Biodiversity Offset Case Study:
Compañía Minera Antamina's *Polylepis* Initiative

ABOUT BNI

Biodiversity Neutral Initiative (BNI) is a non-profit organization that researches and promotes best practices for corporate biodiversity management. The organization's long-term goal is to develop guidelines for measuring, communicating, and offsetting biodiversity impacts with compensatory conservation projects -- helping leading companies to become "biodiversity neutral."

Regulatory standards exist for environmental offsets in the U.S., Australia, and Europe. BNI will build on those experiences to develop guidelines that can be applied in a broad range of ecosystems found worldwide. This will be particularly important for multi-national corporations operating in regions where biodiversity is highest and impacts are of greatest concern. BNI will develop guidelines using a consultative approach that includes conservation groups, scientists, and industry.

BNI is currently consulting with major international conservation groups, legal experts, energy and mining companies, auditing and certification companies, and government regulators.

For more information about BNI, visit our web site: www.biodiversityneutral.org. We also welcome feedback on this study. Our email address is info@biodiversityneutral.org.

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INTRODUCTION

Environmental offsets are activities undertaken to counterbalance the unavoidable adverse environmental impacts of development, with the objective of achieving a net neutral or beneficial outcome. In this study we focus on *biodiversity offsets* – primarily conservation projects that compensate for the degradation or destruction of natural habitats and their resident biota.

Countries differ in the extent that offsets are regulated. The United States, for example, has developed extensive regulations and guidelines for offsetting impacts to wetland ecosystems. *Voluntary* offsets for impacts not covered by regulations are still in their infancy, although interest among corporations operating in areas of high importance for conservation is growing, especially for multi-nationals working in species-rich developing countries where regulatory frameworks are absent. In these cases, voluntary offsets may become an integral part of a corporation's environmental management policies.

The use of offsets generally falls within a hierarchy of actions a developer should take to minimize environmental impacts. Companies should first avoid areas of the highest priority for conservation, then mitigate damages to areas impacted by following environmental regulations and best environmental management practices, and only then, when the developer has taken measures to avoid and mitigate to the maximum extent practicable as many impacts as possible, should offsets be considered. In other words, *offsets are not a license to trash the environment*, but rather a tool to improve environmental management beyond that which is possible through site selection, regulatory compliance, and best management practices.

The objective of this case study is to demonstrate an evaluation method for voluntary *biodiversity offsets*. We focus on the Antamina mine, operated by Compañía Minera Antamina S.A. (ANTAMINA). The Antamina mine is among the world's largest copper and zinc mines, and is located in the Andean mountains in Ancash, Peru. In 2004 the company began a voluntary biodiversity conservation program to restore endangered *Polylepis* forests in the area around the mine. While the program was not originally designed as a biodiversity offset, the case study examines its potential to serve as one.

We begin with an overview of biodiversity impacts of ANTAMINA's mine and the company's voluntary conservation initiative. This is followed by a brief description of our biodiversity offset evaluation methodology, and then its application to ANTAMINA's *Polylepis* restoration program. We conclude with recommendations for including the offset in ANTAMINA's sustainability reporting.

This case study is a demonstration of a generalized biodiversity offset evaluation methodology. The authors anticipate that this document will serve as the basis of discussion for further improvements to the methods. This report is not an endorsement or certification of ANTAMINA's conservation program as a biodiversity offset.

OVERVIEW OF ANTAMINA MINE AND BIODIVERSITY IMPACTS

ANTAMINA was incorporated in Peru in 1996, and is currently owned by multi-national investors Falconbridge Inc., BHP-Billiton, Teck Cominco, and Mitsubishi Corporation. ANTAMINA's Antamina project, among the largest copper and zinc mines in the world, commenced production in 2001 and is expected to have an operating life of approximately 20 years.

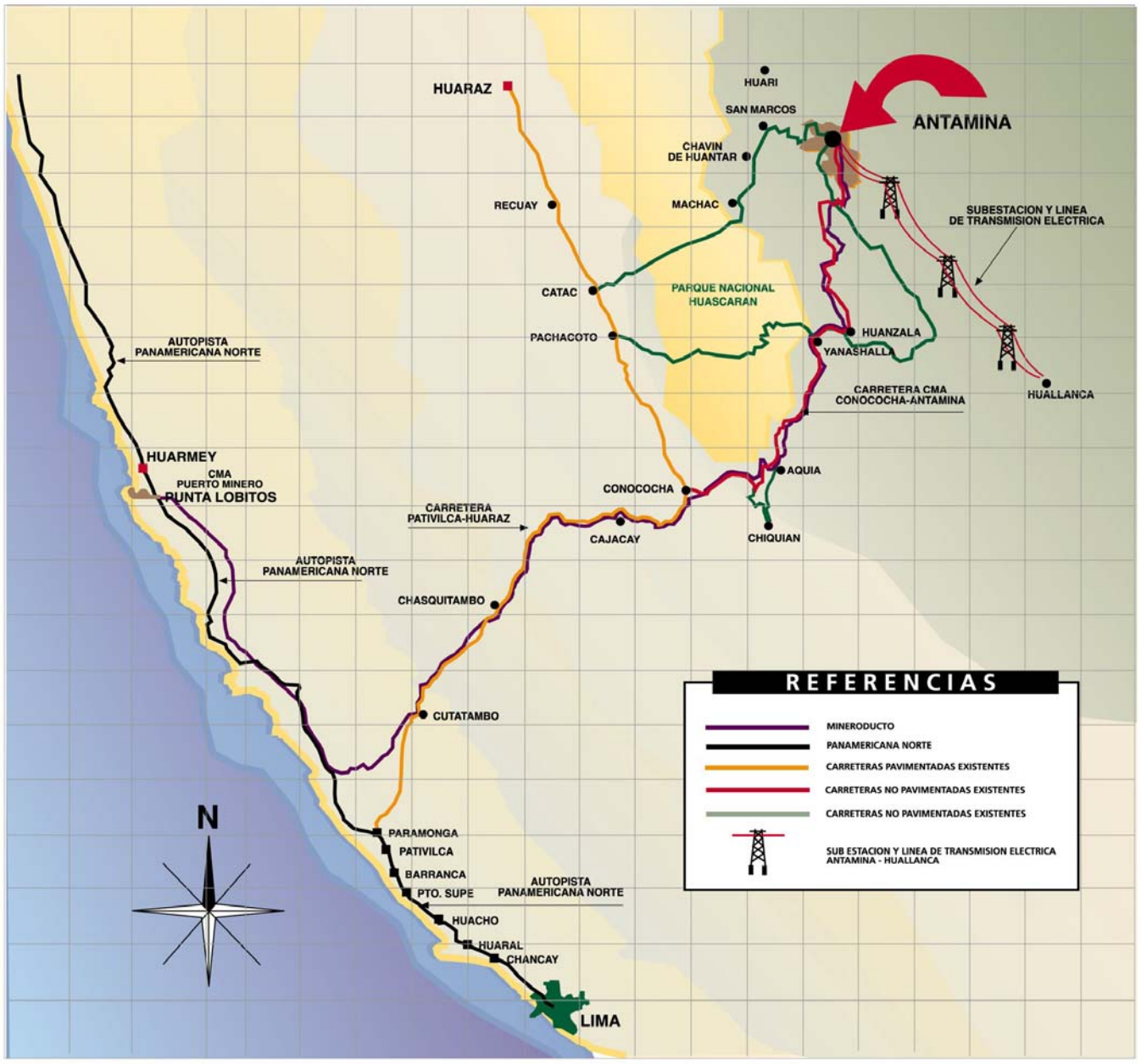
ANTAMINA's operations are located at two sites, an open pit mine located east of the Cordillera Blanca and 20 km from Huascarán National Park at 4,200 msl (see Map One), and a port facility located near the coastal town of Huarmey. The two sites are connected by an underground pipeline that transports a mixture of water and minerals from the mine to the port, where minerals are loaded onto ocean-going vessels. The mine and the port both have the potential for ecological impacts, but given the vast geographic separation of the facilities and their location in distinctly different ecoregions, this study focuses exclusively on the mine site and the conservation program designed to offset its local impacts.

During the life of the project, the mine will produce approximately 500 million tons of ore and 1.36 billion tons of waste rock. The final mine pit will be approximately 465 m in depth, 1.7 km in diameter, and cover an area of 220 ha. A 32 ha lake located within the mine area has been drained. The area of direct impact will cover 2,221 ha.

In 1998, ANTAMINA commissioned an Environmental Impact Assessment to be performed for the then proposed mine by Klohn-Crippen-SVS S.A. – a joint venture between Klohn Crippen of Vancouver, Canada and SVS Ingenieros S.A. of Lima, Peru. Ecological baseline and impact information described here are based on that study. The EIA was reviewed and approved by the relevant regulatory bodies in Peru, and presented in a public stakeholder forum. For a more detailed review of the relevant environmental regulations for the mining project, baseline conditions, environmental impacts, mitigation measures, and monitoring, please refer to the EIA[1].

[1] Since completion of the EIA in 1998, ANTAMINA decided to avoid road transport of mineral concentrates from the mine to its port facility in favor of an underground pipeline. This change eliminates expected impacts identified in the EIA from a planned roadway passing through Huascarán National Park.

