Biodiversity Offsets:
Policy options for governments

An input paper for the IUCN Technical Study Group on Biodiversity Offsets

Kerry ten Kate and Michael Crowe

FOREST TRENDS

Published by: IUCN, Gland, Switzerland

Citation: ten Kate, K. and Crowe, M.L.A. (2014). *Biodiversity Offsets: Policy options for governments. An input paper for the IUCN Technical Study Group on Biodiversity Offsets*. Gland, Switzerland: IUCN. 91pp.

ISBN: 978-2-8317-1676-3

Cover photo: © Kerry ten Kate

Available from: IUCN (International Union for Conservation of Nature)
Business and Biodiversity Programme
Rue Mauverney 28
1196 Gland
Switzerland
Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org/publications

Acknowledgements: This report was written by Kerry ten Kate, Director of the Biodiversity Initiative and of BBOP at Forest Trends, and Michael Crowe, an independent consultant in Victoria, Australia. The authors are grateful to many people who provided information cited in the report, and for comments from Steve Edwards, Martine Maron and Brendan Wintle.

Contents

Boxes, Figures & Tables

Boxes

Figures

Tables

Take home messages in a page

Governments, companies, banks and civil society are placing more emphasis on the rigorous application of the mitigation hierarchy to avoid, minimize and compensate for projects' impacts on biodiversity. The mitigation hierarchy is a sequence of steps, starting with avoidance of impacts, minimization of inevitable impacts, on-site restoration and finally biodiversity offsets to achieve No Net Loss (NNL) or a Net Gain (NG) in biodiversity.

Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development 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.

There are risks and opportunities associated with policies for NNL/NG and the use of biodiversity offsets, and indeed policies have not always achieved their goals nor been clear as to what is understood by NNL/NG and what is the baseline. The principal opportunities are more and better conservation, improved land-use planning, livelihood and job opportunities. The main risks are the use of unrealistic mitigation commitments to allow inappropriate projects to proceed, and failure to achieve NNL/NG as a result of unclear and inadequate rules and methodologies and the lack of enforcement.

Thirty-nine countries have existing laws or policies on NNL/NG, biodiversity offsets or compensation and 22 countries (some of which already have measures in place) are developing them.

In addition to public policy, a major driver for No Net Loss and a Net Gain of biodiversity in recent years has been the requirement for NNL/NG within the loan conditions for project finance and safeguards policies of at least 80 financial institutions. Principles and standards on biodiversity offsets are available.

Core concepts include: the principles that underpin NNL/NG; the statement of policy itself, whether this is mandatory or voluntary and how it is established in law and guidance; the scope and limits of the policy; the exchange rules governing which residual impacts can be offset by what type of gains; the metrics for measuring loss and gain; land-use and landscape level planning and the location of mitigation measures (especially areas to be avoided and areas suitable for offset activities); identification of the set of activities which can deliver the secure and additional long-term gains needed to offset residual impacts; clarification of which organizations can undertake the offsetting activities and the standards by which they should abide; underlying data and capacity needs; monitoring and enforcement of commitments on avoidance, minimization, restoration and offsetting; and the governance of the system for delivering NNL/NG.

International experience suggests that NNL/NG measures succeed when: measures are in place to improve the application of the mitigation hierarchy, and not simply to plan offsets (the last step); clear, consistent guidance is available, for certainty and to avoid delays; there are clear roles for national, state and local government and good coordination between government departments; performance monitoring and enforcement is ensured through good governance and adequate budgetary provision; clear principles and standards are in place; legal and financial instruments needed to secure long-term implementation are available; proportionate approaches are planned, with more streamlined procedures and simpler baseline studies and metrics for less significant impacts on biodiversity, and full assessments and metrics for more significant impacts; there is a realistic roadmap to develop the NNL/NG system and improve it over a few years; preparation for implementation (including supply) takes place during the policy development phase; good baseline data, mapping and landscape level planning are available; methods that don't deliver NNL/NG (e.g. poor metrics) are avoided; several options for implementation are possible, provided the same standards are met; perverse incentives are removed; and assistance is offered to parties such as developers and offset providers who need to find each other.

Recommended first steps for governments interested in exploring NNL/NG policy options include: fact-finding and gap analysis on the existing policy framework, the availability of biodiversity data and maps, and the socioeconomic costs and benefits associated with introducing NNL/NG policy; and pilot projects. This can lead to integrating biodiversity offsets with land-use planning at the national or regional levels, identifying, analysing and evaluating policy options, formulating policy and designing NNL/NG systems, and implementing, monitoring and reviewing policy.

To complement this work by individual governments, it would be helpful for research to provide a more in-depth and critically rigorous comparative analysis of international experience with mitigation measures, offering evidence on whether they have achieved their policy objectives, such as NNL/NG.

Executive summary

Why this paper?

