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Opinion

Responsible Mining: The Key to Profitable Resource Development

Robert Goodland

Independent Consultant, Canada; E-Mail: rbtgoodland@gmail.com

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Abstract: Better mining corporations want to adopt "Responsible Mining". This paper outlines the essentials of responsible mining and offers a guide to corporations who want become responsible. Eight principles are discussed: (1) Social and environmental assessment, (2) Transparency, (3) Acceptance by stakeholders, (4) Food production trumps questionable mining, (5) Compliance with international standards, (6) Corporate prequalification, (7) Insurance and performance bonds, and (8) Royalties, taxes and fees. These principles are followed by a discussion of No-Go Zones to mining: why some types of sites should be off-limits to all mining. The Annex on Compensatory Offsets suggests that, on occasion, there may be exceptions to a No-Go Zone.

Keywords: responsible mining; social and environmental assessment; no-go mining zones

1. Introduction and Perspective

Why should mining become responsible? For two reasons. First, mining is damaging communities and ecosystems worldwide. When the earth was relatively empty of people and ecosystems were intact, a mine here or there seemed acceptable. The world was huge and the human economy tiny. That idyll has shifted and the natural world has become vulnerable and excessively crowded. Our energy and industrial activities have released enough carbon into the atmosphere to damage the climate. Industrial waste has so polluted the oceans that they are becoming less alkaline (they acidified by 30 percent over the last few decades) [1]. Lower ocean pH is already reducing the size and weight of oyster and crab shells and corals as calcium carbonate becomes less available [2]. Slowing the pace of destruction is no longer adequate; the human economy must back down to an earlier and safer state of environmental resilience by actively reversing damage as well as improving prevention.

Even as some mining companies begin to incorporate some sustainable practices, certain forms of metal mining are intensifying social and environmental impacts because, as the price of gold and other metals soars, it becomes economical to exploit leaner ores in more remote places, such as tropical forests in developing countries, and in areas with weak governance. Big companies often excavate huge open pits, which may be abandoned after mining. Also abandoned are the commonly toxic and extensive tailings lagoons retained by impermanent dams, which often fail in severe weather, according to UNEP and others (references listed below). Open mining pits and tailings lagoons can remain risky for decades or longer.

Mine closure procedures are improving in the best-run corporations and in countries with prudent regulations and enforcement. For example, Barrick Resources is operating a water treatment plant in perpetuity at a nickel plate mine it inherited after taking over North Dakota's Homestake, the biggest goldmine in North America. However, in weakly governed countries, mine closure bonds are often still incommensurate with prudent costs and communities can be left in the lurch when companies leave or sell their holdings (see Section 2.7). Vast literature supports the claim that mining operations are causing increasing social and environmental disruption [3–13]. Damage is also caused by artisanal miners and by small farmers who settle and deforest areas opened by mining roads; however, this paper focuses on solutions for large mining companies, which differ from solutions for local enterprises.

Second, responsible mining, as defined in this paper, can actually offer companies bigger and quicker profits, with no conflicts with surrounding communities and with fewer impacts than irresponsible mining. Industrial mines present both opportunities and risks to local residents, governments, and the environment. Clearly, mining can provide significant local employment, economic opportunity, and government revenue. It provides many basic materials for our generation and future generations. But because minerals are public assets, decisions about their exploitation must be transparent, participatory and subject to informed scrutiny by civil society. Problems arise from the gross asymmetry of power between rich and knowledgeable mining corporations and impacted people who are unprotected by weak governance. Best-practice responsible mining seeks to redress this imbalance.

New mines are increasingly squeezed between communities or placed where they damage community life-support systems such as forests or wetlands. Thus, communities and their life-support systems need protection. In addition, current mining of leaner ore veins produces more severe impacts because it requires the processing of a greater volume of material—thus producing more waste—to produce the same amount of metal [3].

Responsible mining is a relatively new concept, and it is taking time for companies to understand it. Mining corporations are under pressure to deliver results. Even in companies with high standards, contractors may cut corners, and the remoteness of sites limits government oversight.

Responsible mining's default position—the course of action that takes precedence when no overriding alternative is specified—is that mining should not damage life-support systems. As Christian S. Monsod points out: "Mining is an issue of social justice, because its impacts on agriculture, rivers and coasts are mostly borne by the poor." [4,5]. It is also an issue of intergenerational justice where our generation—the current mining industry—is burdening our grandchildren with expensive problems while bequeathing them fewer resources to cope. Thus mining operations should be designed to secure optimal net benefit for the citizens of the host country over the

long term with the lowest social and environmental impact. Without such care, mining could become an example of privatizing benefits and socializing costs.

The conditions outlined in this paper are robust. Importantly, this paper mainly focuses on developing countries and especially nations where governance is weak. It focuses mainly on social and environmental aspects of mining, and scarcely at all on technical and economic factors. Decisions about mining clearly need to balance economic, technical, environmental and social factors in participatory and transparent ways. The corporate view of mining can be found in the International Council on Mining & Metals' (ICMM) website [6]. The 2012 Prospectors and Developers Association of Canada's (PDAC) Annual International Convention in Toronto concluded that a growing number of companies want to take responsibility for social change because it's good for business and it's the right thing to do.

Useful background material on mining is available from the International Institute for Environment and Development [7].

Some regions are not suitable for mining for the reasons outlined in Section 4, which is why an increasing number of governmental jurisdictions have mandatory moratoria on metal mining. El Salvador, Costa Rica, and the Philippines are examples where moratoria on metal mining are in place or proposed as the prudent course. Because government regulators on their own cannot assure responsible mining, an increasing number of jurisdictions are enacting forms of moratoria [8]. Only when strong governments, a responsible mining industry, and empowered local citizens can have transparent discussions and make decisions on local projects, can mining be done in a way that provides benefits to all over time.

Box 1. The Non-Sustainability of Mining.

Mining is an extractive industry, hence inherently depletes a stock resource. Metal recycling and efficiency can postpone exhaustion, but cannot make mining sustainable. Under the concept of "weak or quasi-sustainability," mining can be considered to contribute to sustainable development if its economic benefits outweigh social and environmental costs, and if mining revenues are invested in building sustainable industries, enterprises and productive capacities.

The "weak sustainability" principle posits that different forms of capital (natural, human, physical) are substitutable, although, in fact, the substitutability among them is not great. Activities can be considered "sustainable" if the overall stock of capital is at least not diminished and preferably augmented. This definition suggests that mining can contribute to sustainable development, but only if it gives rise to long-term net benefits (environmental, social, or economic) that equal or exceed the values that existed prior to exploitation. To arrive at the "net", all social and environmental costs and all external costs must be subtracted from the benefits. Since these costs are rarely accurately calculated, it can be hard to claim a positive net value. In addition, the 'trickle down theory'—that some fraction of the benefits accrued by the recipients of royalties, profits, and taxes eventually trickle down to the impacted people—is aspirational.

Over the past two decades, the mining industry has attempted to improve its image in terms of mine safety, environmental restoration, and community relations. Through ICMM and PDAC, the concept of sustainable mining has been promoted throughout the industry. Twenty years ago, no one at a mine talked about sustainability; today there are vice presidents responsible for sustainable development. Yet, sustainable mining, as defined by the industry, follows the model of "weak sustainability" that

allows trade-offs among economic, social, and environmental responsibilities (see Box 1) and is less stringent than the concept of Responsible Mining outlined in this paper.

Mining issues are complex and responsibility boundaries between the company and local, regional, and national governments are often fuzzy. Obtaining a "social license to mine" requires a mining company to gain the respect, trust, and collaboration of governments and local populations, especially First Nations. Without proper dialogue between these parties, without communication on all aspects of the proposed project—technical, economic, environmental, and sociopolitical—the project is likely to be rejected locally and eventually, nationally.

Mining corporations that adhere to responsible mining principles can reduce local conflicts, prevent environmental impacts, and even improve their profits.

2. Eight Principles of Responsible Mining

Following the eight principles outlined here would ensure that risky mines are never proposed. These principles encourage the best mining corporations, while keeping away those that cause the most damage. The principles can also apply to small and artisanal mining, but those types of mining deserve special treatment through training, education, poverty reduction, health and safety, and alternate job creation, and are not addressed in this paper.

Mining corporations wanting to follow best practices for responsible mining will find this section useful in selecting future projects. Following best practices means fully espousing all relevant policies and procedures as set out in OECD's Guidelines for Multinational Enterprises [9], plus the eight principles listed in this article (all followed in the same project), plus the guidance regarding No Go Zones in Section 4, below. Together, they provide voluntary principles and standards for responsible business conduct in areas such as employment and industrial relations, human rights, environment, information disclosure, combating corruption, consumer interests, science and technology, competition, and taxation.

The term "responsible" means having a capacity for moral decisions and therefore being accountable; liable to legal review or, in case of fault, to penalties; based on or characterized by good judgment; and honest, reliable, and trustworthy. Decisions, sound thinking, and good judgment require accurate information. The term "mining" is used to mean the extractive industries of oil and gas, as well as mining mainly for metals, which is currently causing the most serious problems.

