Report

Independent report on biodiversity offsets

Environmental Stewardship
January 2013

CONTENTS

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- the beginning of the report
- the start of the section you are in
- the start of any other section.

ACKNOWLEDGEMENTS

ICMM IUCN (2012) Independent report on biodiversity offsets. Prepared by The Biodiversity Consultancy. Available at: www.icmm.com/biodiversity-offsets

The International Council on Mining and Metals (ICMM) and the International Union for Conservation of Nature (IUCN) have jointly commissioned this report on biodiversity offsets. This report seeks to inform the mining industry and the conservation sector of the offsets agenda. The report was prepared by The Biodiversity Consultancy (TBC). ICMM and IUCN are grateful to them for this piece of work.

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Swamp forest along the shores of Lake St Lucia, South Africa.

EXECUTIVE SUMMARY

This report provides an overview of the current and key issues regarding biodiversity offsets. These are ways to counterbalance, compensate, or make up for the disturbance of land, ecosystems and habitat which occurs in mining and processing operations.

It sets out some pragmatic ways forward, covering the business case for offsets, principles and methods, application to the mining sector, best-practice case studies, relationship to ecosystem services and the remaining challenges. It can be read as a summary for executives and managers or as a detailed scoping report for environmental specialists with some familiarity with biodiversity offsets. It also functions as a sourcebook of key references for technicians and consultants in mining and conservation.

The report explores the industry's experience that, rather than a lack of theory, it is practical issues of implementation and adaptive management (combined with external risks such as differing government expectations) that can cause offsets to fail. It is the absence of a solid track record that causes the business community to remain hesitant to invest in offsets due to uncertainty of outcomes. However, some best-practice offset designs have recently emerged that demonstrate solutions based on practical experience.

Section 1 defines biodiversity offsets in comparison with other forms of environmental stewardship.

Section 2 sets out the newly emerging business case illustrated by new government policies and regulations, requirements of financial institutions and the rise in voluntary private sector commitments to No Net Loss or similar.

Section 3 outlines offset principles. Principles of stakeholder involvement, additionality, equivalence, permanence and limits to offsetting are explained, using case studies and government legislation as examples.

Section 4 outlines a core approach to measuring and exchanging biodiversity losses and gains. A simple four-step method is provided, based on current global best practice, and its application is illustrated with reference to government regulation and case studies.

Section 5 covers offset implementation within regulatory and voluntary regimes, including implementation mechanisms, availability of service providers and the potential for using existing protected areas as sites for offsets.

Section 6 compares biodiversity offsets to the ecosystem services approach and finds the two fields largely distinct, both useful and with some overlap in business case and methods.

Section 7 defines some pragmatic steps that ICMM, its members and the conservation community can take to put offsets to work.

1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP

DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP

WHAT ARE THE DEFINITIONS OF BIODIVERSITY OFFSETS?

There are numerous definitions of biodiversity offsets, spanning the regulatory, business and scientific sectors. The Business and Biodiversity Offsets Programme (BBOP) multi-stakeholder process agreed the following definition, which links with the BBOP Principles and Standard:[1]

"Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from development plans or projects after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity."

Many governments and businesses have their own definitions. The Western Australia Environmental Protection Authority (WA EPA), for example, defines offsets as "environmentally beneficial activities undertaken to counterbalance an adverse environmental impact, aspiring to achieve 'no net environmental loss' or a 'net environmental benefit'" (WA EPA 2006), while Rio Tinto defines offsets as "conservation actions leading to measurable gains for biodiversity on the ground, designed to compensate for the unavoidable residual impacts of Rio Tinto's project developments on significant biodiversity" (Rio Tinto 2008).

WHAT ARE THE MAIN TYPES OF BIODIVERSITY OFFSETS?

Offsets can be classified by the type of conservation employed to generate biodiversity gains. There are two major types, "restoration offsets" and "protection offsets":

- **restoration offsets** entail restoring, enhancing or establishing biodiversity, and are more common in OECD countries
- **protection offsets** (also known as **averted loss offsets**) involve protecting biodiversity from further threats such as grazing, fire, overfishing and deforestation – they are more common in non-OECD countries.

1 http://bbop.forest-trends.org/pages/guidelines

DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP

Figure 1

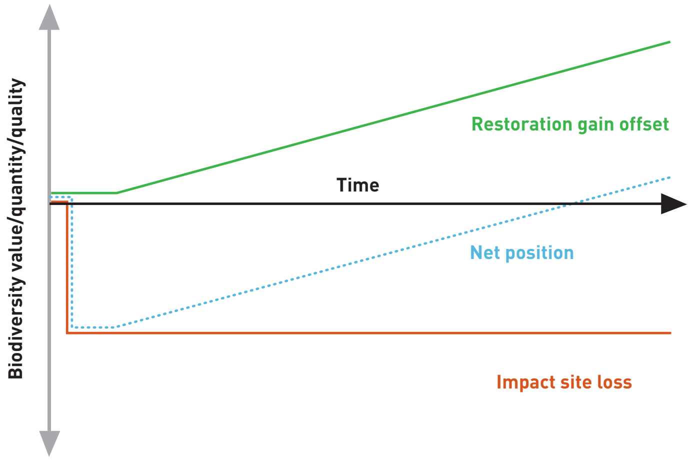


Figure 1 An impact (red line) can slowly be offset over time through restoration of biodiversity at an offset site (green line). The combined actions of the loss and the gain give net effect. Over time, this may reach No Net Loss (horizontal black line) or Net Positive Impact (above the horizontal black line). The better the restoration activities, the greater are the gains in this type of offset.

Figure 2

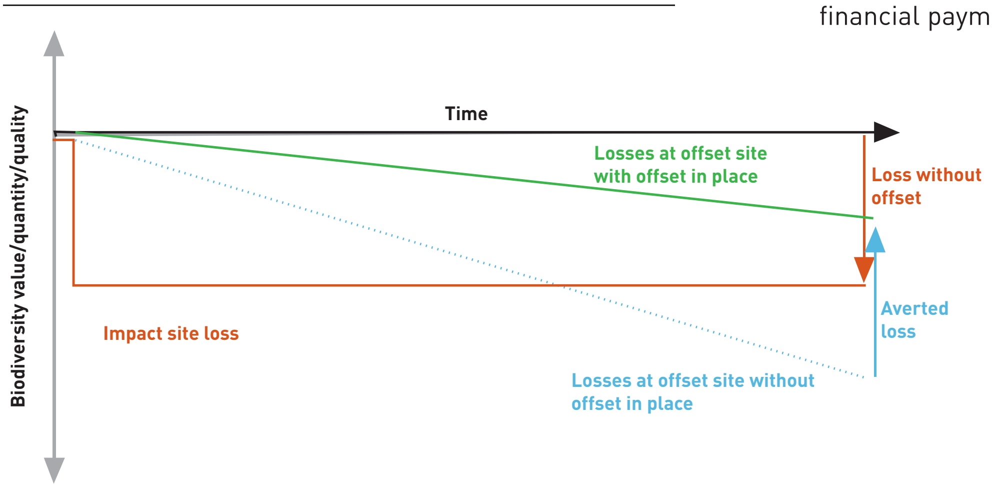


Figure 2 An impact (red line) can slowly be offset over time through the protection of biodiversity at an offset site. The gains come from averting loss of biodiversity through protecting the site from pressures, such as grazing and tree clearance. The gains are calculated by comparing the background rate of loss (blue dotted line) with the reduced rate of loss achieved through the offset protection activities (green line). The difference between these lines is the offset gain (blue arrow "Averted Loss"). The better the protection measures, the greater are the gains in this type of offset.

Figures 1 and 2 explain these two main types of offsets. Restoration and averted loss offsets have been frequently discussed in the literature (eg Gibbons and Lindenmayer 2007). Some regulators only allow one type; others require higher ratios for protection offsets (ie a larger offset contribution is needed). Both can be put in place simultaneously at a single site – for example where a site is fenced to prevent further grazing (averted loss), and a tree planting program is also undertaken at the site (restoration). Many regulatory offset systems recognize both mechanisms as valid offset actions, and have rules concerning their application (eg differing offset ratios for protection vs restoration in wetland mitigation offsets in the US). One example of regulatory application of the two mechanisms is the Queensland fish habitat offset regulations[2]. The government website notes four mechanisms:

restoration offset mechanisms:

1. fish habitat enhancement
2. fish habitat restoration, rehabilitation or creation

averted loss/protection mechanisms:

3. fish habitat exchanges are secured where the lands proposed for exchange contribute to similar fish habitat (a fourth mechanism is also provided, a type of financial payment for indirect offsets).

2 http://www.daff.qld.gov.au/documents/Fisheries_Habitats/Marine-Fish-Habitat-Offset-Policy-12.pdf

DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP | 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS | 3 OFFSET PRINCIPLES | 4 A FRAMEWORK FOR MEASUREMENT | 5 OFFSET IMPLEMENTATION | 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES | 7 NEXT STEPS | A ANNEXES

OFFSETS COMPARED WITH OTHER FORMS OF ENVIRONMENTAL STEWARDSHIP

Biodiversity offsets are one of a number of environmental stewardship approaches, including traditional philanthropy, and other kinds of positive environmental contributions and compensation actions. Offsets differ from these other approaches in being more explicitly linked to project impacts.

Non-technical risks such as biodiversity, ecosystem services and local community/stakeholder issues are increasingly important to mine managers, and the potential costs of delays due to such risks are very large. Corporate environmental stewardship comprises all activities available to manage environmental risk. In addition to biodiversity offsets, the following types of stewardship are considered here, to facilitate comparison with the potential added value of biodiversity offsets:

1. **Traditional philanthropy.** For example, funding support to environmental organizations with no identified link with the impacts or operations of a company.
2. **Positive environmental contributions.** For example education, training and research. These actions have been called "indirect offsets" by the Australian Government and "Additional Conservation Actions" by Rio Tinto. For example, offset investments approved by state governments in Australia include capacity building and research. The effects of such investments are not measurable as quantitative biodiversity outcomes.
3. **Compensation actions linked to the impacts of a development but not commensurate with the type and scale of impacts.** These could be as loosely linked as those of Walmart's "Acres for America"[3] or Enbridge's "Acre for an Acre"[4] programs. These are not No Net Loss biodiversity offset programs, and are quantified in nothing more than hectares of land rather than in terms of biodiversity value of the land.

Biodiversity offsets can offer several advantages over these three forms of stewardship. First, their quantitative nature makes them generally more transparent and possibly less open to criticism such as "greenwash". Second, they may be the preferred form of risk management by regulators and lenders. Third, offsets have less risk of "political capture" by interest groups by virtue of their more structured nature – for example, a politician may champion an investment in a particular national park, but a biodiversity offset requires broader stakeholder consultation. Fourth, biodiversity offsets allow companies to precisely link gains to losses to ensure that the most affected stakeholders are those who gain the most.

National and global biodiversity stakeholders (such as major NGOs, scientific institutions, and – in some cases – government authorities) have increasing interest in biodiversity offsets over other forms of compensation. This is because they are tangible, quantitative and enduring. Despite this, non-quantitative compensation activities (2 and 3 above) remain attractive in some circumstances because they are simpler and cheaper to implement, and can relate directly to stakeholder expectations. Such actions are permitted as part of compensation packages by some governments (eg up to 100 per cent of Australian Federal Government Environment Protection and Biodiversity Conservation (EPBC) Western Australia offset requirements;[5,6] a proportion of Queensland fish compensation packages[7]).

3 http://www.walmartstores.com/Sustainability/5127.aspx
4 http://www.enbridge.com/AboutEnbridge/CorporateSocialResponsibility/NeutralFootprint/AcreForAnAcre.aspx
5 http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html
6 http://www.dmp.wa.gov.au/documents/FINAL_Env_Offsets_Policy_for_release_by_Minister_generic_government.pdf
7 http://www.daff.qld.gov.au/documents/Fisheries_Habitats/FHMOP001-Fish-Hab-Manage.pdf

DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP

OFFSETS AS PART OF THE MITIGATION HIERARCHY

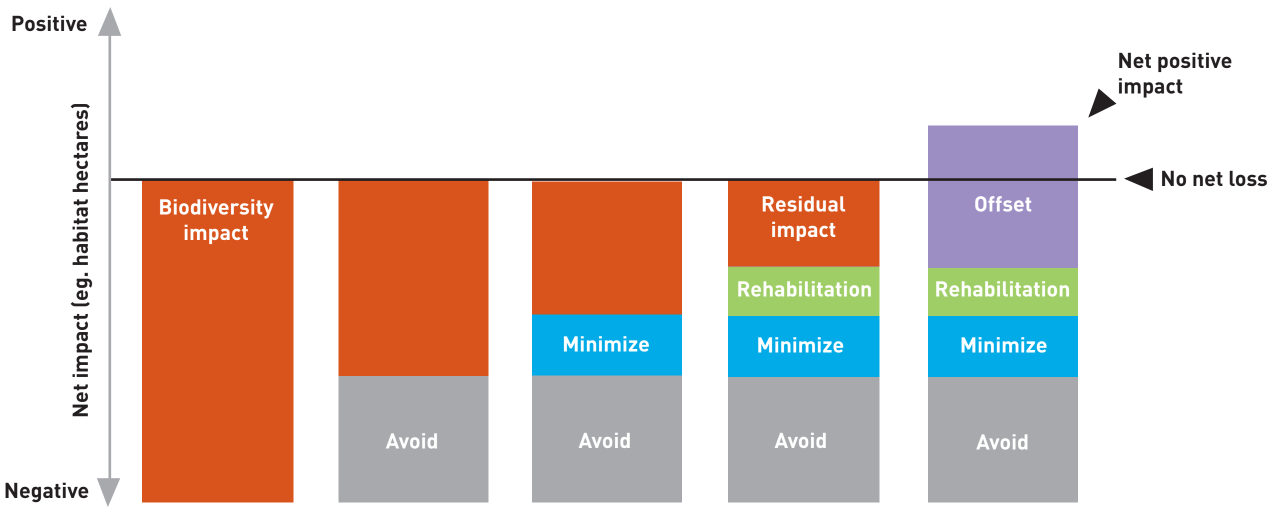
Offsets are part of the suite of environmental mitigation measures defined in the mitigation hierarchy (Figure 3). The mitigation hierarchy is the logical, sequential framework in which impacts are avoided, minimized, remediated and any residual impacts offset. Adherence to the mitigation hierarchy is central to biodiversity offsetting.

The mitigation hierarchy was formalized 20 years ago within the Convention on Biological Diversity (CBD 1992) but has been active policy in Germany and the US since the 1970s. Its application in a transparent, stakeholder-engaged process is fundamental to environmental best practice (International Association for Impact Assessment – IAIA 2005; Rio Tinto 2008; BBOP 2009a, 2012a; Kiesecker *et al* 2010; Gardner and von Hase 2012). The mitigation hierarchy is the framework by which biodiversity and ecosystem services are incorporated into the project life cycle.

