

¹²⁰ Bawa and Hayes, 2010, p.97

¹²¹ Bawa and Hayes, 2010, p.97.

¹²² Mubalama, 2009

¹²³ Temple, Levin, Turay, & Renzi, 2005

¹²⁴ Women’s central role in agricultural production in Sierra Leone further emphasizes their role as important stakeholders. See Temple, Levin, Turay, & Renzi, 2005

4. Local markets for high-value/low-volume commodities such as gold, diamonds or precious stones often lack transparency and formal trading chains do not extend into ASM communities. This provides the ideal setup for extraordinary profits in grey or black markets, such as money laundering or smuggling by unscrupulous middlemen. These agents count on economic and political means to perpetuate the marginal and informal condition of ASM so crucial for their businesses.

Artisanal miners may not know how to reduce or mitigate their impacts on the environment, or understand the ways in which what they do is environmentally damaging. This is coupled with a widespread lack of incentives for miners to introduce improved techniques or rehabilitate mining sites. If miners' returns depend solely on how much and how fast they can dig and there is no similar incentive to rehabilitate or backfill, it is not surprising that it is rarely done. In large-scale mining, financial profits are larger than the costs of requisite conservation programmes. In ASM, the profits are significantly smaller or sometimes altogether elusive (profit is not guaranteed, especially for gem miners), and dispersed amongst a large group of people. Given the severe human health and environmental consequences that unmanaged ASM can bring, there is a clear role for government to take a leadership position in mainstreaming the sector. Mainstreaming may be via formalization strategies or technical assistance, or some combination of both. Interventions that support poverty alleviation and conservation together are likely to do more towards mitigating the impacts of ASM on protected areas and critical ecosystems than efforts focusing on conservation alone.

Informality: Exacerbating vulnerability, dire conditions, and poverty

Ghana

Ghana presents an example of what happens when the sector goes unaddressed by a government: In Ghana, there is a shortage of arable land and lack of alternative livelihoods. This, coupled with a strong government preference for industrial mining and reticence to address widespread mercury use, is increasing miners' economic and social vulnerability. An estimated 90 per cent of Ghanaian miners are operating informally,¹²⁵ which they attribute to a complex licensing process which makes it difficult to become formal. Mercury use is widespread in the informal sector: it is sold legally and inexpensively to miners. Despite two decades of local and internationally-coordinated initiatives to address and ameliorate the negative impacts of mercury used in Ghana's ASM sector, it is still widely used and inadequate awareness of proper handling and health and environmental consequences persist.¹²⁶ Exposure to mercury is a serious risk for humans and animals, even at very low levels of exposure. The harm mercury causes is multifaceted. It can be devastating or damaging to the central nervous system, kidneys, lungs, thyroid, immune system, eyes, gums, and skin; neurological damage caused by mercury is irreversible.¹²⁷ Yet the state currently does not provide artisanal miners with technology, education, or other ways of mining without using mercury;¹²⁸ nor does it educate miners on how to minimize their use of the toxic chemical.¹²⁹

Cambodia

In Cambodia, the most recent Mining Code (2001) makes only brief mention of ASM, and, in doing so, makes the majority of ASM activities illegal and informal.¹³⁰ This lack of formality in the ASM sector has repercussions at the local level, namely increasing the social and economic vulnerability of miners. In many instances, people migrate to mineral-rich areas of the country either because their crops have failed or due to a lack of other income-earning activities.¹³¹ As they are both poor and mining illegally, these individuals are in a vulnerable position and are often forced to pay bribes to middlemen or even the military.¹³² In short, legislative gaps result for artisanal miners operating in a type of (extra)legal "limbo", characterized by short-term decision making, smuggling, and ecologically unsustainable mining methods. From a development perspective, the lack of legal clarity surrounding the status of artisanal mining stymies cooperative development efforts, and prevents the governments from collecting potentially significant tariffs and revenues.

¹²⁵ Armah et al, 2011

¹²⁶ Nyame, F.K. 2010

¹²⁷ United Nations Environment Programme, 2008

¹²⁸ Tschakert & Singha, 2007

¹²⁹ Singha & Tschakert, 2007

¹³⁰ Spiegel and Hoeung, 2011

¹³¹ Spiegel and Hoeung, 2011.

¹³² Spiegel and Hoeung, 2011.

3.4. The complex issue of Protected Areas and their many stakeholders

There are very particular challenges of working on ASM in PACE. These include the typical challenges of working within the ASM sector plus:

- Convincing governments and other stakeholders that engaging with miners is not condoning or accepting illegal behaviour but trying to alter it
- Some solutions might — in fact — not be possible, such as allowing negotiated access because deposits and important wildlife overlap in ways that will not allow compromise. Therefore, finding a workable solution becomes even more challenging or requires clear prioritization backed by budgets, improved capacity, and planning
- For reasons of history or contemporary reality, national parks in remote areas and/or along international borders are perceived as national security threats, limiting perceptions of what is desirable or possible (e.g., Liberia, DRC)
- Sorting problems of conflicting mandates (particularly when mining and forestry laws directly conflict) or where there is no public sector coordination in practice, sending mixed signals to those working in protected areas (e.g., Liberia, DRC)
- Protected areas do not always have clear boundaries and/or boundaries that are accepted by local communities. Border disputes appear to be commonplace, particularly when the protected area was gazetted (delimited) in a time of political crisis (e.g., Madagascar, Liberia, DRC)
- Protected areas, due to their nature of being created to discourage or prohibit human settlement, are often areas of very little infrastructure, except in cases where the area receives a steady stream of tourists. This lack of infrastructure presents a challenge for monitoring
- In some countries, the preservation of national protected areas is simply not a budget priority. In other words, in the development-conservation balance, addressing threats to critical ecosystems is not among the top priorities and consequently, mining and other incursions may continue unabated by the government
- Environmental impacts of ASM may be even more severe or complex given the sensitive nature of these areas
- There may be unique environment and health threats that ASM in PACE raises. For example, artisanal mining in remote areas may increase the risk for exposure to new or re-emerging zoonotic infectious diseases, including Ebola, Marburg Virus, Lassa Fever and MonkeyPox¹³³

¹³³ When the surrounding vegetation is removed and mining camps are established, generalist species - such as bats and rodents - tend to thrive. Compounding the problem are the numerous domestic animals (chickens, cattle, dogs etc.) found in mining camps that interact with infected wildlife and dramatically increase the exposure risk for human populations. (Source: USAID Emerging Pandemic Threats Program: How Mining Can Address Infectious Diseases.) While there are programs to sensitize workers in large scale mining operations about the risk of infectious diseases, there is a critical dearth of education and risk management among artisanal mining camps.

4. STRATEGIES FOR ADDRESSING ASM IN PACE

There are many organizations working on mitigating the impacts of ASM, particularly mercury use and the links between ASM and conflict. ASM's increased presence in protected areas also merits attention as it is a growing challenge with little data and few tested practical solutions.

This desk study identified eight general strategies that institutions and/or governments have used to address the issue of ASM in and around PACE. These strategies have had varying degrees of success. Where information was available, report authors documented the strategy model, motives, risks, and lessons learned, in order to fully inform future efforts.

4.1. Eviction

Eviction is the most widely used strategy to address the issue of illegal ASM in protected areas and critical ecosystems. Evictions use force or the threat of force to move artisanal miners from a particular area. The ASM-PACE global solutions study identified eviction strategies being used to address ASM in PACE in China, Gabon, Ecuador, Ghana, Indonesia, Liberia, Mozambique, Sierra Leone, Suriname and Tanzania, among many other countries. In most cases, evictions are not a sustainable strategy given the continued resources and security required to keep miners out over the long term. In addition, evictions often result in escalating tensions between artisanal miners, protected area officials, large scale mining operations and even the protected area itself. In some cases, this has led to increased levels of violence, sabotage and mistrust between stakeholders. During forced evacuations of the DRC's Kahuzi-Biéga National Park in the early 1990's, indigenous groups retaliated against the force used on them (which included destroying their farms and cattle) by setting fire to hundreds of hectares in the Park and refusing compensation for resettlement.¹³⁴

Issue in focus

Mozambique

In Mozambique, there are approximately 20,000 people of Mozambican and Zimbabwean origin engaged in artisanal gold mining in Gorongosa and Chimanimani National Parks (the latter being a Critical Protected Area in a World Bank-funded trans-boundary park plan). Poaching, deforestation and the mercury pollution have all been documented in the park — in addition to escalating conflicts between Zimbabwean and Mozambican miners. Eviction attempts by the Mozambican government have been largely ineffective: miners eventually return to the site; mining activities are dispersed further into the park; accusations of physical abuse are raised.

Suriname

In Suriname, small-scale gold miners are occasionally expelled from Brownsberg National Park by the national army, but without continuous vigilance the miners return as soon as the military is gone. The park only has a handful of guards who are poorly equipped and hesitant to prevent ASM since the majority are from the same villages as the miners.

Liberia

In Liberia, where the 2010 eviction of gold miners from Sapo National Park is referred to as a “voluntary departure”; it was conducted by the Liberia National Police's Emergency Response Unit (ERU) in conjunction with the Forest Development Authority and the Bureau of Immigration and Naturalisation. Since the 2010 eviction, a post-eviction plan has not been published or enacted upon and relations between communities living close to SNP and government agencies have deteriorated. Sapo-based FDA rangers, who are unarmed, expressed a fear of retribution against them once the Emergency Response Unit (ERU) departs the area. The ERU are accused of violence, confiscating mining equipment inside the park and, in attempts to address bushmeat hunting concerns, taking villagers' guns and hunting snares, which, in a rural context, increases food security risks.