Excellent sources on responsible mining are available from The Initiative for Responsible Mining Assurance (IRMA) website [10]. Also see Miranda *et al.*, *Framework for Responsible Mining: A Guide to Evolving Standards* [11]. In 2008, the International Union for Nature Conservation (IUCN) passed a resolution supporting Responsible Mining and established its Extractive Industry Responsibility Initiative [12].

The benefits to corporations of mining in a socially responsible manner include reduced labor shortages though investing in local education and skills training; more consistent production as a result of a healthier workforce; less likelihood of conflict by building better relationships with local indigenous people and artisanal miners by means of functioning dialog and grievance procedures, which lead to fewer impacts and faster remediation; better access to lower cost services and supplies through regional business development; and faster access to financing because of lower perceived risk

by equity markets. Socially responsible mining corporations will have few, if any, conflicts with Indigenous Peoples and communities surrounding the mine site. Absence of conflicts and fostering of the consensual approach will avoid lengthy delays and will accelerate the permitting process.

Achievement of social responsibility will benefit best-practice corporations and severely hamper slow adapters. Corporations that earn the people's and government's trust will ultimately be rewarded with a higher stock price. Ethical investors will shun corporations in conflict with communities and government, thus depressing stock prices. Mining companies choosing not to become responsible face scrutiny of their human rights (e.g., slavery) and labor (e.g., child labor) records, as well as their environmental prudence. Shocking headlines exposing irresponsibility can damage the mining companies share price.

To be frank, no modern, large-scale, open-pit mine can be operated without significant long-term impacts, partly because most (99% in the case of gold; much less in the cases of coal and iron) of all rock moved and processed at modern open-cast metal (e.g., gold, copper, uranium, silver) mines ends as waste, that is overburden and ore remaining after the metallic fraction has been removed. (Overburden used for structural and rehabilitation purposes, such as in highways, is not classified as waste by the European Union). To pretend otherwise is to ignore the world's mining track record. All other decisions, such as how best to follow the mitigation hierarchy of "avoid, minimize, restore, and offset," follow from accepting this reality (see Annex).

2.1. Principle 1: Social and Environmental Assessment

An Objective Social and Environmental Assessment Must Be the Starting Point for Project Design toward Responsible Mining

The laws of many national governments mandate social and environmental assessment (ESIAs) that begin as soon a project's engineering (pre-) feasibility planning starts, with standard procedures [13–15]. ESIAs are regulated by governments, paid for by companies, and generally carried out by third-party consultants. Improved oversight is important from the earliest stages (e.g., where terms of reference are agreed) as well as during the work, and just before the results are published. The main goal of an ESIA is to internalize all social and environmental costs and to use full-cost pricing to determine whether the project is economically feasible. If the project passes this stage, a mitigation plan based on the social and environmental assessment is designed to prevent impacts where possible, minimize the remainder, and fully compensate affected communities after gaining their consent.

The quality and professionalism used in preparing some ESIAs are questionable. For example, when the mining proponent selects the ESIA team, there is an inherent conflict of interest; the ESIA team is motivated to find few serious impacts against its employer. Two mechanisms to foster the objectivity of ESIA teams paid by the mining proponent have been developed over the past few decades. The first effective mechanism is for a small team or panel of social and environmental experts (PoE) [16] to help the proponent select the most appropriate ESIA team. The PoE is composed of about three highly seasoned professionals who care more for their lifetime professional reputations and scientific objectivity, than for their next consultancy. They meet on site a couple of times a year to

ensure the ESIA is off to a reliable start and that the final draft, released in about 24 months, is of good quality. If ESIA team members are not identified, suspicion may arise about their capabilities.

PoE professionals usually attach their names to the report, however sometimes their names are not revealed and their reports are secret. The PoE supports and strengthens the in-house E&S unit of the proponent and may liaise with the government's E&S staff. The second mechanism to foster quality is to ensure that an independent third-party reviews the final draft ESIA report and ensures that it is reliable before it is released.

2.2. Principle 2: Transparency vs. *Secrecy*

No Social and Environmental Assessment Should be Kept Secret from Potentially Impacted Stakeholders

Responsible companies make clear statements about having zero tolerance for corruption and for fostering a culture of open information exchange, particularly with communities. Potentially impacted people, both women and men, must fully and openly participate in or be meaningfully involved throughout the approximately two-year ESIA preparation period, from stakeholder identification, through the PoE review, ESIA report, Impact/Compensation Contract, to restoration, rehabilitation, and monitoring. Citizens groups must actually participate in the collection and interpretation of data. Simply allowing citizens to speak at public meetings has little value. Corporations should pay for citizen participation efforts—affected people and communities may need access to independent technical and legal assistance—but remain at arms-length in terms of influence on civil society. The Canadian government routinely finances this assistance, called intervener financing. At present, all project data comes from the financially interested project proponent. Transparency is one of the most important key principles; therefore, publicizing the names of the PoE members should be mandatory, not optional. An "expert" who is willing to be paid by the mining company for expert advice, but not willing to risk tarnishing his/her name, is not an expert, but a consultant.

Most mining operations increasingly take place at remote sites. Before the age of the Internet, mobile phones, and social networking, this meant that mining companies could operate with relative impunity. Not anymore; in this "age of transparency" corporations must be accountable to a degree that was never anticipated. Stories about mining operations are spread worldwide at a moment's notice.

2.3. Principle 3: Acceptance by Stakeholders

If Stakeholders Don't Want the Proposed Project, it Should Not Go Ahead

Stakeholders include mining company employees, local communities and residents, and the government units that receive taxes, royalties and grant permits, as well as the stockholders and managers of the company. Responsible mining corporations don't force mines on people and communities who don't want them. If the national interest, creation of many well-paid permanent jobs and unequivocally big net benefits will accrue to impacted communities, local, and national governments, then there may be a rare case to override local government.

Soon after the stakeholder identification (see Section 2.2), as one of the earliest best-practice steps in the ESIA process, all mines should establish legitimate, independent, and representative citizens' advisory councils (CACs) [17] as called for by IUCN [12]. Even after free prior informed consent (FPIC) has been achieved, active citizen engagement in the EIA process is necessary. Still, this engagement is insufficient: local stakeholders need legitimate independent oversight responsibility of a mining project over its entire life. If the grievance mechanisms cease functioning, or if unforeseen impacts are not mitigated, the CAC negotiates and can halt the project until the situation is remedied.

Corporations should follow some degree of corporate social responsibility (CSR). The best corporations aim to ensure that all potentially impacted stakeholders actually welcome a project because the risks are slight; compensation is great; and job training, employment, and local procurement are attractive. FPIC, as mandated by the UN's Declaration on Indigenous Peoples [18], is the best practice. FPIC means the days when exchanging beads, blankets or footballs to Indigenous People for the rights to mine on their territory are over (see Box 2). FPIC is mandatory for International Finance Corporation (IFC) projects; the rest of the World Bank has not yet adopted FPIC.

Box 2. Negotiating with Indigenous Peoples.

Mining companies are under new pressure to comply with a 2004 Supreme Court of Canada ruling giving the country's Indigenous Peoples, aboriginal peoples, or vulnerable ethnic minorities the right to review land-use decisions by mining companies that might affect their legal right to harvest, hunt and fish on lands for which they do not possess paper titles. Mining companies say the best strategy is to avoid court battles by persuading Indigenous Peoples to agree in writing to mining projects before drilling begins. When a proposed mine is on land directly owned by an aboriginal group, the mining company should negotiate an Impact/Compensation Contract in the public domain, and pay a royalty.

Meanwhile in Panama, Canadian mining companies are involved in a situation in which fights between the Ngöbe-Buglé Indigenous People and Panama's military police led to bloodshed and deaths in early 2012. The protest concerned reform of the mining code, which would allow mining in indigenous territories, one of the strictest No Go Zones to mining (see Section 4). The Canadian mining corporations, Corriente Resources and Petaquilla Minerals, could invoke theCanada-Panama Free Trade Agreement of 2010, because it includes investor protection clauses allowing them to sue Panama for millions in lost "future" profits if trade tribunals deem that the companies were unfairly prevented from mining in Panama. The United Nations Special Rapporteur on indigenous rights and the Inter-American Commission on Human Rights have both urged the government to halt the police violence and negotiate.

Source: [19].

2.4. Principle 4: Food Production Trumps Questionable Mining

Mining Must Not Decrease Resources in Areas of Scarce Land or Water

The prioritization of minerals over people cannot be allowed. The threats to life through depletion of water and food from mining are severe. Mine workers' bodies must not be considered cheap while the minerals are seen as precious. Adequate safety regulations and living wages must be integrated into the cost-benefit analysis. Many national laws set priorities for water with domestic use, first; municipal water supply, second; irrigation, third; power generation, fourth; fisheries, livestock raising, and industrial use, fifth; and last, mining. Mining proponents often claim that people will benefit from the mine because the royalties the company pays to the government will permit it to import foreign food.

This "trickle down" theory of economics is grossly inefficient and usually fails. Domestic agriculture, especially irrigation for food crops, must always be given priority over mining in water allocation. Of course, companies cannot decide upon development priorities; that is the job of government. That is why mining in areas of weak governance or in failed states is not advisable. In such cases, companies may wittingly or unwittingly assume a development role, which brings with it many conflicts of interest.