The purpose of this paper[1] is to contribute to the consideration of policy options by the IUCN Technical Study Group on biodiversity offsets[2] and the subsequent Working Group, and to provide information more broadly to governments and their advisors. It is intended as a basic introduction to policy on No Net Loss (NNL) or a Net Gain of (NG) of biodiversity, and biodiversity offsets. Discussions of technical issues are explored in more depth in the companion piece (Pilgrim and Ekstrom, 2014). This paper reviews current information, but evidence is lacking as to the extent to which NNL/NG and offset policies are achieving their goals or contributing to better biodiversity outcomes in the jurisdictions where they exist. Bearing in mind these limitations, this paper aims to identify policy options at a general level in the anticipation of subsequent discussion and more evidence.

While new projects are essential for development, they are currently a significant cause of today's unprecedented loss of biodiversity, which is recognized as one of the most critical global issues facing humankind. Biodiversity is lost as natural habitats are destroyed and fragmented for agriculture, fisheries, forestry, oil and gas, mining, transport, tourism and the construction of infrastructure. In the search for sustainable development, governments, companies, financial institutions, and civil society are seeking innovative mechanisms to compensate for unavoidable losses to biodiversity and impacts on human well-being and to attract more investment to conservation. Policies specifically aimed to achieve No Net Loss (NNL) or a Net Gain (NG) of biodiversity offer one approach. Efforts are centred on improving the rigour with which the mitigation hierarchy is applied, and in using biodiversity offsets to address residual impacts (which were generally left uncompensated in most planning processes).

No Net Loss, Net Gain and the mitigation hierarchy, including biodiversity offsets

The mitigation hierarchy is a sequence of steps, starting with avoidance of impacts, and where avoidance is not possible, minimization of inevitable impacts, then restoration measures to reverse impacts and bring an area back to its pre-disturbance biodiversity state. Even after these steps, however, a residual impact on biodiversity usually remains, so biodiversity offsets go beyond traditional mitigation and are a final step intended to achieve NNL or a NG in biodiversity following development impacts.

According to the definitions we use in this paper, the term 'mitigation measures' refers to the full suite of steps in the mitigation hierarchy, including biodiversity offsets. 'Biodiversity offsets' are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development 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.

Risks & opportunities

- There are risks and opportunities associated with policies for NNL/NG and the use of biodiversity offsets. The principal opportunities are more and better conservation, improved land-use planning, livelihood and job opportunities. The main risks are the use of unrealistic mitigation commitments to allow inappropriate projects to proceed, and failure to achieve NNL/NG as a result of unclear and inadequate rules and methodologies and the lack of enforcement.

NNL/NG policies and processes

Thirty-nine countries have existing laws or policies on NNL/NG, biodiversity offsets or compensation and 22 countries (some of which already have measures in place) are developing them. In addition to public policy, a major driver for No Net Loss and a Net Gain of biodiversity in recent years has been the requirement for NNL/NG within the loan conditions for project finance and safeguards policies of at least 80 financial institutions. Principles and standards on biodiversity offsets are available. Governments tend to approach NNL policy through a series of steps, starting, typically, with a regulatory instrument and

[1] This paper is based on a document contributed by the authors to the Business and Biodiversity Offsets Programme (BBOP) in 2010.
[2] The IUCN Technical Study Group on biodiversity offsets was set up in November 2013 by the IUCN Secretariat. See ten Kate and Pilgrim (2014, in press).

putting in place or improving the complementary information, maps, planning tools, strategies, guidance and training for effective implementation of the policy instruments over the following years. Systems in Australia and the USA, for instance, took well over a decade to develop the suite of policy measures, tools and information needed to operate effectively, particularly where implementation is through market-based systems such as conservation banking and biodiversity credits.

Core concepts in NNL/NG policy

Section 2 of the paper outlines the basic concepts in NNL/NG policy, including the principles underlying NNL/NG and offsetting policy, typical statements of policy and their scope and limits, exchange rules according to which the kind of biodiversity needed for an offset is defined, and the metrics that quantify losses and gains. Land-use planning and marine planning are vital for defining and locating appropriate mitigation measures. Spatial planning thus represents a significant responsibility for policy-makers. Another basic concept is the definition of the activities that create additional conservation outcomes and qualify as the 'gains' to offset the residual losses of biodiversity.

Governance

The manner in which governments set out and run the rules on the rights and responsibilities related to delivering NNL/NG is fundamental to the success of policy implementation. Governance issues embrace planning permission, social and environmental impact assessment, conservation prioritization, granting authority to organizations to play their part in the system (for instance, delegated authority for local governments, or accreditation of private sector organizations to undertake assessment and verification of mitigation measures), and verification and enforcement of the performance of mitigation measures (including offsets). A particularly important aspect of governance for NNL/ NG is coordination between different ministries and departments within government.

Principles

National laws and circumstances vary widely around the world, so there is no single 'correct' approach to designing and implementing mitigation measures (including biodiversity offsets) to demonstrate NNL/NG, nor to introducing national policy and regulation on this topic. In recognition of this, some laws, policies and standards take a principles-based approach. Provided the principles are adhered to, there is room for flexibility and tailoring the approach to reflect the specific circumstances, and a number of different ways in which mitigation measures including biodiversity offsets can be designed and implemented and their success verified.