No Net Loss is conceptualized and implemented within the mitigation hierarchy. Without prior application of the mitigation hierarchy, conservation actions would not qualify as offsets under most definitions of the term (eg European Bank for Reconstruction and Development (EBRD) 2008;[8] BBOP 2009a; IFC 2012). They may also not be acceptable under key policies or guidance (eg EBRD 2008; Department of Environmental Affairs & Development Planning (DEA & DP) 2011). Offsets without prior mitigation of project impacts may be technically challenging to achieve due to the magnitude of unmitigated residual impacts.

Guidance on the mitigation hierarchy and definitions of its constituent elements (avoidance, minimization, rehabilitation and restoration, offsets) can be found in a number of publications, including those by ICMM (2005a and 2005b), Rio Tinto (2008), BBOP (2009a), Kiesecker *et al* (2010) and others.

Figure 3: The mitigation hierarchy



Different versions of this diagram have been used by ICMM (2005b), Rio Tinto (2008), BBOP (2009a), Kiesecker *et al* (2010) and others.

8 http://www.ebrd.com/pages/about/principles/sustainability/requirements.shtml

2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS

NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS

WHAT IS DRIVING THE OFFSETS AGENDA IN THE MINING SECTOR?

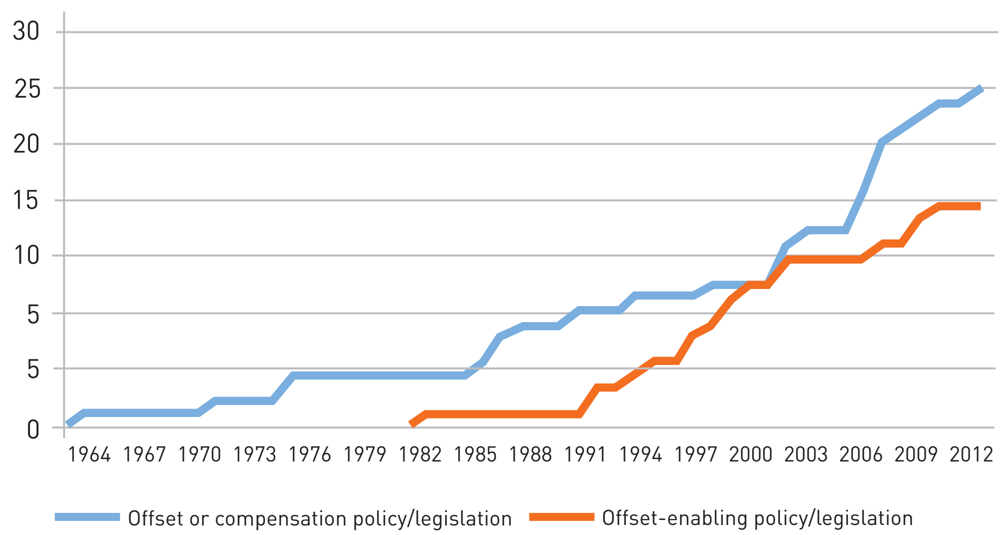
There are three main business drivers for biodiversity offsets and No Net Loss-type approaches: regulation, finance and business risk management. Additional emerging drivers are accelerating government legislation, broadening stakeholder expectations and more stringent financial lending requirements.

BUSINESS CASE 1: GOVERNMENT REGULATION – LEGISLATION AND POLICIES

Government policies now commonly refer to biodiversity offsets as a potential or required tool to meet government targets to balance development with environment.[9] There has been a steady increase in offset-related legislation for some decades and this has accelerated during the past 10 years. Figure 4 shows the rise in government policies, guidance and legislation that require or enable biodiversity offsets (TBC 2012a)[10] since 1965.

Madsen *et al* (2011) note 45 biodiversity market mechanisms (such as conservation banks) globally and 27 more in current development, an increase from 39 documented a year previously (Madsen *et al* 2010). Further details on the global growth in biodiversity markets and other programs can be found in BBOP (2009) and Tanaka (2010). The programs reviewed by Madsen *et al* (2010, 2011) cover a broad spectrum, including biodiversity banking systems, financial compensation systems and more rigorous offset programs. Additional government programs include such initiatives as the EU Working Group on No Net Loss of Ecosystems and their Services. This group is investigating options for an EU-wide policy on the use of the mitigation hierarchy, including offsets.

Figure 4



Cumulative rise in number of nations/states/provinces with offset legislation/policies (blue line) or with offset-enabling legislation/policies/guidance (red line). Offset-enabling legislation facilitates the development of offsets, but does not necessarily require them.

9 In economic terms, biodiversity offsets are one of a number of tools which can be used to internalize environmental externalities. This means that biodiversity is a public good that has historically been provided "for free" for economic development. Now biodiversity is more scarce, and more highly valued by society, it is appearing on our economic accounting sheets.

10 http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/Government-policies-on-biodiversity-offsets.pdf

NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP | 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS | 3 OFFSET PRINCIPLES | 4 A FRAMEWORK FOR MEASUREMENT | 5 OFFSET IMPLEMENTATION | 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES | 7 NEXT STEPS | A ANNEXES

TBC (2012a) identified legislation or policy specifically guiding or requiring offsets in 14 countries, as well as in a number of states and provinces. At least 15 further governments have legislation or policy, often related to environmental impact assessment, that suggest or facilitate use of offsets. Australia, for example, has strong offset policies and well-developed guidance and implementation mechanisms in some states. Queensland alone now has two different programs (including one dedicated to koalas).[11] The overarching biodiversity offsets policy (Department of Environment and Resource Management (DERM) 2011) aims **"to increase the long-term protection and viability of the state's biodiversity where residual impacts from a development, on an area possessing State significant biodiversity values, cannot be avoided. The policy provides the framework to ensure that there is no net loss of biodiversity."**

BOX 1

Draft Australian Federal Government Environment Protection and Biodiversity Conservation (EPBC) Act offset requirements[12]

Exemplifying the rigour of recent policy developments, a draft offset policy for the EPBC suggests that suitable offsets must:

- deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed development
- be efficient, effective, transparent, proportionate, scientifically robust and reasonable
- be built around direct offsets but may include indirect offsets
- be of a size and scale proportionate to the impacts being offset
- be in proportion to the level of statutory protection that applies to the affected species or community
- effectively manage the risks of the offset not succeeding
- have transparent governance arrangements, including being able to be readily measured, monitored, audited and enforced.

It further suggests that, in assessing the suitability of an offset, government decision making will be:

- Informed by scientifically robust information
- Conducted in a consistent and transparent manner.

BUSINESS CASE 2: FINANCE

Financial institutions have also been incorporating biodiversity offsets into their environmental safeguard systems (Table 1). International Finance Corporation (IFC) Performance Standard 6 (PS6) is the best-known financial lending requirement. PS6 now requires a net gain for impacts on critical habitat and No Net Loss where feasible for impacts to natural habitat (IFC 2012).[13] Many development/multilateral banks follow IFC PS6 guidelines or have developed similar approaches themselves (eg EBRD 2008). In addition, financial institutions that abide by the Equator Principles (Equator Principles 2006) have agreed to follow PS6 in their loan agreements.

PS6 is becoming a major driver of biodiversity offsets within industry, even for companies that do not normally use multilateral finance, for the following reasons:

- PS6 is becoming viewed as leading practice by many stakeholders. Therefore, corporations are increasingly using PS6 as a global best-practice benchmark.
- The Equator Principles Financial Institutions (more than 75 institutions) have committed to follow PS6 for all relatively large projects in developing countries.[14]
- Nations (especially non-OECD) that own a percentage of mining projects often obtain their financing from development/multilateral banks, which increasingly follow PS6 or similar.
- In joint-venture or multi-partner projects, one partner may have PS6-related financing, which can impact schedules and costs for all partners.
- Purchase of small or medium-sized companies or projects that were started with bank finance results in inheritance of loan conditions.

11 http://www.ehp.qld.gov.au/wildlife/koalas/strategy/pdf/offset-netgain.pdf
12 http://www.environment.gov.au/epbc/publications/pubs/consultation-draft-environmental-offsets-policy.pdf
13 An introduction to IFC Performance Standard 6 and the concept of critical habitat is given in Annex 2.
14 > US$10m capex in non-OECD and non-high-income countries: http://www.equator-principles.com/index.php/about-ep/the-eps

Table 1: **Examples of offset requirements of some developments banks**

INSTITUTION	OFFSET REQUIREMENTS
International Finance Corporation (IFC)	The revised Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources states that clients "should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented." In addition, it states that: "For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, which may be considered only after appropriate avoidance, minimization, and restoration measures have been applied. A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity; however, a net gain is required in critical habitats."
Asian Development Bank (ADB)	The ADB 2009 Safeguard Policy Document prioritizes avoidance, minimization and mitigation, but acknowledges the use of offsets as a last resort (ADB 2009, paragraph 24).
European Bank for Reconstruction and Development (EBRD)	The EBRD 2008 environmental and social policy explicitly recognizes the mitigation hierarchy, with one of the stated objectives of Performance Requirement 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources being "to avoid, minimise and mitigate impacts on biodiversity and offset significant residual impacts, where appropriate, with the aim of achieving no net loss or a net gain of biodiversity".
European Investment Bank (EIB)	EIB follows the principles of the EU Nature Conservation Policy, including the Birds and Habitats Directives, and Natura 2000. They also support the use of the mitigation hierarchy. They state, "promoter may propose biodiversity offsets, where appropriate" (EIB 2009, paragraph 70)
Inter-American Development Bank (IDB)	The IDB Environmental and Safeguards Compliance Policy encourages the use of the mitigation hierarchy, including offsets (IDB 2006, section B).
Chinese Development Bank (CDB)	The CDB has not yet committed to the mitigation hierarchy but does state that "banks shall effectively identify, assess, monitor, control and mitigate environmental and social risks".
Equator Principles Financial Institutions[15]	Equator Principle 3 states that: "For projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the Assessment will refer to the then applicable IFC Performance Standards [ie PS6] and the then applicable Industry Specific EHS Guidelines."

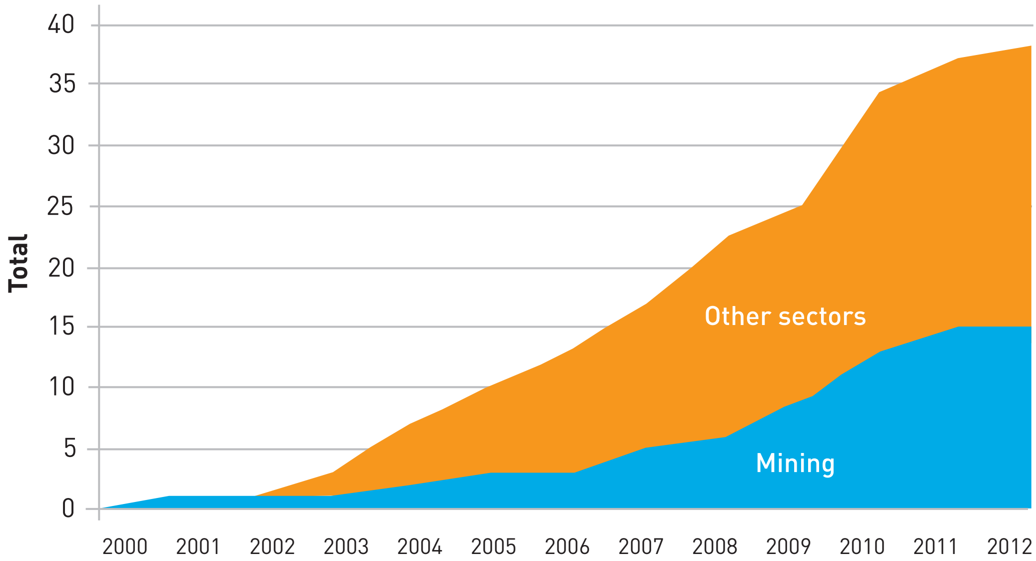
15 Equator Principles Financial Institutions: http://www.equator-principles.com/index.php/members-reporting/members-and-reporting

BUSINESS CASE 3: RISK MANAGEMENT AND SOCIAL AND ENVIRONMENTAL RESPONSIBILITY

The traditional business case for biodiversity and offsets has been well explained in the literature (ICMM 2005a, b; Rio Tinto 2004a, b, 2008; BBOP 2009a). For the extractive industries sector, demonstration of good biodiversity performance and risk management is important in gaining access to land and resources, obtaining a "licence to operate", maintaining regulatory goodwill and demonstrating responsible company performance to investors and other stakeholders (F&C Asset Management 2004). There has been growing recognition that the private sector can play a greater role in biodiversity conservation (CBD 2010b;[16] The Economics of Ecosystems and Biodiversity (TEEB) 2010). All of these factors contribute to explaining the increase in No Net Loss-type commitments within the private sector.

Figure 5 shows the rise in the numbers of private sector companies making public commitments to No Net Loss (or similar statements such as "net environmental benefit" or "Net Positive Impact") (TBC 2012b).[17] All these appear to have been made since 2001.

Figure 5: The rise in No Net Loss-type commitments in the private sector 2000-2012



There are currently 38 companies with no net loss-type commitments, including 15 from the mining and aggregates sectors (TBC 2012b).[18]

16 See CBD COP 10 Decision X/21 on business engagement: http://www.cbd.int/decision/cop/?id=12287
17 http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/Private-Sector-No-Net-Loss-commitments.pdf
18 http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/Private-Sector-No-Net-Loss-commitments.pdf

3 OFFSET PRINCIPLES

OFFSET PRINCIPLES

Offset principles are a set of factors that need to be taken into account during design and implementation to ensure that offsets are used appropriately and that No Net Loss[19] is achieved. Effective application of these principles aims to reduce business risk and improve biodiversity outcomes by ensuring that offsets are fair, sustainable, bring real change and involve appropriate stakeholders.

Different offset systems define different principles, but all cover similar ground. BBOP (2012a) defined 10 offset principles, the New South Wales Government refers to 13 principles and other Australian state governments have also defined their own (see Annex 3). Although significant consensus has emerged, there continues to be debate about what these high-level principles mean in practice.

A fundamental principle in offset design is the appropriate involvement of stakeholders and rights-holders. This means not only government and local communities but also different parts of the business and staff, possibly located in different countries. Stakeholder input ensures that offsets are designed appropriately, so that local, regional and global values are recognized and managed to high standards. Local and international acceptance of offsets by stakeholders will create an environment for long-term support, contributing to the enduring success of offsets. These issues are similar to those faced by conservation organizations in creating and implementing protected areas. Mining companies experience similar issues regarding concession rights, which are often legally recognized but may not be locally approved. There is a wealth of guidance on stakeholder and rights-holder engagement already available, such as *Getting it right* by Zandvliet and Anderson (2009).