2.5. Principle 5: Compliance with International Standards

Responsible Mining Corporations Will Uphold all International Social and Environmental Agreements as Well as the Practices of Corporate and Social Responsibility

Better corporations possess in-house environmental and social units staffed by seasoned social and environmental professionals, which are adequately resourced to ensure the corporation follows best practices of corporate and social responsibility (CSR). CSR seeks to ensure that the interests of all stakeholders about social and environmental impacts are met in corporate policies and projects. In a narrow sense, CSR means operating a business in a manner that accounts for the social and environmental impacts it creates. CSR is a form of voluntary corporate self-regulation such that the company actively complies with the spirit of the law, ethical standards, and international norms [20].

Box 3. International Environmental and Social Agreements Relevant to Mining

African-Eurasian Waterbird Agreement (AEWA, 1995)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)
Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2000)
Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)
Convention on Biological Diversity (CBD, 1992)
Convention on Climate Change (UNFCC, 1992) and Kyoto Protocol (1997)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973)
Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention, 1979)
Convention on Wetlands (Ramsar, 1971)
Convention to Combat Desertification (UNCCD, 2007)
International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty, 2004),
Montreal Convention on Substances that Deplete the Ozone Layer (1987)
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (2010)
Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in International Trade (1998)
Stockholm Convention on Persistent Organic Pollutants (2001)
UN's Protect, respect and remedy framework (see Ruggie 2011)
UNESCO Biosphere Reserves (1968)
Vienna Convention for the Protection of the Ozone Layer (1985)
Vienna Convention on the Law of Treaties (1969)

Clear CSR policies ensure compliance with all applicable social and environmental policies of both the host country and the proponent's home country. Double standards must be avoided. Principled mining corporations are aware of and comply with the standards set in international agreements on the environment and social issues (see Box 3).

One of the main goals of CSR is the social license to operate (SLO) which is formalized in free prior informed consent (FPIC). The concept of a mine to have a "social license to operate" is emerging within the hard-rock mining community and acceptance of the definition and application is broadening. SLO is a comprehensive and thoroughly documented process in which local stakeholders identify their values and beliefs as they participate meaningfully throughout the environmental and social impact assessment process of the proposed project, from scoping through mine closure and restoration. Social license [21] must be earned and then maintained. It is dynamic and nonpermanent because beliefs, opinions, and perceptions are subject to change as new information is acquired. A social license is usually granted on a site-specific basis: hence, a company may have a social license for one operation but not for another. The bigger the impacts of a project, the more difficult it becomes to earn the social license. For example, an independent fisherman, who is member of an indigenous group, will normally get an automatic social license from his community. A mining company wanting to relocate an entire village faces a much bigger challenge [22].

CSR becomes the SLO for mining as it includes rigorous independent certification of compliance with the agreed standards, donation of 1% of profits to environmental conservation initiatives, and functioning CACs to ensure meaningful public participation. The SLO usually includes three goals for successful development: first, maximize advantages of the mining project to local national economies; second, minimize damages to communities, environment, and sociocultural assets; and third, strengthen the capacity of impacted communities and their advocates (civil society) and governments to participate meaningfully in the mining process.

A sample of standards and codes of conduct followed by better mining corporations is provided in Box 4. Weak corporations sometimes attempt to get away with whatever they can—especially when the median educational level encourages such abuse, and where weak governance provides no real buffer for the citizenry. ESIAs from such companies can become tantamount to public relations documents—yet national regulators approve them. The Netherlands' Environmental Assessment Agency specializes in judging whether specific international ESIAs are reliable. When mine protesters are shot, raped or tortured by security or the military, it suggests that the ESIA process has been deficient. For example, after Mayan Indigenous Minorities were shot, killed, and injured in 2005, International Finance Corporation's Ombudman found the ESIA of Glamis Corporation's Marlin Gold mine in Guatemala deficient. The Inter-American Commission on Human Rights (IACHR) ordered the mine to be suspended [23].

Box 4. Codes of Conduct and Standards Followed by Better Mining Corporations.

Most of these codes and performance standards are voluntary; they need to become mandatory; compliance must be monitored by independent third parties and enforced. Of course, not all of these codes and standards will apply to every mine. But the mining corporation's in-house E&S unit should be aware of the codes, keep up to date as the codes evolve, and tell their corporation which codes it has to meet and how.	
EITI: The Extractive Industries Transparency Initiative Plus.	The EU Directive on Environmental Liability to foster the polluter pays principle.
UNDRIP: The United Nations Declaration on the Rights of Indigenous Peoples.	International Petroleum Industry Environmental Conservation Association (IPIECA) Guidance Document on Sustainable Social Investment.
UNHCR The United Nations High Commission for Human Rights.	Economic Community Of West African States (ECOWAS) Directive on the Harmonization of Guiding Principles and Policies in the Mining Sector.
The Voluntary Principles on Security and Human Rights.	UN ILO Convention 169: Core Labor Standards.
IRMA: The Initiative for Responsible Mining Assurance.	The International Convention on Economic, Social and Civil Rights.
UN Convention Against Corruption.	The International Convention on Elimination of all Forms of Racial Discrimination.
UN Precautionary Principle.	Convention on the Prevention and Punishment of the Crime of Genocide.
The 1990 Bergen Declaration on Sustainable Development.	UN Guiding Principles on Business and Human Rights.
The Equator Principles.	The OECD Guidelines for Multinational Enterprises.
The UN Århus Convention.	Fairtrade & Fairmined gold certification standard The Akwé: Kon Guidelines.
The Extractive Industry Review.	ISO 26000 Guidance on Social Responsibility.
Corporate Social Responsibility.	
The UN Global Compact.	
The Global Reporting Initiative (GRI).	
UN Principles of Responsible Investment (PRI)	
The London Convention on the Prevention of Marine Pollution by Dumping of Wastes, UN IMO, 1996.	

2.6. Principle 6: Prequalification or Certification of Potential Mining Permit Seekers

The Best Practice is for All Mines to Engage in a Rigorous Independent Certification Regime, as Suggested in the IUCN World Conservation Congress' Resolution 4.088

This certification should be funded by the payments from the mining corporation (out of profits or revenues, irrespective of taxes, royalties, *etc.*, to the government), and be entirely independent. National governments often mandate prequalification or certification of potential bidders on governmental work. This prequalification mechanism encourages the better corporations that have in-house E&S units, E&S codes and standards, and a reputable track record of E&S quality in previous projects. For example, Solomon [24] evaluated whether independent, third-party certification of environmental and social performance could be applied to mine sites. Three questions were investigated encompassing governance, standards, assessment, and assurance. Mining corporations with reprehensible track records, with no in-house E&S units, and no CRS or E&S policies often fail to meet prequalification criteria. Thus, prequalification promotes the better companies, and discourages the weaker companies.

Third-party independent review is powerful. An ESIA Consortium on Mining, largely funded by corporate contributions to IUCN or the United Nations Environment Program (UNEP), or another independent body, could be responsible for ESIA contracting, guidelines, international standards, and quality review. For most major metal mining projects, which generally cost a few billion dollars, the added cost would be trivial, but the benefits enormous: companies would finally get objective advice. An increasing number of organizations are capable of undertaking independent third-party monitoring, conformity assessment and certification, including Global Witness [25], the Environmental Investigation Agency [26], the Environmental Law Institute [27], SGS of Geneva, Switzerland [28], and Bureau Veritas. This does not preclude participatory monitoring by impacted communities, which can be very effective. Finding an organization that is truly independent is challenging. Independent does not just mean "not paid for by the company"—it also means neutrality, objectivity, and lack of bias.

2.7. Principle 7: Insurance and Performance Bonds

Insurance and Performance Bonds, Mechanisms to Foster Compliance with Contractual Obligations and to Improve the Quality of Results, should Become Standard in Mining

Bonds are in widespread use in the construction industries and elsewhere. The challenge is setting the insurance and bonds high enough to cover accidents and noncompliance adequately and for far enough into the future. Often, after mine closure, a mining corporation may declare bankruptcy or be taken over by another company. If, some decades after a mine closes, a toxic waste lagoon ruptures, liability may not be clear. Reclamation bonds are designed to finance clean-up and restoration. The most notorious case is in Ecuador where Texaco polluted vast areas of Amazon forest for 30 years before it was bought out by Chevron. After 18 years of court trials in Ecuador and the United States, Chevron was fined US$18 billion. The transferability of insurance and bonds with the sale of the company needs to be clarified in advance. Frequently, the "interested party" or proponent is allowed to choose the consultant that will calculate the amount of the bond or insurance. Even more frequently, the bond calculator fails to make truly conservative assumptions about future costs. Mostly they succeed in bonding only for earth-moving activities and avoid bonding for expensive tasks, such as collecting and treating contaminated waters—often in perpetuity. Thus, they are thinking only in the short-term and passing actual costs to the future generations. For example, Goldcorp recently posted a mine closure surety bond of US$1 million to Guatemala for its Marlin gold mine although it estimates closure costs at $17 million, while experts say they may reach $49 million.