The EU NNL Working Group in 2013 considered clusters of principles and drew on the set of basic principles developed and agreed by all the members of the Business and Biodiversity Offsets Programme. The BBOP Principles incorporate principles found in international and national law and policy, financial safeguard policies and voluntary best practice from around the world and have subsequently been used and adapted in several other policies and standards. They provide that: developers must adhere to the mitigation hierarchy; limits to what can be offset must be recognized; projects and offsets should be planned within a landscape context; offsets should be designed and implemented to achieve no net loss or a net gain of biodiversity; offsets should achieve additional conservation outcomes; stakeholders should be involved effectively in design and implementation; offsets should be designed and implemented in an equitable manner; planned to secure outcomes that last at least as long as the project's impacts and preferably in perpetuity, undertaken and communicated transparently; and document the appropriate use of sound science and traditional knowledge.

Standards

Principles are generally high level and aspirational, so if they are to form the basis of NNL/NG policy, they need to be accompanied by clear implementation rules. One approach is to embed the principles within standards that set out independently verifiable and auditable criteria and indicators that enable governments and the developers themselves to tell whether the principles have been applied properly. The BBOP Standard on Biodiversity Offsets published in January 2012 was developed along these lines. Governments operating NNL/NG systems frequently promulgate a number of standards to which third parties taking part in the system must adhere, including standards on use of the exchange rules and metrics for the assessment of losses and gains, and standards for the long-term management and performance of biodiversity offsets (including through conservation banks and provision of biodiversity credits).

Policy options The paper introduces typical policy options for which individuals and organizations can implement biodiversity offsets. There are three main approaches: (i) developer-initiated ('first party offsets'); (ii) 'third party' offsets through in lieu fees; and (iii) market mechanisms, namely conservation banks and biodiversity credits. Governments typically consider market mechanisms if they wish to encourage landowners, communities and companies to undertake conservation activities and provide them as offsets through conservation banking and the generation and sale of biodiversity credits.

The paper considers the data and capacity needs of government if it is to run effective NNL/NG polices and offsetting systems, and the vital role of government in monitoring and enforcement. It also offers some observations from experience with the governance of a NNL/NG system. The paper explores various different kinds of offsets (namely, voluntary, regulatory, prospective, retrospective, composite and aggregated offsets) and the policies and legal provisions that give effect to NNL/NG. Governments can introduce NNL/NG and biodiversity offsetting policy and regulation in two basic ways: (i) through specific provisions on mitigation including biodiversity offsets; and (ii) by incorporating provisions on mitigation including offsetting into other laws and policies that deal with environmental impact assessment (EIA), land-use planning, strategic environmental assessment, sectoral policies or broader sustainable development or environmental policies. The decision on which approach to take depends to some extent upon the legal customs of the jurisdiction concerned, and also upon the scope of the other laws relative to the intended scope for NNL/NG requirements.

Roles of government Government is faced with a broad range of potential roles in designing and administering NNL/ NG policies and offsetting systems, as outlined in Section 3. Perhaps most obviously, it is the policy-maker and regulator, a role in which it must weigh up the risks and opportunities of policy options and take into consideration the views of stakeholders as to the desirability and nature of NNL/NG policies. Government can also be the provider, curator and source of authoritative biodiversity data, a buyer and seller of offsets, a broker helping developers needing offsets to find the individuals, communities and organizations that can supply them, and the operator of the registry of credits. Government has an important role in setting standards for the various activities within the system (particularly assessment of mitigation measures, loss-gain calculations, biodiversity offset management plans, and generation of biodiversity credits by third parties). Government is also responsible for the processes that ensure the permanence of mitigation measures. A vital role of government is as monitor and enforcer of NNL/NG policy and of developers' and offset providers' individual project commitments under this policy. Given this variety of roles, probity is vital, and government must identify and manage potential conflicts of interest between these roles. Finally, if policy is to encourage third-party individuals, communities and organizations to generate and supply offsets, government has certain functions in stimulating and regulating the market.

Costs Planning for NNL/NG inevitably involves some costs, and the principal cost categories in developing and implementing NNL/NG policy are identified in Section 4. These vary from country to country and need to be estimated on a case-by-case basis, but experience has shown that it can take several years and the input of a variety of expertise to develop NNL/NG policy and establish an operating scheme. Government can recover these costs in part or in full by charging fees for the services provided to the users of the offset scheme. The main sources of cost in the policy development process are: preparing and analysing policy options, selecting and preparing policies and writing guidelines, creating of any new legislation needed or amendments to existing legislation, preparing standard forms and procedures (and accompanying guidance manuals for users), improving biodiversity information systems (collection, storage, analysis). Once a NNL/NG policy is under way, the principal costs of operating it include the assessment of individual development proposals, specification of mitigation measures based on like-for-like-or better criteria and loss/gain metrics; a case management system that documents the flow of applications through the process, monitoring and compliance of on-site mitigation measures (i.e. avoidance, minimization and restoration) and of offset sites; and communications (websites, information sheets, brochures).