Anglo American has developed an award-winning Socio-Economic Assessment Toolbox: SEAT.[20] BBOP (2009c) provides a useful 15-page summary of the issues and solutions concerning offset stakeholder and rights-holders.[21] This includes brief guidance on free, prior and informed consent (FPIC) as required for activities on Indigenous Peoples' land. FPIC is relevant for offsets under PS6, but is a broader issue for the mining and conservation sectors and the issue is not treated further here since alternative guidance exists.

Four of the most discussed technical principles in biodiversity offsetting are limits to offsetting, additionality, equivalence, and permanence. This section provides a brief technical summary, which assumes some prior knowledge.

- **Limits to offsetting** recognizes that not everything can be offset – such as species extinction. It therefore refers to whether losses are so great in type or amount that no offset could appropriately compensate for them.
- **Additionality** requires that offset gains are caused by offset actions and not by other factors. In other words, the offset gains would not have happened in business-as-usual scenarios.
- **Equivalency** requires that the balance of losses and gains represents a fair exchange. This requires quantitative measurement of losses and gains to biodiversity and the scaling of compensatory gains. This includes consideration of trading systems such as like-for-like and like for better/"trading up".[22]
- **Permanence** (or longevity) refers to ensuring that gains last at least as long as impacts (this is covered in section 5).

19 Biodiversity offsets operate under varying principles. However, most have always stated that their aim is No Net Loss (McKenney and Kiesecker 2010). Over time, biodiversity offsets have come to be more strictly defined in terms of No Net Loss to biodiversity (ten Kate *et al* 2004; Gibbons and Lindenmayer 2007; BBOP 2009a; Levrel *et al* 2012). There appears to be considerable scientific debate over the meaning of "No Net Loss" (reviewed by Gardner *et al* in prep). However, this has not inhibited the proliferation of offset regulations and policies.

20 http://www.angloamerican.com/development/social/seat; http://www.angloamerican.com/~/media/Files/A/Anglo-American-Plc/development/SEAT-v3-overview-21-06-12.pdf

21 http://www.forest-trends.org/documents/files/doc_3082.pdf

22 Like-for-like offsets are exchanges of same species for same species, same ecosystem for same ecosystem. Trading up involves exchanges of impacts of lower-priority biodiversity for offsets in higher-priority biodiversity (species, ecosystems, etc).

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP | 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS | 3 OFFSET PRINCIPLES | 4 A FRAMEWORK FOR MEASUREMENT | 5 OFFSET IMPLEMENTATION | 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES | 7 NEXT STEPS | A ANNEXES

LIMITS TO OFFSETTING

Much progress has been made on setting rule-of-thumb limits to which impacts cannot be offset (eg IFC 2012), and developing decision frameworks for developers and regulators to identify limits to offsetting (eg TBC 2012d, Pilgrim *et al* 2013). The existence of an upper limit to offsetting is intuitive to most stakeholders; it would be impossible to offset the extinction of tigers. But the loss of 50 per cent, 10 per cent or 1 per cent of the world's population of tigers – would that be possible to offset? A national or regional conservation plan is the most useful framework from which to derive limits; however, these are rare in non-OECD countries.

There are limits to offsetting because some impacts are so large that they cannot be compensated for with a sufficient equivalent (ie No Net Loss) or in a socially acceptable way. Species extinction is the most commonly cited example of an impact that cannot be offset. It is easy to imagine other impacts that would be effectively impossible to offset: for example, half of the world's population of tigers or half of a country's forest. There are few examples of upper limits to impacts that can be offset in government policies, or guidance documents from other authorities. The most well known are the IFC (2012) Tier 1 critical habitat quantitative species thresholds. Table 2 provides the most common types of justification for limits to offsets.

Table 2: **Some types and examples of justification for limits to offsetting**

TYPE OF JUSTIFICATION	EXAMPLES	CITATIONS WHERE USED
Uniqueness of the biodiversity feature (unquantified statements)	"Where the residual negative impacts of a proposed project are likely to be so great as to lead to irreplaceable loss of biodiversity (eg global EXTINCTION of a species), no biodiversity offset could compensate for such loss".	BBOP (2009a, 2012b)
	"Where the irreplaceable loss of values is likely to occur and the loss cannot be adequately compensated by the proposed offsetting actions, the administering authority may refuse an offset proposal".	State of Queensland (2011)
	"Residual impacts ... of very high significance" or where "Biodiversity losses would not be adequately compensated by offsets".	DEA & DP (2011)
Quantitative thresholds based on precedents of irreplaceabilty and vulnerability	Critical habitat Tier 1: > 10 per cent of a globally Endangered or Critically Endangered species; or > 95 per cent of a locally endemic, restricted-range or migratory/congregatory species.	IFC (2012)
	Five-tier matrix of extinction risk based on irreplaceability and vulnerability.	Pilgrim *et al* (2013)
National conservation planning targets that function as "caps"	Due to offset ratios based on ecosystem/habitat conservation targets, some impact compensation requirements are so large that suitable offsets do not actually exist (Western Cape Province, South Africa).	DEA & DP (2011)

Despite the simple nature of this idea, beyond extinction of biodiversity, it is very difficult in practice to define limits to what impacts can be offset. Possible approaches include the following:

- **Use regional or national conservation plans.** At the national level, where conservation policies and plans often de facto define maximum societally acceptable levels of biodiversity loss, limits to offsets are easier to set. Despite this, few government or regulatory systems explicitly mandate such upper limits (BBOP 2009a; Pilgrim *et al* 2013), principally because the fact that an impact cannot be offset does not mean the project is unworkable. The decision to go ahead with a project or not is a societal one and biodiversity losses are accepted, for example, in cases of overwhelming value to society (Darbi *et al* 2009) or of national security. If conservation planning has been undertaken within the region in which a development is planned, conservation targets may exist for priority biodiversity features. These targets effectively define societally acceptable levels of biodiversity loss, and thus limits to what impacts can be offset (and, in some regulatory systems, the offset ratio; eg DEA & DP 2011).
- **Follow the precedent set by IFC Performance Standard 6.** In the absence of a national conservation plan, ICMM members can follow the advice on limits to offsets in IFC (2012) for the identification of Tier 1 critical habitat: more than 10 per cent of the global population of a globally Endangered or Critically Endangered species (ie a large proportion of a globally threatened species) or more than 95 per cent of a restricted-range, endemic or migratory/congregatory species (effectively equating to near extinction of a species).
- **Use a decision-making framework such as Pilgrim *et al* (2013),** which outlines a general approach on offset limits of different impacts, based on globally derived quantitative thresholds drawn from conservation biology. This system can be applied in any country, region, ecosystem and for almost any impact type. The approach establishes the burden of proof (evidence) necessary to confirm the appropriateness and achievability of offsets, given varying levels of conservation concern for affected biodiversity, residual impact magnitude, opportunity for suitable offsets and feasibility of offset implementation in practice.

ADDITIONALITY

Additionality refers to whether offset gains are real, ie are outcomes the result of offset actions, or would they have happened anyway, perhaps due to government policy or alternative causes such as economic profit? Biodiversity gains to compensate for losses must come about as a result of conservation actions financed through the offset. If biodiversity gains are not caused by the offset actions, the offset does not demonstrate additionality.

Additionality has been extensively covered in other literature (eg McKenney 2005; BBOP 2009a; Dickie and Tucker 2010). Within Clean Development Mechanism regulatory carbon offsets, additionality requires very extensive documentation to prove,[23] with lengthy guidance manuals.[24] Additionality is an extremely important criterion, without which there will be a net loss of biodiversity. Where there is little or no additionality, essentially no offset occurs and the residual impacts of the development remain.

Examples of offsets that *do not* demonstrate additionality include:
- funding of protected areas that are already sufficiently financed by government programs
- protection of ecosystems such as forests or wetlands that are not threatened nor undergoing degradation: in these cases, intervention (eg putting a fence around a forest to protect it) would lead to no material change in reality
- investment in an offset for economic reasons, such as a tourist lodge: in this case, the investment would have happened anyway, and so would the biodiversity gains – hence, using this as an offset would not be additional to the business-as-usual scenario
- improvement in the condition of habitat through management financed by government (EU, Australian, etc) schemes to incentivize landowners to manage their land for biodiversity – once again, these outcomes are the product of existing incentives or actions, so the gains cannot be used to compensate for the impacts at a development site.

23 http://www.cdmrulebook.org/84; http://www.ucl.ac.uk/laws/environment/docs/hong-kong/The%20Concept%20of%20Additionality%20(Charlotte%20Streck).pdf
24 This gives the mining industry an idea of the risks and challenges of a truly regulated biodiversity offset system, and the very low level of understanding of biodiversity offset issues that currently exist within all sectors compared with carbon.

EQUIVALENCY

How to measure equivalency is the most debated of all technical offset issues. An offset would be regarded as equivalent if gains are scaled to balance losses in type, amount, quality, time and space. This will mean that gains are commensurate with losses. This is important to ensure that the exchange is fair.

Equivalency requires scientific and stakeholder consultation on many issues (Quetier and Lavorel 2011). This means considering questions such as: Are the species lost the same as the species protected? How many hectares of an ecosystem are impacted and how many offset? For how many years is there a net loss to a species' population? For how many months are fishery resources inaccessible? Is the offset sufficiently near to the impact site? Achieving equivalency by quantifying the type and amount of biodiversity is the primary feature that distinguishes offsets from other forms of environmental compensation.

Equivalency in the type of biodiversity

To be equivalent within a like-for-like system,[25] biodiversity gains at an offset site need to be of an appropriate type, ie gains of the same kind of species, habitats, ecosystems or ecological functions as those impacted. The type of biodiversity is the principal biological issue involved in selection of appropriate offset sites: does the offset site hold the relevant species and habitats? A matrix of key biodiversity values or components (Ekstrom and Anstee 2007; BBOP 2009a) is a practical tool for ensuring the correct biodiversity features are selected for inclusion in offset design and loss– gain calculations. Equivalency in type is Step 1 in Figure 6.

Equivalency in the amount of biodiversity

A like-for-like offset must result in gains of an equivalent amount of biodiversity compared to the losses at the impact site, such as 100ha of forest losses and 100ha of forest gains. This amount can be measured in many different ways, eg hectares, habitat hectares and species population sizes. This question of equivalency in amount is covered in Steps 2 and 3 of Figure 6.

Equivalency in time

This issue concerns the timing of biodiversity losses and gains. An existing forest is obviously worth more to stakeholders than a forest promised at some point in the distant future. To be fully equivalent, offset gains need to be realized within an appropriate timescale for both stakeholders and for the biodiversity concerned: for example, an offset that is equivalent in type and size does not effectively compensate for losses if it only achieves its goals in 100 years' time. Equivalency in time is discussed in more detail in Annex 4.

Equivalency in space

Equivalency in space refers to the proximity of impact sites to offset sites. Situating offsets near impact sites is a commonly used rule-of-thumb to improve equivalency in ecosystem composition: nearby sites are more likely to have similar species and habitats, and perform similar functional roles. Proximity is also more likely to satisfy regulatory demands and stakeholder preferences. Equivalency in space is discussed in more detail in Annex 4.

Guidance on a number of the issues discussed in this section (and other key topics in biodiversity offsetting) can be found in the BBOP documentation, which is available online;[26] the BBOP Executive Summary[27] provides a useful overview and concise description of the different resources available. Gardner *et al* (in prep) will be a useful scientific reference on the subject of equivalency.

25 Like-for-like offsets tend to be preferred by regulators and stakeholders (eg Darbi *et al* 2009; New South Wales Government 2011; DEA & DP 2011; US wetlands mitigation, Canadian fish habitat compensation). However, the principle of "like-for-like or better" or "trading up" has gathered support for impacts on biodiversity of low conservation concern (Dickie and Tucker 2010; New South Wales Government 2011; IFC 2012; Temple *et a*l 2012). Trading up is greatly facilitated by the presence of national or regional conservation planning as this enables judgement of whether any given biodiversity feature or area is of higher conservation concern than any other.

26 Click-through links to all the BBOP resources can be found here: http://bbop.forest-trends.org/pages/guidelines

27 http://www.forest-trends.org/documents/files/doc_3116.pdf

4 A FRAMEWORK FOR MEASUREMENT

GO TO SECTION ►
1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP
2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS
3 OFFSET PRINCIPLES
4 A FRAMEWORK FOR MEASUREMENT
5 OFFSET IMPLEMENTATION
6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES
7 NEXT STEPS
A ANNEXES

This section outlines a generic four-step method that can be used in almost all situations and allows different principles and contexts to be taken into account. Annex 5 demonstrates its application in a real world case study, Rio Tinto's QMM Ilmenite mine in Madagascar (Temple *et al* 2012).[28] The method is consistent with approaches used in many different regulatory and voluntary offset systems worldwide. Biodiversity offset design can be somewhat complex and requires specialist expertise. It is, however, demonstrably achievable, even to comply with PS6.[29]

Guidance on offset design is beginning to emerge (BBOP 2009a; BBOP 2012b), but the lack of a consensus approach is repeatedly noted by industry. This section focuses on one aspect of offset design, the quantitative measurement of biodiversity loss and gain, in which much progress has been made over the past decade.

Figure 6: Loss-gain calculations for biodiversity offsets

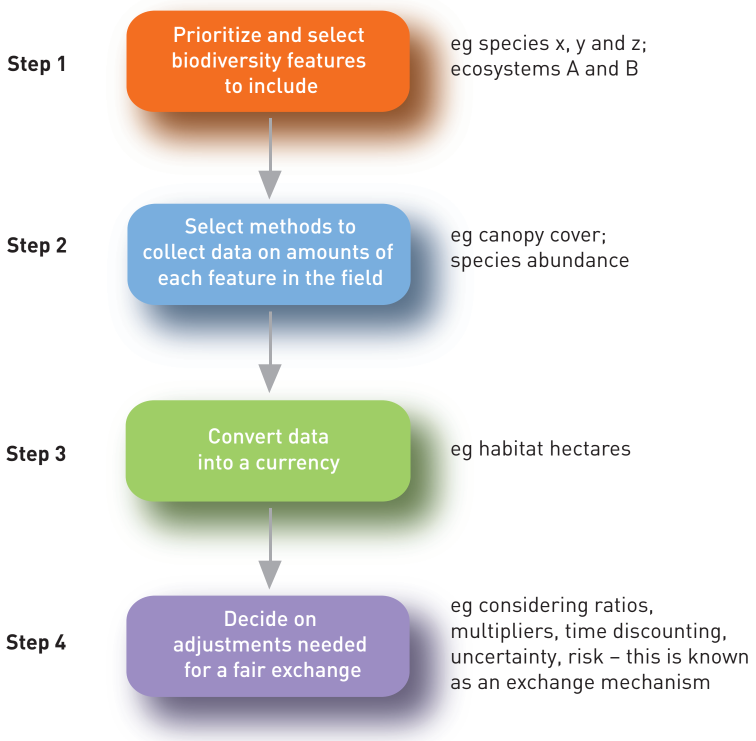


Figure 6 illustrates the relationship between, selection of biodiversity features (**Step 1**), selection of biodiversity measures (**Step 2**), conversion of measures to a currency (**Step 3**) and development of an exchange mechanism (Step 4). Similar approaches have been taken by Treweek (2009), Temple *et al* (2012) and Gardner and von Hase (2012).