2.8. Principle 8: Royalties, Taxes and Fees

Responsible Mining Accurately Assesses all Relevant Costs and Benefits to Ascertain whether the Proposed Mine Will Earn a Significant Net Benefit

Net benefit means the profits, benefits, *etc.*, accruing to the corporation or government, minus the environmental and social impacts accruing mainly to the impacted communities. Companies should publish what they pay to governments in royalties, taxes and fees. The Extractive Industries Transparency Initiative (EITI) is followed by best practice corporations. Bauer [29] shows how to enhance payments from the mining corporation to the government, and how to prevent corruption. Could emphasizing how much foreign investment the mine will bring, as Pearce [30] does for the Philippines' Tampakan mine, while omitting all costs, especially social and environmental costs, border on being a joke? Although it is true that social and environmental costs are more difficult to estimate than the costs of bulldozers, diesel, cement, and steel, it must be attempted and corroborated by independent third parties. For example, in the case of acid rock drainage to be controlled in perpetuity, the cost for a "typical" mine may well rise to US$1 billion (see Box 5). Full cost allocation means that all the internal and external costs and benefits, including social and ecological, of alternative decisions concerning the use of natural and social capital should be identified and allocated.

Countries need robust governance if they are to verify data on the volume and value of resources being extracted and exported. It is relatively easy to estimate engineering costs and financial payments to governments. Estimating social and environmental costs is more difficult but unavoidable. If the impacted people find that social and environmental costs are significantly underestimated, or if they find the compensation of residual impacts are too low, the project is best halted until agreement can be reached. Above all, following the system of No Go Zones (see Section 4) will help prevent damage to valuable agricultural lands, water catchments, fresh water, and marine ecosystems.

One caveat: as mentioned above, responsible mining can be achieved by ensuring that the benefits accruing to the potentially impacted people clearly exceed the costs and impacts. This issue comes down to compensation and other payments from the mining proponent to the impacted people. As certain costs cannot be outweighed by compensation at any level, the ESIA process must fully inform local communities about the long-term consequences of the project. That is why FPIC is so essential. Best-practice mining companies should agree to contribute at least 1% of profits (or revenues, or even better, of the value of the minerals extracted) to environmental conservation efforts in their area of operation, as proposed in IUCN's World Conservation Congress Resolution 4.085 of 2008: establishing the 1% Earth Profits Fund [31]. This contribution should be above and beyond any compensatory offsets (see Annex), linked to inflation, and standard even if the project does not offset.

Investing part of the mining revenue to finance mine closure and restoration, community retraining as mine jobs dry up, and creation of sustainable sources of livelihood is standard. World experience shows that compensation to impacted peoples and to their government is almost always marginal. Revenue Watch calculates that, in the Philippines, since 2005, the mining industry's contribution increased to 1% and above of GDP with its greatest input at 1.4% in 2007 [32].

Fiscal instruments include: royalties, signing and other bonuses, tax on profit, windfall profit tax, government's equity, tax on dividend (minus withholding tax). Information asymmetry means companies know the value of minerals much better than the government, hence can game the tax/royalty system. Setting appropriate royalties, taxes, fees, *etc.*, and other compensation is an important issue not dealt with here, but outlined by Bauer [29]. Royalties differ markedly among countries, roughly from 1% to 15% of profits. Taxes vary from 10% to 30%, but tax holidays are commonplace.

In struggles over resource rights, transnational companies are increasingly using a powerful new weapon—the right to sue governments in international arbitration tribunals granted under a complex web of free trade agreements and thousands of bilateral investment treaties. In June 2009, Canadian mining company Pacific Rim Cayman LLC., sued the state of El Salvador under CAFTA for $77 million, after the Ministry of the Environment of that country failed to issue the company extraction permits for its El Dorado gold mine. Pacific Rim is the first company to pursue international arbitration against El Salvador using CAFTA provisions. Since Canada is not part of that free trade agreement, Pacific Rim used its U.S. subsidiary in Reno, Nevada to gain access to CAFTA's investor-state dispute settlement mechanism [33].

Box 5. Acid Rock Drainage and Submarine Tailings Disposal.

Acid rock drainage (ARD) and disposal of tailings, a waste product of mining, are the most serious environmental impacts of mining.

ARD occurs when sulphide-bearing minerals in rock are exposed to air and water, converting sulphide to sulphuric acid. It can devastate aquatic habitats; is difficult and very expensive to treat; and, once started, can continue for centuries. Roman mines in Great Britain and Spain continue to generate acid drainage more than 2000 years after mining ceased. Moran [34] notes many mine sites where water treatment costs exceed hundreds of millions of U.S. dollars, yet the contamination problems persist (e.g., Summitville, Leadville, Eagle Mine, Crested Butte, Colorado, Clark Fork and Zortman-Landusky, Montana, Bingham Canyon-Kennecott, Utah). Acid rock drainage can develop throughout the mining process: in underground workings, open-pit mine faces, waste-rock dumps, tailings deposits, and ore stockpiles [35]. Many coal mines also suffer from acid rock drainage. Much ARD also contains toxic heavy metals, such as lead, mercury, arsenic, and cadmium.

Mining practice is improving in its methods of tailings disposal and the decadal struggle to find a lower impact disposal is almost over. What nearly became the standard method of disposal (riverine tailing disposal [RTD]) is now banned in many countries, with Papua New Guinea an exception. Another disposal method, submarine tailings disposal (STD), remains one of the most polarized and contentious issues in mining. Mining proponents strongly prefer STD because of its low cost. Others object that, to the extent possible, lower impact methods of tailings disposal should be preferred over higher impact methods. Already, the planet is damaged and deteriorating, therefore dumping tailings out-of-sight on the seabed appears risky. That is why it is almost impossible to obtain STD permits in the United States, Canada, and Australia. STD risks can be reduced by removing some of the more toxic chemicals, and de-aerating the tailings before disposal. Risks can be reduced even more by pumping the tailings further offshore (several kilometers), at deeper levels (below the thermocline, halocline, and euphotic zones), especially where off-shelf abysses are available, and in anoxic sites where there are no ocean currents. Even so, some added chemicals such as frothing agents, floatation agents, flocculants, dispersants and detergents don't sink like tailings.

Box 5. *Cont.*

Permitting ocean dumping offers weak dynamic incentives to internalizing tailings disposal costs. The scientific evidence for and against STD is not yet clear. STD might become acceptable in some cases, but science cannot yet predict which situations are acceptable. Large volumes of tailings smother benthos. STD proponents claim that eventually benthos repopulates the tailings, and that land-based disposal is even riskier. The Precautionary Principle means that STD should not be adopted until the deep-sea ecosystem has been thoroughly studied and understood by independent scientists. If severe impacts appear years after disposal, little or no remediation will be possible at such depths.

3. Government and Social Support for Best-Practice Responsible Mining

The above eight principles for best-practice responsible mining apply to mining corporations. However, self-regulation and voluntary compliance are not enough. For real change, societies cannot rely only on the good intentions and aspirations of corporations. Mining corporations need support and guidance from government. The founders of most developed, Western countries mandated the creation of checks and balances, although many seem to be eroding in the natural resource and environmental arenas. Rather, we seem to be evolving toward partnerships between business and governments, with the needs of the citizens largely ignored. For example, right now there are more than 200 ongoing demonstrations or disputes around mining projects in Peru alone.

The widespread and strengthening opposition to mining, the increasing number of jurisdictions adopting metal mining moratoria, and the soaring need for improved protection of the earth, are evidence that voluntary, nonbinding, and self-reported standards are not working adequately. Although mining corporations can make many improvements through adopting best practices and working with their industry groups to enhance sustainable practices, corporate efforts must be overseen by mandatory regulations, with third-party monitoring, and government sanctions for violations. These regulations should be backed up by performance bonds, escrow accounts, insurance, and meaningful penalties, including in the stock markets where mining corporations are listed. In establishing the creditworthiness of a mining company, credit agencies should weigh the corporation's environmental and social risk-taking, along with its ability to prevent catastrophic damage (e.g., waste dump breaches), conduct effective post-mining restoration, clean-up toxic spills, and prevention of acid rock drainage in perpetuity.

4. No-Go Zones for Mining

Five types of socially or environmentally sensitive areas [36] need special consideration in mining regulations [37]. These areas are extremely valuable when intact, and their value would be jeopardized by extractive industries. If the potentially affected communities reject a project on one of these categories of lands, the area would be off-limits to mining. With the community meaningfully informed, and with free prior consent as a precondition for licensing, mining operations should ensure these categories are excluded. The default position is clear: No Go Zones to mining are nonnegotiable.

The five main types of areas off limits to mining are: Indigenous Peoples reserves, conflict zones, fragile watersheds, special biodiversity habitats, and cultural properties.

4.1. Indigenous Peoples Reserves

Indigenous Peoples reserves are defined as areas in which Indigenous Peoples live, or on which they depend, territories, reserves or usucapion lands (in which the right to property is legally held by uninterrupted possession for a certain term), and ancestral domains of Indigenous Peoples, tribal people, forest dwellers, and vulnerable ethnic minorities. Experience shows that Indigenous Peoples cannot be resettled successfully. The World Bank Group concluded that projects should be moved and the Indigenous Peoples left in peace.