¹³⁴ Barume, 2003

ASM-PACE research to date has revealed that the probability of an eviction being successful rests on four things:

1. **The way the eviction is carried out:** The clearance of ASM from industrial mining concessions is governed by international voluntary standards that provide guidance for best practice in conducting resettlement (e.g. IFC) with a view to ensuring good process and preventing human rights abuses. No such guidance exists for the evictions of ASM from protected areas.¹³⁵ There is a case for such ASM-relevant guidance to be developed, given: the frequency with which eviction is chosen as a management option; allegations of human rights abuses committed in the course of evictions. ASM-PACE intends to examine experiences of best and worst practice in resettling ASM from corporate mining concessions, in evicting ASM from PACE, and utilise directly relevant voluntary guidance from other sectors in order to develop such a guidance for PACE stakeholders.
2. **The importance of the protected area's mineral deposit to the local or regional ASM sector:** This is determined by the accessibility and economic value of the deposit in comparison to other mineral sources in the area. The question that miners and mineral dealers will consider when determining whether to return after an eviction is really: 'is it worth it?' The higher the economic importance and accessibility of the mineral deposit, the more likely they are to return.
3. **The quality of post-eviction planning:** In the vast majority of the evictions studied, a well-considered, clear, coordinated, well-funded and implementable post-eviction plan was either not developed or not implemented. As a result, with little or unattractive support for a livelihood outside the protected area, miners return to the eviction site after only a short period of time.
4. **The demographic characteristics of the miners being evicted:** The success of evictions is further influenced by the presence of illegal or undocumented miners from neighbouring countries.

Chance of success is elevated if a proper risk and impact assessment is carried out before the eviction. This should direct decisions on how the eviction should occur, what resettlement should comprise, what compensation and livelihoods restoration is necessary to ensure success and what post-eviction planning is necessary. Questions might include: Who are the miners? Where are they mining? How important is this ASM site to them? How serious are their environmental impacts? Is eviction the only acceptable option given the importance of this PA? How likely are they to leave on a voluntary basis or is forced eviction necessary? What type of resettlement compensation or assistance are they entitled to under local, national and international law, or best practice guidance? If none, what type of resettlement assistance is necessary in order to ensure they do not return? Will conservation authorities require a greater budget for increasing patrols and training in managing incursions after the eviction has occurred? What community outreach is necessary to consult with local communities likely to be impacted by the eviction? What other resources are necessary to equip those carrying out the eviction with the skills and tools for doing it well?

¹³⁵ However, there are guidelines from which to draw, such as the Principles and Guidelines adopted by WWF and IUCN/WCPA in 2000 (see Beltrán, J. and Phillips, A. 2000) on indigenous peoples, conservation, and protected areas that outlines consultation processes, among other things. There is also the World Bank involuntary resettlement policy and its annex (see 'World Bank 2001a' and 'World Bank 2001b') that broadly address resettlement in cases of development projects.

4.2. Negotiated Access

Negotiated access is conditioned access to protected areas where limited ASM is allowed under agreed-upon conditions. ASM-PACE researchers found that this has been attempted in both Gabon's Minkébé National Park¹³⁶ and Suriname's Brownsberg National Park¹³⁷ but without success.

In focus: Negotiated access

Gabon

In Gabon's Minkébé National Park, elephant poaching for ivory has long been a problem and is presumed to be tied to the artisanal and small-scale gold miners active in the Park's buffer zone.^{138,139} In 1998, WWF-Gabon began to engage with the Minkébé mining populations to address poaching as well as observed environmental impacts. Efforts first centred on evicting an elephant poacher from one of the mining camps and later included several sensitization and investigation missions to the region. This led to several agreements between the camps, WWF and local authorities.¹⁴⁰ These agreements typically included a ban on hunting of protected species, notably elephants, and tentative plans to control the arrival of illegal immigrants from Cameroon by coordinating with the Cameroonian local authorities. However, as the draft agreement list of potential signatories shows, Cameroonian authorities were not party to the agreements.¹⁴¹ After significant efforts over several years, WWF-Gabon finally developed a multiparty memorandum of understanding (MOU) to control the situation in some of the camps. The MOU includes representatives from some of the gold mining sites¹⁴² and a variety of government agencies ranging from the forest authority, mining ministry, security agency, and local government council. The last draft version dates from 28 March 2008, spans several pages, and aims to control hunting, gold mining, trade and transport. Though never signed, the draft MOU prohibits the use of mercury, cyanide and other chemicals in the area, likely as a preventive measure as mercury is not known or thought to be in use.

A look at the details

At the core of the memorandum was a plan for negotiated access:¹⁴³

- *Formalization requirements and the introduction of more responsible mining methods:* The miners present in the area would need to be in possession of valid 'Cartes d'Expant' (legal artisanal mining license) issued by the Ministry of Mines. This was used to collect statistics on gold production and promote better mining methods.
- *Enforcement of the agreement using security forces:* Patrols of local security forces and other authorities were to guarantee enforcement of the agreement.
- *Severe restrictions on hunting:* Most detailed in the draft MOU are the sections that aim to rigorously constrain hunting. Only subsistence hunting by miners identified as legal was to be permitted provided this hunting was of non-protected species with specific kinds of weapons and only in highly restricted areas.
- *Restrictions on the presence of illegal immigrants.*

¹³⁶ See Hollestelle 2012.

¹³⁷ WWF Guianas 2008; Finkie, board member of Foundation AHALA, pers. Com with Heemskerk. July 2011

¹³⁸ Hollestelle, 2012.

¹³⁹ Koumbi 2010 and Mabaza 2011 in Hollestelle 2012.

¹⁴⁰ Hollestelle 2012

¹⁴¹ Hollestelle 2012

¹⁴² According to multiple interviews in Hollestelle 2012.

¹⁴³ Hollestelle 2012.

The negotiated agreement's failure to be enforced

Despite years of negotiations and efforts, the draft MOU was never signed. This was likely due to the influx of miners the camps in the Minkébé zone suffered from 2008 onwards. It was felt that the 4,000 people in the region, most of them newcomers with whom the conservationists did not have existing relationships, rendered the draft MOU disproportionate and impossible to enforce. What is more, it was, and is still strongly felt by WWF-Gabon and the ANPN, that such numbers will most likely always be beyond the natural carrying capacity of the zone in terms of environmental impact.¹⁴⁴ In 2011, the arrival of thousands of mostly-Cameroonian miners to the site (reports indicated a rise in Minkébé's population from roughly 650 to 5,000 in less than three years¹⁴⁵), raised widespread alarm among conservationists. The government of Gabon began eviction actions in March 2011¹⁴⁶ followed by the use of its security forces in June 2011. ¹⁴⁷ As of June 2012, the Gabonese military are continuing to secure the site but at a significant human resource cost to a small army and a financial cost of 30 million XAF (approximately 50,000 USD) per month for the employment of the army to maintain the eviction; not surprisingly, this is draining the financial resources of the Ministry.¹⁴⁸ For several reasons, the Government of Gabon is interested in the possibility of re-opening the Minkébé mining sites and extracting its gold reserves in a more organized and sustainable form and WWF-Gabon and ASM-PACE will be assisting in that process.

This strategy is likely to be most successful in contexts of permanent ASM and where there are long established mining sites with strong local community connections and potential for good-faith effort to fulfil the agreement. Trust-building, accountability, and arbitration methods are necessary for success, as are tactics for promoting compliance and enforcing agreements. These can include:

- Targeted outreach and technical assistance to a specific group, followed by prolonged follow up to ensure the changes are applied in a sustainable way¹⁴⁹
- Publication and locally-appropriate praise of positive examples¹⁵⁰
- Creating financial incentives for environmental and social compliance beyond access to the site

An important consideration in this strategy is whether the ASM-friendly geology and critical conservation areas within the park inconveniently overlap. Where they do, a choice may need to be made between conservation and allowing mining; if the former, that decision must be backed by significant financial resources to maintain security in the area.

¹⁴⁴ Personal communication between Hollestelle and ANPN and WWF staff

¹⁴⁵ Koumbi 2010; Kengue; and interviews in Hollestelle 2012

¹⁴⁶ L'Union, March 29, 2011 in Hollestelle 2012

¹⁴⁷ Hollestelle 2012

¹⁴⁸ Hollestelle 2012

¹⁴⁹ Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002)

¹⁵⁰ Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002)

Table 6: Sample Responses and Sanctions for Noncompliance with Environmental or Social Requirements¹⁵¹

| Offence level | Pressure-point Tactics | Civil (Administrative) Responses | Civil (Judicial) Responses | Criminal Case (Judicial & Executive) Responses |
|---------------------|--|---|---|---|
| Low-level | Conversation to mediate the conflict or misunderstanding | In the first offence against environmental rules, a warning is issued | | |
| Low to medium-level | Phone call to lead-miner or pit owner Involve mine-site educator Involve presiding traditional leader ¹⁵² | Administrative sanctions (e.g. fines) | | Per local legislation |
| Serious | Involve media Refer to competent authority | For repeated offences, more drastic measures may be needed Refer to judicial authority and deny access to the site. Deny access to other sites in the region. | Sanctions imposed by a judge in the cases of repeated non-compliance and in cases where there is serious damage | Punishment should increase if it can be proved noncompliance was intentional. This should generally be the last resort. |

4.3. Introducing Responsible Mining Techniques

Wherever it may be occurring (whether inside or outside of PACE locations), artisanal mining's impacts on the environment are best managed through the introduction of responsible mining techniques. In some cases, this approach has even allowed ASM to continue their activities within a protected area on the basis that its environmental impacts were mitigated. This is a good and practical option in situations where: eviction is unlikely to be a success (with miners simply return after an eviction or repeated evictions); where the ASM are unlikely to transition into alternative, less damaging livelihoods; or where de-gazettement of a protected area is to be carried out but the ASM is still occurring in what might be classed a 'critical ecosystem'. Indeed, if the miners refuse to leave and the problem remains, then this may be the only option if the goal is to maintain an ecosystem's conservation value above all else.