Map 1: Location of Antamina Mine in Ancash, Peru



Biodiversity Baseline at the Antamina Mine

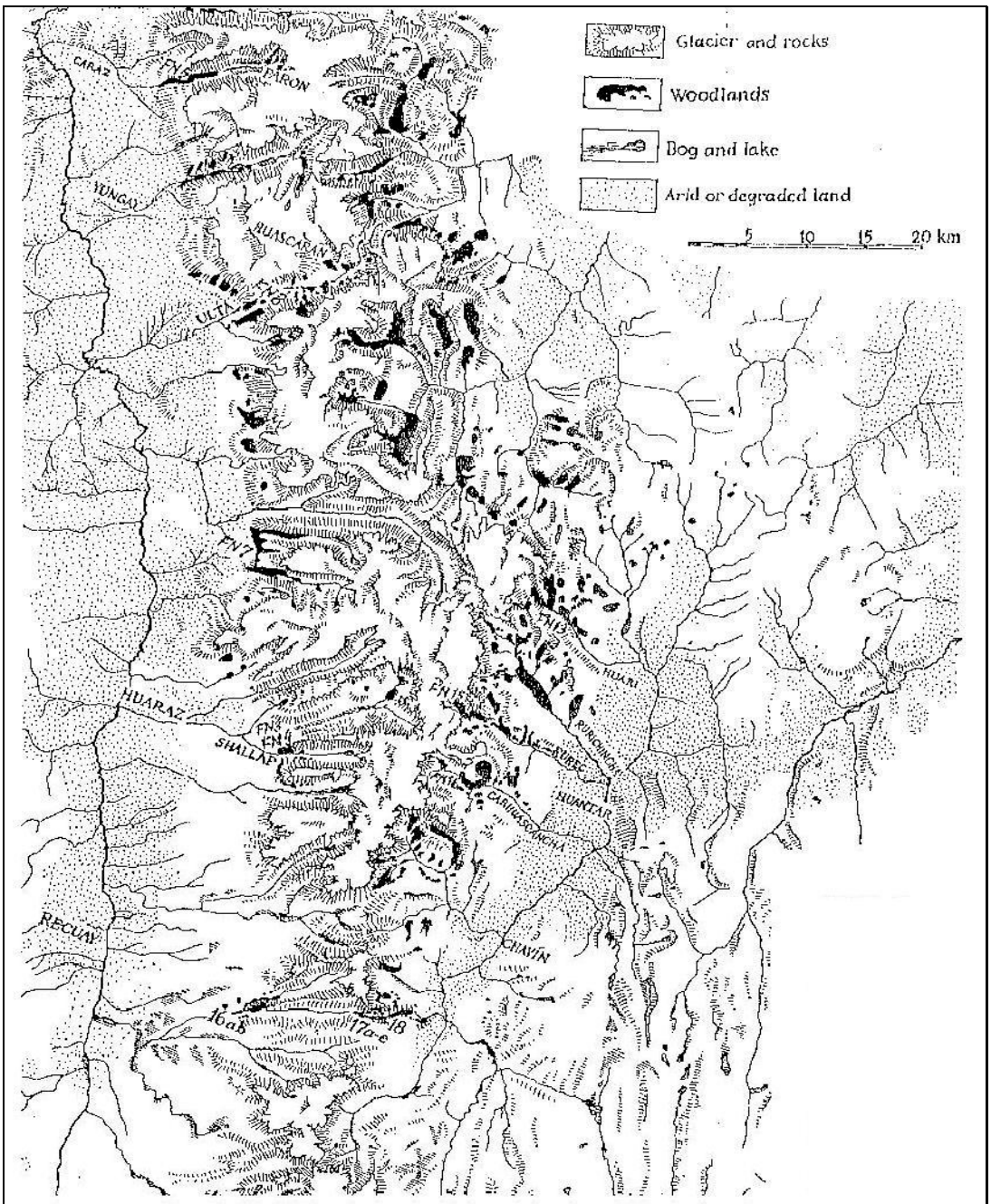
The ecological context of the Antamina mine is strongly influenced by its elevation, located in the high Andean Steppe Ranges (2,000 – 3,800 msl) and the Puna ecoregion (above 3,800 msl). The average temperatures at the mine range from 4.1° C to 5.1° C and mean annual rainfall is estimated at 1,550 mm. The life zones encompassed in this area include: Tropical Alpine Rainy Tundra (4,300-5,000 msl); Tropical Subalpine Humid Paramo (4,000-4,300 msl); Tropical Subalpine Very Humid Paramo (3,900-4,500 msl); Tropical Subalpine Rainy Paramo (3,900-4,500 msl); and Tropical Montane Steppe (2,800-3,800 msl).

Baseline studies of fauna in the region found five species of fish, 16 bird species, 13 mammal species, two species of reptiles, and three species of amphibians. No migratory species were identified. Of the fauna species found in the baseline, species listed as rare, threatened, or endangered included the Andean condor (rare), river otter (endangered), and wildcat (vulnerable).

Baseline studies of flora indicate the terrestrial ecosystems are dominantly grasslands interspersed with shrubs and isolated dense forest patches of tall shrubs. Flora species recorded in the area total 180. No endemic species are known to exist in the area, but there are three endangered species of shrub: *Buddleia coriacea*, *Polylepis weberbaueri*, *Polylepis incana*.

The shrubs and the forest habitat they create are considered the most important ecological feature in the landscape from a biodiversity conservation perspective. The current distribution of shrub forests is characterized by patches rarely exceeding tens of hectares and located in steep rocky terrain. As a result the overall spatial density is low, as demonstrated in Map 2 depicting *Polylepis* forests located within nearby Huascarán National Park.

The Antamina EIA concludes that the area of the mine is not notably diverse in terms of the taxonomic groups of flora and fauna (see Annex 1 for table of species). Aquatic habitats appear to be limited by the absence of littoral habitat and low nutrients. Terrestrial habitats exhibit normally low diversity given the elevation and harsh climate. In addition, the terrestrial ecosystems at the mine site were extensively impacted by local communities. Grasslands were used for grazing and shrub forests utilized for fuel wood.



MAP 2: POLYLEPIS DISTRIBUTION WITHIN HUASCARAN NATIONAL PARK
(This map shows a typical distribution pattern of these remnant forests, a large number of which can be found to the immediate east in the Conchucos Valley, but are as yet not mapped.)

Source: Fjeldsa & Kessler, 1996

Box A: Conservation Importance of *Polylepis*

While *Polylepis* habitat is not directly impacted by the Antamina mine, it is the most important type of habitat for biodiversity conservation in the region. Over the course of hundreds of years, 20 species of *Polylepis* have dispersed across the Andes (Kessler 1995). Peru supports fifteen of these species, making it the most diverse host of the genera in the world. However, detailed studies of *Polylepis* forests in Bolivia and Perú (Kessler & Driesch 1993; Kessler 1995a, b; Fjeldsa & Kessler 1996), have shown that the genus occupies only a small fraction of its potential distribution (10% and <3% respectively); paleontology and other studies suggest that Peru once maintained 55,000 square kilometers of *Polylepis* forests, but this number has been reduced by human forest and land use to between 700 and 1,200 square kilometers (Fjeldsa 2002). The conservation implications of such alarming findings are obvious. *Polylepis* forests are a vanishing ecosystem urgently in need of conservation action and ecological study (Fjeldsa J. 2002).

The Cordillera Blanca of Peru's Ancash Department is dotted with *Polylepis* forests between 3,400 and 4,600 meters above sea level. This region, including the Conchucos Valley to the east and Huayhuash to the south, is cited as a *number one priority for Polylepis conservation* (Fjeldsa and Kessler, 1996). It is one of two areas in the Andes with the highest level of complementarity of endemic and specialist species, the other in Cuzco/Apurimac (a third, less marked site is the northern edge of the Cochabamba basin in Bolivia). Based on the complementarity of species distributions, the most effective plan for reducing risks of global extinction should focus in these areas, which altogether contain populations of 48 percent of all threatened highland birds living at 0-30°S (Fjeldsa J. 2002).

Biodiversity Impacts of the Antamina Mine

The Antamina project is unquestionably of great proportions. The open pit mining complex will extend over 2,221 hectares. The active footprint within this complex (mine, dumps, roads, and ancillary facilities) entirely displaces the resident biota in those areas. Outside the active footprint, large areas of habitat are not directly disturbed, but are identified in the EIA as potentially affected by the mine. Table 1 details the distribution of terrestrial habitats affected by the mine. Within this area, less than one hectare of shrub forest is displaced[2].

Table X: Terrestrial habitats affected by antamina mine

Mine Component	Total Area (Ha)		Grassland (Ha)	Wetland (Ha)	Brush (Ha)	Rock (Ha)	Cropland (Ha)
Total Habitat in Mine Site	2,221		582	28	478	1,110	23
Habitat as % of Total	100%		26.2%	1.3%	21.5%	50.0%	1.0%

Source: Environmental Impact Assessment, 1998

[2] Personal communication with Steven Botts, ANTAMINA Vice President for Environmental Health and Safety.

The closure plan for the mine includes restoration of 874 ha of grasslands and 1,034 ha of aquatic habitat. There will be a temporal loss of this habitat during the operation of the mine, and a long-term (post mine closure and restoration) net loss in brush but an increase in grasslands and aquatic habitat.

In addition to the direct displacement of habitat, the mine will generate effluent that may impact local biodiversity. According to the EIA,

> During operation, effluent from the tailings facility is predicted to contain metals (copper, zinc, iron, molybdenum) below [national] regulatory limits. The effluent effects immediately downstream will be moderated by the diversion of inflows. Results from water quality modeling indicate that the downstream water quality will provide suitable conditions for fish. The effluent may affect sensitive invertebrates and algae as far as the village of Ayash, which is roughly 3 km downstream from the tailings dam. Biological diversity and production is not predicted to be significantly affected downstream of Ayash.
>
> After closure, metal levels from the tailings facility will decline and any affected stream areas will re-colonise with taxa from upstream areas and tributaries. Full recovery of aquatic biota is anticipated.

The EIA concludes that overall impacts to flora and fauna are limited. The key concern identified in the EIA was the potential for destruction of the endangered shrub species found at the site (*Buddleia coriacea*, *Polylepis weberbaueri*, *Polylepis incana*.) However, the actual mine site displaced a very small area of these shrub forests (<1 ha). The vast majority of habitats impacted are common and extensive throughout the region, allowing for resident wildlife to utilize habitat adjacent to the impact site. Although several listed species are known to live in the region of the mine, none were identified at the mine site itself. The EIA states:

> In the rockland, grassland and brushland habitats, which will be affected, wildlife sensitivity is relatively low for a number of reasons. First, the rockland and grassland habitats are the predominant habitat types in the region, occupying almost the entire land area within the mine site. Second, no unique or endangered animal species or their critical habitats have been found within the mine site. Third, the reproductive rate of the dominant wildlife (mainly vertebrates, small rodents and passerine birds), is typically very high, which makes these populations highly resilient to changes in habitat and food supply. Although there will likely be some degree of temporarily increased competition between displaced wildlife populations and those in adjacent undisturbed habitats, this effect is not considered significant at either the local or regional levels.
>
> Wildlife associated with the shore of Laguna Antamina and Laguna Condorcocha will be irreversibly lost as a result of construction and operation of the open pit and North Waste Dump, respectively. [editorial note: Antamina managers state that no wildlife was observed at Laguna Antamina before construction of the mine.] Waterfowl and shorebirds that use this habitat will be displaced to one or

> more of the many other lakes that exist within the locality. At other lakes in the surrounding area, waterfowl and larger shorebirds, such as ducks, geese and ibis, may be subjected to increased hunting pressure due to influx of mine workers to the area.
>
> A related effect is potential for increased overgrazing in adjacent undisturbed grasslands by domestic sheep, horses and cattle displaced from the natural pastures occupied by the various mine components. However, overgrazing is already occurring in the area. If not mitigated through suitable range management practices, overgrazing will continue to occur even in the absence of the Antamina project. The proposed relocation of present residents of the mine area and their livestock will, however, result in a reduction in grazing pressure.