4.2. Conflict Zones

These zones include areas of overt or simmering social conflict, especially armed conflict. Worldwide, experience shows that mining in such conflict zones almost invariably exacerbates conflict. Land grabbing, deforestation, and illegal expansion of mining, cattle ranching, and oil palm plantations are fuelled by violence. Though violence against mine workers seems to come from all directions, the problems that beset the world's mines are all driven by the same business model: a partnership between an industry that plunders local communities, and a regime that keeps people from fighting back. The UN is developing guidance on whether projects should go ahead in conflict-prone areas; when is it better to postpone a project, and under what conditions a project might go ahead despite being in a conflict zone.

4.3. Fragile Watersheds

Areas providing critical water resources, locally or downstream, such as those protecting a dependent project downstream, and riparian ecosystems important for conserving riparian services, as well as watersheds that conserve water for irrigation or intensive agriculture are included. Some countries prohibit mining within 1000 meters of any source of water. Some nations ban mining in all mountainous zones. As critical sources of water, glacier ecosystems are also especially fragile water-regulating systems, and should be preserved. Areas with active seismicity or geological faults should be avoided for mining because of the risk that toxic lagoons and heaps of mine wastes will rupture or leak. Steep slopes should be protected. Areas prone to landslides, lahars, or mudslides should be off limits. No mining should be permitted in a wide swath either side of possible hurricane or cyclone paths. Areas subject to very high rainfall should also be off limits. All water catchments above or feeding into irrigation systems need conservation. Small islands are No Go Zones for industrial mines (see Box 6. Unfortunately, many of the highest-grade metal ore bodies exist in the headwaters of some of the highest and most seismically active regions of the world. Some leaders, such as the present prime minister of Peru, argue that these restrictions would essentially stop mining in some regions.

Box 6. No More Mining on Small Islands.

According to Indonesian law, it is now illegal to mine anything on small islands because a big mine on a small island is likely to damage water supplies and marine livelihoods by dumping wastes [38]. Witness current decadal struggles of BHPBilliton on Indonesia's Gag Island (56 km^2) in which a nickel mine proposed to dump all wastes onto the coral reefs surrounding this proposed UN World Heritage Island and protected forest. On Bangka Island (12,000 km^2) in Sulawesi, a Chinese iron ore mining project would devastate the entire island and destroy much life in the Coral Triangle, one of the most species-rich marine regions on earth. Since 2000, Newmont's Batu Hijau copper/gold mine on Sumbawa Island (15,448 km^2) has dumped 40 million tons of untreated waste off the coast. Dumping the overburden into the open-cast mine pit would be lower impact. Marcopper and Placer Dome's damages in 1996 on Marinduque Island (920 km^2) in the Philippines are one of the worst environmental disasters ever. In 1997, the World Bank Group financed Newcrest's Lihir Island (22 km × 14.5 km) gold mine in Papua New Guinea, which dumps 5 million tons of exceptionally acidic wastes, containing cyanide and heavy metals, annually into the ocean. From the early 1970s, on Bougainville Island (9318 km^2), the impacts of Rio Tinto's Panguna copper mine led to bloodshed in the 1970s and 1980s, and to civil war in 1990. Misima is a mountainous and densely forested volcanic island (202 km^2) in Papua New Guinea where Placer Dome opened a gold and silver mine in 1990, which was closed in 2004 after the pipe carrying waste containing cyanide for dumping in the ocean broke killing fish. Placer Dome refuted the Australian Mineral Policy Institute's 2005 report on the social and environmental impacts. The Philippines' forested and highly endemic mountainous Sibuyan Island (445 km^2) is mainly under protected and conservation status, but much of the protected area is concessioned for mining. Mario Kingo, head of security of the Altai Resources nickel mine killed a protester, Municipal Councilor and former World Wildlife Fund official, the Hon. Armin Rios-Marin on October 3, 2007. Kingo was convicted of criminal negligence [39].

4.4. Biodiversity, Habitats, and Wildlands

Areas of high biodiversity and endemism, rare or endangered species, rare habitats, and intactness (e.g., coral reefs, mangroves, tropical rain forest, remaining old growth forests, biological hotspots, wetlands, and wilderness, as defined by IUCN and by Phillips [40] are included (see Box 7). This category includes all conservation units, IUCN's Categories I thru IV and to a certain extent Categories V and VI, such as national parks, state or provincial parks, UN Biosphere Reserves, UN World Heritage Sites, areas scheduled for inclusion in the national system of conservation units, protected forests, UN Ramsar Convention wetland sites, as well as their buffer zones. Most mangroves and old-growth tropical forests should be included.

Box 7. The New Priority of Conserving Forest for Carbon Sequestration.

In the last few years, forests have become more important for their greenhouse gas (GHG) sequestration function, which the world urgently needs. Agreement on a price for GHG emissions would earn a double dividend, first by decreasing fossil fuel use, and second by providing a huge fund for measures to combat climate risks, such as reforestation.

The planet's two biggest sinks of GHG emissions, forests and oceans, are being vitiated by deforestation and forest fires, and by acidification of oceans. A warmer world surely means more forest fires. Forest and grassland fires worldwide already burn about 400 million has annually, an area bigger than the size of India. Indonesia's 1997–1998 peat-land forest fires smoldered for months over 8 million has, releasing the equivalent of at least 30% of worldwide fossil fuel GHG emissions for the entire year. As possibly the biggest forest fire in recorded history, it polluted much of Southeast Asia, almost from Northern Australia, Kalimantan, Sumatra, Java, Malaysia, Singapore, Vietnam, Thailand, Philippines, and Sri Lanka to the Horn of Africa.

Deforestation must be halted as soon as possible and promptly reversed. Any tree cutting must be more than compensated for by tree plantations or regeneration. There is little or no suitable land left for expansion, even for food production. The forest has great value for community livelihoods, providing water in the dry season, attenuating floods, and conservation of biodiversity.

Averting the worst consequences of human-induced climate change is a "great moral issue" on a par with slavery, according to James Hansen *et al.* [41]. Storing up expensive and destructive consequences for society in future is an "injustice of one generation to others". A worldwide tax on all carbon emissions has now become urgent. That is why mining must not destroy any more forest and should become carbon-neutral as soon as possible. The world needs an immediate 6% annual cut in carbon or GHG emissions, and a substantial growth in global forest cover, to avoid catastrophic climate change by the end of the century. The carbon emissions tax would increase year on year, with the tax income paid directly back to the public as a dividend, shared equally, rather than put into government coffers.

4.5. Cultural Property

Areas of Indigenous Peoples' religious sites, sacred groves, battlefields, archeological sites, petroglyphs, geoglyphs or rich fossil sites are no-go zones for mining. There may be exceptions, for example, when a compensatory offset reserve is purchased by the mining proponent, which is unambiguously bigger in size and richer in contents than the area sought for the mine (see Annex).

5. Conclusion

This paper outlines what "Responsible Mining" means in practice. It is designed for mining corporations that want to adopt responsible mining. Responsible mining would become a valuable goal if mining corporations agree with definitions advanced in this paper. Mining corporations that follow the eight principles, abide by all international environmental agreements, strive to achieve best practices, and avoid No Go Zones would become industry leaders. The transition from voluntarily following these measures to accepting mandatory regulations with third-party monitoring should be made as smoothly as possible. Many mining corporations already have adopted responsible mining rhetorically. The best mining corporations will put it into practice.

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References

1. United National Environment Programme (UNEP). *UNEP Emerging Issues: Environmental Consequences of Ocean Acidification: A Threat to Food Security*; UNEP: Nairobi, Kenya, 2010.
2. Honisch, B.; Ridgwell, A.; Schmidt, D.; Thomas, E.; Gibbs, S.J.; Sluijs, A.; Zeebe, R.; Kump, L.; Martindale, R.C.; Greene, S.E.; *et al.* The geological record of ocean acidification. *Science* **2012**, *335*, 1058–1063.
3. Klare, M.T. *The Race for What's Left: The Global Scramble for the World's Last Resources*; Metropolitan Books: New York, NY, USA, 2012.
4. Monsod, C.S. Chair of the Philippines Commission on Elections. Personal Communication, June 2012.
5. Monsod, C.S. Mining a Social Justice Issue. abs-sbnnews.com. 3 March 2012. Available online: http://www.abs-cbnnews.com/-depth/03/03/12/christian-monsod-mining-social-justice-issue (accessed on 21 August 2012).
6. International Council on Mining & Metals (ICMM). Available online: www.icmm.com (accessed on 20 August 2012).
7. International Institute for Environment and Development. Available online: http://www.iied.org/mining-minerals-sustainable-development (accessed on 20 August 2012).
8. Mindanao Declaration: Defending the Dignity of Life, Securing our Future, 2012. Available online: http://taborasj.wordpress.com/2012/01/27/mindanao-declaration-defending-the-dignity-of-life-securing-our-future/ (accessed on 20 August 2012).
9. Organisation for Economic Cooperation and Development (OECD). Guidelines for Multinational Enterprises. Available online: www.oecd.org/daf/investment/guidelines (accessed on 17 August 2012).
10. Initiative for Responsible Mining Assurance (IRMA). Available online: http://www.responsiblemining.net (accessed on 21 August 2012).
11. Miranda, M.; Chambers, D.; Coumans, C. Framework for Responsible Mining: A Guide to Evolving Standards. Available online: http://www.csp2.org/reports.htm (accessed on 20 August 2012).
12. Resolution 4.088, passed at the International Union for Nature Conservation (IUCN) World Conservation Congress in Barcelona in 2008 supporting Responsible Mining and established its Extractive Industry Responsibility Initiative. Available online: http://earthmind.net/wcc/resolutions.htm (accessed on 20 August 2012).
13. Goodland, R. *Environmental and Social Assessment*; World Resources Institute: Washington, DC, USA, 2008. Available online: www.accessinitiative.org/sites/default/files/ESAMemo.pdf (accessed on 20 August 2012).