Incentivizing responsible mining practices can be done through public or private sector initiatives. For private sector initiatives, see 'Market-Led' approaches below. In public-sector initiatives, outreach and training can be organized by government agencies. International development organizations can prove successful in changing how miners mine and minimizing their impacts on the environment. In these cases, the international and national agencies may work together to design and implement the programme, with on-the-ground support to the miners

¹⁵¹ Adapted from Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p. 69

¹⁵² In African contexts, successful engagement with traditional leaders (e.g. chiefs) will likely significantly help in two ways: 1) regulate the situation so that non-compliance doesn't occur in the first place (at least in situations where chiefs have a great deal of authority over their people and they have a successful way of managing conflicts and rule-breaking (e.g. Itombwe Reserve in DRC); and 2) if and when non-compliance occurs, it can first be dealt with by customary means without having to resort to criminal penalties.

being conducted by government agents, local civil society groups and/or specialist mining institutes. Examples include:

- The Guianas; a 2008-2009 WWF-Guianas/Guyana Gold and Diamond Mining Association (GGDMA) effort to: reduce the environmental impacts of gold mining; improve miners' tailings management practices via demonstration tailings ponds; induce compliance with local environmental regulations through training¹⁵³
- Six countries; a 2002-2007 Global Mercury Project program to encourage mercury management and elimination around the world [key findings can be found in the program's Summary Report]¹⁵⁴
- Bolivia; the Integrated Management of the Environment in Small Mining (MEDMIN) program has targeted the most environmentally and health hazardous activities in Bolivia's artisanal gold sector, particularly: mercury use, discharge of tailings into river systems, uncontrolled acid rock drainage from mines and dumps¹⁵⁵
- Brazil; the Mercury Contamination from Gold Mining in the Tapajos and Madeira River Basins, Brazilian Amazonia Project, which aimed to identify the impacts of ASGM and develop cleaner technical alternatives to current methods¹⁵⁶

There have been significant lessons learned from these projects, the most important of which is that it is critical to involve miners early and throughout the process of any technological intervention. Context is critical; simply assuming that miners will immediately adopt cutting edge techniques is a strategy destined for failure:

*"Before selecting a specific technique, the traditional techniques used by small miners should be examined carefully. In any case, it is important to take into account that in the majority of situations, it is better to optimize a known technique and improve its operation than to introduce a new one. Small miners in general are very reticent in regards to technology unknown to them. An optimum technical package can fail because the miners reject it. Consequently, an analysis of this acceptance should form part of any technical project plan. Experience has shown on many occasions that improvement on known existing technology has a better chance of being employed and diffused than new techniques unknown to miners."*¹⁵⁷

Due to generally low levels of environmental education and awareness, conservation interventions seem only to work in practice when they are specifically tied to increased production.¹⁵⁸ See Table 7 for key factors to consider when considering technical interventions.

¹⁵³ See WWF Guianas, 2008.

¹⁵⁴ The Global Mercury Project (2008)

¹⁵⁵ See MEDMIN case study in Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p 215-237.

¹⁵⁶ See case study in Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p 215-237.

¹⁵⁷ From Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002)

¹⁵⁸ Wotruba et.al (1998 & 2002), p. 66.

Table 7: Factors to consider when planning technological interventions in ASM¹⁵⁹

| Factors to Consider | Criterion for the Evaluation of a Technical Solution |
|--------------------------------------|---|
| Social and Cultural | <ul style="list-style-type: none"> • Is the solution useful for the miners? • Is it accepted and approved by the miners? • Does it take into account traditional methods in use in the specific ASM site? • Does it facilitate work or create more work? • Does the process allow for the miners to see and observe the process, thereby retaining visible control of their minerals? • Are any operative personnel required to perform the task available in required quality and quantity? • Does the equipment potentially interfere with customs, superstitions, or beliefs of the targeted group? • To work in practice, any new process should not require substantial organisational/structural changes (hierarchy, responsibilities, etc.). |
| Technical | <ul style="list-style-type: none"> • Does it increase yield? • Does it increase recovery? • Does it have low investment costs? • Does it have low operating costs? • Is any new individual equipment inter-compatible with existing equipment? • Do the solutions integrate well into the current processes? • Are elements of the new equipment/tools available in local markets? • Is local manufacture possible? • Is the new equipment easy to manage and maintain? • Is the equipment compatible with locally available energy sources? • Does the equipment have a long life? |
| Environmental | <ul style="list-style-type: none"> • Does the intervention lessen the environmental impact of ASM? • Does it improved environmental performance via little work and low cost? • Does it significantly increase worker safety? • Does it follow national environmental standards? • Any solution should enable miners to obtain legal certificates and environmental permits, not thwart that chance. • Any solution should lower future environmental costs. |
| Implementation of the project | <ul style="list-style-type: none"> • The solution improves both women and men's mining methods and reduces gender-specific negative health & safety impacts of mining • The application of the solution is accompanied with trainings of the targeted group. • Any tests/experiments should be done quickly in order to generate decisions. • The target group should participate in selection, experimentation, and adaption of solutions. • The solutions should be scalable for efficient diffusion in the target area. • The miners should approve of the solution concept before implementation. • The solution should be compatible with financial realities of artisanal miners. |

¹⁵⁹ Adapted from the table in Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002). In version 2002, see page 167.

A combination of direct and indirect incentives can be put in place to encourage more responsible mining techniques and innovations in environmental management in the ASM sector. Some of these incentives can include:

- Professional support — provided directly by the government or a contractor, or by a concerned and authorized conservation stakeholder — that provides technical assistance to miners, environmental training services, etc.¹⁶⁰

For example, where mercury is prolific, mobile mercury clinics¹⁶¹ or mining-community educators may be options considered to reach miners in more remote locations, such as protected areas and critical ecosystems. The government can provide formalization assistance and support for more formal organizational structures. In more organized and formal ASM, the government can provide financial credit for investment, or rotating funds for environmental rehabilitation, and so on.¹⁶²

Finally, within the environmental intervention field, there are examples of ‘win-win’ scenarios whereby the environmental footprint of the activity is reduced, health and safety is improved and miners achieve greater yields and economic benefits. See Table 8 below.

Table 8: Use of Win-Win Options in Mining & Smelting¹⁶³

| Area | Win-Win Option | Economic Benefit | Environmental Benefit |
|--------------------------|---|---|--|
| Mining | Use mill tailings for mine backfill | Reduces costs of buying or producing fill material | Reduces amount of sterile material to be stacked on surface and the area require; stabilizes the mine increasing mine safety |
| | Planned mining sequence, backfilling mined-out areas with overburden from currently mined areas (strip mining instead of “digging holes”) | Increasing mineral reserves by not blocking access to un-mined areas with overburden and waste rock | Systematic backfilling of mined-out areas |
| Ore Beneficiation | Introduce retorts for mercury recovery in “burning” the amalgam | Mercury costs reduced | Eliminates operator intoxication and emissions into atmosphere |
| | Recover gold pyrites from tailings | Low-cost by-products to be sold, increasing income | Reduces sulphide content in tailings, and acid rock drainage from sulphide oxidation in tailings, less heavy materials in rivers, etc. |
| | Pre-concentration to avoid whole-ore amalgamation | Increased capacity of mills if used only for milling and not for amalgamation. | Less material (only pre-concentrates) amalgamated and therefore mercury losses reduced |

¹⁶⁰ In Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p. 179

¹⁶¹ In Veiga, M. (2010) he discusses the idea of the implementation of mobile training centres (TDUs – Transportable Demonstration Units) to address Colombia’s mercury problem. The TDUs could introduce several locally-appropriate and locally-buildable machines that could be used in the amalgamation and leaching processes but that would reduce pollution.

¹⁶² In Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p. 179

¹⁶³ Adapted from Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p. 67. Additions by Felix Hruschka.

| | | | |
|-----------------|--|--|---|
| | | Higher mill throughput allows for processing of otherwise rejected waste rock and increase gold production | |
| | Measures to recover lost mercury before tailings are dumped to tailings pond, (e.g. mercury traps) | Lost mercury from amalgamation always contains gold | Recovering mercury is equivalent to increasing recovery of gold; reduction of mercury emissions |
| Smelting | Slag treatment to obtain road building material | Income generated from sale of additional products | Reduces slag to be stored |

4.4. Market-Based Approaches

An increasingly popular technique is for 'ethical' mining practices to be incentivised through market-led approaches. This approach is not unique to minerals, but was applied to the minerals sector based on the successful experiences of supply chain certification initiatives in timber, agricultural forests, and others (e.g., Rainforest Alliance, Fairtrade, Utz, Forest Stewardship Council, among others). Since the turn of the millennium, there have been a small but important number of attempts to incentivize miners to mine and trade more responsibly. Examples follow.