In a regulated context where offsets are supplied through a credit market, there are likely to be costs associated with establishing and operating a credit register and developing guidelines for any mechanisms to facilitate transactions, such

as ‘over the counter’ methods for the smallest impacts. Costs associated with the role of brokers (which may be served by government) include the recruitment of suppliers including site assessment, preparation of management plans and calculation of biodiversity gains; dealing with enquiries for offsets from developers and matching these to supply, managing databases of buyers and suppliers, facilitating transactions between buyers and sellers through negotiation or bidding, arranging and executing contracts of sale and managing contracts for site management and reporting to compliance authorities

Lessons learned

Section 5 sets out some of the lessons that have been learnt from the experience in various countries from designing and operating NNL/NG and biodiversity offset policy and programmes. Experience suggests that policy on NNL, NG and biodiversity offsets needs to be clear and definitive about how to ensure adequate measures for avoidance and minimization, and whether and when offsets are required, and should remove ambiguity about the meaning of NNL and NG and the baselines against which these goals are to be measured. Policy should be based on sound principles and allow some flexibility and options as to how these are to be applied, subject to clear rules that specify the outcomes expected and set out basic requirements such as exchange rules, metrics and standards for delivery. If the objective is to achieve a comprehensive NNL/NG policy, then regulation is required so developers are obliged to demonstrate NNL/NG, but the rules should be kept as simple as possible. If the system allows offsets to be delivered by third parties, it is important to create legal certainty about the circumstances that give rise to a demand for offsets, the property rights of credits and the security of offset sites to enable people to make investments.

Streamlined, coordinated processes between different levels and departments of government are a key part of good governance. Guidance and examples set out in clear and authoritative publications are important for people to know what to do and what to expect from the system in terms of cost, time and support. NNL/NG policy requires biodiversity data and mapping as the basis for implementation. Since comprehensive nation-wide and consistent datasets and detailed biodiversity maps at a fine scale may not be available from the outset, it is important to have a plan for improving this over time, and also to take into account from the outset the uncertainties created by the limitations of information and methods, in order to avoid unintended losses of biodiversity. Adequate monitoring and enforcement of offset requirements are absolutely critical to success. Past failures have often been associated with lack of monitoring and enforcement of environmental impact assessment (EIA) or mitigation measures, including offset requirements. Adaptive learning, based on monitoring of experience, is recommended to help policy design and implementation evolve. Experience shows that governments do not put all the elements of a NNL/NG system in place at one time, but that the system develops over a period of years. It is wise to set out a ‘roadmap’ with a plan over a few years for developing key parts of the NNL/NG strategy, such as rules and guidelines, data gathering and capacity building, pilot approaches and market mechanisms.

Recommendations

Finally the paper outlines suggested ways forward for governments interested in exploring NNL/NG policy options. The recommended steps start with fact-finding and gap analysis on the existing policy framework, the availability of biodiversity data and maps, and the socioeconomic costs and benefits associated with introducing NNL/NG policy; and pilot projects. This can lead to integrating biodiversity offsets with land-use planning at the national or regional levels, identifying, analysing and evaluating policy options, formulating policy and designing NNL/NG systems, and implementing, monitoring and reviewing policy.

The paper ends with two appendices: one offers more detail on a variety of definitions of the key terms summarized in Section 1, and the second consists of a table listing countries where there is some form of law, policy and/or practical experience of NNL/NG, biodiversity offsets and biodiversity compensation.

1. INTRODUCTION

1.1 Context and background

1.1.1 Why the interest in No Net Loss (NNL) and a Net Gain (NG) of biodiversity?

While new projects are essential for development, they are currently a significant cause of today's unprecedented loss of biodiversity, which is recognized as one of the most critical global issues facing humankind.[3] Biodiversity is lost as natural habitats are destroyed and fragmented for agriculture, fisheries, forestry, oil and gas, mining, transport, tourism and the construction of infrastructure. In the search for sustainable development, governments, companies, financial institutions, and civil society are seeking innovative mechanisms to compensate for unavoidable losses to biodiversity and impacts on human well-being and to attract more investment to conservation.

According to the definition we shall use in this paper, biodiversity offsets are designed to achieve no net loss (NNL) or a net gain (NG) of biodiversity in the context of development projects, following rigorous measures to avoid and minimize impacts. By addressing the residual impacts after avoidance and minimization, offsets go beyond traditional mitigation, and encourage developers to take comprehensive responsibility for their impacts. Interest in this approach is growing as the potential of biodiversity offsets to help achieve wider goals of conservation, wise land-use planning and sustainable development is increasingly appreciated. Governments see NNL/NG policies and biodiversity offsets as one approach to balancing economic development with the public interest in protecting biodiversity and achieving the CBD's 2020 strategy commitments.[4] The experience in various countries over decades of implementing compensation and NNL/NG policies has only met with partial success. As this paper will explore, there is a fair level of agreement on the features of NNL/NG, offset and compensation policies that make them a success, and useful lessons to be learned from past experiences both of success and failure.