14. *New Directions in Social Impact Assessment: Conceptual and Methodological Advances*; Vanclay, F., Esteves, A.M., Eds.; Edward Elgar: Cheltenham, UK, 2011.
15. Esteves, A.M.; Franks, D.; Vanclay, F. Social impact assessment: The state of the art. *Impact Assess. Proj. Apprais.* **2012**, *30*, 5–44.
16. Goodland, R.; Bedy, S.; Maniates, S. *Best Practice for Panels of Experts: Effective Independent Oversight of High Risk World Bank Group Projects*; Bank Information Center: Washington, DC, USA, 2011. Available online: www.bicusa.org/en/Search.aspx?s=panels+of+experts (accessed on 20 August 2011).
17. Steiner, R. *Citizens' Advisory Councils for Mining in the Pacific—Mining and Mining Policy in the Pacific: History, Challenges, and Perspectives*; Noumea: New Caledonia, France, 2011. Available online: oasis-earth.com/Resources/Steiner%20Noumea%202011%20paper.pdf (accessed on 20 August 2012).
18. United Nations. *United Nations Declaration of the Rights of Indigenous Peoples*; United Nations: New York, NY, USA, 2008. Available online: www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf (accessed on 20 August 2012).
19. The Wall Street Journal Online. Indigenous Peoples Get Last Word on Mines. 26 March 2012. Available online: online.wsj.com/article/SB10001424052702303863404577283321113646182.html (accessed on 20 August 2012).
20. United Nations. United Nations Principles for Responsible Investment. Available online: http://www.unpri.org/ (accessed on 20 August 2012).
21. Shepard, R.B. Gaining a Social License to Mine. Applied Ecosystem Services. 6 February 2008. Available online: www.appl-ecosys.com/publications/social-license.pdf (accessed on 20 August 2012).
22. What is a Social License? socialicense.com. Available online: socialicense.com/definition.html (accessed on 20 August 2012).
23. IACHR Modifies Marlin Mine Precautionary Measures. Request to Suspend Mine Operations Removed. majortraders.com. 19 December 2011. Available online: http://majortraders.com/articles/?aid=309385&title=iachr_modifies_marlin_mine_precautionary_measures__request_to_suspend_mine_operations_removed (accessed on 20 August 2012).
24. Solomon, F.; Schiavi, P.; Horowitz, L.; Rouse, A.; Rae, M. *Hard Thinking: The Mining Certification Evaluation Project Final Report*; WWF: Australia, Melbourne, 2006.
25. Global Witness website. Available online: www.globalwitness.org (accessed on 20 August 2012).
26. Environmental Investigation Agency website. Available online: www.eia-international.org (accessed on 20 August 2012).
27. Environmental Law Institute website. Available online: www.eli.org (accessed on 20 August 2012).
28. SGS of Geneva. Switzerland website. Available online: www.sgs.com (accessed on 20 August 2012).
29. Bauer, A. Revenue Watch International. Philippine Mineral Wealth for Development? Presented at *Mining in Mindanao Conference*, Ateneo de Davao University, Davao, Philippines, January 2012.

30. Pearce, D. *Assessment of the Potential Economic Benefits of the Tampakan Project (Philippines)*; Sagittarius Mines Inc. Centre for International Economics: Canberra, Australia, 2011.
31. Resolution 4.085, passed at the International Union for Nature Conservation (IUCN) World Conservation Congress in Barcelona in 2008 establishing the 1% Earth Profits Fund. Available online: http://earthmind.net/wcc/resolutions.htm (accessed on 20 August 2012).
32. No to Mining in Palawan website. Available online: http://no2mininginpalawan.com/about/ (accessed on 20 August 2012).
33. Anderson, S.; Pérez-Rocha, M.; Dreyfus, R.; Artiga-Purcell, A. *Mining for Profits in International Tribunals: How Transnational Corporations Use Trade and Investment Treaties as Powerful Tools in Disputes over Oil, Mining, and Gas*; Institute for Policy Studies: Washington, DC, USA, 2011.
34. Moran, R.E. *The Conga Mine, Peru: Comments on the Environmental Impact Assessment (EIA) and Related Issues*; Environmental Defender Law Center: Bozeman, MT, USA, 2012. Available online: derechoshumanos.pe/2012/03/informe-sobre-eia-proyecto-conga/ (accessed on 20 August 2012).
35. Rekacewicz, P. *Mining Effects on Rainfall Drainage*; UNEP/GRID: Arendal, Norway, 2005. Available online: www.grida.no/graphicslib/detail/mining-effects-on-rainfall-drainage_cac4 (accessed on 20 August 2012).
36. Business and Biodiversity Offsets Programme (BBOP). *Biodiversity Offset Design Handbook*; BOP: Washington, DC, USA, 2009. Available online: www.forest-trends.org/biodiversity offsetprogram/guidelines/odh.pdf (accessed on 20 August 2012).
37. Dudley, N.; Stolton, S. *To Dig or Not to Dig? Criteria for Determining the Suitability or Acceptability of Mineral Exploration, Extraction and Transport from Ecological and Social Perspectives*; WWF International: Gland, Switzerland and WWF UK: London, UK, 2002.
38. Earthworks and Mining Watch Canada. Troubled Waters: How Mine Waste Dumping Is Poisoning Our Ocean, Rivers, and Lakes. 2012. Available online: www.nodirtygold.org/troubledwaters.cfm (accessed on 20 August 2012).
39. BHP Billiton Watch. The Philippines: Supply-chain responsibility: The Sibuyan killing and Culture of Corruption. 21 October 2009. Available online: http://bhpbillitonwatch.net/2009/10/21/supply-chain-responsibility-the-sibuyan-killing-and-culture-of-corruption (accessed on 20 August 2012).
40. Phillips, A. *Mining and Protected Areas*; Mining Minerals and Sustainable Development project of the International Institute for Environment and Development: London, UK, 2001. Available online: http://naturalresourcecharter.org/fr/content/phillips-2001-mining-and-protected-areas (accessed on 20 August 2012).
41. Hansen, J. Scientific case for avoiding dangerous climate change to protect young people and nature. *Proc. Natl. Acad. Sci. USA* **2012**, in press.

Annex: Compensatory Offsets

This Annex outlines the issues of compensatory offsets, which are the fourth element in the mitigation hierarchy of first, do no harm; second, minimize; and third, mitigate any residual impacts. Offsets and other compensation are the last option if the other three cannot be accomplished.

The term "offset" is often used interchangeably with "compensate." "Compensation" has several meanings, including financial payment for impacts as in "impact-compensation contracts," or it can mean measures designed to counteract harm or impacts.

Responsible mining permits no harm to communities or to their life-support systems; the precautionary principle (see Box A1) should prevail. In the face of uncertainty about potentially irreversible impacts to natural and social capital assets, decisions concerning their use should err on the side of caution. The burden of proof should shift to those whose activities potentially damage natural and social capital, namely the mining corporations. After best efforts—first at prevention of impacts, followed by minimization, then by mitigation as needed—there may be some rare exceptions to No Go Zones.

Box A1. The Precautionary Principle.

Pliny's (61 AD—*ca.* 112 AD*) Quod dubitas ne feceris* (When in doubt, don't do it) is one origin of the Precautionary Principle, in the sense of: first do no harm, an ounce of prevention is worth a pound of cure, better safe than sorry, err on the side of caution, and look before you leap.

In case of risks of social or environmental damage, precautionary measures should be taken even in uncertainty, if cause and effect are plausible, but not fully established, scientifically. Precautionary measures are an investment in insurance. Such risk-aversion means that the burden of proof is on the mining proponents, rather than the people or communities potentially impacted. We should not wait for scientific certainty, because impacts on people and their environment may be irreversible. ESIA mandates the analysis of alternatives—better, safer, cheaper ways to do things—and the development of "cleaner" products and technologies. One powerful alternative is simply slowing down in order to learn more about potential harm—or doing nothing—the "no project" alternative [1].

In 1854, without evidence for the causal link between the spread of cholera and contact with an infected London drinking-water pump, and certainly without proof beyond a reasonable doubt, John Snow recommended removing the handle of the suspected pump in a neighborhood with numerous cholera cases to stop the epidemic. This simple and cheap measure was effective and led to research linking cholera and contaminated water. Conversely, the harmful impacts of inhaling asbestos dust have been known since 1898 and 55 nations now ban it. However, despite clear evidence of its toxicity, Canada still subsidized its export to developing nations as of March 2012.