4.4.1. Fairtrade and Fairmined Gold

In the Fairtrade system, the incentives are financial, political, and social. The approach is based on rights and responsibilities determined through standards for production and trade. It is driven by a proven consumer demand for ethically and responsibly sourced gold which is not only traded under fair conditions, but also mined in a socially and environmentally responsible way. Complying with all of the requirements of the Standard demands an enormous voluntary effort from an ASM organization. Nevertheless, ASM organizations are motivated to engage by a series of incentives:

- A guaranteed price for their gold
- A social premium
- If applicable, an additional ecologic premium intended for investment in the organization and/or community's development
- Support to the organisation to empower it through capacity building
- Achievement of more sophisticated and professional organisational and commercial practices
- Access to pre-financing
- Access to a growing market of jewellers, retailers and consumers who seek out and demand ethical practices and products

In focus: Colombia's Green Gold in the Chocó Bioregion

Perhaps the most famous example to date, and indeed one of the pioneering attempts to use market forces to incentivize responsible mining, is the Oro Verde® (Green Gold) project occurring in the Chocó bioregion, a WWF Priority Ecoregion.¹⁶⁴ Oro Verde® was created to harness the power of artisanal mining to benefit Afro-Colombian communities in the Chocó, where artisanal mining has a long history in these communities, and where more mechanized operations using more environmentally destructive techniques were becoming the prevailing mode of production. A commercial gold and platinum programme, Oro Verde® is based on the premise of sustainable, environmentally-friendly mining and community benefit utilizing social, economic, environmental and labour standards. It was launched in 2000 and was the inspiration for the creation of the Alliance for Responsible Mining (ARM) in 2004; ARM has since launched Fairtrade and Fairmined gold from producers in Peru, Bolivia and Colombia.¹⁶⁵ There are ten certification criteria for Oro Verde artisanal and small-scale alluvial gold and platinum production in the Chocó. These include¹⁶⁶:

- (1) Minimal ecological destruction
- (2) No toxic chemicals used in the extraction process
- (3) The mined areas are to be restored to ecological stability within three years
- (4) Any top soil removed during the exploitation process should be replaced
- (5) Tailings and poolings that are produced will not exceed the natural ecosystem capacity for rehabilitation
- (6) The silt load into streams and rivers will be controlled in quantity and frequency in order to not disrupt the native aquatic ecosystems
- (7) Mining operations will be conducted with the input and consent of the local community council
- (8) The origin (municipal level) of gold and platinum will be disclosed for royalty purposes
- (9) Mining activities within forested areas will not exceed 10 per cent of a hectare
- (10) Local, regional and national laws and regulations will be observed

All of the mining is alluvial and traditional techniques include: underground extraction, panning in the area's rivers and streams, and diving to collect sediment. Neither mercury nor cyanide is used. After extraction, participating miners restore the natural landscape and vegetation of the area. Miners get a direct premium of 2 per cent and 1 per cent over the official prices of gold and platinum, and an additional 15 per cent premium goes to the organization for use by the miners upon the sale of the minerals.¹⁶⁷ The premiums throughout the process serve to continually incentivize the environmental-friendly practices and dis-incentivize them from choosing instead to rent their land to larger corporate mining actors whose impacts on local ecosystems are more devastating.^{168,169}

ARM has expanded beyond the initial Oro Verde® programme. In partnership with Fairtrade International (FLO), it has launched Fairtrade and Fairmined gold and platinum initiatives in Bolivia, Colombia and Peru — from where the first Fairtrade and Fairmined certified gold was produced in 2011.¹⁷⁰ The first Fairtrade and

¹⁶⁴ Indeed, at the time of this writing, WWF Colombia is currently completing a study on the programme assessing its potential for being replicated and WWF has promised to distribute a copy to ASM-PACE researchers.

¹⁶⁵ Corporacion Oro Verde website, 2011.

¹⁶⁶ Corporacion Oro Verde website, 2011.

¹⁶⁷ This is because they qualify for the 'ecological' premium offered under the FAIRTRADE/FAIRMINED Standard.

¹⁶⁸ Corporacion Oro Verde, 2011.

¹⁶⁹ While Oro Verde is widely recognized for its community and environmental model and leadership in pioneering socially responsible mineral production, it has gained some criticism; this is mainly focused on the vagueness of some of its guidelines. For example, the rules require "ecological stability" within three years, but "ecological stability" remains undefined. In addition, rehabilitation is required but the methods, precise goals, and timelines are absent, and it does not require restoration of the ecosystem to its pre-existing conditions. See Cardiff 2010.

¹⁷⁰ Fairtrade International (FLO) is a non-profit international organisation with 24 member organisations in producer and consumer countries. ARM is an international multi-stakeholder initiative that works to achieve "the transformation of ASM into a socially and environmentally responsible activity, and to the improvement of: the quality of life of marginalized artisanal miners, their families and communities." Alliance for Responsible Mining, 2011.

Fairmined gold bar ever traded originated from the Bolivian Cotapata Cooperative, which is situated in a protected area.¹⁷¹ The Cooperative went into operation more than ten years prior to gaining Fairtrade and Fairmined certification. During that period, the ASM cooperative operated under permanent supervision of Mining and Environmental government authorities. By accumulating a positive track record of extraordinary environmental performance, it contributed to the conservation target of the National Park. The culmination of its best practices was the prestigious achievement of becoming the world's first Fairtrade and Fairmined certified ASM cooperative.

The vision for Fairtrade and Fairmined gold and platinum is for "ASM to [be] a formalised, organised and profitable activity that technologically is efficient, socially and environmentally responsible; the sector's development takes place within a framework of good governance, legality, participation and respect for diversity; it seeks to make an increasing contribution to improved workplace conditions, local development, poverty reduction and social justice within ... countries, stimulated by growing consumer demand for sustainable minerals and ethical jewellery."¹⁷²

The FT/FM standard was first published by ARM and FLO in March 2010. It is expressly oriented toward improving the development gains for communities where gold is mined artisanally.¹⁷³ Certified miners are guaranteed a minimum price of 95 per cent of the London Bullion Market Association's (LBMA) fix for their rough gold.¹⁷⁴ They earn a 10 per cent premium on top of this for investment in development projects and may also earn another 5 per cent 'ecological premium' when they use no chemicals and "ensure minimum ecological disruption and forest restoration from the outset of new operations."¹⁷⁵ ARM's environmental standards cover management of toxic substances (11 minimum requirements; two progress requirements), ecological restoration and ecosystem health (five minimum requirements and five progress requirements), and three requirements for achievement of the ecological premium.¹⁷⁶ The minimum requirements largely cover: mercury management and use of other toxic chemicals; legal compliance; slope height and gradient (open-pit mines); disposal of fuel residues and containers; and environmental mitigation planning. Progress requirements cover: sophisticated measures for mercury management; cyanide management; mine closure, ecological regeneration and rehabilitation of mined out areas; methods for minimising acid mine drainage; and "good waste management practices."¹⁷⁷ Consequently, the ARM/FLO environmental standards are more rigorous than those of any other standard oriented at ASM. The ARM/FLO certification does allow for the use of mercury and cyanide, but provides standards for the amalgamation process to ensure minimum release into the environment.¹⁷⁸

Critics argue that the FT/FM standards are not as detailed or comprehensive as those outlined by the Global Mercury Project, and that there are mercury-free technologies available and therefore the standard is below what could be considered best practice.¹⁷⁹ However, ARM/FLO conscientiously state upfront that, "These Fairtrade requirements prioritize environmental challenges for artisanal miners, which can be realistically achieved in the short or medium term, given their human and capital resources. The aim of the STANDARD is to drive ASM towards environmental responsibility and progressive environmental improvement. Furthermore the standards reflect that responsible mining is also a vision of artisanal mining without environmental contamination and with full ecological restoration."¹⁸⁰ A second critique is that ARM-FLO's standards for tailings and siltation management could be improved, though this criticism has been waged against other Standards seeking to manage environmental risks posed by ASM.¹⁸¹ Lastly, the ARM/FLO standard does not prohibit mining in protected areas and critical ecosystems completely nor does it require reclamation or restoration after mining in the area ceases.

¹⁷¹ It is located within the Cotapata National Park, which protects part of the Yungas cloud forest.

¹⁷² The Fairtrade Labeling Organization and the Alliance for Responsible Mining, 2010, p.4.

¹⁷³ ARM-FLO, Fairtrade and Fairmined Standard for gold from artisanal and small-scale mining, including associated precious metals, March 2010, in The Fairtrade Foundation and ARM, 2011.

¹⁷⁴ The Fairtrade Foundation and the Alliance for Responsible Mining, 2010.

¹⁷⁵ The Fairtrade Foundation and Alliance for Responsible Mining, 2010, p.12.

¹⁷⁶ ARM/FLO, 2010.

¹⁷⁷ ARM/FLO, 2010.

¹⁷⁸ See Cardiff, 2010. There is debate amongst environmental and ASM campaigners, with the former pushing for a no mercury policy, and the latter emphasizing how it is far more realistic, and ultimately developmental, to allow miners to use mercury, but in a way that is managed.

¹⁷⁹ See Cardiff, 2010.

¹⁸⁰ ARM/FLO, 2010; p. 21.

¹⁸¹ See for example, the ASM management standards of CRED Jewellery, EcoAndina, Fairtrade in Gems and Jewelry, Mammoth Tusk Gold (MTG), Oro Verde™, and URTH Solution in Cardiff, 2010.

Instead, ARM/FLO allows for continuation of ASM operations which have a proven track record of operating for at least ten years under the monitoring and legal permit of local authorities.¹⁸²

The FT/FM standard goes beyond any other standard that seeks to support artisanal and small-scale miners who are willing to mine in ways that are not only responsible but developmental. It is unfortunately unlikely that a majority of artisanal gold miners will ever be able to achieve FT/FM certification as it sets a very high standard which requires formal status and an enabling market. Nevertheless, efforts are emerging to help gold miners move incrementally towards compliance with FT/FM's performance criteria. It may be possible to engage one of these initiatives for work in PACE contexts.