1.1.2 The purpose and structure of this paper

The purpose of this paper[5] is to contribute to the consideration of policy options by the IUCN Technical Study Group on biodiversity offsets,[6] and the subsequent Working Group, and to provide information more broadly to governments and their advisors. It is intended as a basic introduction to NNL/NG and biodiversity offsets policy. We recognize that many of the issues presented here are complex and will benefit from more in-depth and detailed research and discussion, and we would like to start with four important points about the scope and nature of this paper. First, it is intended as a companion piece to a paper which covers the technical issues involved (Pilgrim and Ekstrom, 2014), and thus discussions of technical issues are kept to a minimum in this document. Second, this paper sets out the opinions and experience of the two authors and is not a reflection of the position of IUCN or its Members. Third, this paper was prepared at the request of IUCN within a short time. It is a discussion of policy options for government and the assignment from IUCN did not allow for new research or a thorough comparative analysis of the content and effectiveness of the many policy instruments around the world related to the mitigation hierarchy, NNL/NG, offsets and compensation and the mitigation referred to in Appendix 2. Fourth, one of the authors' principal conclusions is that evidence (particularly in the form of peer reviewed papers) is lacking in most settings as to the extent to which NNL/NG and offset policies are achieving their goals or even contributing to

[3] Secretariat of the Convention on Biological Diversity, 2010a.
[4] Secretariat of the Convention on Biological Diversity, 2010b.
[5] This paper is based on a document contributed by the authors to the Business and Biodiversity Offsets Programme (BBOP) in 2010.
[6] The IUCN Technical Study Group on biodiversity offsets was set up in November 2013 by the IUCN Secretariat. See ten Kate and Pilgrim (2014, in press).

better biodiversity outcomes in the jurisdictions where they exist. There is an urgent need to investigate this empirically. Bearing in mind these limitations to this paper, its main aim is to identify policy options at a general level in the anticipation of subsequent discussion and more evidence.

In preparing this paper, the authors identified the principal topics relevant to policy-makers exploring options for developing policies related to the mitigation hierarchy, NNL/NG, based on the content and processes for developing and implementing policy in a range of countries where these already exist (particularly the USA, Australia and Europe) and some countries with policies under development. To summarize the issues under each heading, we drew on available literature, our personal experience working on these issues in at least 17 countries, and information from presentations by and discussions with experts from around the world over several years, including in a series of meetings under the auspices of the Business and Biodiversity Offsets Programme (BBOP). The paper builds on a document contributed by the authors to BBOP in 2010. It has taken into consideration comments received on that paper as well as comments by two independent individuals appointed by IUCN to review a draft of this paper in March 2014, and a member of the IUCN Secretariat.

Section 1 starts with definitions of some key terms, including the mitigation hierarchy which provides the basis for achieving NNL/NG and the context for biodiversity offsets. (A fuller set of definitions of various terms used is included in Appendix 1). Then we examine the background and trends in government, business, banks and civil society that are leading to the growth in commitments to NNL/NG and the greater use of biodiversity offsets. We review the number of governments with related policies, and the multi-year processes under which these evolve and are implemented.

Section 2 outlines the basic concepts involved, including: (i) the principles underlying NNL/NG and offsetting policy and typical statements of policy and their scope and limits; (ii) core defining issues such as the exchange rules according to which the kind of biodiversity needed for an offset is defined as well as the metrics that quantify losses and gains; (iii) the importance of land-use planning and landscape level planning in order to define appropriate mitigation measures; (iv) the activities that create additional conservation outcomes and qualify as the 'gains' to offset the residual losses of biodiversity; (v) typical options for the individuals and organizations that can implement biodiversity offsets; (vi) the data and capacity needs of government if it is to run effective NNL/NG polices and offsetting systems; (vii) the vital role of government in monitoring and enforcement; (viii) and some observations about governance of a NNL/NG system. We introduce various different kinds of offsets and the policies and legal provisions that give effect to NNL/NG, including specific policy and law on NNL/NG and biodiversity offsets and integrating provisions on NNL/NG and biodiversity offsets into other relevant policy and law such as environmental impact and strategic environmental assessments. After exploring the different ways of implementing biodiversity offsets, this section looks at some of the key aspects involved if government wishes to encourage landowners, communities and companies to undertake conservation activities and provide them as offsets through a market mechanism such as conservation banking and the generation and sale of biodiversity credits.

Section 3 identifies the various possible roles of government in offsetting schemes, including the most obvious one as policy-maker or regulator, and also as provider, curator and source of authoritative biodiversity data, buyer and seller of offsets, broker, operator of register of credits, in standard setting, as provider of processes to ensure the permanence of offsets, and as monitor and enforcer. The section also runs through the importance to government of probity, namely in identifying and managing conflicts of interest between these roles, and finally considers the function of government in creating a market, if a market mechanism is to be considered as one way of achieving NNL/NG.