Human Impacts of Habitat Loss

Small communities are scattered across the Cordillera Blanca and Conchucos Valley, and the Antamina mine potentially affects them in a variety of complex ways. This study focuses only on direct human impacts from natural habitat loss. According to the EIA there are two potential impacts to local communities from habitat loss. First, the temporal loss of grasslands used for grazing. Second, in one community there is a risk of contamination of surface water. However, the mine is engineered to maintain effluent standards below regulatory limits, and monitors water quality on a regular basis. There are no anticipated human health impacts, and the populations of fish are not expected to be affected. Since the EIA, ANTAMINA has conducted studies related to both of the aquatic risks and has not found any health impacts, or any significant impacts to aquatic ecosystems nor fish populations in the area of the mine[3].

There are also potential economic and social impacts caused by the mine, beyond the scope of this study. Prior to the establishment of the mine, most local communities had poor transportation infrastructure linking them with larger population centers, and existed in relative isolation and extreme poverty. This has changed markedly for some communities now that paved roads pass close by, presenting economic opportunity, heightened expectations, and social change previously unknown to these people. ANTAMINA has a comprehensive and proactive community engagement program designed to assist in the alleviation of poverty and to promote sustainable development in the region.

[3] Personal communication with Steven Botts, ANTAMINA Vice President for Environmental Health and Safety.

ANTAMINA'S *POLYLEPIS* RESTORATION PROGRAM

In 2003, ANTAMINA management became interested in a voluntary conservation project in the region of the mine. At that time the options for projects ranged widely. Based on consultation with technical advisors and conservation groups, ANTAMINA decided that a project to restore endangered *Polylepis* habitat would provide an ideal blend of biodiversity conservation and local community benefits. The project would build on experience with a local NGO in a smaller scale *Polylepis* nursery program. This project was not envisioned as an "offset" but rather as a voluntary initiative within the framework of the company's Corporate Social Responsibility strategy.

Program Partners

ANTAMINA engaged several NGOs in a partnership to implement the *Polylepis* restoration program: Asociación Ancash**,** Conservation International (CI), The Mountain Institute (TMI), and Asociación de Conservación de los Ecosistemas Andinos (ECOAN). There is no direct involvement of government regulators in this project.

- Asociación Ancash is an independent foundation established with funding from ANTAMINA to assist sustainable development initiatives in the Peruvian Department of Ancash where the mine operates. Their role is to provide technical assistance and partial funding for the project.
- CI is an international conservation group, also nationally incorporated in Peru, whose role is to provide technical oversight and partial funding to the project through its Global Conservation Fund.
- TMI is also an international conservation group, operating out of the nearby city of Huaraz. The organization has partnered with ANTAMINA on a variety of community-based conservation projects in the area of the mine, and in this project leads field activities.
- ECOAN, a Peruvian NGO based in Cuzco that specializes in *Polylepis* restoration, provides technical assistance to TMI.

Project Design

The Polylepis restoration program will contribute to the development of a connective conservation corridor between two protected areas, Huascarán National Park (a UNESCO World Heritage Area and Biosphere Reserve) and the Huayhuash Reserve Area. The corridor is almost entirely owned by communities, necessitating their collaborative engagement. The participatory process employed is based on a model developed by ECOAN in Cuzco, where today a series of communities manage restored *Polylepis* forests in that part of the country. The program also builds on pilot initiatives in the region by TMI, which designed a participatory forestry plan with communities in the immediate vicinity of the Antamina mine and initiated a two year program to train local groups in nursery development. They trained over 150 families who then produced

seedlings for their own households and sale to ANTAMINA for reforestation programs at the mine site (approximately 50,000 seedlings).

Program design is comprised of four major elements.

1. A technical team (including two botanists, an ornithologist, an entomologist, a mammalogist, and a soils and hydrology specialist) completed an ecological map of local Polylepis forests, and generated an ecological baseline for measuring long-term impacts of the initiative, prioritized sites for restoration and conservation based on ecological principles, and identified the appropriate genetic stock to be used for restoration across sites in the area of focus. Baseline data from healthy forests in the region serves as a reference to ascertain the success of restored forests in achieving habitat conditions similar to naturally occurring forests. This study also identified biodiversity in the area not described in the EIA.
2. Another technical team (including a community forester and community development specialists) visited the communities located in the area and entered discussions about forest resource use, changes in those patterns over time, and the potential need for restoration and conservation. Through these discussions it became possible to ascertain which communities have a concrete interest, and at what scale, in pursuing a restoration and conservation program.
3. The program is engaging those communities that appear most receptive to, and capable of, a restoration and conservation project, *and* own priority forests for restoration and conservation. The engagement takes the form of a series of participatory workshops. In the first workshop, the overall spatial plan is presented to the communities as a means to explain the overall results sought by the project and to seek community endorsement. The final products of this engagement will be a written commitment, in the form of a Community Agreement (*Acta*), to participate in a restoration and conservation project, and a diagnostic of the needs of each participating community that must be fulfilled to ensure project success. One of those needs may be alternative sources of fuel wood.
4. Once communities are committed to the restoration program, they will set up nurseries to raise *Polylepis* seedlings. Once established, the nurseries will provide stock for multiple restorations, each conducted as a single day of community activity and resulting in multiple acres of plantings. Threats to the planted areas are few, and experience in Cuzco indicates that community protection of the planted areas from grazing animals is sufficient to ensure that plantings survive to maturity. By five years, habitat conditions should be sufficient to support most bird species that inhabit *Polylepis* forests.
5. A conservation agreement will legally identify forests for full protection and forests for long-term management and the norms for their conservation. The project will develop and implement a legal model that

> draws on one of three strategies to permanently protect remnant and restored forests on private lands: private conservation areas; land trusts; and, land foundations. This final step is an innovation of this project, not an element of the ECOAN model. The expectation is that a legal agreement will encourage the long-term protection of the restored forests after ANTAMINA is no longer operating in the region.

The evolution of each restoration and conservation project from initial community commitment to permanent protection is envisioned to be a multi-year process, progressing through several stages of community consensus building for conservation and written commitment. The long term vision of the project is to build sufficient capacity in participating communities to continue restoration and forest management activities such that the corridor will grow ever more extensive and connective, at the same time as generating economic benefits to communities in the form of employment, tree nursery business, and access to fuel wood in a subset of forests designated for sustainable management.

Area of Impact

The program aims to restore forest patches at appropriate sites in the southern Conchucos Valley. The overall area within which the program selects forest restoration sites covers approximately 50,000 hectares, however, the distribution of appropriate sites for *Polylepis* forest restoration is characterized by a scattering of small forests. Total area of actual Polylepis forests to be restored in a distributed pattern across the Conchucos Valley is approximately 1,000 hectares in the first five-year phase of the program.

Program Costs

The total cost of the first five-year phase of the project is approximately one-million dollars, divided in even increments over each year. The majority of the first year's budget is dedicated ecological assessments and stakeholder engagement. The initial design of the program cost approximately twenty-five thousand dollars.

Environmental Impacts not Covered by Offset

The Antamina EIA identifies impacts to ecosystems, mostly grasslands, rivers, and lakes, that are not covered by the offset. It is important to re-emphasize that the *Polylepis* restoration program was not originally designed as an "offset." For this reason, it did not target all affected ecosystems, but rather that system in greatest need for conservation in the region. In an separate program, however, ANTAMINA has been working with the Comité Pro Conservación de San Marcos and TMI on grassland management systems with local communities.

The EIA views impacts to grassland as *de minimus* because of: a) the degraded state of this ecosystem before development of the mine; and, b) the abundance of this ecosystem in the region. ANTAMINA plans to restore grassland habitat upon closure of the mine.

Technically speaking, there is a temporal loss of grassland habitat, but the biodiversity implications are not great.

The case for aquatic ecosystems is similar. The EIA sees impacts to these habitats as insignificant for wildlife given the relative abundance of these systems in the area. ANTAMINA is mitigating impacts to aquatic ecosystems according to environmental regulations, and plans for restoration at the time of mine closure. Again, there is a temporal loss of this type of habitat.

The EIA identifies a risk of increased hunting of waterfowl as a consequence of an influx of mine workers in the area. ANTAMINA prohibits firearms at the mine (with the exception of the Security Department), and consequently there is no hunting pressure from mine workers. We have no information on whether hunting patterns of local communities have changed as a result of the mine, but it is certain that no hunting activity occurs on Antamina property[4].

Human Benefits of Polylepis Restoration Program

A project to restore *Polylepis*, following the logic of ANTAMINA and its advisors, would provide the greatest benefits for biodiversity conservation of any conservation target in the region. At the same time, it would also provide an opportunity to address the need for alternative economic activities in the area. The basis of this idea is that communities would directly participate in the restoration program, filling demand for labor and materials. Once up and running, the program's design calls for a demand of approximately US$ 80,000 per year in goods and services from these communities. The restoration activities will take place, provided local interest, on community lands. Restored forests provide two additional economic benefits to communities. First, to a limited extent the project will allow some long-term extraction of timber to ameliorate a growing shortage of fuel wood and building material in the region. Second, communities have identified watershed management as a key issue now that the majority of the steep Andean topography surrounding their villages is deforested. Reforesting specific areas will provide the benefit of mitigating current runoff and erosion problems.