Lastly, ARM/FLO recently announced that the ARM/FLO standard will be undergoing review in 2012 with a specific objective of developing "a more generic system to facilitate standards development of ASM of other minerals in the future."¹⁸³ This would make the FT/FM model more widely applicable as a way of incentivising good environmental and social practice in ASM. Simultaneously, in 2012, ARM and FLO continued working with national and international partners to expand the Fairtrade and Fairmined producer network to Africa (Tanzania, Uganda, Kenya, Ghana) and Asia (Mongolia).

4.4.2. Initiatives Targeting Conflict Minerals

In the "conflict minerals"¹⁸⁴ space there are a number of supply chain standards seeking to assure the human rights (and occasionally environmental) performance of a supply chain. The incentive in this space is market access. It is increasingly difficult for miners that are not part of one of these initiatives to find the finance to mine and a market for their goods at all.

Applied examples of each of these market-led approaches are given below. Market-led incentivizing of responsible mining techniques as a solution to ASM in PACE is not universally suitable. First and foremost, market-led initiatives typically require some type of assurance (usually third party certification). The supply chain operators will have achieved specified performance levels on social, environmental, economic and/or commercial issues which guarantee to consumers that the minerals have indeed been produced and traded ethically. For this to work, chain-of-custody systems are necessary; these can be costly and challenging to implement. To meet this traceability requirement, it is often necessary for new supply chains to be established to get the product from mine site to market, as existing supply chain operators may be unwilling to cooperate or may be too many to make traceability feasible. Time and money must be spent ensuring the viability of these new structures. Yet, there may be strong cultural or socio-economic reasons why ASM do not wish to abandon their existing buyers.¹⁸⁵ Thus, certain conditions must be present for feasibility to be assured: Are the miners organized enough to be able to be engaged? What is their potential to achieve the performance standards and the cost to bring them to compliance? How willing are they to participate? To what extent would new supply chains be necessary? And, above all, are they able to be formally recognized as legal? Where the law forbids ASM in a protected area and where they are unable to achieve special exemption from the law, it is extremely problematic, if not impossible, for the miners to market their wares as 'ethical'. However, depending on the geology of the areas surrounding the protected area, the restriction on 'ethical' marketing may provide an opportunity: it may be feasible to create a system which incentivises people out of the protected area.

¹⁸² EcoAndina is currently the only working ASM standard that specifically includes demarcation of ecologically sensitive areas that are to be avoided, but EcoAndina's Standard is only applied at its operations in Argentina. See Cardiff, 2010.

¹⁸³ Fairtrade Labelling Organization and the Alliance for Responsible Mining, 2012.

¹⁸⁴ "Conflict minerals" are defined as tin (cassiterite), tantalum (tantalite), tungsten (wolfram), and gold, and their derivatives, mined by artisanal or small-scale means anywhere in the world that "make a substantial contribution to **financing, sustaining and perpetuating** conflict." (UNEP, 2010). Ordinary minerals are labeled conflict minerals "when their control, exploitation, trade, taxation, or protection contributes to, or benefits from, armed conflict." (See USAID, 2004) Accordingly, the minerals – or set of minerals—labelled as conflict minerals can shift depending on the context. For example, the term 'conflict minerals' has been used to describe the role of minerals in several countries, from 'blood diamonds' or 'conflict diamonds' in the civil wars in Sierra Leone, Liberia, and Angola, to the role of the 3TG in DRC's ongoing armed conflict today. The common association with the term 'conflict minerals' has to do with minerals that: (a) are mined artisanally in the East DRC; are mined in poor conditions where there is the occurrence of human rights abuses; are a source of income for armed groups; and which are smuggled illegally across borders.

¹⁸⁵ Van Bockstael, Levin and Weinberg (2011).

4.5. Alternative Livelihood Programmes

Alternative livelihood programmes are a common strategy to address human encroachment into protected areas. In the context of mining, programmes are most effective when miners are from the local area and have permanent settlements. In areas comprising large numbers of economic migrant miners — be they from the same country or foreigners — the model has proven less effective owing to the population's impermanent status, lack of cohesive social capital and disinterest in long term collective enterprises. In Liberia, an alternative livelihoods strategy was attempted following an eviction of artisanal miners from Sapo National Park (SNP) in 2005. The project worked on the premise that the introduction of new livelihoods would replace income generated from environmentally deleterious activities which included ASM. In practice, the alternative livelihood programme was not robust and people with the requisite equipment, skills and desire recommenced mining in SNP: ASM is an integrated part of the local economy. For many, the presence of gold means an option for supplemental income to the suite of available livelihood options. In the case of SNP, in a context of rising gold prices and unguarded park borders, mining simply recommenced despite semi-coordinated donor intervention.¹⁸⁶

Contrary to the Liberia example, in Sierra Leone the use of alternative livelihood programmes is working to help control ASM in the Gola Rainforest National Park. The Gola Forest Programme (GFP) — an international consortium that includes the Sierra Leonean Government, the Royal Society for the Protection of Birds (RSPB) and the Conservation Society of Sierra Leone (CSSL) — has had apparent success bringing ASM within the Gola Forest National Rainforest Park under control. The multi-pronged approach merges community engagement, direct payment and alternative livelihood programmes. The GFP works with local communities to preserve the forest by guaranteeing them an income stream that is meant to substitute the income they may have gained from logging. “The project will offer benefits to local communities in the form of development payments, employment and involvement in developing and implementing the management plan. These benefits will contribute to efforts to improve local livelihoods and aid in post-war reconstruction, as well as secure communities' active support for conservation.”¹⁸⁷ The GFP has used a similar strategy to address mining within the park. GFP forest guards evicted all artisanal miners from the reserve in 2007.¹⁸⁸ Since then, the GFP has: paid compensation packages to land owning families and the paramount chiefs of the seven area chiefdoms; undertaken infrastructure developments like building schools, community centres, roads, bridges and health centres; and given scholarships to students. The project operates a forest management committee in every chiefdom comprised of ten elected members.¹⁸⁹ ASM in the Forest has been seemingly brought under control by the Gola Forest Programme.¹⁹⁰ ASM-PACE plans to study this programme in depth to understand the precise model, its on-going challenges, and replicability potential within Sierra Leone, the wider region, and elsewhere.

In the context of alternative livelihood programmes, tourism is regularly touted as a way to incentivize the residents of forest-adjacent communities to protect a park. ASM-PACE researchers found that tourism's alternative livelihood potential is limited. For example, Suriname's Brownsberg National Park is a popular tourist destination, particularly for residents of Paramaribo and foreign tourists. While the park does provide a source of income for communities near the Brownsberg National Park, it is not a realistic alternative to small-scale gold mining because the number of required guides, cooks, cleaning staff, etc. needed for BNP-related tourism is relatively small. Moreover, the wages offered for these regular jobs are a fraction of gold mining wages.

The strategies below are more rare but are listed here as a way to complete the picture of available options.

4.6. Selected De-gazettement

Gazettement is the process by which an area is delineated and declared a protected area. Selected de-gazettement is when parts of that area are strategically exempted from protected area status. In Uganda, artisanal salt mining has been taking place for hundreds of years on the Katwe Crater Lake. The Lake is located less than 1km from the shores of Lake Edward and is surrounded by the famed Albertine Rift landscape of Queen Elizabeth National Park. When Queen Elizabeth National Park was being gazetted, Katwe and twelve other towns — mainly fishing

¹⁸⁶ Small 2012.

¹⁸⁷ Gola Forest Programme (n.d.)

¹⁸⁸ Personal communications between Babar Turay, Musa B. Taimeh, and Manna I Swarray, September 2011.

¹⁸⁹ Personal communication between Babar Turay and Mr Alusine Fofana, director of the Gola Forest Programme, September 2011.

¹⁹⁰ Personal communication between Babar Turay and Manna I Swarray, September 2011.

villages — were demarcated to protect existing industry and livelihoods. Thanks to that strategic demarcation, Katwe’s artisanal salt mining was allowed to continue despite being surrounded by a protected park.¹⁹¹

4.7. Conversion to Formal Protected Status

In Colombia, protected areas have heightened Constitutional protection. In addition to enjoying a complete ban on mining they 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 to stop the mining — industrial and artisanal — and other activities from occurring on their lands. For example, Alto Fragua Indi Wasi National Park (168,000-hectares; established 2002) and Orito Ingi-Ande Plant Sanctuary (22,000-acres; established 2008) were both established in this manner under an initiative now termed ‘bio-cultural conservation’. Both received help from the Amazon Conservation Team (a US-based NGO)¹⁹², the Colombian Ministry of the Environment, Housing and Territorial Development, the Special Administrative Unit of the Colombian National Park System, Rosario University, and the Union of Traditional Yagé Healers of the Colombian Amazon (UMIYAC)¹⁹³. In practice, this will only work in contexts where there are stringent contractual safeguards and trust that the government will not undermine the agreement.

4.8. “Mining Mindful” Conservation Strategies

In the DRC, a similar model is being proposed in the Itombwe Nature Reserve (*Reserve Naturel d’Itombwe* or RNI). The Reserve’s final demarcation awaits final approval by the State. Meanwhile, WWF and other major conservation organizations have joined with local CSOs to propose that the RNI be split into three zones: human habitation; a resource use zone, where people access specific agreed-upon resources in a sustainable manner; and a core protected zone, where there will be no utilization of the zone.

¹⁹¹ Byaruhanga, Kasoma, & Po, n.d.