In Section 4, the main sources of the cost of developing and implementing NNL/NG policy are identified. These vary from country to country and need to be estimated on a case-by-case basis, but experience has shown that it can

take several years and the input of a variety of expertise to develop NNL/NG policy and establish an operating scheme. Government can recover these costs in part or in full by charging fees for the services provided to the users of the offset scheme. The main sources of cost in the policy development process are: preparing and analysing policy options, selecting and preparing policies and writing guidelines, creating of any new legislation needed or amendments to existing legislation, preparing standard forms and procedures (and accompanying guidance manuals for users), and improving biodiversity information systems (collection, storage, analysis). Once a NNL/NG policy is under way, the principal costs of operating it include: the assessment of individual development proposals, specification of mitigation measures based on like-for-like-or better criteria and loss/gain metrics, a case management system that documents the flow of applications through the process, monitoring and compliance of on-site mitigation measures (i.e. avoidance, minimization and restoration) and of offset sites, and communications (websites, information sheets, brochures).

In a regulated context where offsets are supplied through a credit market, there are likely to be costs associated with establishing and operating a credit register and developing guidelines for any mechanisms to facilitate transactions, such as 'over the counter' methods for the smallest impacts. Costs associated with the role of brokers (which may be served by government) include the recruitment of suppliers including site assessment, preparation of management plans and calculation of biodiversity gains, dealing with enquiries for offsets from developers and matching these to supply, managing databases of buyers and suppliers, facilitating transactions between buyers and sellers through negotiation or bidding, arranging and executing contracts of sale and managing contracts for site management and reporting to compliance authorities.

Section 5 sets out some of the lessons that have been learnt from the experience in various countries from designing and operating NNL/NG and biodiversity offset policy and programmes. Finally the paper outlines suggested ways forward for governments interested in exploring biodiversity offset policy options. The recommended steps are:

- Fact-finding and gap analysis – policy
- Fact-finding and gap analysis – biodiversity data
- Fact-finding– cost-benefit analysis
- Pilot projects
- Integrating biodiversity offsets with land-use planning at the national or regional levels
- Identify, analyse and evaluate policy options
- Policy formulation and system design
- Implementation of policy, monitoring and review.

There are two appendices: one offers more detail on a variety of definitions of the key terms summarized in Section 1, and the second consists of a table listing countries where there is some law, policy and/or practical experience of NNL/NG, biodiversity offsets and biodiversity compensation.

1.1.3 The international context

Starting in 2004 and continuing today, a number of international and intergovernmental processes have begun to address and are developing guidance and policy on NNL, NG and biodiversity offsets. They are presented here in chronological order:

The Business and Biodiversity Offsets Programme: 2004 to date

In 2004, Forest Trends established the Business and Biodiversity Offsets Programme, a collaboration initially of some 40 (now 80) governments, companies, NGOs and financial institutions developing best practice on biodiversity offsets, of which IUCN was a founding member. BBOP has developed 'Principles on Biodiversity Offsets' supported by all its members (incorporating principles found in international and national law and policy, financial safeguard policies and voluntary best practice from around the world). Other products from BBOP include guidelines and methodologies on offset design, cost-benefit for communities and implementation, resource papers, case studies and a glossary. In January 2012, BBOP published the 'Standard on Biodiversity Offsets' with accompanying guidance notes.[7] BBOP's Secretariat is provided by Forest Trends and the Wildlife Conservation Society, and its strategy is set by a rotating Executive Committee comprising one government, two NGOs, two companies, one bank and a member of the Secretariat elected by all the members of the Advisory Group. The focus of BBOP's work is now to improve the Standard on Biodiversity Offsets based on practical experience of using it and to coordinate an international community of practice.

Convention on Biological Diversity: Decisions from 2006 to 2012

In March 2006, the Conference of the Parties to the Convention on Biological Diversity took its first decision on biodiversity offsets at its eighth meeting,[8] noting that contributions from business and industry towards the implementation of the Convention and its 2010 target could be facilitated by work under the Convention to develop guidance for potential biodiversity offsets in line with the objectives of the Convention.

At COP9 in 2008, decisions on implementation of the CBD's financial articles set out a goal to explore new and innovative financial mechanisms to increase funding to support the Convention's objectives, including consideration of "biodiversity offset mechanisms where relevant and appropriate while ensuring that they are not used to undermine unique components of biodiversity".[9] The same meeting took a decision on protected areas that invited Parties to explore the potential of biodiversity offsets as a financing mechanism[10] and the decision on promoting business engagement[11] set out a framework of priority actions on business which invited the Executive Secretary, in collaboration with relevant organizations and initiatives, such as the Business and Biodiversity Offsets Programme (BBOP), to compile and/or make available case studies, methodologies, tools and guidelines on biodiversity offsets and relevant national and regional policy frameworks. (After this, BBOP published its Principles, guidelines and handbooks, resource papers, case studies and glossary, making them available to the CBD Secretariat and Parties.)