Another component to the *Polylepis* restoration program is the introduction of more fuel efficient cooking stoves in local households, aiming to halve current demand for fuelwood (including *Polylepis*). This can be accomplished by replacing current open cooking systems with burning chambers of ceramic or other material. The primary efficiency comes from insulating the burning surface from the humid bare ground, where most energy is currently lost. A collateral benefit is improved indoor air quality – a major factor in women's health, especially as it relates to development of cataracts and lung diseases. Furthermore, fuel wood collection, often a responsibility of women in rural areas such as Conchucos, will become less onerous. A similar stove introduction program in Cuzco has been very well received by rural communities.

[4] Personal communication with Steven Botts, ANTAMINA Vice President for Environmental Health and Safety

The *Polylepis* initiative will focus its initial attention on communities located in the direct area of influence of Antamina, in particular those that have the most important native forest areas and the greatest propensity for constructive engagement with the project team. Based on TMI's assessment in 2003 of communities in the area, the project will initially focus on the Ayash and Huancayoc watersheds. The communities in the Ayash watershed expected to participate are Ayash Huaripampa and Santa Cruz de Pichiu, as well as the community of Juprog located nearby but in a separate watershed. In the Huancayoc watershed, the communities expected to participate are Vistoso, Huancayoc, and Wishllag. These communities already have established small enterprises that conduct business with Antamina, and therefore have an organizational base upon which to start the project. As the project progresses, it will expand to include at least an additional 14 communities to the north and south of Antamina's area of direct influence.

EVALUATION METHOD FOR VOLUNTARY BIODIVERSITY OFFSETS

Biodiversity offsets are conservation projects that compensate for unavoidable damage to habitats and species from business activity. In some countries biodiversity offsets are regulated for specific ecosystems and species. However, there are no comprehensive regulations for offsetting impacts to the majority of the world's ecosystems and species. In these cases, corporations may consider *voluntary* offsets. Biodiversity offsets should be used only after a company has avoided damages to priority habitats for conservation, and all regulatory and best management practices have been implemented to minimize environmental harm. At that point, residual damages should be the focus for compensation using an offset.

The design and evaluation of a voluntary offset should consider the following components:

- Environmental regulatory compliance;
- Corporate best practices for environmental management;
- Conservation impact;
- Norms for offsets, as defined in countries with offset regulations.

The first two components evaluate the regulatory and corporate environmental management context in which the offset takes place, the third component assesses the conservation impact of the project without consideration of its relevance to offsetting specific impacts, and the fourth component focuses directly on the offset itself, aiming to provide equivalent ecological benefits to damages caused by the company.

For each of the components, Annex 2 presents indicators accompanied by a description of how to interpret the information gathered, using logical thresholds to rate performance. The list of indicators is intended to be comprehensive; it may be possible to simplify and focus the design and evaluation considerations with pilot project experience.

Environmental Regulatory Compliance

This component is not developed in detail, as it relates to local regulations. The objective is to simply ensure that a company is following environmental regulations that relate to biodiversity, regardless of whether local regulations include biodiversity offsets as a compensatory mechanism.

Offsets within the Framework of Corporate Environmental Management

Biodiversity offsets are a single tool, among many, for managing environmental impacts. They are not a catch-all remedy for mitigating "any and all" environmental problems. To ensure that biodiversity offsets are used for the specific purpose for which they were

intended, it is important that corporations implement them within the context of a biodiversity management framework.

A series of initiatives on corporate biodiversity management informed a distillation of key elements for a management system and descriptions of their qualities (Wong and Gullison 2005, available at www.biodiversityneutral.org). The reviewed initiatives include those of the International Union for the Conservation of Nature, World Business Council for Sustainable Development, International Finance Corporation, Insight Investment, Energy and Biodiversity Initiative, International Council on Mining and Minerals, and the Global Reporting Initiative.

Corporate biodiversity management begins with a policy that describes a company's goal for mitigating biodiversity impacts and at what scale, with site level management in the most limited case and corporate wide management in the broadest. A company-wide policy on biodiversity management generally incorporates biodiversity considerations into company decision making. The expectation is that companies understand not only their impacts to biodiversity but also the risks such impacts pose to a company's access to future sites and capital, its reputation, liabilities and operating costs – i.e., its *biodiversity risk*. Corporate biodiversity policies should include a definition of ecologically sensitive areas, and a statement of the conditions under which a company operates in and around such areas, and under what circumstances areas are deemed "no-go" because of their importance for conservation.

On an operational level, a corporate environmental management system should include six core elements concerning biodiversity.

- ***Biodiversity impact assessment*** - In the *pre-bid/site selection and exploration stages* of project development, baseline assessments of biodiversity and evaluation of the consequences of a proposed project are essential. In the most rigorous case, the assessment should consider direct, indirect and cumulative impacts on all levels of biodiversity: genetic, species and ecosystems. A company's policy for operating in sensitive areas may lead to rejecting a site.

- ***Site and rehabilitation plans*** – The preferred hierarchy of actions at a site are: 1) avoid impacts to biodiversity, 2) reduce impacts, 3) mitigate impacts, and then 4) compensate. Rehabilitation plans for mitigating a project's impacts on biodiversity should also be developed at the permitting stage and contain site-specific objectives and targets. Sites should be progressively rehabilitated as projects mature.

- ***Monitoring system and methods*** – A company should regularly monitor its impacts to biodiversity. Companies may design a monitoring system at a range of spatial scales – e.g., capable of reporting impacts at the levels of the operational unit, across the company and other scales deemed important by scientific experts and other stakeholders. The minimum expectation is for monitoring by staff at

the decommissioning stage only, whereas the most demanding expectation is for monitoring by an external organization throughout operations.

- ***Reporting*** -- Reporting on corporate biodiversity management should follow the eleven principles for reporting on sustainability of the Global Reporting Initiative: transparency, inclusiveness, auditability, completeness, relevance, sustainability context, accuracy, neutrality, comparability, clarity, and timeliness. Reporting should present information in a manner by which internal and external stakeholders can judge its integrity and meaningfully compare information with that from different reporting years and business units, regions and/or countries. There is no guidance on how to set a reporting boundary for corporate biodiversity management.

- ***Adaptive management*** – Adaptive management of biodiversity requires updating biodiversity action plans as new monitoring information becomes available. Because the response of biodiversity to management approaches may vary widely with context, it is important to periodically re-examine management plans and modify as needed to meet biodiversity conservation goals.

Set within the larger context of a corporate environmental management system that explicitly addresses biodiversity issues, a biodiversity offset can be a useful tool for enhancing environmental performance. Legislative frameworks in some countries further guide the specific use of this tool.

Conservation Impact

While very specific requirements guide the implementation of offsets to ensure that they properly compensate for impacts to natural habitat and species, they do not necessarily provide guidance on how to implement a successful conservation project in its own right. A system developed for National Fish and Wildlife Foundation and the U.S. Bureau of Land Management (Hardner & Gullison Associates, LLC 2005) provides clear guidance for the design and evaluation of conservation projects. The system examines projects at three stages of a project cycle: *design*, *implementation*[5], and *outcome*. Successful conservation projects have a series of characteristics at each stage.

Design Characteristics

- ***Priority of species or habitat targeted*** – Projects should be clear and specific about their conservation target. Those targets should be conservation priorities, as defined by the scientific community.

[5] Guidance for project implementation is based on the *Open Standards for the Practice of Conservation* (2004), developed by African Wildlife Foundation, Conservation International, The Nature Conservancy, Wildlife Conservation Society, World Wide Fund for Nature/World Wildlife Fund, Foundations for Success, Cambridge Conservation Forum, Enterprise Works Worldwide, and World Commission on Protected Areas.

- ***Geographic scale of project*** – Projects should be based on an established science-based model of conservation biology for the given target, including knowledge of the minimum dynamic area[6] for the target species to maintain a viable population, minimum viable population size[7], and the area required to allow for sustained normal structure and function of an ecosystem[8]. In its design, the geographic scale of the project, or regional strategy of which it is a part, should exceed the minimum necessary to ensure species viability and/or support ecosystem structure and function.

- ***Linkage between project activities and outcomes*** -- Project activities should be based on an established scientific model, proven to generate a predictable conservation outcome.

Implementation Characteristics

- ***Planning*** – Projects should have clear goals, objectives, and activities, organized into a *logical framework*, with a corresponding work plan and budget. Project stakeholders should be clearly identified, described, and an engagement strategy should be developed and, if possible, integrated into any regional conservation strategies.

- ***Administration*** – Projects should be implemented on schedule and within budget.

- ***Adaptive management*** – Projects should have scientifically sound baseline data for the conservation target. Projects should have a monitoring and evaluation plan that tracks changes in conservation targets and marks progress toward goals. Project managers should analyze the data on a continuous basis, and adapt management to reflect results, revisiting conceptual models and key assumptions, project plan, and addressing management shortfalls.

- ***Communication*** – Project managers should clearly communicate, on a periodic basis, the results of project outcomes to all relevant stakeholders.

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[6] *Minimum Viable Population (MVP):* Population has 99% chance of remaining extant for 1000 years despite foreseeable effects of demographic, environmental, and genetic stochasticity, and natural catastrophes. See Shaffer. 1981. Minimum population sizes for species conservation. BioScience 31: 131-134; Primac, R. 2000. *A Primer of Conservation Biology:* Sunderland MA, Sinauer Associates, Inc. Publishers.

[7] *Minimum Dynamic Area (MDA):* Amount of suitable habitat necessary to maintain minimum viable population (MVP). See *A Primer of Conservation Biology:* Sunderland MA, Sinauer Associates, Inc. Publishers.

[8] *Structure and Function of Ecosystem (SFE):* Characteristic assemblages of species, demographic distributions, and energy and nutrient dynamics.

Outcome Characteristics

- ***Scale of impact*** – As an outcome of the project, the conserved target species population should exceed the minimum viable population size. Conserved habitat should exceed minimum dynamic area or be sufficient to maintain ecosystem structure and function.

- ***Response of conservation target*** – Projects should increase and fully restore populations of target species relative to the baseline conditions prior to the project. Projects should increase the target habitat area with *fully* restored structure and function. In the case of protection projects, the rate of destruction of the target should be halted.