¹⁹² http://www.amazonteam.org/index.php/245/Colombia_Program

¹⁹³ http://www.amazonteam.org/news/index.php/5/New_Category_of_Rainforest_Preserve

5. CONCLUSIONS AND KEY RECOMMENDATIONS AT THIS STAGE FOR ASM IN PACE

This report's aim was to summarize the scope and scale of ASM in protected areas and critical ecosystems worldwide, describe its known effects, document 'push and pull' factors contributing to the problem, study attempted solutions and offer recommendations that balance development opportunities with conservation goals. ASM, when done in PACE, can have specific and sometimes severe environmental impacts. These can be exacerbated depending on the type of ASM in practice (community mining, rush-mining, etc.) as well as on the mineral and ecological context. 'Push and pull' factors contribute to and further exacerbating this problem. Of the many issues contributing to ASM's negative environmental impacts, foremost are: ill-considered policies which marginalize the sector; a lack of knowledge by miners about their impacts and how to reduce or mitigate them; and a widespread lack of incentives for miners to introduce improved techniques or rehabilitate mining sites. If miners' returns depend solely on how much and how fast they can dig and there is no similar incentive to rehabilitate or backfill, it is not surprising that it is so rarely done. Approaches to these challenges are being developed and implemented, as illustrated by eight types of existing response programmes — each working to address ASM in PACE locations, each presenting opportunities and hazards.

Moving forward, what has the 36 country scoping study and this solutions study identified as ways to constructively address ASM's social and environmental liabilities in the world's most important ecosystems?

5.1. Policy Recommendations

Difficult policy decisions need to be made by both governments and conservation organizations. ASM in protected areas is illegal in most cases, yet it continues. Ignoring the problem due to fears of condoning an illicit activity has resulted in an untenable situation: ASM will continue to be a marginalised sector working in tough and unsafe conditions and pursuing livelihoods by chipping away at the earth's last remaining tropical forests and endangering flora and fauna. Engagement and leadership by all stakeholders is urgently needed.

5.1.1. For Governments:

1. ***A lack of policy harmonization and coordination on ASM continues to thwart progress.*** ASM in and adjacent to protected areas can impact multiple sectors and jurisdictions. Accordingly, ministries of forestry, water, mining or agriculture and national park agencies may have jurisdictional responsibilities of varying levels. If the protected area rests on an international border, the country's military, immigration and other security forces may also have relevant jurisdiction. However, in a great many cases, there is little to no clarification or coordination across the various sectors in terms of how to manage or regulate artisanal mining. As a result, policies and laws either do not cover ASM directly, routinely contradict each another, or work at cross-purposes.

For example:

- In Liberia's Gola Forest, artisanal mining licenses are being given out at the same time the forestry authority is taking steps to upgrade the forest reserve into a national park.
- In Cambodia, the most recent Mining Code (2001) makes only brief mention of ASM, and, in doing so, makes the majority of ASM activities illegal and informal¹⁹⁴ and without any sort of technical assistance.
- In the DRC, the Mining Code is not harmonized with the Forestry and Land Codes, leading to conflicts over entitlements.¹⁹⁵ There are further unclear and contradicting mandates between Ministries (Environmental and Mining) at the national and provincial levels.

There is a clear need to harmonize the various laws, regulations and codes across relevant sectors in order to coordinate management of the ASM sector and ensure that artisanal mining does not continue to slip through legislative loopholes.

Specific activities could include:

¹⁹⁴ Spiegel and Hoeung, 2011.

¹⁹⁵ Bawa and Hayes, 2010

- i. Improve national land use planning. Most planning around ASM — if it exists at all — seems to occur after concessions have been mapped and allocated to industrial mining operations. As such, it is recommended that ASM issues be integrated, when possible, into on-going national or regional-level land use planning exercises currently under way in many developing countries. Land use planning represents a strategic opportunity to raise and address many of the concerns associated with ASM, including environmental impacts, population influxes and appropriate sites for ASM.
- ii. Clarify ministerial jurisdiction over activities within a protected area and provide appropriate financial-resources to the agency in charge of protected area management.
- iii. Provide robust security and park management staffing; clearly delineate protected area boundaries in coordination with communities; provide communities with a stake in conservation of the area (otherwise, face conflicts).
- iv. Legalize and formally incorporate artisanal and small scale mining into national mining acts, codes and other regulations. Legal standards for artisanal and small-scale mining should be clearly defined; identify plans and policies to transform ASM into a more efficient, regulated, formalized and environmentally-sensitive sector.

2. **Supporting formalization and development of the ASM sector is urgently needed.**

In a 2012 United Nations Environment Programme (UNEP) report, the Alliance for Responsible Mining wrote:

“Formalization is a process that seeks to integrate ASGM into the formal economy. The process of formalization includes the development or adaptation of mining (and other) laws or policies to address the challenges of ASGM. A well-designed formalization process generates the enabling conditions for accountability within the sector so that it can ultimately be integrated into the formal economy. Formalization can only be successfully achieved if programmes and public policy deal with the different dimensions of ASGM activities simultaneously and in an integrated way. Legalization is just one dimension of the process of formalization [...] Experience shows that the ASGM sector can transform itself quickly when the enabling regulatory, economic and other conditions are created.”¹⁹⁶

Too often, mining codes are overly ambitious, vague, or too poorly crafted to cope with the realities and dynamics of the sector. As illustrated in this report, marginalization of the ASM sector and its sometimes-disastrous environmental consequences are closely linked. Formalization strategies should be well-considered to incentivize miners to become formal (with affordable licenses, clear and achievable environmental protocols, stable security of tenure, technical assistance opportunities, etc.) complemented with enforcement planning.

To make the sector more environmentally and socially responsible, specific activities could include:

- i. Mobile licensing units to reach miners outside of the capital cities
- ii. Mobile technical assistance units for health, safety, and environmental matters
- iii. Promoting miners’ access to credit to build their businesses and access innovative greener technologies
- iv. Facilitating their access to markets using participatory consultations (avoiding setting national gold prices, etc. which can facilitate smuggling)
- v. Facilitating ethical market initiatives through policy changes
- vi. Pilot programmes
- vii. Economic incentives

¹⁹⁶ UNEP 2012.

For all regulation and planning, it is critical that artisanal miners are a central part of the decision making processes surrounding ASM policymaking and regulation.

5.1.2. For Conservation Organizations

While artisanal mining is considered illegal in legally protected areas (IUCN Categories I-IV) according to national law in most countries, there is far less legal clarity or enforcement with respect to artisanal mining in multiple-use protected areas. Given the scale of the problem (32 of 36 countries examined had critical ecosystems affected by ASM), there is an urgent need for increased awareness about ASM within the global conservation community.

The most popular form of response to the issue of ASM in PACE is the use of evictions. Case studies from around the world indicate that law enforcement and eviction (either forced or voluntary) are extremely difficult to sustain. They require significant on-going human and financial resources. They often serve to further inflame tensions with local communities whose economies and food security are interrupted due to the eviction.¹⁹⁷ While in some situations eviction may be the necessary course of action, it is critically important to survey the potential management alternatives and maintain awareness that evictions are rarely sustainable unless backed-up with significant financial and human resources to maintain it.

In approaching any ASM in PACE situation, it is important to recognize that:

- **Education in each context is needed.** Education includes researching and understanding the ecological impacts of ASM, understanding the push and pull factors, scoping the technical intervention opportunities and the geology of the site (to understand if it is possible to incentivize mining outside of the park), and finally harvesting and sharing lessons-learned with other conservation organizations facing the similar issues.
- **Economic incentives are a key tool.** Case studies clearly indicate that the most successful approach to incentivize behaviour change among artisanal miners is by improving their economic welfare. Sustainable supply chain initiatives, for example, require miners to adhere to specific social and environmental standards in exchange for a higher purchase price. The additional income earned acts as an incentive to reduce the ecological footprint of artisanal mining, and can be used strengthen the capacity of conservation authorities and NGOs to fulfil their mandates. Case studies also indicate however that (to date), the only successful market-led interventions in ASM have been located in Latin America (i.e. the Green Gold Corporation in Colombia, Cotapata Mining Cooperative in Bolivia). While these models are currently being adapted for Africa and Asia, other less formalized economic incentives should also be explored.
- **Enforcement is important.** Traditional enforcement and anti-poaching measures will remain an important strategy for protected area managers, particularly when illegal and rampant ASM is occurring in sensitive ecosystems. There are, however, a range of other enforcement and intelligence gathering actions that PA managers can take to prevent or mitigate the impact of artisanal miners within protected areas. These include: rapid assessments to collect baseline ecological data regarding observed impacts of ASM within a PA, identifying the specific incentives and motivations encouraging artisanal miners to enter the park, and gaining a clear understanding of how illegal poaching and smuggling networks intersect with artisanal mining.
- **Address the 'push and pull' factors.** Collaboration with Large Scale Mining (LSM) companies may be necessary if industrial development threatens to displace miners into a protected area or critical ecosystem (e.g., Liberia). Alternatively, closure of industrial mining sites can create a surge of impoverished and out-of-work miners in rural areas who migrate towards protected areas in order to maintain their livelihood (e.g. in Ecuador and DRC). Direct and indirect impact of ASM resettlement plans, alternative livelihood projects and mine closures on the environment are often overlooked by LSM but important for conservation stakeholders to watch because they may be forced to cope with the consequences.
- **Encourage formalization of the ASM sector.** ASM-PACE case studies, coupled with commentaries from leading formalization authorities, indicate that when ASM is illegal or informal, the environmental consequences are more severe because: 1) there are no rules to require or reward more environmentally-sensitive mining; 2) the incentive is to extract as quickly as possible; 3)

¹⁹⁷ During the eviction of artisanal miners from Sapo National Park (Liberia), security forces were accused of confiscating the unregistered guns and traps of local villagers. In a rural context, taking away guns and traps is akin to taking away their traditional protein source.

decision making is short-term; and 4) there are few technical resources available to them because informality or illegality discourages organizations that could otherwise be allies.