28 http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/120917_UICN_ANG_trimweb.pdf
29 http://www.ot.mn/en/about-us/environmental-social-impact-assessment

THE FRAMEWORK IN THEORY

There are four principal steps required to ensure the correct types and amounts of biodiversity are taken into account in an offset exchange:

1. **Prioritize and select the biodiversity features to include** in the offset calculation at the impact and offset sites.
2. **Select methods to collect data on the amounts of each feature** in the field: measure the quantities of these biodiversity features directly (eg surface area of an ecosystem, abundance of a rare species) or, more commonly, through a surrogate or indicator of the biodiversity of interest (eg habitat area and quality as indicators of a species' abundance).
3. **Convert the measures/counts/metrics into a fungible currency** or currencies (ie to facilitate trade or exchange). Convert these counts and measures into one or more currencies to allow comparison of biodiversity losses and gains. Some of the most popular currencies for biodiversity offsets are Extent x Condition currencies, ie the multiplication of the surface area (or length, for streams; or volume, for marine) by the condition (quality) of the ecosystem or habitat.
4. **Decide on adjustments needed for a fair exchange (eg No Net Loss):** issues such as ratios, uncertainty, time lags, etc are tackled in this stage. These are core issues in the debate on No Net Loss. Step 4 has been the most extensively discussed and debated in the literature and in offset forums. Developers need only know that either the regulator will have decided these rules of exchange, or consultants and stakeholder engagement will be required to define these rules in a voluntary system, using global best-practice guidance on No Net Loss.

STEP 1: PRIORITIZE THE BIODIVERSITY FEATURES TO INCLUDE

What types of biodiversity should be included in the offset calculation? The term biodiversity covers a wide range from ecosystem and habitat diversity to intra-specific genetic diversity. However, it is impossible and impractical to measure everything. Scientifically defensible approximations and surrogates are required. Furthermore, different stakeholders attach differing values for the same biodiversity feature. For example, a forest may be important to NGOs for conservation of rare species, whereas it is important to local people for hunting resources. Global stakeholders might favour primates and rainforests, while national stakeholders favour fisheries, and local stakeholders favour a totem bird species. Stakeholder input is essential to define the scope of offsets.

An appropriate method to identify and prioritize stakeholder values is a biodiversity values matrix (Table 3). This matrix divides biodiversity into species, habitat/site and ecosystem components. The value of these components is considered for biodiversity itself, and as ecosystem services. This is an effective way of completing Step 1 of Figure 6: assessing the types of biodiversity relevant to different stakeholders.

Irreplaceability and vulnerability are central tenets by which levels of conservation concern can be judged (Margules and Pressey 2000; Wilson *et al* 2005; Brooks *et al* 2006). Irreplaceability is the degree of geographic/spatial rarity of a biodiversity feature; a locally endemic species has high irreplaceability. Vulnerability is the degree of threat that the feature is subject to or the rate at which a biodiversity feature is disappearing. A threatened species of whale found throughout several oceans can be said to have high vulnerability but low irreplaceability.

Table 3: **A biodiversity values matrix as used in biodiversity management and offset design**

	SPECIES	HABITATS AND SITES	ECOSYSTEM PROCESSES
Biodiversity	Irreplaceability and vulnerability of species. International Union for Conservation of Nature (IUCN) Red List species	Irreplaceability and vulnerability of habitats. Also "prime"/exemplary habitats	Ecosystem health and functioning. Evolutionary diversification
Ecosystem services	Food, fibre, fuel: mainly provisioning services. Genetic resources, totem/cultural species	Hunting, gathering and fishing sites and landscapes. Cultural services and culturally valued landscapes and sites such as sacred groves, recreation areas. Includes many cultural values	Large-scale ecosystem services – regulating and supporting: air quality, climate regulation, water purification

A biodiversity values matrix as used in biodiversity management and offset design. Columns are major components of biodiversity, rows are the biodiversity itself (sometimes called intrinsic values) and the ecosystem services derived from the biodiversity (which can be further divided into economic and cultural values). Adapted from Ekstrom and Anstee (2007); BBOP (2009a).

At this stage a developer will have identified both biodiversity and ecosystem service values of relevance to the operation. A strategic assessment is required to decide on the risk mitigation approach for these values. Some might be appropriate for biodiversity offsets and therefore require offset accounting. Others may be better tackled through other forms of environmental program and stakeholder involvement. In particular, careful consideration should be given to whether ecosystem services will form part of the biodiversity offset, or will require a separate land-based offset, or whether they will be compensated for in alternative ways. For simplicity in terminology this section is written from the perspective of the first row of Table 3 covering biodiversity itself. However, the same broad approach also is applicable for ecosystem services.

STEP 2: SELECT METHODS TO COLLECT DATA ON AMOUNTS OF EACH FEATURE IN THE FIELD

Step 1 may have resulted in three different species as the priority biodiversity features: a plant, a frog and a bird. How can we measure the amounts of each feature? First, choose a metric: for example, hectares of forest understorey for the plant and numbers of tree holes for the bird. Then, appropriate methods are used in the field to measure and count these amounts of each biodiversity feature. In regulatory regimes, regulators may prescribe exactly what methods should be used; otherwise (and in voluntary or PS6 systems), suitable methods should be selected with appropriate expert input. The resulting data will be used to construct a currency in Step 3. In some regulatory offset system the requirements of this currency will drive methods for this data collection (Habitat Hectares requires measurement of about 10 vegetation attributes).

STEP 3: SELECT A BIODIVERSITY CURRENCY OR CURRENCIES

Biodiversity currencies, like financial currencies, are designed to facilitate trade and exchange. This means they must be fungible, ie allow exchange using a common unit of loss and gain. Governments, Rio Tinto and BBOP projects regularly use Extent x Condition currencies in offset calculations (Parkes *et al* 2003; Rio Tinto 2012; BBOP 2012b). These currencies are a multiplication of quantity and quality: the extent of the biodiversity feature (hectares of vegetation community, hectares of fauna habitat) multiplied by the condition of the biodiversity (species density, vegetation condition, etc). A simple example of such a currency would be Hectares x Percentage Forest Canopy Cover. Condition (quality) is a measure of how intact an ecosystem is and is usually in relation to a benchmark or pristine ecosystem. This concept is useful to demonstrate differences in the relative value of biodiversity features that are in different condition.

Australian State of Victoria's Habitat Hectares and Rio Tinto's Quality Hectares are both examples of Extent x Condition currencies. How do these work? Put very simply, 100ha of forest at 50 per cent condition is 50 Habitat Hectares; whereas at 25 per cent quality, 100ha only represents 25 Habitat Hectares. These percentages of condition are theoretically comparisons against a benchmark pristine environment that is regarded as 100 per cent condition.[30] Extent x Condition currencies are popular due to their adaptability, flexibility and widespread applicability (Parkes *et al* 2004). They can be used almost anywhere. However, they have significant limitations (eg McCarthy *et al* 2004). The ability of currencies to represent biodiversity is a subject leading some academic authorities to question the reliability of offset systems to truly achieve No Net Loss (Salzman and Ruhl 2000; Walker *et al* 2009).

Many regulators, especially in North America and Australia, have developed specific and mandatory currencies along with custom methods to measure biodiversity guided by lengthy instruction manuals. Extent x Condition currencies can also be used in combination with other currencies to provide greater accuracy and precision for some biodiversity features of high conservation concern like a Critically Endangered species (eg Temple *et al* 2012).

STEP 4: DECIDE ON THE ADJUSTMENTS FOR A FAIR EXCHANGE

Why is this step needed? As an example, if a development causes the loss of 100ha of forest today, is it appropriate to deliver an offset of 100ha in 50 years' time in another location? Most stakeholders will not regard this as a fair exchange. There is no one-size-fits-all approach to follow in determining a fair exchange, but there are principles to take into account as covered in the preceding section. The BBOP Standard (BBOP 2012a) is primarily concerned with criteria and indicators to assess projects against such principles and help them to drive improved performance in an evolutionary fashion.

Annex 5 demonstrates the application of this generic four-step method in a real world case study, Rio Tinto's QMM Ilmenite mine in Madagascar (Temple *et al* 2012). Annex 6 provides further information on methods for dealing with data limitations and uncertainty in biodiversity loss–gain calculations and offset design.

30 Benchmarks either need to be measured (ie to have data on the characteristics of a pristine habitat, eg Parkes *et al* 2003; BBOP 2009a; Akyem case study p 25) or derived from professional judgement (eg Temple *et al* 2010).

5 OFFSET IMPLEMENTATION

IMPLEMENTATION OPTIONS WITHIN REGULATORY REGIMES

Many countries have legislation, guidelines and methods for offset design and delivery.[31] In a regulatory market, many options are provided by different offset suppliers such as entrepreneurs and businesses, land trusts and NGOs. Some of the best-known options available for developers are government-administered conservation banks and tradeable offset credit systems, species conservation banks and custom-built offsets by authorized agencies (Table 4). In addition, regulations in some countries allow for types of in lieu fees and payments to central government conservation funds (eg Brazilian development tax of 0.5 per cent capex, US wetlands mitigation and the Queensland Government[32]). However, these fall outside a No Net Loss definition of biodiversity offsets.

Regulatory biodiversity offsets can be planned and implemented either:

- **using a set of guidelines and principles** provided by the regulator (where offsets need to be designed and implemented on a case-by-case basis). Examples include most Australian states, Western Cape and Kwazulu Natal Provinces of South Africa and Canadian fish habitat compensation, or,
- **using a market-based mechanism** (where credits are available for sale off the shelf). Offsets can be put in place by the government, the developer or by entrepreneurs (private sector conservation banks) whose existence has been facilitated by the regulator. Examples include BushBroker scheme of Victoria State,[33] biobanking of New South Wales,[34] wetland and species banking in the US, some fish habitat compensation within Canada and species conservation banking.[35]

Table 4: **Examples of regulatory offset options**

TYPE OF OFFSET	EXAMPLES
Private conservation banks	Clean Water Act Compensatory Mitigation ("wetland banking", US); Corporation of the Society of the Missionaries of the Sacred Heart BioBank (New South Wales, Australia); Endangered Species Program Conservation Banks (US); Environmental Offsets Policy (Western Australia)
Government conservation banks	BushBroker (Victoria, Australia); biobanking (New South Wales, Australia)
Contracts with private organizations	Some Clean Water Act Compensatory Mitigation ("wetland banking", US)
Partnerships or contracts with non-profit organizations (eg with conservation NGOs)	Some Australian mining companies are considering partnerships with existing NGOs to deliver their offset commitments
DIY offsets by developers	BushBroker (Victoria, Australia); Environmental Offsets Policy (Western Australia); Fish Habitat "HADD" Compensation Banks (Canada)
In lieu fees	Clean Water Act Compensatory Mitigation ("wetland banking", US); Environmental Offsets Policy (Western Australia)

Note that in some cases there are several options within a single regulatory offset system. For example, under US wetlands mitigation, there are options (dependent on certain conditions) for in lieu fee arrangements, DIY offsets by developers themselves, private contracts and (most commonly) purchase of credits from wetland mitigation banks.

31 Yet arguably few or none of these have a good record of implementation success (Darbi *et al* 2009; Treweek 2009).
32 http://www.ehp.qld.gov.au/management/environmental-offsets/pdf/biodiversity-offset-policy.pdf
33 http://www.dse.vic.gov.au/conservation-and-environment/biodiversity/rural-landscapes/bushbroker
34 http://www.environment.nsw.gov.au/biobanking/
35 http://www.fws.gov/endangered/landowners/conservation-banking.html

OFFSET IMPLEMENTATION

Corporate offset policies and design methods are emerging that are sufficiently detailed yet broad enough to take into account the majority of government offset policy requirements. A key lesson is that it is necessary to base a corporate offset approach on principles, and allow flexibility in methods to suit local circumstances. Unnecessary conflict between government and business approaches can be avoided. Some mining companies in Australia are leading such approaches.

CASE STUDY

Biobanking in New South Wales

Biobanking was described by the 2006 New South Wales environment minister[36] as comprising the following components:

- establishing a biobank site on land via an agreement voluntarily entered into between the minister for the environment and the landowner
- creating biodiversity credits where the landowner agrees to undertake positive environmental management and/or rehabilitation actions to improve biodiversity values on the biobank site
- allowing such credits to be traded, once they are created and registered, thus enabling the credits to be used to offset a biodiversity impact on another site, caused by urban development
- establishing a transparent assessment methodology to ensure that the overall operation of the scheme results in the maintenance of or an improvement in biodiversity values.

The biobanking approach facilitates strategic landscape benefits (eg connectivity) more easily than through individual separate offsets. Such areas can maximize retention or enhancement of the most threatened vegetation types or facilitate linkages between existing remnants.

CASE STUDY

BushBroker, State of Victoria, Australia

BushBroker is a market-based system by which private landowners can fulfil government requirements for native vegetation offsets. Private landowners register their biodiversity credits, developed using standardized methods, for sale, and potential buyers can register expressions of interest. Credits are evaluated by government. The system is similar to US conservation banking systems. The oversight of native vegetation credit registration, listing, extinguishing and quality control will soon be run through the computer-based Native Vegetation Credit Register.[37]

IMPLEMENTATION OPTIONS WITHIN VOLUNTARY AND PS6-TYPE REGIMES

In the voluntary market there are insufficient options for companies wishing to integrate biodiversity offsets into their environmental risk management systems. To date there is no one-stop-shop organization for the supply of voluntary or PS6-driven biodiversity offsets. The non-OECD focus of such offsets makes issues more challenging. Land management in non-OECD countries is so complex that there is unlikely to be such a facility available to developers for some time. The best approach for voluntary offsets will therefore probably include a combination of:

- engaging national or provincial government agencies, and community-based organizations where appropriate
- engaging an NGO with institutional capacity and a track record of success to implement site-based conservation
- engaging a specialist consultancy group.