- ***Critical threats managed*** – Many conservation projects address a single threat, although conservation targets may have multiple threats. Successful projects should manage for a*ll* factors affecting the target population or habitat, for the long term. Permanent funding, such as an endowment, should be established. An institution should be identified to manage the project over the long term and it should have sufficient capacity to fulfill this role.

Norms for Biodiversity Offsets Based on Existing Regulations

Countries that currently have regulations governing biodiversity offsets include Australia, Brazil, Canada, European Union, Switzerland, and United States. A recent review of legal, regulatory, and policy guidance governing offsets (McKenney 2005, available at www.biodiversityneutral.org) details how these legislative frameworks address a range of methodological issues for offsets, and highlight key similarities, differences, and challenges. While legislative frameworks are still evolving, and some critical gaps may exist, we summarize here the goals, principles, criteria, and assessment methods found in these policies, laws, and regulations. This can serve as a starting point for assessing *voluntary* offsets in countries where no relevant regulations presently exist.

Offset Policy Goals and Principles

Policy goals for biodiversity offsets in different countries vary from "no net loss" and "net gain" of specific species and habitats, to more general statements about the need to address adverse ecological impacts from development. For example, the United States maintains a policy of "no net loss" of wetlands, indicating that all wetlands damaged by development must be replaced by *new* wetland habitat with similar structure and function.

In considering mitigation options for a proposed project's impacts, offset policies generally adhere to a sequence of: (1) avoidance, (2) minimization, and (3) compensatory mitigation. In the first step of the sequence (avoidance), it is important to note that

impacts to unique and rare habitats, special aquatic sites, and other critical environmental assets are generally prohibited; they must be avoided unless it is an exceptional case. In evaluating the proposed impact site against potential alternatives, the main criterion is which site represents the *least environmentally damaging* option. Other assessment criteria, such as economic considerations, cannot be seen as overruling ecological criteria.

Offset Criteria

Biodiversity offset regulations typically address several core criteria, although not every country with biodiversity offset regulations addresses them all. Following is a review of core criteria found in current regulations.

- *Equivalence* of project impacts with offset gains (*in-kind* vs. *out-of-kind*) -- As no two areas are ecologically identical, care is required to ensure that offsets provide benefits that are "equivalent" to losses caused by project impacts. The most direct means of establishing equivalence is to offset with the same ecosystem that is impacted, known as *in-kind* offsets. Alternatively, *out-of-kind* offsets are possible in some contexts. Offset policies typically prefer in-kind offsets, but there is a trend toward more acceptance of out-of-kind mitigation as long as it can provide greater environmental benefits than in-kind options.

- *Location* of the offset relative to the impact site (*on-site* vs. *off-site*) -- Offset policies generally prefer on-site mitigation to off-site mitigation because compensation benefits accrue to the project affected area. However, off-site offsets may be supported in cases where they are located in the same ecoregion or watershed as the project site and can provide greater environmental benefits than on-site mitigation options.

- Contribution to conservation (*additionality*) -- Legislative frameworks call for offsets to represent new or additional contributions to conservation, but in many cases there is wide latitude provided regarding what types of offsetting activities are allowable, including restoring degraded ecosystems, preserving areas in healthy condition but under threat, and improving management practices. Implicit in *additionality* is that the project does not actually cause environmental harm elsewhere by displacing environmental threats to another site (often known as *leakage*).

- Measuring project impacts and offset gains (*currency*) -- Offset policies call for "currency" to incorporate values associated with ecological functions, quality, and integrity. Currency may be expressed in the form of area (habitat hectares) or ecological structure and function.

- *Timing* of project impacts vs. offset benefits – There is a general preference that offsets are in place and effective prior to project impacts. In cases where the offset is implemented after project impacts are incurred, or a period of years is

required for an offset to become ecologically mature, a "temporal premium" may be required in the form of a higher mitigation ratio (see above) for the offset.

- Offset *duration* -- In most cases, offset policies call for conservation of offset sites to be established in perpetuity. Offset frameworks note the need for legal and financial assurances to secure site tenure, restrict harmful activities, support long-term management and monitoring, and cover contingency and remedial actions in the event of offset failure. Where the success of an offset is less certain, or early credit release has been allowed, higher financial assurances may be required.

- Comparing project impacts and offset gains (*mitigation ratio*) -- Using an established currency, it is possible to compare the magnitude of development impacts to gains from an offset. In the simplest case, a mitigation ratio might be 1:1, but consideration of other factors such as quality of habitat impacted, relative benefits of creating new habitat versus restoring existing but degraded habitat, risk of offset failure, and temporal issues may result in a requirement that the mitigation ratio be higher.

Offset Assessment Methods and their Implementation

Offset assessments involve mapping and delineation of sites, analyzing conditions, functions, services, and values, assessing potential alternative options, determining required mitigation, and determining compensation needs and appropriate compensation ratios. In conducting these activities, offset assessment methods vary considerably in their approach. At one extreme are methods that require complex modeling and at the other are more rapid approaches that may involve little more than measuring the size of the impact area and applying professional judgment about impacts. The tension between these extremes reflects two valid concerns – the need for sophisticated approaches that produce scientifically defensible results, and the need for practical approaches that can be implemented within existing time and budget constraints.

A number of "middle-ground" approaches have emerged aimed at reconciling these competing needs. These approaches generally involve weighting key variables (based on professional judgment) and applying a scoring system. While such methods rely heavily on the subjective judgment of the user, they also provide a systematic and repeatable approach where judgments and assumptions require justification and can be verified. In addition to emerging "middle-ground" methods, there has been renewed effort to improve the assessment *process*, with particular emphasis on better screening at the front-end to narrow the scope of values and functions requiring more intensive analysis. Such process improvements aim to reduce time and costs while still supporting intensive assessment for identified values and functions of concern.

EVALUATION OF ANTAMINA's *POLYLEPIS* RESTORATION PROGRAM

ANTAMINA's *Polylepis* restoration program is a voluntary conservation initiative. Although ANTAMINA did not originally design the program as a biodiversity offset, we evaluate its potential as one. The evaluation examines the four components described in our overview of methods and presented in detail in Annex 2. Results are detailed in the following tables

In general, ANTAMINA's voluntary Polylepis project performs very well as a biodiversity offset. Following are general conclusions, by component.

Regulatory Compliance

According to ANTAMINA, the mine meets or exceeds Peruvian regulatory requirements for environmental protection. The company follows the management requirements for environmental management set forth in its EIA. ANTAMINA also follows World Bank Guidelines for Environmental Management for the Mining and Milling Sector and adheres to World Bank Operational Policy 4.04 (Natural Habitats), which includes requirements for biodiversity conservation. This study did not include consultation with Peruvian regulators on ANTAMINA's compliance record.

Corporate Best Practices for Biodiversity Management

We find that the voluntary *Polylepis* conservation program fits within a comprehensive environmental management system. This includes the appropriate use of an offset in a larger biodiversity management hierarchy of avoid, minimize, mitigate, and *then* compensate with an offset.

Conservation Impact

The program rates well as a stand-alone conservation project. Some criteria in which the program does not receive the top mark relate to practical constraints that simply can not be overcome, such as the inability to extend the project over the natural range of the project, or the relatively nascent experience base for *Polylepis* restoration.

Norms for Biodiversity Offsets

As compensation for the loss of *Polylepis* forest, the program meets or exceeds the norms for biodiversity offsets. A significant result is the offset ratio of 1,000 hectares of restoration to compensate for 1 hectare of impacted *Polylepis* forest. On only two criteria does the program fail to achieve the highest rating, *units of currency* and *timing*, although both would satisfy the norms for biodiversity offsets according to some current regulations. We should note that the project does not specifically offset impacts to other impacted ecosystems, such as grasslands (regardless of their degraded status) and lakes,

or ecosystems under risk of impacts, such as nearby rivers. These ecosystems are addressed by other ANTAMINA programs, however.

COMPONENT 1: ENVIRONMENTAL Regulatory Compliance				
Theme	**Excellent Performance**	**Acceptable Performance**	**Poor Performance**	**Comments**
Compliance with Environmental Regulations (Should include regulations relevant to any impacts to natural ecosystems)	X			According to ANTAMINA, the mine meets or exceeds Peruvian regulatory requirements for environmental protection. ANTAMINA follows World Bank Guidelines for Environmental Management for the Mining and Milling Sector and Operation Directive 4.04 regarding Natural Habitats. This study did not include consultation with Peruvian regulators.

COMPONENT 2: CORPORATE BEST PRACTICES For BIODIVERSITY MANAGEMENT				
Theme	**Excellent Performance**	**Acceptable Performance**	**Poor Performance**	**Comments**
Biodiversity Policy	X			ANTAMINA's Environmental, Health, and Safety policies include all environmental impacts of the company's operations. While the term "biodiversity" is not explicit in the text, it is implied in the comprehensive statement on environmental responsibility[9].
Considering Biodiversity in Business Decisions	X			ANTAMINA's impacts on environment, including biodiversity, are considered in decision making. ANTAMINA follows the World Bank Standards of Mining and Milling.
Responsibility for Managing Biodiversity Mgmt	X			Biodiversity management is explicit responsibility of Environmental, Health, and Safety, up to level of Vice President of ANTAMINA. (Senior management and board of directors involved in decision to implement voluntary *Polylpeis* conservation program.)
Including Stakeholders		X		Stakeholders engaged during mine planning (including EIA), development, and operation. (Local stakeholder consultation is integral in *Polylepis* restoration program for site selection and restoration implementation). Stakeholder conflicts have arisen. Some local communities are not fully satisfied with the mine's environmental management.
Policy on Sensitive Areas	X			ANTAMINA follows World Bank Guidelines for Environmental Management for Mining and Milling, which includes explicit language about avoiding destruction of critical natural habitats. The original plan for the mine included building a road through Huascaran National Park to transport minerals to port. This plan was abandoned, however, in favor of a far lower impact alternative, an underground viaduct.
Biodiversity Impact		X[SDB1]		Biodiversity impacts of project described in EIA at the habitat and

[9] "Ambiente, Salud y Seguridad Industrial en Antamina," available at www.antamina.com.