- ***Understand ASM's role in rural development contexts.*** Most poverty reduction strategies papers (PSRPs) for developing countries do not focus on rural residents diversify their livelihood strategies. The strategies focus predominantly of strengthening rural agrarian economies, and pay little attention the growing number of people who also engage in ASM to supplement their incomes. ASM is typically poverty driven, not a “get rich quick scheme” (even if many dream of striking it rich through the elusive 'big find'). Moreover, the ease of entering the sector means that it is increasingly blended with other livelihood strategies to supplement incomes.
- ***Explore new strategies to manage ASM, even if potentially controversial.*** This report's Section 4 lays out a variety of strategies that have worked, succeeded partially, or failed partially for various reasons. Revisiting and building upon these or exploring other options is important as the problem persists or worsens. One underexplored option is a managed-mining scenario in the spirit of negotiated access programmes in IUCN Category V and VI protected areas, where some economic activities are permitted.
- ***Shift from Alternative to Complementary Livelihoods approaches.*** Research indicates that the vast majority of alternative livelihood projects focused on artisanal mining communities do not in fact discourage people from engaging in ASM. Rather than championing alternative activities that seek to replace ASM, it is recommended that efforts encourage complementary activities that reduce environmental impacts and seamlessly co-exist with ASM (As examples: using former mining pits for fish ponds or vegetable gardens; the Property Rights and Artisanal Diamond Development (PRADD) programme in the Central African Republic).

5.1.3. For donors

In order to protect hard-won conservation victories, leadership funding is needed from the donor community (public and private donors alike). If the conservation community (broadly defined) is to succeed in creating 'no go' areas for any type of mining or to cope and manage successfully the present incursions, then they must be supported with accompanying financing to properly resource such initiatives over the short and long term. There is a critical role for donors in these efforts and their leadership is quite urgently needed.

5.2. Concluding Remarks

ASM-PACE is a joint programme of global conservation organization WWF and specialist consultancy firm Estelle Levin Ltd. that seeks to address the environmental impacts of artisanal and small-scale mining in some of the world's most important ecosystems. Via reports, tools and commentary, ASM-PACE works with all ASM stakeholders to create a space for information-exchange and best practice. We welcome additional qualitative or quantitative information on specific sites or issues or requests for technical assistance in specific contexts. Please note that we do not provide financial assistance or give grants of any kind; we can, however, work as technical partners under an already-awarded grant. Please contact ASM-PACE through its website, www.asm-pace.org.

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ANNEX A: MANAGEMENT OPTIONS FOR MITIGATING THE IMPACTS OF ARTISANAL MINING IN PROTECTED AREAS

Below is a list of the most widely adopted policy strategies to contain ASM in PACE as well as analysis of their success and constraints. Generally, the major constraint is the lack of adequate enforcement of existing national laws due to lack of human capacity, corruption and/or technical knowledge. Whether or not all stakeholders (miners, government agencies, international non- and governmental organizations) work together on a long term strategy and have enough funding to finance the longevity of the strategy can influence the policy's success.¹⁹⁸

| Strategies for addressing ASM in Protected Areas and Critical Ecosystems | | |
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| STRATEGY | EXAMPLES | CONSTRAINTS |
| <p>1. Eviction</p> <p><i>Definition:</i> Clearance by use of force, or threat of force, of miners from a specified area. This appears to be the most commonly-used strategy.</p> <p><i>Motive:</i> To stop ASM in PACE.</p> <p><i>Type of mining where this response may be successful:</i> Rush-situations and only if coupled with robust alternative livelihood programmes and a park security plan.</p> <p><i>Risks of taking this approach:</i> Many. Worsening relations with forest-adjacent communities; interruption of mining-dependent rural economies; waste of resources as miners will likely return if park security is short-term only; potential for human rights abuse if eviction is done by an undisciplined military (or risk of military involvement in mining sector); pushing miners into increasingly remote and sensitive ecosystems, with significant effects for biodiversity.</p> | <p><u>Sapo National Park (Liberia)</u></p> <p><i>Reasons:</i> The official rationale for the 2011 'voluntary departure' was for conservation. Other reasons could have included an upcoming presidential election in October 2011, the park's remote location near an international border yet access to roads leading to the capital city, and the profile of miners as ex-combatants.</p> <p><u>Gola Forest National Park (Sierra Leone)</u></p> <p><i>Reasons:</i> To stop ASM in PACE; to establish rule of law within the park; to establish primacy of conservation priorities.</p> | <p>Without a long-term security strategy, there is little to prevent miners from re-entering the area.</p> <p>Without a robust alternative jobs programme or programme offering miners an economic-stake in respecting the border areas of the park, there is little to discourage communities from re-entering.</p> <p>By using this tactic, government risks community alienation, including possibly threatening its ability to operate there in the short to medium term. It also risks disruption of a regional economy based on mining. Without a robust follow up plan of security and economic incentives, eviction is likely to fail and ultimately be a waste of resources.</p> |

¹⁹⁸ Tranquilli, S., et al. (2011)

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| <p>2. Negotiated Access</p> <p><i>Definition:</i> Conditioned access to protected areas where limited ASM is allowed and under agreed-upon conditions.</p> <p><i>Motive:</i> To regulate and limit ASM in PACE.</p> <p><i>Type of mining where this response may be successful:</i> Long established permanent or seasonal ASM sites with strong local community connections and potential for good-faith effort to fulfil the agreement.</p> <p><i>Risks of taking this approach:</i> There is the real risk that it will not work, which is why thoughtful incentives, monitoring and compliance strategies and mechanisms are needed from the start. This report's Section 4 lists some of the principles in compliance. There is also the likelihood that it will need to be updated based on experience, which means taking an opportunity to make it work better in practice but also the risk that some environmental demands might be negotiated away.</p> | <p><u>Brownsberg National Park (Suriname)</u></p> <p><i>Reasons:</i> In 2010-11, an 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.</p> <p><u>Minkebe National Park (Gabon)</u></p> <p>Several efforts were made between 1998 and 2010 for a negotiated situation in the buffer zone of Minkebe National Park.¹⁹⁹ These agreements typically included a ban on hunting of protected species, notably elephants, and tentative plans to control the arrival of illegal immigrants from Cameroon by coordinating with the Cameroonian local authorities. However, despite years of negotiations and efforts, the draft MOU was never signed. This was likely due to the influx of miners the camps in the Minkébé zone suffered from 2008 onwards. It was felt that the 4,000 people in the region, most of them newcomers with whom the conservationists did not have existing relationships, rendered the draft MOU disproportionate and impossible to enforce.</p> | <p>The devil is in the details. In the Brownsberg case, the agreement mutually broke down when authorities failed to clearly delineate the park boundaries and the miners did not fix the road within the desired time frame. Ultimately, the dialogue has apparently stopped and the miners continue to work as before. Since then, the government has returned to a policy of no ASM in protected areas.</p> <p>Trust-building, accountability, and arbitration methods are necessary for success.</p> |
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¹⁹⁹ Hollestelle 2012

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| <p>3. Market-based and supply chains initiatives</p> <p><i>Definition:</i> Using a variety of incentives to engage all stakeholders in developing a sustainable supply chain.</p> <p><i>Motive:</i> Address ASM's environmental impacts.</p> <p><i>Type of mining where this response may be successful:</i> Permanent ASM in areas of sustained interest and investment by key stakeholders.</p> | <p><u>Oro Verde® (Green Gold) Project</u></p> <p>Launched in 2000 in the Chocó Bioregion of Colombia. Uses ASM to benefit Afro-Colombian communities through sustainable, environmentally-friendly mining and community benefit utilizing social, economic, environmental and labour standards. Inspired the Alliance for Responsible Mining (ARM) in 2004.</p> <p><u>FairTrade & FairMined</u></p> <p>In the Fairtrade system, the incentives are financial, political, and social. The approach is based on rights and responsibilities determined through standards for production and trade. It is driven by a proven consumer demand for ethically and responsibly sourced gold which is not only traded under fair conditions, but also mined in a socially and environmentally responsible way.</p> <p><u>The Durban Process for Ethical Mining (DRC)</u></p> <p>Launched by the Gorilla Organization to reduce the environmental, social, economic and political ramifications of ASM in the Kahuzi-Biéga National Park (KBNP) and to involve stakeholders from every part of the KBNP's coltan supply chain in a participatory process of problem and solutions identification and implementation.</p> | <p>Complying with all of the requirements of the Standard demands an enormous voluntary effort from an ASM organization. Nevertheless, ASM organizations are motivated to engage by a series of incentives</p> <p>By 2009, the Durban Process began to wind down due to several reasons representative of challenges to this approach:</p> <ol style="list-style-type: none"> (1) Difficulty of securing 'legal' Artisanal Mining Zones (AMZs) (2) Donor reluctance and fatigue (3) Fickle nature of global demand for minerals (4) A shift in priorities of a stakeholder can pull critical support for an initiative. |
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| <p>4. Introduction of Responsible Mining Methods within PACE</p> <p><i>Definition:</i> Use a toolbox of political, financial and social incentives to encourage positive change in the mining sector.</p> <p><i>Motive:</i> Recognizes even small adjustments to mining technique can vastly ameliorate negative impact.</p> <p><i>Type of mining where this response may be successful:</i> Both permanent and seasonal ASM.</p> <p>If successful eviction is unlikely; where ASMs are unlikely to transition into alternative livelihoods; where de-gazettement is to be carried out but ASM is still occurring in a critical ecosystem.</p> | <p><u>Sustainable Management of Mineral Resources Programme</u> Funded by the World Bank in Uganda (2003-2011) to improve ASM areas and sector governance.</p> <p><u>Global Mercury Project</u></p> <p>Works to encourage mercury management and elimination in eight countries around the world</p> <p><u>Integrated Management of the Environment in Small Mining (MEDMIN)</u></p> <p>Sought to address the most environmentally and health hazardous activities in Bolivia's artisanal gold sector, particularly mercury use, dumping tailings into river systems, and uncontrolled acid rock drainage from mines and dumps.²⁰⁰</p> <p><u>Mercury Contamination from Gold Mining in the Tapajos and Madeira River Basins, Brazilian Amazonia Project</u></p> <p>Aimed at identifying the impacts of ASGM and develop cleaner technical alternatives to current methods.²⁰¹</p> | <p>Considered a moderate, pragmatic approach not devoid of environmental consequences (though they are significantly reduced). I.e. while the ARM/FLO environmental standards are more rigorous than those of any other Standard oriented at ASM, it does allow for the use of mercury and cyanide.</p> |
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²⁰⁰ See MEDMIN case study in Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p 215-237.