36 Quoted in Fitzroy Basin Association (2008).
37 http://www.dse.vic.gov.au/land-management/land/native-vegetation-home/native-vegetation-credit-register

Options within the voluntary market are, however, growing rapidly (Table 5). This is certainly not the main constraint on offset success for any serious developer. The BBOP biodiversity offset implementation handbook[38] is a succinct and readable guide to relevant issues for those new to offsetting. There are now several case studies on planned or completed voluntary and PS6-driven offsets:

- Rio Tinto's Oyu Tolgoi copper-gold project in Mongolia is the first project to publicly disclose full documentation that conforms with the revised (2012) PS6 requirements[39]
- Inmet Cobre Panama project (Annex 7)
- several BBOP pilots: Newmont's Akyem in Ghana,[40] the Strongman coal mine in New Zealand,[41] Bainbridge Island US[42]
- the Rio Tinto QMM Net Positive Impact (NPI) assessment is covered in an IUCN-published report[43] and covers three biodiversity offsets, including the Mahabo littoral forest managed by Missouri Botanical Gardens in south-east Madagascar[44]
- the Holcim Bardon Hill Quarry, UK (Temple *et al* 2010).

Table 5: **Examples of voluntary offset options**

TYPE OF OFFSET	DEVELOPER
Private conservation banks	CDC Biodiversité (Bouches-du-Rhône, France); the Environment Bank (UK), eg Thames River Conservation Credits Bank
Government conservation banks	Unlikely as a medium for voluntary offsets
Public–private conservation banks	Environment Agency-Associated British Ports (UK); Malua BioBank (Sabah, Malaysia)
Contracts	Possible with private consultancy firms and NGOs
Partnerships	Rio Tinto QMM and Missouri Botanical Gardens (Madagascar); Walmart (USA: "Acres for America")[45]
DIY offsets by developers	Ambatovy Sherritt and Wildlife Conservation Society (Madagascar)
In lieu fees	Unlikely as a medium for voluntary offsets

38 http://www.forest-trends.org/publication_details.php?publicationID=3092
39 http://www.ot.mn/en/about-us/environmental-social-impact-assessment; biodiversity offsets strategy: http://www.ot.mn/sites/default/files/documents/ESIA_BA4_Biodiversity_Offset_Strategy_for_the_Oyu_Tolgoi_Project.pdf
40 http://www.forest-trends.org/documents/files/doc_3122.pdf
41 http://www.forest-trends.org/documents/files/doc_3124.pdf
42 http://www.forest-trends.org/documents/files/doc_3120.pdf
43 Temple *et al* (2012) http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/120917_UICN_ANG_trimweb.pdf
44 http://www.mobot.org/MOBOT/research/littoral/mahabo_forest.shtml
45 http://www.walmartstores.com/Sustainability/5127.aspx

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP | 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS | 3 OFFSET PRINCIPLES | 4 A FRAMEWORK FOR MEASUREMENT | 5 OFFSET IMPLEMENTATION | 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES | 7 NEXT STEPS | A ANNEXES

IMPLEMENTATION FOR FINANCIAL AND LEGAL SUSTAINABILITY

In practice, biodiversity offsets often involve changes in land management or land use, such as conservation easements, improved conservation management, ecological restoration, or control of hunting or invasive species. These practices are already widely implemented by government and non-government conservation organizations, particularly in protected area management. Opportunity exists for collaboration between ICMM members and some of these organizations. Offsets can be seen as quantified and verified versions of typical conservation management of land.

Offset implementation is likely to be needed over long timeframes. McKenney and Kiesecker (2010) review offset legislation (in the European Union, the US, Brazil and Australia) and find permanence a key requirement in policy, and a major failure in practice. Two main types of solution have been proposed:

- **Long-term financing mechanisms (eg trust funds):** Funding offset management through a mechanism that provides annual funding in perpetuity, such as the national Madagascar Conservation Fund.[46] Such mechanisms are increasingly common to assure long-term conservation. See Conservation Finance Alliance (2008) for a brief review.
- **Handovers after gains have been achieved:** In rare cases where long-term management of offsets is not necessary after gains have been achieved (eg after complete removal of an invasive species from an island, or putting a conservation easement on land that was previously allocated for development), it might be possible to hand over offsets to competent authorities with no additional management funding required. In cases where it seems likely that long-term management will not be necessary but there is uncertainty (eg after restoration of simple habitats or reintroduction of species followed by decades of monitoring), handover may be appropriate if accompanied by bonds or insurance provided by developers.

The conservation sector can provide useful lessons from protected area management, land trusts, easements and payments for environmental services. **Protected areas** are one of the best-established and robust mechanisms for protecting biodiversity (Bruner *et al* 2001; Mulongoy and Chape 2004). Most nations have some form of network of areas set aside specifically for the conservation of biodiversity or landscape values (Protected Planet; WDPA[47]). **Legal agreements,** such as conservation easements on land, are an appropriate mechanism in some countries, and have been used particularly successfully in the US (Dielh and Barrett 1988). Easements are conditions on land title that add rules on how the land can be managed. These conditions are tied to the title and have to be maintained regardless of future ownership of the land. Such mechanisms are effective in countries with a strong rule of law, and provide long-term security for conservation actions. Land trusts are organizations that purchase land or easements on land in order to set areas aside for conservation. **Payments for environmental services,** such as for water catchment or carbon storage, are being applied in some places but are not universally applicable (Wunder 2007). Similarly, income from tourism, or sustainable resource extraction, contributes to conservation funds in some instances (Clements *et al* 2010).

46 http://www.conservation.org/global/gcf/portfolio/africa/Pages/madagascar.aspx
47 http://www.wdpa.org/

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP | 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS | 3 OFFSET PRINCIPLES | 4 A FRAMEWORK FOR MEASUREMENT | 5 OFFSET IMPLEMENTATION | 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES | 7 NEXT STEPS | A ANNEXES

MECHANISMS FOR PERMANENCE OF OFFSETS

Permanence (or longevity) refers to ensuring that gains last at least as long as impacts. A number of potential mechanisms exist to help offsets succeed in the long term, including the following.

Ensure permanence through insurance mechanisms. Permanence is one of the most challenging issues in forest offsets for carbon emissions, and sufficient lessons and guidance can be taken from this field and simplified for use in voluntary and PS6-driven biodiversity offsets.[48] The World Bank outlines seven mechanisms to deal with non-permanence in forest carbon,[49] including credit buffers, insurance, aggregated pools, discounting and host-country guarantees. Experience from forest carbon indicates that national habitat conservation banks (with credit buffers) set up by governments would greatly simplify the issue of permanence for developers.

Ensure permanence by registering biodiversity offsets through changing land tenure, for example as legal protected areas. Ilmenite company Rio Tinto QMM in Madagascar has secured the tenure of biodiversity sites through financing their legal conversion to protected areas. Six tracts of forest, holding the priority biodiversity features, are now protected areas under Malagasy law. Three are biodiversity offsets; perhaps more extraordinarily, three are avoidance zones established on the mine lease itself (St Luce, Mandena and Petriky).

Ensure permanence by using appropriate land tenure agreements, for example as recommended in the Australian Bowen Basin. The impact on biodiversity represented by open cut mining can be permanent, because restoration within human timeframes may be either challenging or very uncertain. Therefore, in some cases offsets need to be permanent. Several options are available to provide protective tenure, including gazetting as National Park, Conservation Park or Nature Refuge; statutory covenants; and conservation agreements.

Indigenous protected areas could be used as a vehicle to deliver biodiversity conservation in areas where Aboriginal parties own the land. Stewardship arrangements of limited duration and without transparent management expectations or statutory or third party enforcement provisions are considered to be unsuitable for the creation of biodiversity offsets.

PROTECTED AREAS AND OTHER RECOGNIZED SITES

Selecting offset sites, finding agreement with stakeholders and choosing conservation interventions are a large part of offset design, and can be costly and complex. Transaction costs can potentially be reduced, and outcomes improved, by using priority sites that have already been identified but are unprotected (or inadequately protected). Recognized biodiversity priority sites such as Key Biodiversity Areas and some unfunded protected areas therefore may offer potential, mainly in non-OECD countries. Another source may be found in national conservation plans including the National Biodiversity Strategy and Action Plans (NBSAPs), required by all national signatories to the Convention on Biological Diversity.[50] Nationally approved plans offer a number of advantages as offsets for the mining sector: these are government-approved plans and pre-existing national targets that may offer lower transaction costs, and in effect de-risk land management and land rights issues to some degree (tenure, usufruct rights, etc). Disadvantages include the fact that stakeholder acceptance will vary: for example, additionality will be an issue in cases where governments have already allocated sufficient funding for their implementation. There may also be issues of like-for-like and equivalence (see section 3) in cases where potential offset sites differ markedly from impact sites. The answers are context-specific and the opportunities are worth investigating.[51]

48 Eg http://www.unepfi.org/fileadmin/documents/Exploring_Insurance_Solutions_for_Permanence.pdf
49 http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/WEB_Addressing_Non-permanence_in_CDM_AR_Activities_Information_Note.pdf
50 http://www.cbd.int/nbsap
51 http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/Globally-important-sites-as-offsets.pdf

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS 3 OFFSET PRINCIPLES 4 A FRAMEWORK FOR MEASUREMENT 5 OFFSET IMPLEMENTATION 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES 7 NEXT STEPS A ANNEXES

Many conservation planning approaches take place at national and international levels, often led by NGOs. Many different types of site exist such as Ramsar (wetlands) sites, Key Biodiversity Areas and Alliance for Zero Extinction sites. The bank- and industry-funded UNEP-WCMC website Biodiversity A-Z[52] is the most useful resource to navigate these sites and understand their business relevance.

CASE STUDY

Simandou project, Guinea, is aligning offset site selection with national and international priorities

Rio Tinto Iron Ore is developing a large-scale resource in the Republic of Guinea in West Africa. The project involves mine, rail and port infrastructure, spanning 700km from mine to port. At an early stage, the project recognized the importance of harmonizing its biodiversity approach with pre-existing national and international priorities.
A dedicated working group has been established with representation from government, NGOs and Rio Tinto to ensure that the project's mitigation and offset plans are appropriately aligned with the Guinean Government's national biodiversity and protected areas strategy.
This was recognized as critical because mining companies face significant risks in engaging in land use change at potential offset sites outside of their concessions, unless such interventions have been government approved.

52 http://www.biodiversitya-z.org/.

6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES

INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES

GO TO SECTION ► 1 DEFINING OFFSETS IN ENVIRONMENTAL STEWARDSHIP 2 NEW BUSINESS DRIVERS FOR BIODIVERSITY OFFSETS 3 OFFSET PRINCIPLES 4 A FRAMEWORK FOR MEASUREMENT 5 OFFSET IMPLEMENTATION 6 INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES 7 NEXT STEPS A ANNEXES

Biodiversity offsets can be designed to provide ecosystem services[53] as their primary or secondary deliverable. Some regulatory regimes have dedicated methods for ecosystem service offset design, such as Habitat Equivalency Analysis and Resource Equivalency Analysis used in the US and the EU. It can be challenging to demonstrate the links between offset actions and the change in flow of ecosystem services. This and a number of other reasons may account for the relative lack of ecosystem service offsets within the voluntary offsets sector.

Interest in and understanding of ecosystem services has increased significantly since the Millennium Ecosystem Assessment (2005),[54] promoted by The Economics of Ecosystems and Biodiversity (TEEB 2010).[55] This paradigm has proven a useful approach to environmental risk management. Mining industry best practice already involves compensation for impacts to some ecosystem services (eg hydrology, community livelihoods) in the field of natural resources management. These actions are not generally labelled as biodiversity offsets. In the revised Performance Standard 6 (IFC 2012a), ecosystem services no longer trigger the critical habitat for which biodiversity offsets may be required. Therefore, PS6 does not in general require biodiversity offsets for impacts to ecosystem services, but focuses on appropriate mitigation.

Recently, a new risk- and opportunities-based approach to ecosystem services has emerged and is in use in parts of the private sector.[56] The Corporate Ecosystem Services Review is a way for the private sector to understand new risks, and assess dependence and impacts upon ecosystem services. This is a useful approach but does not replace nor is it an alternative to biodiversity offsets; it fulfils a different function. A mining project risk assessment will highlight the issues of importance (rare plants, erosion, natural resources of economic importance, cultural sites and practices) and a manager can then select the appropriate tools for the job.

STATE OF PLAY IN ECOSYSTEM SERVICE OFFSETTING

The term "ecosystem service offset" is clearly not in common use, returning only five Google results, whereas "biodiversity offset" returns 16,500 search results. Compared with the rise in biodiversity offset policies (section 2), policy and practice for offsetting ecosystem services is poorly developed outside North America. The US and Canada have put in place several policies to allow trade in ecosystem service credits such as water quality, water quantity and nutrient cycling. The comparative lack of ecosystem service offsets or government-administered trading systems elsewhere is perhaps surprising given the increasing focus within environmental policy upon ecosystem services. For example, the Convention on Biological Diversity's Aichi Targets (2010) and the European Union 2020 vision to halt the loss of biodiversity both explicitly include ecosystem services.

What is an ecosystem service offset?

Offsets specifically designed to deliver ecosystem services have been successfully designed and implemented, almost entirely within regulatory regimes where methods and requirements are clear and agreed upon (such as wetland mitigation in the US). Offsets for ecosystem services exist but have not been labelled in this way, such as water quality trading credits, fisheries compensation, wetlands mitigation, etc, mainly in operation under government-administered schemes in North America. For example, North Carolina, US, has a dedicated state-wide government-run Ecosystem Enhancement Program[57] that brings together the different types of ecosystem service credits available for purchase.

53 Ecosystem services are defined in the Millennium Ecosystem Assessment (2005) as "the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling." See http://www.millenniumassessment.org/documents/document.356.aspx.pdf
54 www.maweb.org
55 www.teebweb.org/
56 The World Resource Institute's Corporate Ecosystem Services Review; see www.wri.org/publication/corporate-ecosystem-services-review
57 http://portal.ncdenr.org/web/eep

Biodiversity offsets that also deliver ecosystem services

In some cases biodiversity offsets may be sufficient compensation for impacted ecosystem services: ecosystem services can sometimes be extra to biodiversity offsets even if they are not the principal driver for their design. Erosion control, water purification or provision of forest products are common examples. This is because most ecosystem goods and services are natural inherent ecosystem processes and functions (such as water purification, pollination, erosion control) that society makes use of.

In other cases, dedicated expertise and specific offset actions (such as watercourse management, enrichment planting for pollinators) may be required to enhance the ecosystem services provided by a biodiversity offset. These actions will have been identified through an appropriately comprehensive biodiversity values and risk assessment in the offset design phase.