Assessment				species level. Impacts not described at genetic level. Subsequent baseline studies of local Polylepis forests for the conservation program found a range of species not identified in the BIA, included species of flora and fauna new to science. BIA could have been more thorough, suggesting a possible rating of "poor."
Site and Restoration Plans	X			Biodiversity offset for *Polylepis* shrub forest underway. Project follows hierarchy of: avoid; mitigate; offset. Project aims for net gain in biodiversity. Offset implemented *after* development of mine project. Site plan includes biodiversity impact mitigation, monitoring, and reporting strategy. Project will rehabilitate mine site though ecosystem restoration of grasslands, shrub forests, and replacement of aquatic habitat. Progressive restoration will occur as areas cease production.
Monitoring System and Methods		X		ANTAMINA monitors biodiversity in the areas where impacts are of concern, namely aquatic organisms potentially impacted by effluent and bird populations reliant on lake habitat near the mine. With implementation of the *Polylepis* restoration program, monitoring of this habitat and resident species will commence. Biodiversity metrics target species and habitats of concern, include baseline information, performance targets, and are measured consistently over time. ANTAMINA does not achieve highest rating because not all biodiversity monitoring is conducted by an independent third party.
Reporting	X			Annual reporting on biodiversity impacts available in ANTAMINA's Sustainability Report. Report is shared widely with stakeholders and is available to general public.
Adaptive Management	X			Biodiversity monitoring feeds back into environmental management decision making through an EMS. ANTAMINA is in the process of earning ISO 14001 certification (expected late 2006), requiring continuous improvement of environmental performance.

COMPONENT 3: Conservation Impact					
Factor of Success	**Rating**				**Comments**
	Excellent	**Good**	**Fair**	**Poor**	
Design					
Priority	X				Program is clear and specific about its conservation target, *Polylepis* – a shrub species that is deemed of the highest of priorities for conservation by scientists. *Polylepis* has been reduced to only a few percent of its original natural range and provides habitat to a large percentage of the endemic birds of the Andes.
Scale		X			Program is based on known conditions required for successful restoration of Polylepis, as well as size of restored habitat required to support endemic bird species. Program will restore multiple forest patches of sufficient size to maintain ecosystem structure and function, and support endemic bird species. Program is a pilot that could be replicated over an area far larger than currently planned in the current 5-year program design. Practically speaking, however, it will not extend over the natural range of the species.
Linkage		X			Project is based on an existing and successful model for Polylepis restoration in Cuzco, Peru that has been underway for several years. Additional time and study will be required to achieve the highest linkage score given the still experimental nature of the program.
Implementation					
Planning		X			Project planning is laid out in detail in a logical framework, supported by annual work plans and budgets. A detailed stakeholder map and engagement strategy for the program was developed and is being executed by The Mountain Institute. To date, however, there is no regional conservation strategy into which this program fits. This is a reflection of the lack of institutional capacity in this region for conservation, rather than a flaw in the company's program.
Administration	X				To date, program is implemented on time and within budget.

Adaptive Management		X			Scientifically sound baseline data has been collected. Program has monitoring plan that tracks progress towards goals. Monitoring results are reviewed on an intermittent basis. Project has not yet been underway long enough to determine ability to respond to monitoring data.
Communication					Information not yet available for evaluation.
Outcome					
Scale of Impact					Information not yet available for evaluation.
Response of Target					Information not yet available for evaluation.
Target Secured					Information not yet available for evaluation.

COMPONENT 4: BIODIVERSITY OFFSET NORMS BASED ON CURRENT REGULATIONS				
Theme	**Exceeds or Conforms to Most Regulations**	**Conforms to Some Regulations**	**Does Not Conform to Any Regulations**	**Comments**
Avoidance and Mitigation Hierarchy	X			Project satisfies criteria for avoiding especially sensitive areas for biodiversity, and then mitigating all ecological impacts according to regulatory requirements. Only after satisfying these criteria does ANTAMINA develop a voluntary conservation project to mitigate unavoidable impacts of its operations.
Equivalence ("in-kind vs. "out-of-kind")	X			Mine site impacts three native ecosystems: 1) Puna grassland; 2) rivers and lakes; and, 3) shrub forest. According to the EIA, impacts to grassland, rivers and lakes is not deemed significant for local biodiversity. Impacts to shrub forest extend over only 1 hectare, however this ecosystem includes the endangered *Polylepis* genus. Given the importance of Polylepis and the habitat it creates for endemic species, it was chosen for a voluntary conservation project. The scale of the offset could allow it to count as an "out-of-kind" offset for grassland and aquatic habitat impacts. Based on this information, the offset is "in-kind" for the ecosystem of significance for biodiversity conservation. This conforms to most regulatory standards.
Location of offsets ("on-site" vs. "off-site")	X			The conservation project is distributed across a 50,000 hectare corridor in the Conchucos Valley that runs adjacent to the mine site. The offset conforms to the "on-site" preference of most regulations.
Additional conservation benefits	X			*Polylepis* restoration is not duplicative of any existing conservation program, and focuses on private lands that form a corridor between two protected areas. The project qualifies as *additional*.
Units of currency		X		The unit of currency is hectares. The offset methodology does not attempt to quantify ecosystem functions. This conforms to some regulatory standards, with the exception of U.S. wetlands offsets that

				require quantification of ecosystem structure and function.
Mitigation Offset Ratio	X			The restoration project offsets impacts to *Polylepis* forests at a ratio of 1,000:1. This exceeds all regulatory standards.
Timing of offset relative to impact		X		The offset is implemented after development of the mine. While this conforms to some regulations, a more rigorous approach would involve implementation of the offset prior to development or at least within one year of impact. Some regulations allow temporal delay to be compensated for with a mitigation ratio greater than 1:1 (see Mitigation Offset Ratio above).
Duration of offset	X			The conservation project is intended to be permanent, based on legal obligations by local communities to protect restored forests. Offsets typically are required to last as long as impacts. Because the mine site will be restored upon mine closure, duration of impact is the operational life of the mine (approximately 20 years). Therefore, a permanent offset exceeds most regulations.

MONITORING AND REPORTING

As ANTAMINA implements the voluntary *Polylepis* restoration program, the company will monitor the status of restored forests and the resident populations of species of concern. This should include bird species known to be endemic or specialists for *Polylepis* forest habitat. Antamina's annual sustainability report should include the following information going forward:

- Quantification of shrub forest originally displaced by Antamina mine;
- Explicit target, in hectares, for *Polylepis* restoration, expressed in absolute terms and as a ratio of *Polylepis* displaced by mine;
- Status of restoration project in terms of implementation process;
- Status of restoration program in terms of area restored;
- Status of restored forests in terms of survival of *Polylepis* and fauna and flora anticipated to inhabit *Polylepis* forest habitat – a periodic survey of endemic birds in restored forests would be ideal;
- Community benefits generated by offset program, such as employment in restoration activities and sustainable community utilization of restored forests.

In addition, Antamina should report ecological findings that occur as a result of working on the conservation program, but that otherwise were not identified in the EIA. The issue here is that a much closer examination of local ecosystems performed to assess baseline conditions of local *Polylepis* forests found a number of important species for conservation, including the possible identification of species of flora and fauna new to science. In the best case, these findings would not have been overlooked in the EIA. An appropriate response at this time is to report these findings to government regulators (INRENA) as an update to the EIA and to stakeholders through the company's sustainability report or other communications mechanisms.

CONCLUSIONS

ANTAMINA's voluntary conservation program to restore *Polylepis* forests in the Conchucos Valley of Ancash, Peru could serve as a formal biodiversity offset for ecological impacts incurred due to the Antamina mine. The biodiversity offset is a component of a larger corporate biodiversity management strategy that largely follows the recommendations laid out in voluntary industry best practice standards. The impacts of the Antamina project include several habitat types, but with the exception of minimal impacts to the shrub forests, the conservation importance of those habitats was low. ANTAMINA's Polylepis restoration will more than offset the impacts to shrub forests at the mine site, and will create additional shrub forest habitat along a conservation corridor between two existing protected areas.

A potential point of weakness in the offset is timing, because it is implemented more than a year after impacts were experienced from the mine project. This is, of course, to be expected since the idea of a biodiversity offset arose after the development of the mine and the design of the voluntary conservation program. In strict terms, the company had essentially no impact on *Polylepis*, so the timing of the offset may not be relevant, but if it were it is compensated for by the large mitigation ratio of the offset.

The currency used to compare the impacts of the mine to the benefits of the offset is simply area of habitat. We understand that *Polylepis* habitat can be restored to a sufficient extent to be inhabited by endemic bird species in five years. We do not attempt in this evaluation to compare baseline data from other mature *Polylepis* forests in the region with restored forests. This comparison of ecosystem structure and function would provide more clarity in our analysis, and might be pursued in a future study permitting that resources are available.

This case study is an early application of a generalized biodiversity offset evaluation methodology. Some issues have arisen that require further study and development. First and foremost, the evaluation relies heavily on Antamina's EIA. Once baseline ecological studies were completed for the *Polylepis* project, it was determined that a number of species of conservation importance occupy the area surrounding the mine. This calls into question the ability to rely solely on the EIA for a biodiversity assessment of the project area, or at least an EIA conducted without reliable third party review. Second, more analytic tools should be developed to assess the community component of biodiversity offsets. The ANTAMINA program is fully integrated into a corporate strategy for community engagement. An assessment of how this should be analyzed within the context of an offset would be helpful.

The authors anticipate that this document will serve as the basis of discussion for further improvements to the methods. The report is not an endorsement or certification of ANTAMINA's conservation program as a biodiversity offset.

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Annex A: ANTAMINA Policy Statements

ENVIRONMENTAL HEALTH AND SAFETY POLICY

Objective:
To ensure that all employees, contractors, shareholders and communities in Peru are aware of CMA's commitment to world class Environment, Health, Safety and Community programs and practices.

Principles:
We are Antamina, efficient operators of a polymetallic ore deposit. Our work team is committed to producing and delivering high-quality concentrates in a safe and responsible manner, from the Peruvian Andes to the world. We intend to create value and generate benefits in a responsible manner for the benefit of our workers, shareholders, communities, and Peru. Our mission is to be a company with extraordinary though predictable results as to quality, adaptability, profitability, safety, environment and community relations, by having our people participate and assume a leadership role.