²⁰¹ See case study in Wotruba, H., Hentschel, T., Livan, K. et.al (1998, translated in 2002), p 215-237.

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| <p>5. Alternative Livelihood Programmes</p> <p><i>Definition:</i> Incentivize participants away from ASM by offering jobs with less negative impacts.</p> <p><i>Motive:</i> the introduction of new livelihoods could replace income generated from ASM.</p> <p><i>Type of conditions this response may be successful:</i> When miners are from the local area and have permanent settlements.</p> <p>Shock-push ASM in response to natural or economic disasters; where ASM constitutes the last resort for subsistence; where income opportunities from mining are low; where miners are keen to return to previous occupations or engage in new income generating activities.</p> | <p><u>Sapo National Park (Liberia)</u></p> <p>Attempted following an eviction of ASMs from Sapo National Park (SNP) in 2005. In practice, the alternative livelihood programme was not robust and people with the requisite equipment, skills and desire recommenced mining in SNP, revealing that ASM is an integrated part of the local economy.</p> <p><u>The Gola Forest Programme (Sierra Leone)</u></p> <p>An international consortium has had apparent success bringing ASM within the Gola Forest National Rainforest Park under control (ASM-PACE will study this programme in 2013). Following the 2007 eviction of all ASM, the GFP has been: paying compensation packages to land owning families and the paramount chiefs of the seven local chiefdoms; undertaking infrastructural developments like building schools, community centres, roads, bridges and health centres; giving scholarships to school and college students from the area; and more.</p> | <p>In areas comprising large numbers of economic migrant miners, be they citizens or foreigners, this model has proven less effective owing to the population's impermanent status, lack of cohesive social capital and disinterest in long term collective enterprises.</p> <p>In many areas, ASM's main appeal is how lucrative it is with minimal skill prerequisites. Matching economic weight with alternative livelihoods can be difficult and perhaps even require unsustainable subsidization.</p> |
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| <p>6. Selected De-gazettement</p> <p><i>Definition:</i> Parts of an area are strategically exempted from protected area status during the gazettement process.</p> <p><i>Motive:</i> Takes into consideration known mineral resources, historic mining sites and local community livelihoods.</p> <p><i>Type of mining where this response may be successful:</i> Permanent, seasonal and to some extent even rush type and shock-push ASM.</p> <p>When established communities are willing to work with the government and respect the established boundaries.</p> | <p><u>Queen Elizabeth National Park (Uganda)</u></p> <p>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 gazetted, Katwe and twelve 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 despite being physically in the park area.</p> <p><u>Minkébé National Park (Gabon)</u></p> <p>During gazettement of the Minkébé National Park, an area containing a potentially economic large-scale iron and gold deposit was excluded (the “Minkébé Finger”).</p> | <p>Communication and commitment with the relevant communities must be strong less they expand outside of the allocated space into the protected area.</p> <p>When the mining in the exempt portion runs out, miners may move into the protected area.</p> <p>Environmental impacts of mining may not be contained to the exempt area and could have devastating impacts on the neighbouring protected area.</p> <p>The mineralized area attractive for ASM in Minkébé National Park (smaller satellite deposits) exceeded the de-gazetted area and during a gold rush miners started to invade the National Park. To re-gain control over the area, the Government utilized strategies of negotiated access and eviction; with limited success. Gazetting the protected area properly in the first place (taking into account not only LSM but also ASM) would have avoided the resulting conflicts.</p> |
| <p>7. Conversion to a Protected Area</p> <p><i>Definition:</i> Obtaining or strengthening protection designation to compel significant government protection.</p> <p><i>Motive:</i> Cease all mining.</p> <p><i>Type of mining where this response may be successful:</i> All types of ASM, but only in places with strong rule of law, political will, and sufficient resources.</p> | <p><u>Colombia</u></p> <p>Protected areas in Colombia 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 mining — industrial and artisanal.</p> | <p>Few of the most vulnerable protected areas are in countries with sufficient rule of law, political will and resources to maintain this level of protection.</p> <p>Sufficient trust must exist that the government will not steal, redistribute, nor exploit the land for its own benefit.</p> |

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| <p>8. “Mining Mindful” Conservation Strategies</p> <p><i>Definition:</i> When planning or discussing protected areas, consider on-going and potential ASM.</p> <p><i>Motive:</i> Many of the difficulties in addressing ASM are rooted in the protected area’s earliest planning stages when ASM was neglected or underestimated as a serious factor. By acknowledging it as a major consideration early on, stakeholders will be better prepared to address challenges down the road or avoid them entirely.</p> <p><i>Type of mining where this response may be successful:</i> Areas which are candidates to become a protected area and have on-going ASM or substantial exploitation potential.</p> | <p><u>DRC</u></p> <p>In the Itombwe Nature Reserve (RNI) final demarcation still needs to be validated by relevant stakeholders and approved by the State. Conservation and local CSO’s have proposed the RNI be split into three zones: human habitation zone, a resource use zone and a core protected zone.</p> | <p>Takes considerable forethought and cooperation between government, conservation and mining stakeholders. In the DRC, a major constraint is rebel activity within the RNI and a lack of alternative livelihoods for mining communities.</p> <p>Mining and critical wildlife habitat might overlap in inconvenient but real ways, resulting in a forced choice between conservation and mining activity. Choosing the former will require the deployment of significant enforcement resources.</p> |
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| Bhutan | Japan | Thailand |
| Bolivia | Kenya | Tunisia |
| Brazil | Laos | Turkey |
| Bulgaria | Madagascar | Uganda |
| Cambodia | Malaysia | United Arab Emirates |
| Cameroon | Mauritania | United Kingdom |
| Canada | Mexico | United States of America |
| Central African Republic | Mongolia | Vietnam |
| Chile | Mozambique | Zambia |
| China | Namibia | Zimbabwe |
| Colombia | Nepal | |
| Costa Rica | Netherlands | WWF Associates |
| D.R. of Congo | New Zealand | Fundación Vida Silvestre (Argentina) |
| Denmark | Norway | Fundación Natura (Ecuador) |
| Ecuador | Pakistan | Pasaules Dabas Fonds (Latvia) |
| Finland | Panama | Nigerian Conservation Foundation (Nigeria) |
| Fiji | Papua New Guinea | |
| France | Paraguay | |
| Gabon | Peru | |
| Gambia | Philippines | |
| Georgia | Poland | *As at December 2011 |
| Germany | Romania | |
| Ghana | Russia | |
| Greece | Senegal | |
| Guatemala | Singapore | |
| Guyana | Solomon Islands | |

WWF in numbers

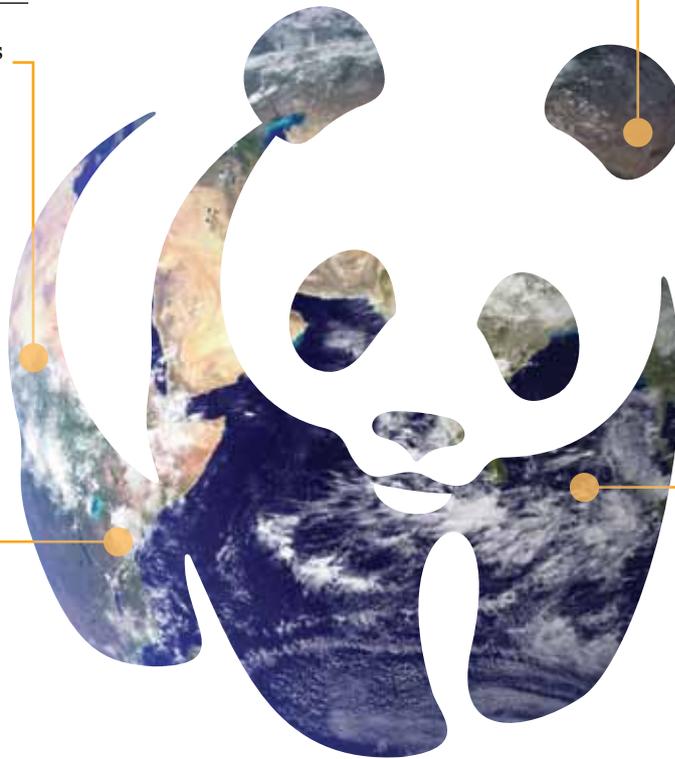


1961

WWF was founded in 1961

+100

WWF is in over 100 countries, on 6 continents



+5M

WWF has over 5 million supporters

+1,300

WWF runs over 1,300 projects worldwide



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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