Developers should always seek to avoid impacts through good initial project design. Normally damage to high-conservation-value areas (No Go Zones discussed in Section 4) is avoided by not mining there. Mining No Go Zones are nonnegotiable, but there may be a rare exception to development in such areas for reasons of overriding public interest. In such cases, the impacts or losses must be fully compensated. Areas are usually defined as No Go Zones because of the irreplaceable and vulnerable nature of their ecosystem services. If it is not possible to achieve "no net loss" (the former minimum for an offset), the project should not proceed. A compensatory offset substantially greater

than no net loss is the best practice. In other circumstances, development can proceed, but the developer should seek to avoid impacts to the extent feasible. After best efforts to first, prevent, second to minimize, and third to restore impacts, offsets should address significant residual impacts on ecosystem values.

Offsets near the project area can often be more valuable for local communities and for conservation than significant expenditure on restoration of areas directly affected, and this should be taken into consideration when deciding how to apply the mitigation hierarchy. In some cases, offsets can be more valuable than restoration to local communities and even for conservation, so the possibility of trade-offs is available in certain cases.

Further information on offsets can be found at ten Kate *et al.* [2], BBOP 2009 [3], BBOP (2012) [4], Soloman *et al.* (2006) [5], Solomon (2011) [6], Goodland (2003) [7].

Definition of Compensatory Offsets

Compensatory environmental offsets are usually environmental conservation measures designed to compensate for unavoidable environmental impacts caused by a development project. The conservation outcomes resulting from these measures are designed to compensate for significant residual adverse environmental and social impacts arising from project's implementation, after appropriate preventive, minimization, and mitigatory measures have been taken. The goal of compensatory offsets is to achieve a clear net gain of ecosystem function. The out-of-date standard of "no net loss" of ecosystem function is no longer adequate.

The advantage to the mining proponent of using offsets is that offsets enhance a company's social license to operate; strengthen trust between proponent, impacted people, and government; bolster regulatory goodwill; and boost the company's reputation—usually at low cost. Offsets often provide proactive companies (ones that move quickly), a "first-mover advantage," as other, more reactive, companies find themselves dealing with high entry costs, unforeseen regulatory hurdles, and fully developed and complex regulatory regimes.

Types of Environmental Offsets

Two types of environmental offsets—carbon offsets and biodiversity offsets—are described below.

Carbon Offsets: As greenhouse gas emissions (GHG) have risen to their highest level—390 ppm—since humans evolved; there is a clear case for offsets when a mining company wants its project to be carbon neutral. To become carbon neutral, the company would calculate the amounts of GHG it expects to emit over the course of the mine's life, then plant and protect enough trees to sequester that amount of GHG (see Box A2). Thus the carbon offset could be tree plantations or could be a degraded forest tract rehabilitated to a semi-natural forest through the years. The trees should preferably be native species (not eucalyptus or pines) and must be planted on appropriate formerly forested land. Support of the local people is essential and they can often be trained as forest managers.

Box A2. Figuring Carbon Offset Costs.

The number of trees needed for an offset will vary by species chosen, and by soil fertility, climate, and elevation *etc.*, of the offset site. As an example, say 120 tons of carbon per ha corresponds to 440 tons of carbon dioxide equivalent per ha of mature forest trees. Carbon's atomic mass = 12 Carbon dioxide. CO_2—molecular mass—12 + 16 + 16 = 44. Thus a mature forest can soak up the equivalent of 440 tons of atmospheric CO_2 per ha in the 50-100 years it takes to reach maturity. That is a one-off total, not per year and may take several decades [8].

If seedlings cost $40 per thousand, and if the typical planting density is roughly 800 per acre, the cost of seedlings is $32 per acre. Labor costs for planting trees are high, but since much of the labor would come from potentially impacted local stakeholders, assume a total of $160 per acre for both seedlings and labor. Planting the needed offset of 380 million acres over the next decade or so will come to roughly 38 million acres per year at $160 each for an annual expenditure of $6 billion [9].

GHG sequestration capacity is severely impaired worldwide by deforestation. Therefore, offsets should expand carbon sequestration capacity. For a discussion of "by how much" see How Much is Enough, below. "No net loss" is now far too modest as a goal; we have already lost too much biodiversity, and too much carbon sequestration capacity. Newmont's Conga proposal (see Box A3) to convert a Peruvian natural water system (including lakes and wetlands) into an engineered system (e.g., managed reservoirs and treatment) is a perverse example of a narrow "compensatory offset." The bigger issue is: who controls (and pays for) the new system? Clearly the private corporation will control the waters of many basins and communities, following the "offset."

Box A3. Newmont's Conga Project in Peru.

Newmont's Conga project is an opencast copper/gold mine, near Newmont's Yanacocha Gold Mine, in Peru. Newmont is the largest gold producer in Latin America. The municipality of Celendín passed a law that declared all watersheds, wetlands, and lakes within the Conga project area as protected. However, in 2007, then-President Alan Garcia signed a decree revoking municipal protection. Thereafter, only regional governments had the authority to do so. In 2010, the regional government of Cajamarca supported Celendín's protection law. The then-minister of the environment ordered that areas could only be declared protected after the owner of the concession agrees, meaning that Newmont would have to allow local communities to protect their land from Newmont's mega mine. The main impact, getting rid of the lakes would be like "dynamiting the glaciers in the Andes, we'd be creating a problem that impacts the ecosystem," observed Environment Minister Ricardo Giesecke [10].

Peru's Deputy Environment Minister Jose De Echave resigned, calling the official environmental impact studies on the project "weak, outdated and lacking in credibility". Political leaders in Cajamarca began a general strike against the project in November 2011, and violence escalated, with sabotage of machinery and clashes with the police. The Prime Minister said in January 2012 that the stalled Conga project would be developed as the government could end up with a "huge" compensation payment if the $4.8 billion mine does not go ahead. The entire region was militarized in March 2012 by 1000 national police and 500 army troops occupying strategic positions in the town centers.

Biodiversity Offsets: Another type of compensatory offset is a biodiversity offset. For example, if a mine cannot avoid converting, say, 10 km^2 of forest, a biodiversity offset would conserve in perpetuity a similar nearby tract of unconserved forest of a small multiple of the 10 km^2 lost. The key here is "similar." Similar means similar in area (e.g., number of square kilometers), and in ecosystem service. Ecosystem services are the benefits or functions that people, including businesses, derive from ecosystems. They include four types of function: (1) provisioning services for food, freshwater, timber, fibers, medicinal plants; (2) regulating services such as surface water purification, carbon storage and sequestration, climate regulation, protection from natural hazards; (3) cultural services such as natural areas that are sacred sites and areas of importance for recreation and aesthetic enjoyment; and (4) supporting services such as soil formation, nutrient cycling, and primary production [11].

Often a "paper park"—a park protected on maps and in legislation but actually afforded little real protection on the ground—is usefully converted into a viable conservation unit by conservation financing by the project proponent as an offset. Bolstering an existing conservation unit, such as by purchasing a critical tract adjacent to an existing conservation unit, is more cost effective than financing a new conservation unit. Inclusion or addition of buffer zones or conservation of corridors between conservation units also can be cost effective.

Rehabilitation of a degraded area into some simulacrum of the ecosystem lost can be a valuable offset. The goal would be restoration of the degraded area into a fully functioning, stable ecosystem with the same ecosystem functions, including the species diversity index, as the surrounding area, or the tract lost to the mine.

Any compensation for biodiversity loss should leave the environment clearly better off than before the project, partly for the reasons outlined in Section 1. The area is better off if there is "informed agreement of stakeholders that the proposed offset is more extensive in area, greater in environmental value (less disturbed, less damaged, more biodiversity, greater environmental service value), higher in ecosystem function, and under a more secure level of protection, such as by financing in perpetuity [12]."

How Much is Enough: Multipliers

Replacing lost area with an equal amount of land elsewhere as an offset—even if the replacement land is similar—is no longer considered an adequate best practice. In practice, research has shown that 1:1 offsets have often failed to deliver similar ecosystem services if they are small isolated tracts, not contiguous to other habitats and thus susceptible to the "edge effect," which reduces reproduction in small conserved plots. Rather than "no net loss," the accepted practice is increasingly to offer a "net benefit" Thus the area or value of the tract lost is multiplied by a "small multiple" of more than one, commonly three, and less than ten.

The small multiplier must be big enough to compensate fully and unambiguously for all areas lost to the project. For example, if the mine has a 100 km access road, then should an area of 100 km × 10 km wide be counted as an area lost to account for unplanned settlements inevitably springing up along the road? Or should the area be 100 km × 20 km assuming traffic, fires, and settlers may use the road to convert or burn forest 10 km either side of the road? Some species require more than 10 km^2 to support a viable breeding population.