CASE STUDY

Tsitongambarika forest, Madagascar

Rio Tinto is investing in Tsitongambarika forest as a biodiversity offset designed specifically for biodiversity losses predicted for its QMM Ilmenite mining operations. The role of Tsitongambarika forest as a biodiversity offset is quantitatively mapped out in a recent IUCN–Rio Tinto report (Temple *et al* 2012). In parallel, the mining company recognized that a range of ecosystem services would potentially also be provided by the biodiversity offset – for local communities, national government and indeed global stakeholders in the case of forest carbon emission abatement. An economic valuation of the ecosystem services of the entire forest (larger than the proposed offset site) was undertaken by IUCN (Olsen *et al* 2011),[58] which calculated that the ecosystem benefits include wildlife habitat (US$2.9 million), hydrological regulation (US$470,000) and carbon storage (US$26.8 million). Potential ecotourism benefits (US$2.5 million) were excluded from the analysis due to uncertainties in tourism revenues. The study found that there were significant net economic benefits associated with forest conservation (about US$17.3 million net of all costs), mainly due to carbon storage values.

CASE STUDY

The "Australia Pacific" LNG project ecosystem service offset

The extractive industry Australia Pacific Liquefied Natural Gas (LNG) project is one of few examples of an offset being designed specifically for ecosystem services, in this case fishery impacts. The project off the Queensland coast is a joint venture between Origin Energy and ConocoPhillips, comprising an oil and gas field development including an LNG plant and associated pipelines. The environmental management plan for the project[59] outlines the estimated residual impact on marine systems (mangroves, saltpans, seagrass beds and sub-tidal habitat) and hence the need for offsets. Offset size has been determined using an area multiplier and potential sites have been identified in nearby declared fish habitat areas and in the Great Barrier Reef World Heritage Areas. The final offset sites and management strategies are still being developed.

ROLE OF ECOSYSTEM SERVICES

Many voluntary offset regimes do not focus on ecosystem services. Why is this? Potential reasons include the following:

- **Biodiversity offsets are not always suitable compensation for lost ecosystem services.** For example, if a community is due to lose partial access to their forest or fishery, best practice requires appropriate consultation to determine their point of view in a free and informed manner. This will determine the type of compensation that most optimally satisfies the greatest majority of affected stakeholders. The answer may well not be offsets.
- **The meaning of No Net Loss for ecosystem services has not been precisely defined or demonstrated.** In particular, ethics are involved: if 90 families benefit and 10 suffer from the project, is No Net Loss achieved? Few projects could demonstrate that every single person experienced improved well-being as a result of the project.
- **Quantitative objective metrics for ecosystem services are possibly more challenging.** However, Habitat Equivalency Analysis provides some good examples for regulating and supporting services (Damage Assessment, Remediation, and Restoration Program (DARRP) 1995, revised 2006); Resource Equivalency Analysis offers further potential.

58 http://data.iucn.org/dbtw-wpd/edocs/2011-062.pdf
59 http://www.daff.qld.gov.au/documents/Fisheries_Habitats/Marine-Fish-Habitat-Offset-Policy-12.pdf

- **The spatial scale of some ecosystem services means that offsets may not be the most suitable mitigation option.** Some ecosystem services are relevant on such a broad spatial scale (eg a continental climate) that mining presents little risk to their functioning and they emerge from risk assessment as not requiring mitigation. Or conversely, some ecosystem services (often provisioning and cultural services) are so localized and site-specific that they are effectively irreplaceable and therefore mining can have a very great impact. Spirit sites are an example. In these latter cases, the primary measures are mitigation and direct compensation.
- **Alternative methods exist, which may be more appropriate than offsets.** Many ecosystem service impacts have traditionally been mitigated with existing tools such as engineering (erosion control, sedimentation ponds and culverts) and natural resource/community development approaches. There is a pre-existing set of methods for managing and compensating for natural resource impacts on local communities in separate professional domains.

MEASURING LOSSES AND GAINS

Two types of currency are most commonly used for measuring ecosystem services:

- **economic valuation** (dollar values), such as financial compensation for forest livelihood impacts
- **measures of the loss and gain of the service over time,** such as months of lost access to a fishery, or months of impaired water purification functions of a forest.

These two currencies can both be used and can usefully inform each other; they are not mutually exclusive.

Economic valuation

Economic valuation converts losses and gains into dollar values. The disadvantage is that financial currencies will never adequately represent the various ways biodiversity is valued, but the advantage lies in fungibility (exchangeability). Currently, very few of the new regulatory, voluntary and PS6-driven offset approaches use economic valuation as the primary method to calculate biodiversity offsets.

Economic valuation for compensation is commonly used in regulatory regimes (eg fines for pollution events, natural resource damage legislation). For biodiversity offsets, economic valuation is rarely wholly relied upon. It is most commonly used to calculate alternative financial compensation to site-based offsets, known as in lieu fees. Such fees can be for the entire project (eg Brazil's 0.5 per cent capital expenditure biodiversity development tax), applied exclusively for minor impacts (eg to reduce transaction costs; Dickie and Tucker 2010) or as a supplementary contribution to incomplete site-based offsets (eg Queensland, Western Australia, Australian Federal Government).

Economic valuation can be usefully applied to provisioning and cultural services for local communities (BBOP 2009c; Olsen *et al* 2011). Choice preference tests are also used to calculate how much people are willing to pay for lost or damaged ecosystem services, such as the cultural value of access to national parks (Bann 1997, cited in BBOP 2009c). There are wide and varied criticisms of all such approaches. ICMM and IUCN could usefully engage in dialogue on this subject.

BOX 2

Putting a dollar value on fuelwood collection in Cambodian villages (Bann 1997)

All families from a particular rural area use fuelwood, costing US$0.40 per basket, for cooking and heating. A family uses 300 baskets a year and the study village uses 14,400 baskets a year. It takes 30 minutes to collect one basket but, given few other available activities, opportunity costs are assumed to be zero. The total value of fuelwood for the village annually is thus US$5,760.

Measures of the loss and gain of the service over time

Ecosystem services methods often measure the quantity of a service lost over time (Figure 7). This is because, for example, loss of access to a fishery or a forest for one year is more serious than loss for one week. Examples of this include several (mainly North American) government-mandated or government-endorsed methods such as Habitat Equivalency Analysis or Resource Equivalency Analysis; and also REMEDE of the EU Environmental Liability Directive (European Union 2004).

INTERPLAY OF BIODIVERSITY OFFSETS AND ECOSYSTEM SERVICES

The loss and gain can be measured in ways relevant to the resource in question such as area, area x condition, fish biomass, volumes of timber or in terms of ecological flows such as river discharge.[60] In Figure 7, the ecosystem service loss over time is represented as the area under the curve and increases into the future. An example would be the loss of access to 10,000kg of fish biomass from a fishery each day, increasing cumulatively as an economic loss over time. To handle this, Habitat Equivalency Analysis uses a metric known as service-acre-years (SAYs). In practice, this metric is in fact discounted due to the lower economic value of resources into the future (eg of 10,000kg of fish) – known as discounted service-acre-years (DSAYs; DARRP 1995, revised 2006).

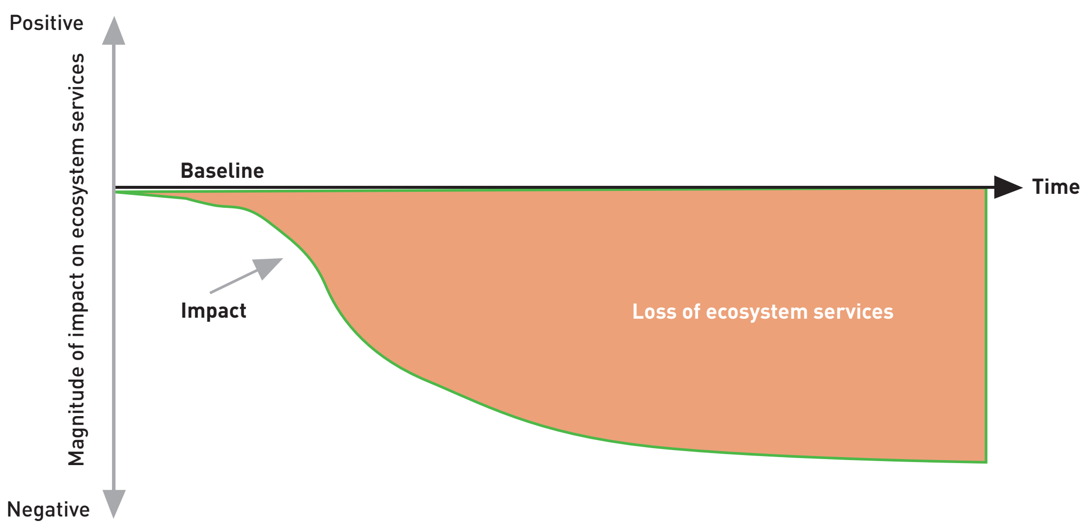
Where ecosystem service impacts are temporary, offset gains can be temporary. For example, fish and firewood can be provided for the period of time that the fishery or a forest is closed to access, or financial compensation can be given. Where ecosystem service impacts are permanent, the offsets may need to be permanent.

BOX 3

Forest carbon abatement methods

The mining sector is unlikely to use REDD (Reducing Emissions from Deforestation and Forest Degradation) and Clean Development Mechanism-based methods in biodiversity offset design because these are more complex than offset methods required by regulators or by best practice (BBOP 2009a, 2012b). These include quantified and rigorous approaches to measuring additionality and leakage. In some situations, useful approaches can be borrowed from REDD carbon methods, particularly issues of permanence, baselines, finance and insurance. Appropriately pitched biodiversity impact guidance is provided in Ebeling and Olander (2011), *Building forest carbon projects*. Regulators, however, may in the future decide to borrow some of the Clean Development Mechanism/REDD methods for biodiversity offset design. This could be a significant future risk for the mining sector and would greatly increase transaction costs of completing a biodiversity offset.

Figure 7: Measuring loss and gain to ecosystem services



Graphical explanation of why time is taken into account for measuring loss and gain to ecosystem services such as lack of access to a fishery or a forest. Vertical axis: quantity of good or service. Horizontal axis: time. The horizontal axis is the baseline. The descending green line represents impacts to ecosystem services over time at a mine site. Hence impacts to ecosystem services, such as fishery access, increase over time and are represented by the red area.

60 These are the "counts and measures" of Step 2 in Figure 6.

7 NEXT STEPS

Despite significant advances in policy and theory, there is still some uncertainty over what constitutes a valid biodiversity offset. Design and implementation of real world offsets – in particular, voluntary offsets – have been little documented. Sufficiently detailed guidance and methods exist, but the mining industry lacks a simple how-to manual for managers, backed by source references for technical staff and consultants.

The BBOP offset case studies (BBOP 2009b) were some of the first to be published on implementation. Further offset documentation is now emerging, such as the Oyu Tolgoi Performance Standard 6 Biodiversity Appendices to the SEIA,[61] Inmet's Cobre Panama project (Annex 7) and the IUCN–Rio Tinto QMM Net Positive Impact study (Temple *et al* 2012; Annex 5). The lack of documented, demonstrably successful offsets is a risk for the mining industry, because there has been remarkably rapid policy development – almost 30 countries now have offset-enabling legislation. This is also a risk for banks, which are aware there is a real lack of expertise available to conduct the biodiversity accounting and offset design and implementation now required in their environmental safeguards. Lack of progress is also a risk for the conservation community, which is unable to say definitively that offsets can commonly achieve No Net Loss when successful documented experience is limited (mainly to some examples of US wetlands and Canadian fish habitat compensation mitigation: potentially as few as 2 per cent of all cases according to Quigley and Harper 2006a, b).

Currently, there is a kind of stalemate, in which conservation groups are hoping industry will develop voluntary offsets, academics are debating offset theory and industry is holding off from engagement until more certainty appears – unless regulation forces action. Some pragmatic real world examples of voluntary offsets mutually supported by industry and the conservation community could end this stalemate. Next steps could include the following:

1. PROVIDE A TRUSTING, SAFE ENVIRONMENT TO SHARE EXPERIENCE

Industry requires a space to explore possible voluntary offset models, make mistakes and learn lessons without undue criticism. ICMM and the conservation community have the capacity to create this space. ICMM and IUCN have mutual convening power within their respective professional fields, and such a learning-by-doing approach is already practised by both organizations in other relevant fields. For IUCN, conservation subjects such as protected area management and species reintroduction are by no means a perfect science: rather, committed practitioners work together in honest peer review to elevate the field. Likewise, the mining industry repeatedly comes together globally to raise the bar on issues such as health and safety and indigenous rights. What makes these forums work is the degree of trust among practitioners: the opportunity to mutually learn from mistakes. It would be a landmark change for the two sectors together to create such a space, in which practitioners were facilitated to build pragmatic experience in voluntary biodiversity offsets in a Chatham House Rules-type environment. Even if such an approach is currently too challenging for the two sectors, parallel working groups (industry and conservation) are already in existence, and could be improved upon.

2. CREATE A SIMPLE ONLINE SOURCE OF OFFSET CASE STUDIES

Offset practitioners are not in contact with each other except through word of mouth and forums such as BBOP, and offset case studies are insufficiently documented. A simple online gazetteer of offset case studies, practitioners, potential partners, etc could be created that is searchable by relevant criteria (eg country). This could also cover those with experience in major types of ecosystem (reefs, rainforest, desert). Design and implementation of offsets should be covered.

61 Biodiversity Appendices of http://www.ot.mn/en/about-us/environmental-social-impact-assessment

NEXT STEPS

3. CONVENE DISCUSSION ON OFFSETS IN PROTECTED AREAS

ICMM and IUCN could make progress on the issue of offsets in legally protected areas. IUCN's convening power will be useful to allow discussion of:

- what (if any) are the conditions under which offsets are appropriate in legally protected areas
- what kinds of issues should be taken into account to determine whether a biodiversity offset might be permissible within a particular protected area
- how a mining company can go about structuring an appropriate stakeholder group to go through this decision-making process.

Given the contextual nature of such decisions, some generic guidance is needed, but with sufficient flexibility to allow bottom-up decision making at the national level. This joint work would fit well with IUCN's current task force on management of protected areas. Some IUCN members will probably oppose biodiversity offsets in all legally protected areas; a number of OECD governments also follow this rule of thumb. Allowing offsets in protected areas under certain conditions could be an opportunity for both sectors, as many protected areas are grossly underfunded, particularly in non-OECD countries. At the same time, many ICMM member companies are developing projects in such countries. Recognized areas (eg Key Biodiversity Areas) that are not currently legally protected present fewer issues, but would benefit from further consideration as potential offsets.