At COP10 in 2010, Parties were invited "to identify a range of options for incorporating biodiversity into business practices that take into account existing developments under various forums, including relevant institutions and non-governmental organizations, such as the Business and Biodiversity Offsets Programme". This meeting also encouraged businesses and the private sector "to adopt commitments to support the achievement of the three objectives of the Convention, for instance, through the approaches set out in the Jakarta Charter and other

[7] BBOP, 2012a.
[8] CBD COP VIII Decision 17 (Private-sector engagement).
[9] CBD COP IX Decision 11 (Review of implementation of Articles 20 and 21).
[10] CBD COP IX Decision 18 (Protected Areas).
[11] CBD COP IX Decision 26 (Promoting business engagement).

initiatives at both national and global levels". (The Jakarta Charter states that "The concept of no-net-loss of biodiversity and net-positive impact, as articulated by the Business and Biodiversity Offsets Programme, is a practical framework for assessing efforts to implement the Convention on Biological Diversity.") The Executive Secretary of the CBD was also requested to encourage the development and application of tools and mechanisms to facilitate engagement of businesses in integrating biodiversity concerns into their work, such as biodiversity offsets.[12]

Most recently, at COP11 in 2012, one decision[13] urges governments to create the enabling environment to mobilize private and public-sector investments in biodiversity, and requests the Executive Secretary to develop a discussion paper on safeguards for scaling-up biodiversity finance and possible guiding principles for submission to the next meeting of the Working Group that reviews implementation of the CBD (WGRI5, June 2014), ready for consideration by COP12 in Korea in October 2014. Submissions are also invited of views and lessons learnt on the risks and benefits of innovative financial mechanisms (which could include biodiversity offsets), including on possible principles and safeguards for their use, in time for consideration by WGRI-5 and COP12. Another decision[14] considers the mobilization of additional resources and urges governments to seek funding support from diverse sources including through private-sector involvement. (Although the Decision doesn't mention them, biodiversity offsets could be one such private sector source.) A third decision[15] calls on businesses to continue liaising with national governments, civil society organizations, academia and other stakeholders to formulate relevant actions for biodiversity conservation that are aligned with the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets, and also calls upon businesses to consider the revised 2012 International Finance Corporation Performance Standards (which integrate no net loss and a net gain – see section 1.3.5 of this report). It also invites Parties to: (i) consider promoting the integration of biodiversity and ecosystem services values into private sector activities; (ii) consider policies and legislation that halt biodiversity loss and reduce incentives, including subsidies, that are harmful to biodiversity; and (iii) adopt policies that respect the goals and objectives of the Convention and the Aichi Biodiversity Targets.

More broadly, in the context of these decisions and the ongoing work under the Convention, biodiversity offsets may have a role to play in helping the 193 Parties to the Convention on Biological Diversity to meet their commitment to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication".[16]

Biodiversity offsets are likely to be considered in the context of biodiversity safeguarding in discussions on the use of innovative financial mechanisms at the CBD's Working Group on Review of Implementation of the Convention in June 2014, and then at the twelfth meeting of the Conference of the Parties in Korea in October 2014.[17]

The EU No Net Loss Initiative: 2011 to 2015

In December 2011, the European Council adopted conclusions on the implementation of the EU 2020 biodiversity Strategy, followed by a resolution of the European Parliament in 2012. A headline target is "Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss." Target 2 under the strategy states that: "by 2020, ecosystems and their services are maintained and enhanced through the establishment of Green

[12] CBD COP X Decision 21 (Business Engagement).
[13] CBD COP XI Decision 4 (Review of implementation of the strategy for resource mobilization, including the establishment of targets).
[14] CBD COP XI Decision 5 (Financial mechanism).
[15] CBD COP XI Decision 7 (Business and biodiversity).
[16] CBD COP X Decision 2 (Strategic Plan for Biodiversity 2011-2020. See https://www.cbd.int/decision/cop/?id=12268).
[17] Secretariat of the Convention on Biological Diversity, 2013.

Infrastructure and the restoration of at least 15% of degraded ecosystems" and Action 7 under this heading is "to ensure no net loss of biodiversity and ecosystem services". The Council agreed that "a common approach is needed for the implementation in the EU of the No Net Loss principle" and invited the European Commission to address this as part of "the preparation of its planned initiative on No Net Loss by 2015", requesting discussions with Member States and stakeholders on "the clear definition, scope, operating principles and management and support instruments". The 2020 roadmap to a resource efficient Europe is also to put forward proposals to foster investments in natural capital, including through the 'No net loss' initiative (2015).

A resolution by the European Parliament in April 2012 urged the Commission to develop an effective regulatory framework based on the 'No Net Loss' initiative, taking into account the past experience of the Member States while also utilizing the standards applied by the Business and Biodiversity Offsets Programme. It noted the importance of applying such an approach to all EU habitats and to species not covered by EU legislation.

A 'No Net Loss Working Group' comprising was established in February 2011 and worked until May 2013, producing papers setting out recommendations on the NNL Scope and Objectives, Operational principles, a Glossary of terms, and Management and Support Instruments.

The European Commission and Member States will take these recommendations into consideration alongside other sources of information when defining the No Net Loss Initiative.