The uncertainty about the relative "value" of different types of ecosystem is an advantage to those interested in controlling permitting costs and has contributed to failure of compensatory offsets. Offsets are inherently risky, and it takes time for even successful ecosystem offsets to achieve full functional capacity, so the multiplier should also account for uncertainty and for time lags in maturation of habitat. Redressing historic losses would be the best practice. Ultimately debates over compensatory ecosystem values and the "equivalency" of ecosystem gains and losses are usually reduced to establishing a "compensation ratio," a number that establishes the number of compensatory hectares required per hectare of ecosystem impacts [13,14]. The U.S. 1972 Clean Water Act (and the U.S. 1990 Clean Air Act) [15] use a rule of thumb of a 3:1 ratio for wetland banking, although this would now be considered minimal. Nowadays, a 10:1 ratio is the best practice. This discussion is important theoretically, but in practice, without theoretical environmental scientists on hand and with weak governance prevailing, it usually comes down to a pragmatic choice of what is realistic. Conservation of an entire watershed of ecosystems similar to the tract to be lost to the mine, if such is available, would be ideal. An offset protected on much of its flanks by a river also would be valuable. The metric of say 5–10 ha of offset for each hectare of lost ecosystem is not theoretically ideal, but in practice often becomes the feasible alternative.

A major caveat is that climate change is already forcing ecosystems to shift polewards, currently at about 4 km/year. What is protected today may be worthless a decade later if such changes are not factored in.

Best practice could be a graduated multiplier, in which a greater multiplier—say 10—would be used for the most valuable ecosystems, such as old-growth tropical forest, or coral reefs, converted by the mining project, and a lesser multiplier for more common ecosystems. Discussion is needed on the graduated approach to balance rehabilitation of degraded sites into intact ecosystems. Rehabilitation can, in some instances, be more appropriate than conservation of an intact ecosystem.

Rehabilitated degraded areas should be given more credit as soon as they begin to function. Even buying time for natural regeneration such as by keeping out fires and goats can be a useful option. Possibly a lower multiplier could be applied for less valuable ecosystems such as degraded areas or brownfield sites, or one of the very many ruined castles in Turkey.

Compensation for Social Impacts

Impacted people sometimes can be compensated for social impacts in monetary terms. Financial transfers can sometimes win the free and informed consent of the impacted community. When an agreed ESIA is ready, the miner pays the impacted community a sum of money negotiated in the publicly Impact-Compensation Contract, often into an escrow account or trust fund, which can be drawn down only for community-approved expenditures.

The Impact-Compensation Contract (ICC) or Impact-Benefit Agreement (IBA) [16–20] is designed to compensate for adverse impacts of mining on local communities and their livelihoods, and to ensure that Indigenous Peoples receive compensation from a mine on their ancestral domains or traditional territories. ICCs should be transparently negotiated in good faith in the public domain between the mining corporation and the impacted people, preferably with government approval as a formal legal contract. The contract should be justiciable and is usually based on the last section of the ESIA, often

called the management plan or mitigation plan. If and when the impacted communities sign the contract, that is taken as evidence that FPIC has been achieved. The contract is renegotiated or amended if there are any changes in the mine project. ICCs may include training and employment in the project, local procurement and services to the project, revenue sharing, environmental provisions, health and safety, reclamation procedures, scholarships, apprenticeships, cross-cultural training, relationships between communities and mine employees, control of employees behavior, penalties and incentives, and dispute resolution. Some ICCs include equity by the impacted community in the mine project.

Compensation contracts without transparency and community involvement can backfire. For example, In Ecuador's first, big, open-cast mine, the Chinese corporation Ecuacorriente contracted with the government on March 5, 2012 to pay $100 million in advance royalties to fund social projects in areas neighboring its $1.72 billion El Mirador copper mine. Indigenous Peoples have already been impacted and at least one community displaced to make room for the mine, which will be more than 2 km in diameter by 1 km deep in the Amazon forest region, some of which is a protected area. Including royalties, value-added taxes, income tax and other duties, Ecuacorriente may pay the state a disputed 52 percent of its revenue, and has created an environmental mitigation fund, to which it plans to contribute $2.5 million annually. The Government of Ecuador expects to receive at least $4.5 billion over the mine's 25-year life. However, thousands of protesters marched on Quito in March 2012 partly because FPIC has not been sought, an environmental impact study has not been approved, the potentially impacted indigenous communities have not been consulted, and because of fears the mine will pollute the water supply.

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Annex References

1. UNESCO. *The Precautionary Principle*; UNESCO: Paris, France, 2005. Available online: unesdoc.unesco.org/images/0013/001395/139578e.pdf (accessed on 20 August 2012).
2. Ten Kate, K.; Bishop, J.; Bayon, R. *Biodiversity Offsets: Views, Experience, and the Business Case*; International Union for the Conservation of Nature (IUCN): Gland, Switzerland, 2004. Available online: cmsdata.iucn.org/downloads/bdoffsets.pdf (accessed on 20 August 2012).
3. Business and Biodiversity Offsets Programme (BBOP). *Biodiversity Offset Design Handbook*; BBOP: Washington, DC, USA, 2009. Available online: www.forest-trends.org/biodiversity offsetprogram/guidelines/odh.pdf (accessed on 20 August 2012).
4. Business and Biodiversity Offsets Programme (BBOP). *Standard on Biodiversity Offsets*; BBOP: Washington, DC, USA, 2012. Available online: http://bbop.forest-trends.org/guidelines/ Standard.pdf (accessed on 20 August 2012).
5. Solomon, F.; Schiavi, P.; Horowitz, L.; Rouse, A.; Rae, M. *Hard Thinking: The Mining Certification Evaluation Project Final Report*; WWF: Australia, Melbourne, 2006.

6. Solomon, F. Security for biodiversity offsets in New South Wales. *Environ. Plan. Law J.* **2011**, *28*, 92–110.
7. Goodland, R. *Sustainable Development Sourcebook for the World Bank Group's Extractive Industries Review: Examining the Social and Environmental Impacts of Oil, Gas, and Mining*; World Bank: Washington, DC, USA, 2003. Available online: www.loc.gov/catdir/toc/fy045/2004354438.html (accessed on 20 August 2012).
8. Cool Antarctica website. Carbon Offsetting by Planting Trees—Is it a Realistic Proposition? Available online: http://www.coolantarctica.com/Antarctica%20fact%20file/science/carbon_offsetting_tree_planting.htm (accessed on 21 August 2012).
9. Brown, L.R. *World on the Edge: How to Prevent Environmental and Economic Collapse*; W.W. Norton: New York, NY, USA, 2011. Available online: www.earth-policy.org/books/wote (accessed on 20 August 2012).
10. Dow Jones Newswires. Newmont CEO: Conditions Not There for Peru's Minas Conga to Proceed. 17 August 2012. Available online: http://www.foxbusiness.com/news/2012/08/17/newmont-ceo-conditions-not-there-for-peru-minas-conga-to-proceed/#ixzz24CMOFm6d (accessed on 21 August 2012).
11. International Finance Corporation (IFC). Performance Standards on Environmental and Social Sustainability. Available online: http://www1.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES (accessed on 21 August 2012).
12. Goodland, R. *Sustainable Development Sourcebook for the World Bank Group's Extractive Industries Review: Examining the Social and Environmental Impacts of Oil, Gas, and Mining*; World Bank: Washington, DC, USA, 2003. Available online: www.loc.gov/catdir/toc/fy045/2004354438.html (accessed on 20 August 2012).
13. King, D.M.; Price, E.W. *Developing Defensible Wetland Mitigation Ratios: A Companion to the Five-Step Wetland Mitigation Ratio Calculator*; University of Maryland, National Oceanic and Atmospheric Administration: Solomons, MD, USA, 2004. Available online: www.kingeconomics.com/pubs/NOAA%20WetMitRatio.pdf (accessed on 20 August 2012).
14. National Marine Fisheries Service (NMFS). *Guidance for the Review, Establishment, Use and Operation of Conservation Banks and In-Lieu Fee Mitigation Programs*; NMFS: Washington, DC, USA, 2011.
15. National Research Council. *Compensating for Wetland Losses under the Clean Water Act*; National Academy Press: Washington, DC, USA, 2001.
16. Sosa, I.; Keenan, K. *Impact Benefit Agreements between Aboriginal Communities and Mining Companies: Their Use in Canada*; Canadian Environmental Law Association: Toronto, Canada, 2001. Available online: www.cela.ca/publications/cardfile.s htmlx=1021 (accessed on 21 August 2012).
17. Martin, S. *Free, Prior and Informed Consent: The Role of Mining Companies*; Oxfam: Melbourne, Australia, 2007.
18. O'Faircheallaigh, C. Public participation and environmental impact assessment: Purposes, implications, and lessons for public policy making. *Environ. Impact Assess. Rev.* **2010**, *30*, 19–27.

19. Gibson, G.; O'Faircheallaigh, C. *IBA Community Toolkit Negotiation and Implementation of Impact and Benefit Agreements*; Walter & Duncan Gordon Foundation: Toronto, Canada, 2010. Available online: www.ibacommunitytoolkit.ca (accessed on 21 August 2012).
20. The Impact and Benefit Agreement (IBA) Research Network website. Available online: www.impactandbenefit.com (accessed on 21 August 2012).