4. SHARE THE RISKS OF DESIGNING AND IMPLEMENTING OFFSETS

ICMM members and IUCN members could together design and implement an offset. This could contribute to progress on a number of the next steps noted here, including sharing best practice; increasing communication, understanding and trust between ICMM and the conservation community; developing effective how-to guidance; providing additional well-documented pilots and case studies; and using real world experience to develop mutually agreed and pragmatic solutions to some of the outstanding issues in biodiversity offsetting.

5. DEVELOP A SHORT INDUSTRY HOW-TO GUIDE TO OFFSET DESIGN

Partly as a result of the complexity of the issue and the abundance of guidance, industry lacks a succinct how-to guide for the design of biodiversity offsets. It should be comprehensible in summary for managers, and contain the major stages, principles to follow, implementation options and likely risks. Much of the information is already available in various forms in BBOP documents and other offset guidance.

6. FIND OUT WHAT WORKS IN THE FIELD: FOCUS ON REAL WORLD PRACTICE

ICMM could facilitate and help member companies to design and implement voluntary biodiversity offsets through partnerships or contracts with consultancy firms and NGOs, including IUCN members. These should focus on appropriate stakeholder engagement to complete the four steps in Figure 6; provide learning-by-doing about issues such as baselines, equity, limits to offsetting and equivalence; and test and improve the current leading guidance and approaches to biodiversity offsets. An example of this approach is the work of Rio Tinto and conservation partners in south-east Madagascar (Temple *et al* 2012). The conservation community has been using such a bottom-up approach to improve conservation practice such as protected area management for decades.

7. PROVIDE REAL WORLD EXAMPLES OF SOLUTIONS TO ISSUES

There are opportunities for trading up (like for better) on the ground, but it is difficult to mandate the rules. A case study-based approach could emerge from collaboration between members of ICMM and IUCN to produce an example of a trading-up offset. There are options for solving permanence emerging within forest carbon such as insurance and buffers of unsold portions of offsets. These are little known in the offsets literature, though some guidance has very recently emerged (BBOP 2012b: No Net Loss calculations).[62]

62 http://www.forest-trends.org/documents/files/doc_3103.pdf

8. LEARN FROM THE FAILURE OF MANY REGULATORY OFFSET POLICIES

Offset policies, even with plentiful regulation and technical guidance, have often failed to deliver their stated objectives. Indeed, some policies have failed to produce valuable conservation outcomes at all (Darbi *et al* 2009; Burgin 2010), making some observers suspect that offsets are nothing but symbolic (Walker *et al* 2009). This is not due to a lack of laws, regulations, toolkits, theory or methods, but the lack of a track record in implementation and monitoring. ICMM and the conservation community could work together to help address these challenges.

9. INCREASE UNDERSTANDING BETWEEN THE TWO SECTORS

Many of the implementation challenges of biodiversity offsets are no different to those of biodiversity conservation more generally, for example insufficient stakeholder participation, unsustainable financing, lack of adaptive management and political constraints such as corruption. ICMM and the conservation community have the potential to work together on particular projects to create pragmatic solutions to some of these issues. Conservation organizations and the science sector could become more aware of the needs of the industry project life cycle in order to understand the opportunities and constraints faced by industry. Likewise, industry could explore the expertise (eg biodiversity accounting, offset design, protected area management) that is available outside the mainstream large consultancy sector.

A ANNEXES

ANNEX 1

State of biodiversity offsets: global progress since 2005

In 2005, ICMM published a proposition paper and a briefing paper (ICMM 2005a, b) on biodiversity offsets, and listed several issues as offset barriers and uncertainties. Since then there have been significant advances in policy and theory, and some field examples of best-practice offset design are emerging.

Regulatory offset requirements have become more stringent in many countries, and options for offsets in regulatory systems are clearer, with offset markets having increased. Many examples exist of offsets in regulated regimes (mainly in North America and Australia). For voluntary offsets and those driven by financial lending requirements, significant consensus has emerged around high-level principles, but the details of what these mean in practice remain open to question. This is partly because different situations require different approaches, so there is no single "right" way of conducting offsets. Robust examples of offset design and implementation in voluntary regimes (mainly non-OECD countries) are emerging, but progress has been slow in agreeing to pragmatic and scientifically defensible approaches in the voluntary offset context. IFC Performance Standard 6 and other financial lending requirements are driving a step change in the quality of mitigation and offset design[63] for No Net Loss. Despite the wealth of offsets guidance and literature, the mining sector needs a how-to manual for offset design and implementation.

There has been seven years' progress on the five key offset issues identified by ICMM in 2005. As a brief summary of some complex issues, this section assumes some prior knowledge of biodiversity offsetting; many of these issues are explained and discussed in greater detail in this report.

1. Establishing appropriate baselines and measuring impacts that include background biodiversity change
Significant progress has been made in establishing baselines and measuring impacts (including metrics and indicators). Generic guidance is available on use of metrics and indicators that can be applied to offsets, and offsets for real projects have been designed using both remote sensing and field data. Regulatory methods for measuring impacts (eg vegetation condition assessments in Australia) are idiosyncratic and can be excessively detailed. Examples now exist of design of averted loss offsets that use background rates of biodiversity change as the baseline (eg regional deforestation rate, hunting levels). Industry requires clearer guidance and examples to ensure a consistent approach to offset design and implementation.

2. Designing appropriate offsets that are acceptable and link to business impacts on biodiversity
Sufficient guidance and real world examples exist of offsets that are linked to business impacts, demonstrating loss and gain in like-for-like terms. Some examples of trading up offsets have been tested. Significant convergence has emerged around fungible currencies to facilitate the trade and exchange of offsets. Most commonly used are Extent x Condition currencies such as Habitat Hectares; fungible currencies exist for biodiversity of high conservation concern such as threatened species (eg percentages of species' national or global range, derived from widely accepted IUCN Red List metrics) and some ecosystem services derived from biodiversity such as water, weaving materials and forest food products.

3. Issues of time, scale and equity
Adjustment of currencies to ensure a fair exchange (eg through ratios or time discounting) remains a top-down challenge for government offset policies, but has proven to be a solution for individual projects (eg Temple *et al* 2010; The Biodiversity Consultancy and Fauna & Flora International (TBC & FFI) 2012). Government offset systems now exist that integrate time discounting or require offset implementation before impacts occur. Temporal loss issues are challenging in the voluntary offsets sector. Fundamental theoretical questions on these issues remain (eg Bekessy *et al* 2010), but it is possible to reach consensus on a case-by-case basis through stakeholder engagement for voluntary offsets (Temple *et al* 2012). Grassroots case-by-case approaches are therefore proving successful in solving these kind of questions. Local socio-economic costs (eg conflicts with livelihoods) of biodiversity offsets remain challenging, as they do in conservation and protected areas management more generally.

63 Eg biodiversity appendices of http://www.ot.mn/en/about-us/environmental-social-impact-assessment

4. Who to involve in offsets decision making, and who ultimately decides and what role government plays

This issue has received comparatively little attention in the literature. In practice, there are several useful case studies (Obermeyer *et al* 2011; BBOP 2012b; TBC & FFI 2012; Temple *et al* 2012) that illustrate the challenges. Where offsets are regulated, these questions are answered by government-defined rules, guidance and consultation processes. For voluntary offsets, these questions have to be answered case by case. Alignment with government plans and processes has the potential to increase the political expediency of a voluntary offset program (see Simandou project case study, section 5). These subjects remain, however, a significant risk to offset success in many different regimes.

5. How to ensure offsets are appropriately managed and are financially and ecologically sustainable

This question has been appropriately answered in theory within regulated regimes but with mixed implementation success. In voluntary offsets, this remains a risk to industry due to poorer legal systems and land tenure clarity in non-OECD countries. In addition, good governance and financial sustainability are challenging to achieve and require dedicated attention. Governance is of paramount importance even in the most highly regulated contexts such as Canadian fish habitat compensation and US wetlands mitigation, where failure is caused not by a lack of guidance or law, but through poor implementation and monitoring/enforcement. Experience from the regulatory offset systems shows without doubt that implementation, governance, monitoring and enforcement are the most common causes of offset failure (eg Harper and Quigley 2005; Burgin 2008, 2010; Darbi *et al* 2009).

ANNEX 2

What is the relevance of critical habitat for biodiversity offsets?

Critical habitat is a concept developed by the IFC within Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources. It is designed to identify areas of high biodiversity value in which development would be particularly sensitive and require special attention. Biodiversity offsets are required for residual impacts on critical habitat. In some cases critical habitat may be so significant (denoted Tier 1 critical habitat) that offsets are unlikely to achieve No Net Loss and therefore developments in these areas are unlikely to be accepted by financial institutions and other institutions adhering to PS6.

Critical habitat and PS6 are becoming recognized as global biodiversity best practice for the private sector. The critical habitat concept has been developed in consultation with numerous international conservation organizations and thus takes into account many pre-existing conservation approaches, such as Key Biodiversity Areas, Important Bird Areas, the Ramsar Convention, World Heritage Sites, and Alliance for Zero Extinction sites. A number of multilateral banks also have policies closely aligned with PS6, and more than 75 private banks signed up to the Equator Principles[64] have a commitment to the IFC Performance Standards. The comprehensive stakeholder consultation carried out when PS6 was revised in 2012 led to high levels of interest.

A four-page summary of critical habitat is given by TBC (2012c).[65] There are five principal criteria by which critical habitat is identified. Importantly, areas are recognized as critical habitat if they qualify under any one of these five criteria. Critical habitat refers to areas of high biodiversity value, including habitat of significant importance for:

- globally or nationally critically endangered or endangered species
- restricted-range or endemic species
- concentrations of migratory and congregatory species
- highly threatened and unique ecosystems
- key evolutionary processes.

64 www.equator-principles.com/index.php/members-reporting/members-and-reporting
65 http://www.thebiodiversityconsultancy.com/wp-content/uploads/2012/07/Critical-Habitat-a-concise-summary.pdf

In addition to the above five biological criteria, Paragraph 57 of the official PS6 Guidance Note[66] identifies many legally protected areas and internationally recognized areas as critical habitat:

- IUCN Category I and II protected areas
- Ramsar sites
- World Heritage Sites
- most Key Biodiversity Areas (including Important Bird Areas, Important Plant Areas, Alliance for Zero Extinction sites, etc)
- and in some cases, IUCN Category III and IV protected areas.

Critical habitat takes into account both global and national priorities and builds on the conservation principles of vulnerability (threat) and irreplaceability (rarity/restricted distribution). It is recognized that not all critical habitat is equal: there are grades of critical habitat of varying importance. The IFC distinguishes two main grades:

- Tier 1 critical habitat, of highest importance, in which development is very difficult to implement and offsets are generally not feasible except in exceptional circumstances
- Tier 2 critical habitat, of high importance, in which offsets may be possible and development may be permitted under some circumstances.

ANNEX 3
Offset principles

Business and Biodiversity Offsets Programme (BBOP) principles[67]

1. Adherence to the mitigation hierarchy: A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.

2. Limits to what can be offset: There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.

3. Landscape context: A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.

4. No net loss: A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.

5. Additional conservation outcomes: A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.

6. Stakeholder participation: In areas affected by the [development] project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.

66 www.ifc.org/performancestandards
67 Eg see p 10 of BBOP 2012b: http://www.forest-trends.org/documents/files/doc_3101.pdf

7. Equity: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a [development] project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.

8. Long-term outcomes: The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the [development] project's impacts and preferably in perpetuity.

9. Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.

10. Science and traditional knowledge: The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

New South Wales Government offset principles (New South Wales Government 2011)

The New South Wales, Australia, Government has set these principles for the design of biodiversity offsets:

1. Impacts must be avoided first by using prevention and mitigation measures
2. All regulatory requirements must be met
3. Offsets must never reward ongoing poor performance
4. Offsets will complement other government programs
5. Offsets must be underpinned by sound ecological principles
6. Offsets should aim to result in a net improvement in biodiversity over time
7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs
8. Offsets should be agreed prior to the impact occurring
9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated
10. Offsets must be targeted
11. Offsets must be located appropriately
12. Offsets must be supplementary
13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

ANNEX 4
Ensuring equivalency of gains and losses in offset design

Equivalency in time

To be fully equivalent, offset gains need to be realized within an appropriate timescale for both stakeholders and the biodiversity concerned. For example, an offset proven equivalent in type and size will still not be considered to effectively compensate for losses if it only achieves its goals in 100 years' time (Ekstrom 2005; BBOP 2009a) – an existing forest is obviously worth more to stakeholders than a forest promised at some point in the distant future. Temporary loss of ecosystem services (eg loss of access to hunting or fishing areas, or loss of forest products such as timber and firewood), even for a short period of time, may represent a critical loss to the livelihoods and economy of a community or region.

In addition to human time preference, there are ecological reasons for negative effects of temporary biodiversity loss (often called temporal loss). Where the biodiversity in question performs an important ecological function, such as an ecological corridor of importance for regional animal migration, even the temporary loss of this area would cause long-term damage to animal populations. Another common example of ecological function is the essential breeding and feeding resources required by migratory species for short periods each year, such as cetacean calving grounds and migratory bird stopover sites.

For both human and ecological reasons, it is ideal to put offsets in place before impacts occur (Bekessy *et al* 2010). Most habitat-, species- and conservation-banking systems are designed to ensure this (Ekstrom 2005; Carroll *et al* 2008; Dickie and Tucker 2010). For example, in Germany, government bodies have set up several hundred habitat pools or banks (Peters *et al* 2002, in Darbi *et al* 2009) that are used by both public authorities and private developers to offset unavoidable impacts (Böhme *et al* 2005, in Darbi *et al* 2009). Hence, in regulated offset markets there are rules to account for (or avoid) temporal loss. These include time discounting (to calculate the present value of future gains), for example in Habitat Equivalency Analysis (HEA)[68] and Resource Equivalency Analysis (REA)[69] (DARRP 1995; Dunford *et al* 2004; Moilanen et al 2009; and see the website of REMEDE[70]).

Equivalency in space

Equivalency in space refers to the proximity of impact sites to offset sites. Situating offsets near impact sites is a commonly used rule of thumb to improve equivalency in ecosystem composition: nearby sites are more likely to have similar species and habitats, and perform similar functional roles. Proximity is also more likely to satisfy:

- regulatory demands: regulated offsetting takes place only within provinces/states/nations, rather than across continents; US wetland mitigation allows mitigation only within watersheds; and US species conservation banking within specific service areas (Womble and Doyle 2012)
- stakeholder preferences: communities are not likely to be satisfied with replacement of their lost biodiversity in a site 200km away, particularly if it performs ecosystem services.

In practice, however, the optimal offset site will often not be the closest – for either biological or socio-political reasons. Optimal location of offsets can be determined on a case-by-case basis (eg Kiesecker *et al* 2009; Temple *et al* 2012) or, preferably, through use of pre-existing national and regional conservation plans where they exist (Brownlie and Botha 2009; DEA & DP 2011).