Scope:
All Employees
All Contractors
All Shareholders
All Communities in the surrounding regions of Antamina

Administrative Responsibility:
EHSC Department

Application:
Aware of our mission, we commit ourselves to:

Honor the culture, traditions, and values of our employees and the communities surrounding our operations.

Keep an open communication channel with the government, shareholders, employees, communities, and other stakeholders, regarding environmental, health and safety issues.

Act responsibly as administrators of the resources we are in charge of, guaranteeing the protection of the environment and the well-being of our employees and neighboring communities.

Prevent environmental, health, safety and community risks in all our activities, ensuring the fulfillment of governmental, World Bank, and company rules and standards.

Train and create awareness among all employees in order to improve their performance, guaranteeing a safe and environmentally healthy workplace.

Keep a monitoring program in place to constantly ensure the fulfillment of said policy and governmental laws and rules.

Regularly review the environmental, health, safety and community relations' systems, programs and practices to continuously improve performance in our activities, and align CMA's strategic partners in the fulfillment thereof.

SUSTAINABLE DEVELOPMENT / SOCIAL RESPONSIBILITY POLICY

Purpose:
At Antamina we accept our corporate responsibility to practice environmental protection and promote social and economic progress without compromising community well being or security. Our goal is to contribute to a better future for our neighboring communities and the country of Peru.

We are committed to building partnerships with our neighboring communities and other stakeholders. Our partnerships are based on mutual trust and are consistent with our core values and community interests, only together can we achieve sustainability.

Scope:
All Antamina Employees

Administrative Responsibility:
EHS&C

Principles:

A. Sustainability is good business practice that reduces risk and supports our relationship with stakeholders.
B. Implementing sustainability requires leadership and a balance between environmental, social and economic needs.
C. We strive to improve the quality of life of our employees and their families.
D. We require the support of our neighboring communities, government and other stakeholders, gained through meaningful dialogue.
E. Society's need for the metals we produce must be balanced with environmental protection.
F. Our activities must be conducted in a way that respects cultures, customs and social values of our neighboring communities.
G. We are committed to act with caution commensurate with the risk, and in an appropriate and lawful manner.
H. We must pursue new technologies to reduce the impact of mining activities.

Our Policy and Principles:
It is our policy to:

1. Implement and maintain ethical business practices and effective systems of corporate governance.
2. Integrate sustainable development considerations and practice into the corporate decision-making process.
3. Uphold fundamental human rights and respect cultures, customs and values in our dealings with host communities and other stakeholders.
4. Implement risk management strategies based on valid data and sound science.
5. Seek continual improvement of our health, safety and environmental performance.
6. Contribute to the conservation of biodiversity and the use of integrated and consultative approaches to land management.
7. Facilitate and encourage responsible product design and usage, and the recycling and disposal of our waste products.
8. Contribute to the equitable distribution of economic benefits and the social and institutional development of neighboring communities.
9. Implement effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders.

Annex B: Evaluation Criteria

COMPONENT 1: ENVIRONMENTAL Regulatory Compliance				
Theme	**Indicators**	**Excellent Performance**	**Acceptable Performance**	**Poor Performance**
Compliance with Environmental Regulations (Should include regulations relevant to any impacts to natural ecosystems)	As indicated in local regulations	Exceeds regulatory requirements for environmental protection	Meets regulatory requirements for environmental protection	Does not meet regulatory requirements for environmental protection

COMPONENT 2: CORPORATE BEST PRACTICES For BIODIVERSITY MANAGEMENT				
Theme	**Indicators**	**Excellent Performance**	**Acceptable Performance**	**Poor Performance**
Biodiversity Policy	Written policy	Policy describes goal for managing biodiversity impacts at scale of all corporate activities	Policy describes goal for managing biodiversity impacts at scale of project site(s)	No policy for managing biodiversity impacts
Considering Biodiversity in Business Decisions	Evidence of business options evaluated based on biodiversity impacts	Company assesses biodiversity impacts of multiple options, and selects options that minimize biodiversity impacts – may override financial considerations	Company assesses biodiversity impacts of multiple options, and selects options that minimize biodiversity impacts	Company does not assesses biodiversity impacts of multiple options as a means to minimize biodiversity impacts
Responsibility for Managing Biodiversity Mgmt	Job descriptions of managers	Specific biodiversity management responsibilities at all management levels of company	Select managers have defined biodiversity management responsibilities	No defined biodiversity management responsibilities
Including Stakeholders	Stakeholder map Stakeholder engagement strategy Stakeholder meetings held Stakeholder concerns addressed	Stakeholders are identified and engaged in a formal process where biodiversity issues are discussed Stakeholders fully satisfied that their concerns about biodiversity impacts are reflected in project planning and implementation	Stakeholders are identified and engaged in a formal process where biodiversity issues are discussed Stakeholders concerns about biodiversity impacts are reflected in project planning and implementation	Stakeholders not fully identified or engaged in a formal process where biodiversity issues are discussed.
Policy on Sensitive Areas	Corporate "No Go" Policy Evidence of iterative planning to minimize biodiversity impacts	"No Go" policy in place and considers multiple major independent conservation prioritization schemes Company evaluates multiple	"No Go" policy in place and follows at least one major independent conservation prioritization scheme Company evaluates multiple	"No Go" policy not in place, or does not follow any major independent conservation prioritization schemes

		options for its activities, and eliminates options that conflict with "No Go" policy	options for its activities, and eliminates options that conflict with "No Go" policy	
Biodiversity Impact Assessment	Range of taxonomic groups included Treatment of direct and indirect impacts Involvement of independent experts Independent peer review of results Concordance with other BIAs in similar contexts	In the *pre-bid/site selection and exploration stages* of project development, baseline assessments of biodiversity and evaluation of the consequences of a proposed project are performed as part of Environmental Impact Assessment (EIA) Assessment considers direct, indirect and cumulative impacts on all levels of biodiversity: genetic, species and ecosystems	In the *pre-bid/site selection and exploration stages* of project development, baseline assessments of biodiversity and evaluation of the consequences of a proposed project are performed as part of EIA	Project EIA does not adequately address potential and actual biodiversity impacts of project.
Site and Restoration Plans	Written impact mitigation strategy Evidence of biodiversity impact management hierarchy Extent of restoration	Site plan follows hierarchy of: 1) avoid impacts to biodiversity, 2) reduce impacts, 3) mitigate impacts, and then 4) compensate Restoration plans for mitigating a project's impacts on biodiversity are developed at permitting stage and contain site-specific objectives and targets Sites are progressively rehabilitated as projects mature	Site plan follows hierarchy of: 1) avoid impacts to biodiversity, 2) reduce impacts, 3) mitigate impacts, and then 4) compensate Restoration plans for mitigating a project's impacts on biodiversity are developed at permitting stage and contain site-specific objectives and targets	Site plan does not include biodiversity impact mitigation strategy
Monitoring System and Methods	Biodiversity metrics for species and habitats of	Independent entity monitors biodiversity impacts of	Company monitors biodiversity impacts of	No monitoring system, or monitoring system lacks one

	concern Baseline data Periodic monitoring data Performance targets	operations over time Biodiversity metrics target species and habitats of concern Baseline data available for impacted species and habitats Data collected consistently over time Explicit performance targets	operations over time Biodiversity metrics target species and habitats of concern Baseline data available for impacted species and habitats Data collected consistently over time Explicit performance targets	or all of the following: -biodiversity metrics for species and habitats of concern; -biodiversity baseline data; -consistent data collection over time; -explicit performance targets
Reporting	Written reports on biodiversity impacts Company Sustainability Report	Annual reporting on biodiversity impacts available in company's Sustainability Report. Report is shared widely with stakeholders and is available to general public	Annual reporting on biodiversity impacts available to key stakeholders	No reporting available on biodiversity impacts
Adaptive Management	Demonstrated use of monitoring data to adapt biodiversity impact management	Biodiversity monitoring directly feeds back into environmental management decision making Company is ISO 14001 certified, requiring continuous improvement of environmental performance	Biodiversity monitoring directly feeds back into environmental management decision making	Biodiversity monitoring does not affect biodiversity management.

COMPONENT 3: CONSERVATION IMPACT					
Theme	**Indicators**	**Excellent Performance**	**Good Performance**	**Fair Performance**	**Poor Performance**
Design					
Priority	Identification of conservation target	Project is clear and specific about conservation target	Project is clear and specific about conservation target	Project is clear and specific about conservation target	Project is *unclear* and *not* specific about conservation target
	Peer references and other proof of priority	Project addresses conservation priorities, as defined by scientific community	Project addresses conservation priorities, as defined by scientific community	Project could better addresses conservation priorities, as defined by scientific community	Project does *not* addresses conservation priorities, as defined by scientific community
	Conservation target ranking in national and international priority setting	Project is a top priority in national and international conservation strategies	Project is a priority in national and international conservation strategies	Project is a low priority in national and international conservation strategies	Project is neither a national or international conservation priority
Scale	Peer references and other proof of scientific basis	Project includes established science-based model of conservation biology of target, including MDA, MVP, and SFE	Project includes plausible science-based model of conservation biology of target, including MDA, MVP, and SFE	Project includes conservation biology model of target, but requires substantial additional scientific research	Project does *not* include conservation biology model of target
	Expected Δ in conservation target relative to MVP[1], MDA[2] or SFE[3]	Geographic scale of project, or regional strategy of which it is a part, exceeds minimum necessary to ensure species viability and/or support ecosystem	Geographic scale of project, or regional strategy of which it is a part, exceeds minimum necessary to ensure species viability and/or ecosystem structure and	Geographic scale of project, or regional strategy of which it is a part, meets minimum necessary to ensure species viability and/or	Geographic scale of project, or regional strategy of which it is a part, does not meet minimum necessary to ensure species viability and/or ecosystem

		structure and function, and extends over natural range of conservation target	function	ecosystem structure and function	structure and function
Linkage	Quality of references and base of experience supporting conservation activities	Project activities based on established scientific model, proven to generate predictable conservation outcome	Project activities based on plausible scientific basis	Scientific basis of project activities could be improved	Project activities have no clear basis in science, and conservation outcome is not predictable
Implementation					
Planning	Logical framework or similar statement of goals, objectives, and activities Work plan and budget, corresponding to logical framework Stakeholder map	Project has clear goals, objectives, and activities, organized into a *logical framework*, with corresponding work plan and budget Work plan and budget is well organized and detailed, *more than adequate* to track project administration Stakeholders are clearly identified, described, and engagement strategy developed and *integrated into regional conservation strategy*	Project has clear goals, objectives, and activities, organized into *a written statement*, with corresponding work plan and budget Work plan and budget is well organized and detailed, and *adequate* to track project administration Stakeholders are clearly identified, described, and engagement strategy developed	Project goals, objectives, and activities *could be better defined* and linked in logical manner Work plan and budget *could be improved, but adequate* to track project administration Stakeholders are clearly identified, described, but *engagement strategy not developed*	Project has *no* clear goals, objectives, and activities, or they are not linked in logical manner Work plan and budget either *absent or not adequate* to track project administration Stakeholders are *not clearly identified*
Administration	Progress reports and project completion documents, accounting	Project is implemented on schedule and within budget	Project is implemented on schedule and within budget, *with minor adjustments*	Project is not implemented on schedule and within budget, *but is eventually completed*	Project is *not* completed

Adaptive Management	Baseline Data M&E Plan Documentation of data & analysis from M&E Evidence of project response to M&E -conceptual model -key assumptions -project plan -management	Scientifically sound baseline data for conservation target acquired and accessible for analysis in M&E Project has M&E plan that tracks progress towards goals Project analyzes M&E results on continuous basis Project adapts fully to M&E results, revisiting conceptual model and key assumptions, project plan, and addressing management shortfalls, and attains project's objectives	Scientifically defensible proxies for conservation target acquired and accessible for analysis in M&E Project has M&E plan that tracks progress towards goals Project analyzes M&E results on intermittent basis Project adapts to large degree to M&E results, although some identifiable changes are not made	Scientifically defensible proxies for conservation target acquired but *not directly useable for analysis in M&E* Project performs some measures of effectiveness, or tracks progress at infrequent/irregular intervals Project analyzes limited metrics of effectiveness, on intermittent basis Project adapts in small part to M&E	No baseline data or proxies collected Project performs no measures of effectiveness Project neither collects nor analyzes measures of effectiveness Project *does not* adapt to M&E
Communication	Evidence of sharing M&E with other experts for opinion and analysis Evidence of stakeholder communication, based on stakeholder map (see *Planning*)	Project clearly communicates, on periodic and reasonable basis, results to all relevant experts and stakeholders	Project clearly communicates, on periodic and reasonable basis, to some relevant experts and stakeholders	Project infrequently communicates results to some relevant experts and stakeholders	Project does *not* communicate with relevant experts or stakeholders

Outcome					
Scale of Impact	Conserved species population relative to MVP[1] and natural range Conserved habitat relative to MDA[2], SFE[3], and natural range Potential to scale/replicate pilots	Conserved species population exceeds MVP, extending over significant portion of natural range of species Conserved habitat exceeds MDA or SFE, and extends over significant portion of natural range of habitat Pilot project demonstrates capability to scale up to exceed MVP, MDA, or SFE, and extend over natural range of species or habitat	Conserved species population exceeds MVP Conserved habitat exceeds MDA or SFE Pilot project demonstrates capability to scale up to exceed MVP, MDA, or SFE	Conserved species population meets MVP Conserved habitat meets MDA or SFE Pilot project demonstrates capability to scale up to meet MVP, MDA, or SFE	Conserved species population does not meet MVP Conserved habitat does *not* meet MDA or SFE Pilot project does *not* demonstrate capability to scale up to meet MVP, MDA, or SFE
Response of Target	Δ target species population relative to baseline (including rate of disappearance in the case of protection projects) Δ target habitat area, structure and function relative to baseline (including rate of destruction in the case of protection projects)	Project increased and fully restored population of target species Project increased habitat area with *fully* restored structure and function -or- In the case of protection projects: project fully halts rate of destruction of conservation target and fully restores target	Project increased population of target species Project increased habitat area with *partially* restored structure and function -or- In the case of protection projects: project fully halts rate of destruction of conservation target	Project maintained population of target species Project maintained habitat area at baseline condition -or- In the case of protection projects: project slows rate of destruction of conservation target	Project did *not* maintain population of target species Project did *not* maintain area of target habitat at baseline condition -or- In the case of protection projects: Project results in no difference in rate of destruction of conservation target

Target Secured	Δ in factors affecting population or habitat recovery/maintenance Funding Institutional capacity and commitment for long-term conservation management	*Long-term* management of a*ll* factors affecting population or ecosystem secured Endowment or other permanent funding mechanism in place Institutional capacity and responsibility for conservation management assigned	*Long-term* management of s*ome* factors affecting population or ecosystem secured Long-term (20+ years) funding secured Institutional capacity and responsibility for conservation management assigned	*Temporary* management of factors affecting population or ecosystem secured Medium-term (10-20 years) funding secured Institutional capacity and responsibility for conservation management assigned	Project does *not* manage factors affecting population or ecosystem No or short term (<10 years) funding secured No institutional capacity or responsibility for conservation management assigned

Notes

1) *Minimum Viable Population (MVP):* Population has 99% chance of remaining extant for 1000 years despite foreseeable effects of demographic, environmental, and genetic stochasticity, and natural catastrophes. See Shaffer. 1981. Minimum population sizes for species conservation. BioScience 31: 131-134; Primac, R. 2000. *A Primer of Conservation Biology:* Sunderland MA, Sinauer Associates, Inc. Publishers.
2) *Minimum Dynamic Area (MDA):* Amount of suitable habitat necessary to maintain minimum viable population (MVP). See *A Primer of Conservation Biology:* Sunderland MA, Sinauer Associates, Inc. Publishers.
3) *Structure and Function of Ecosystem (SFE):* Characteristic assemblages of species, demographic distributions, and energy and nutrient dynamics.

COMPONENT 4: NORMS FOR VOLUNTARY BIODIVERSITY OFFSETS BASED ON EXISTING REGULATIONS				
Theme	**Indicators**	**Exceeds or Conforms to Most Rigorous Regulations**	**Conforms to Some Regulations**	**Does not Conform to any Regulations**
Equivalence ("in-kind vs. "out-of-kind")	Ecosystem type at impact area vs. offset area Ranking of ecosystem types based on independent biodiversity prioritization schemes	In-kind offset is environmentally preferable to other options and provides environmental benefits that exceed the full and equivalent replacement of environmental losses caused by the project. Out-of-kind offset may be environmentally preferable to in-kind options, when it practicably provides environmental benefits that exceed full and equivalent replacement of environmental losses caused by the project.	In-kind offset is environmentally preferable to other options and provides environmental benefits equivalent to environmental losses caused by the project. Out-of-kind offset may be environmentally preferable and to in-kind options, when it practicably provides environmental benefits that are equivalent to environmental losses caused by the project.	In-kind or out-of-kind offset provides environmental benefits that are less than equivalent to environmental losses caused by the project. Out-of-kind offset does not directly involve mitigation (instead, it provides funding for training, research and education).
Location of offsets ("on-site" vs. "off-site")	Location of offset	On-site offset is adjacent to impact site. Offset is environmentally preferable to other options and benefits clearly accrue to the project-affected area. -or- Off-site offset is as close to the project area as possible and is environmentally preferable and practicable to	On-site offset is within the project site area and is environmentally preferable to other options. -or- Off-site offset is within the same ecoregion or watershed area as project impacts and is environmentally preferable and practicable to on-site options.	Off-site offset is outside the ecoregion or watershed of project impacts and does not provide significant conservation benefits.

		on-site options. The offset provides environmental benefits within the same ecoregion or watershed area as project impacts and may be a conservation priority for the area.	-or- Off-site offset is outside the project's ecoregion or watershed area, but is environmentally preferable to other options and provides significant conservation benefits.	
Additional conservation benefits; Acceptable types of offsets (See also: *Conservation Impacts* indicators matrix)	Type of conservation project Conservation activity at site prior to offset	Offset activities clearly result in new conservation benefits (i.e., gains in conservation area/values), additional to any existing values (including values that may be generated by planned or funded programs). These offsets also have a low risk of failure. Preferred type of offsetting activity is habitat restoration.	Offset activities result in new conservation benefits, but these benefits are less significant (due to less effective offsetting measures) and/or less secure (due to higher risks of offset failure). Such offsetting activities include habitat creation, enhancement, and improved management of existing intact habitat.	Offsetting activities do not result in new conservation benefits.
Units of "currency"	Area of impact/offset Ecosystem structure & function (specifics dependent upon ecosystem)	Offset currency incorporates ecological values, rather than simply using acreage/hectare units. This currency is established based on assessment methods involving a systematic and repeatable approach where judgments and assumptions require justification and can be verified.	The currency is an area unit (acre/hectare). Ecological values of the project/offset areas are evaluated based on professional judgment (rather than formal assessment methods). This evaluation provides a basis for adjusting the mitigation replacement ratio for the area units (e.g., higher value impacts at the project site require a greater number of offset area units as replacement).	Offset currency takes no account of ecological values; offset reflects a simple area-for-area swap.

Mitigation replacement ratios	Ratio of impact units (see *Currency* above)	Ratio of offset to project impact units is greater than 1 to 1.	Ratio of offset to project impact units is equal to 1 to 1.	Ratio of offset to project impact units is less than 1 to 1.
Timing of offset relative to impact	Date of offset implementation vs. date of project impact	Offsetting activities are operational and proven prior to project impacts.	Offsetting activities are operational and proven concurrent with project impacts (or within one year following project impacts).	Offsetting activities are operational and proven more than one year after project impacts.
Offset duration, management, monitoring, and compliance	Legal protection of offset Endowment or other financial mechanism to fund long-term management	Offset is protected in perpetuity. Legal and financial assurances are fully established to secure site tenure, restrict harmful activities, support long-term management and monitoring, and cover contingency and remedial actions in the event of offset failure.	Offset is protected in perpetuity, or protected for the duration of project impacts. Legal and financial assurances are in place as needed to secure site tenure, restrict harmful activities, support long-term management and monitoring, and cover contingency and remedial actions in the event of offset failure.	Offset is not protected in perpetuity or for the duration of project impacts. Necessary legal and financial assurances are not established.