68 http://www.darrp.noaa.gov/library/pdf/heaoverv.pdf
69 http://www.envliability.eu/docs/Warsaw_presentations/D1_Josh_Lipton_Remede_20608.pdf
70 http://www.envliability.eu/

ANNEX 5
Case study

Rio Tinto QMM Madagascar – the loss–gain framework in practice

In a joint publication of IUCN and Rio Tinto, Temple *et al* (2012) describe the role of mitigation and offsets to achieve Net Positive Impact (NPI) at an ilmenite mining operation in south-east Madagascar. This is a best-practice example of application of the mitigation hierarchy, choosing what types and amounts of biodiversity to offset, the use of biodiversity currencies in offset design, and science and stakeholder agreement regarding the fair exchange (Steps 1–4, Figure 6).

Both restoration and protection (averted loss) offsets were planned, and losses and gains are compared using simple fungible currencies for habitats and species. The same currencies are used in each stage of the mitigation hierarchy to allow losses and gains to be compared. Each priority habitat and species is given its own accounting line, similar to financial accounting. Most priority biodiversity features were net positive in 2010 (due to early mitigation and offset actions before most impacts have yet occurred). If the project carries out the actions proposed, and restoration goes according to plan, most features would be net positive by mine closure although some temporal loss is predicted. The forecasting technique led to cost-benefit analysis of mitigation versus offset options, and created a business approach to offset financial planning.

In Step 1, in line with the fundamental steps in Figure 6, this study first identified the biodiversity features to be included. These were restricted to terrestrial species and habitats, and prioritized using the principles of vulnerability and irreplaceability. Marine biodiversity was excluded from the analysis due to lack of data and incompletely developed metrics.

In Step 2, methods used included remote sensing of habitat data, ground truthing of forest habitat condition and species abundance surveys.

In Step 3, the measured data were converted into two main currencies that were applied across the whole of the mitigation hierarchy to allow exchange of losses and gains at three progressive mine sites and three maturing biodiversity offset sites from 2004 to 2065:

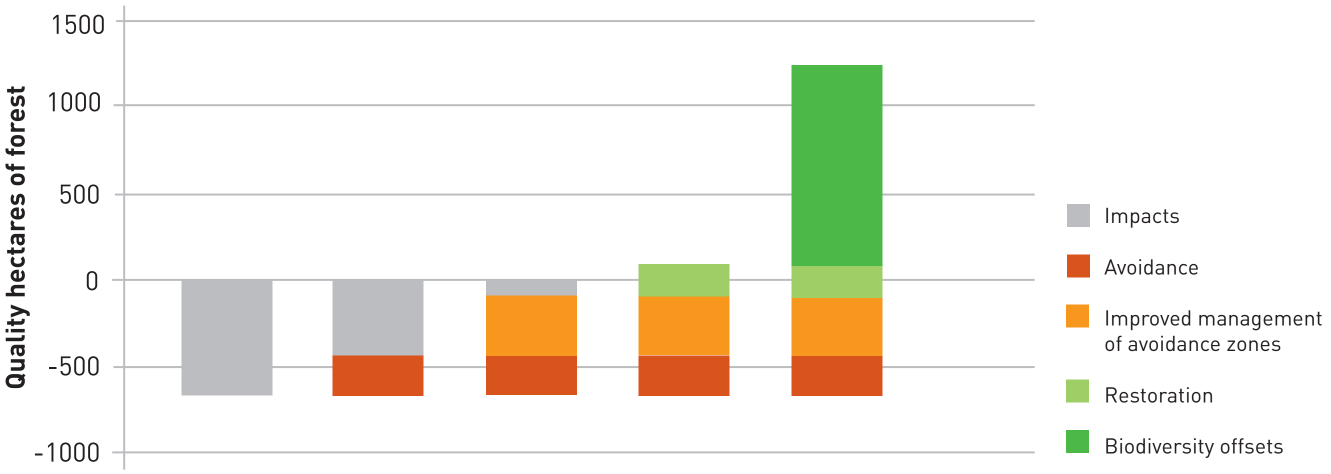
- for habitats and many species, Quality Hectares (QH) sufficed as a currency
- for particularly rare species, a currency was developed called Units of Distribution (UD), based on loss and gain of species' population and/or area of occupancy, an IUCN Red List metric.

In Step 4, a stakeholder review process was conducted involving a dedicated biodiversity advisory committee and extensive peer review within international biodiversity NGOs (IUCN, BirdLife International, Wildlife Conservation Society, Missouri Botanical Gardens). This refined the rules used in the exchange mechanism, including baselines, uncertainty and time discounting. Equity issues were therefore resolved from the bottom up with stakeholders.

Lessons learned included the value of early stakeholder engagement at local, national and international levels and partnerships with conservation organizations having relevant expertise. The project benefited greatly from starting mitigation and offset actions before construction, and from investing in collecting accurate baseline data and Research and Development on biodiversity currencies. Most significantly, it was understood that quantitative metrics are essential, but only the beginning. They provide a transparent platform for stakeholder dialogue.

Challenges included the need for large amounts of baseline data and professional ecological estimations in order to complete the study, such as habitat maps, species inventories for more than 20 forest patches, description of over 40 new species to science, estimates of deforestation rates, estimates of ecological restoration rates and iterative expert peer review. Estimation of appropriate deforestation rates and how to apply these to calculate likely gains over time at offset sites proved particularly time-consuming and challenging. Expert stakeholder consensus was required through participatory mechanisms over a period of nine months to reach agreement.

Figure 8



Cumulative Rio Tinto QMM biodiversity accounting across the whole mitigation hierarchy (avoidance, restoration, and offsets) compared with losses (Grey) from 2004 to 2065. Red = avoidance; Orange = improved management of avoidance zones to increase their quality; Pale Green = gains for post-mining restoration; Dark Green = gains from biodiversity offsets. In this particular case study there were no measurable gains from minimisation.

ANNEX 6

Approaches to address uncertainty and risk in biodiversity offset design

Data limitations cause uncertainty in biodiversity offset predictions and therefore represent a business risk. Various approaches are available to address the issue, including interpolation, expert judgement and statistics. Some pragmatic solutions exist, such as conservation banks, bonds and other forms of insurance. For individual projects there are lessons to be learned from forest carbon abatement projects. In many situations, biodiversity data of optimal quantity and quality are lacking, especially in the early stages of project development. This situation is not unique to biodiversity offsets, and is faced regularly in conservation biology and environmental impact assessment.

Data availability and quality

Limitations on data availability and data quality are an issue for ecological science and biodiversity conservation in general. The issues for biodiversity offsets are similar, but take on a great importance because offset liabilities are based on quantification of biodiversity. These limitations are often taken into account in the exchange mechanism discussed in section 4, as part of ensuring a fair exchange (Step 4 of Figure 6).

Several approaches are available to overcome data limitations, including interpolation, expert judgement and statistics. Post-impact baselines can sometimes be constructed from historical habitat maps. Application of methods to overcome data limitations, especially where the magnitude and significance of impacts are very great, will require discussion with stakeholders and regulators.

Some solutions to uncertainty and risk in offset design[71]

There are a set of reasonable approaches to uncertainty and risk in biodiversity offsets that can be put in place in the design and implementation stages.

In offset design:

- designate a credit buffer (a portion of the offset gains which are never spent, ie never used to compensate for losses)[72]
- minimize the residual impacts, especially for complex and mature habitat (eg Gibbons and Lindenmayer 2007) that may require offset timeframes longer than human planning cycles (over 100 years)
- implement offsets as early as possible in the project cycle, preferably before impacts occur
- purchase offset credits from habitat banks/conservation banks if available
- governments may use formal insurance mechanisms such as bonds (restoration bonds are required of extractive industries by many goverments) – an example of a bond being required for insurance of success of offsets is for impacts on seagrass in New South Wales[73]
- employ bet-hedging strategies, eg multiple simultaneous conservation interventions/ecological restoration methods
- use time discounting to take into account the net present value of biodiversity: a forest in 100 years time is worth inherently less (see United States' Habitat Equivalency Analysis for more details).

In offset implementation:

- employ effective adaptive management based on monitoring and evaluation
- involve all relevant stakeholders from the start
- use multidisciplinary teams in offset design, as in any project, to understand risks from different perspectives.

ANNEX 7
Case study

Cobre Panama – designing averted loss offsets[74]

Minera Panama, S.A. (MPSA) is developing the large-scale Cobre Panama project in Panama's Colon Province. The project is located 120km west of Panama City and 20km from the Caribbean coast. MPSA is committed to complying with the IFC's Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources, and as such seeks to achieve a net benefit for the natural habitats it will affect with its 5,900ha footprint and potential associated indirect impacts.

The site is within an area of tropical humid forest that comprises a large intact segment of the Mesoamerican Biological Corridor. The natural habitats within the area of influence have high species diversity, including numerous IUCN Critically Endangered and Endangered species. In addition, a large number of plant species are currently categorized as Data Deficient and require further study to establish their conservation status. The landscape is also home to human communities with challenging economic circumstances. Deforestation for land use is common and the rate of forest loss in this area is among the highest in Panama. The challenges faced in developing a biodiversity offset that will support the achievement of a net benefit include:

- compensating for impacts to corridor function at the landscape scale
- ensuring that the offset accommodates the needs of a large array of species, many of which have limited scientific information
- developing the offset in a timely manner.

MPSA's biodiversity offset uses a landscape-scale approach to ensure that corridor function will be conserved. The offset includes support to three protected areas: Santa Fe National Park (72,636ha), Omar Torrijos National Park (25,275ha) and a new protected area to be established in the District of Donoso (c 150,000ha). These protected areas have limited funding support and are vulnerable to deforestation.

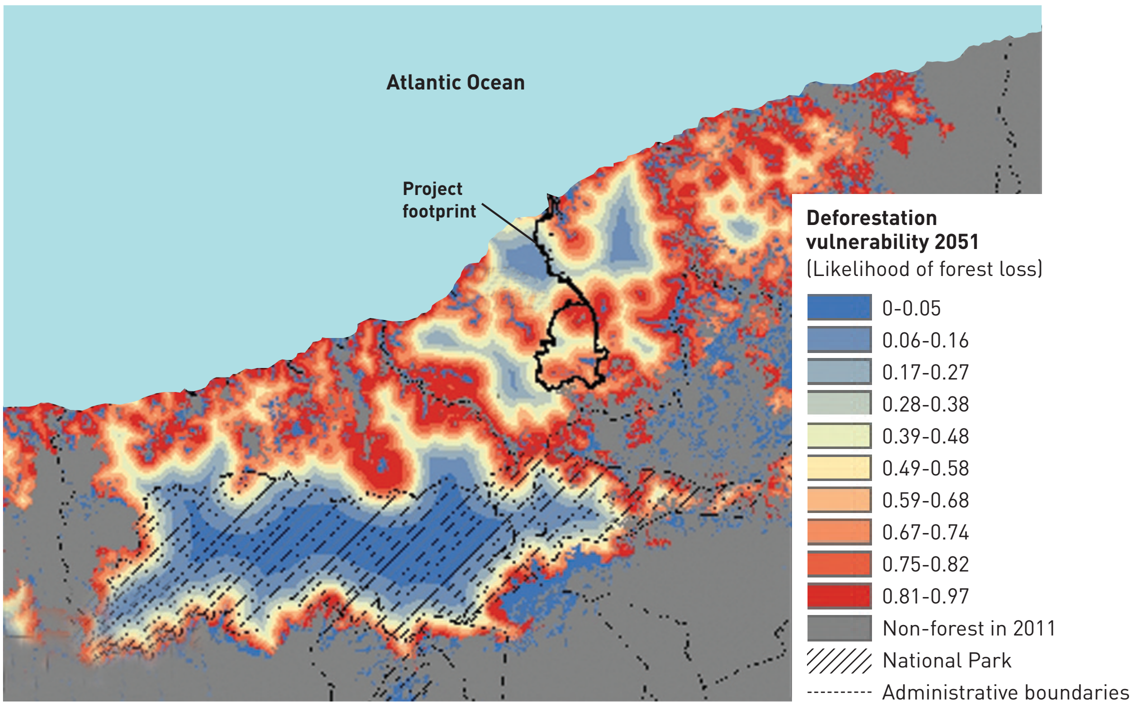
71 Adapted from Ekstrom *et al* (2008). Further information in Gardner *et al* (in prep).
72 http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/WEB_Addressing_Non-permanence_in_CDM_AR_Activities_Information_Note.pdf
73 http://www.environment.nsw.gov.au/resources/greenoffsets/greenoffsets.pdf; http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/202744/Fish-habitat-protection-plan-2---Seagrass.pdf
74 Prepared by: Carlos Sanchez (Minera Panama, S.A.), Craig Ford (Inmet Mining), Jared Hardner and R E Gullison (Hardner & Gullison Associates, LLC).

A land-use change model predicts that without improved management, approximately 79,000ha will be lost to deforestation in this landscape over the next 40 years (Figure 9). Using an "averted loss" approach to offset crediting, the company will accumulate credits for preventing deforestation in these protected areas over this time period, with the goal of averting all 79,000ha of anticipated deforestation in the business-as-usual case.

To ensure that each threatened species inhabiting the area is adequately protected, species distribution maps are being developed based on field sampling, MaxEnt species distribution modelling and field validation of the results. This permits MPSA to determine whether the offset will result in a net benefit for the habitat of each threatened species over the life of the project.

Lessons learned from this undertaking relate to the appropriate scaling of biodiversity offsets. In all cases, the total offset credits expected to accumulate over the life of the mine exceed the area of expected impact by a significant margin. While this may appear generous at first glance, it in fact is required to conserve landscape-scale corridor function and to accommodate uncertainties concerning the numerous species found in the area of which little is currently known. By providing a conservative margin for error with regard to species requirements for the offset, MPSA has greater flexibility in proceeding with mine development as more is learned about the local ecology – an undertaking expected to continue during the life of the mine.

Figure 9: Vulnerability of the landscape to deforestation until 2051



Offsets can generate net benefits from averted loss of ongoing degradation of biodiversity. In this landscape, background deforestation would occur regardless of the project's impacts; the vulnerability of the landscape to deforestation is mapped over the 40-year time period of the Cobre Panama project. Blue areas are least vulnerable, red areas are most vulnerable. Although the project footprint is shown in this map, the analysis did not include the project, and thus serves as the counterfactual scenario to determine the benefits of the offset. An offset site such as the area around the mine may be vulnerable to deforestation. Offset development will thus generate net biodiversity benefits by reducing deforestation in the offset site. Clark Labs conducted this analysis using its IDRISI Land Change Modeler.

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