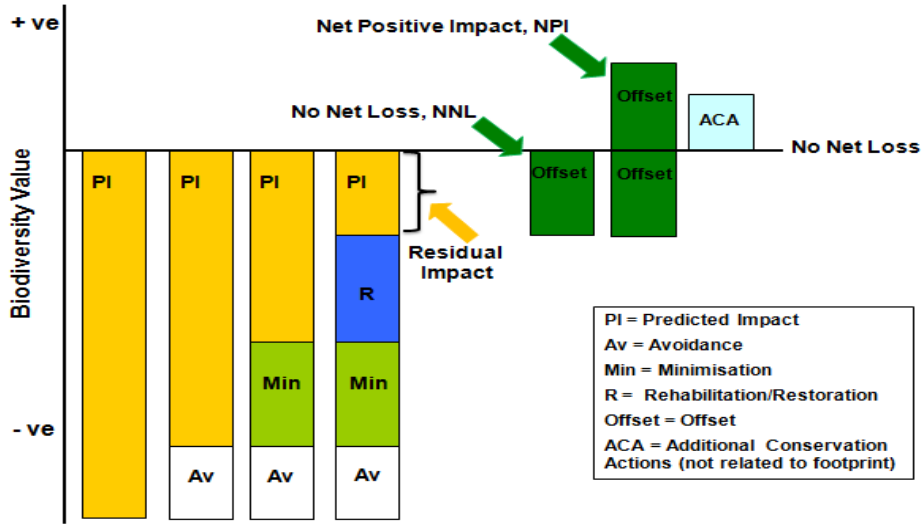
IUCN's work on biodiversity offsets (2012 to date):

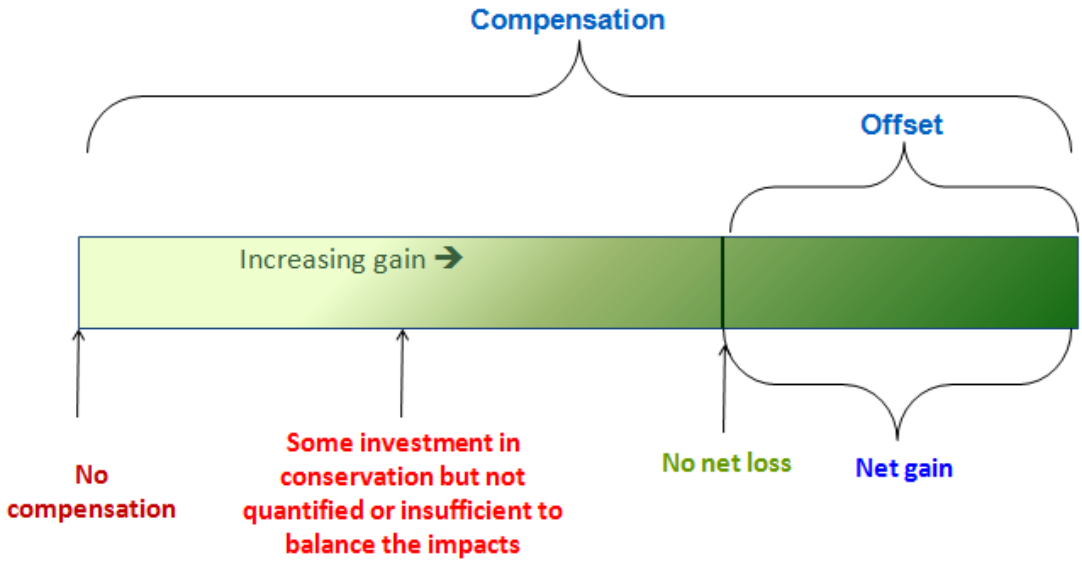
At the World Conservation Congress in Jeju in 2012, IUCN Members adopted Resolution 110, which requires the Director General to establish a working group to develop an IUCN general policy on biodiversity offsets. The Working Group is expected to develop policy recommendations on biodiversity offsets, for consideration by IUCN Council by the end of 2014. Resolution 110 also requests that the Secretariat continues to: "contribute to the current state of knowledge about the practical implementation of biodiversity offsets by (a) undertaking project work with partners, IUCN Members and Commissions and (b) the sharing of experiences." IUCN's policy development process will be implemented in two phases: a Technical Study Group will undertake preparatory analytical work investigating unresolved technical and policy issues related to biodiversity offsets, to result in a brief technical paper; then, drawing from the work of the Technical Study Group and under the guidance of the IUCN Council, a Working Group will analyse policy options and propose a draft IUCN biodiversity offset policy to IUCN Council by October 2015.

1.2 Definitions

A range of different definitions can be found for 'mitigation', 'biodiversity offsets', 'compensation', 'no net loss', 'net gain' and 'net positive impact', together with the core concepts that lie behind these terms, such as 'additionality', 'ecological equivalence', 'metrics' and 'permanence'. These vary according to the political, legal, social and ecological context in which the terms are used, the users (whether government or the private sector, for instance) and the language. For instance, some terms (such as 'mitigation') have different meanings in different countries, while some languages (such as French, Spanish and Swedish) have no separate word for 'offsets' and use 'compensation' to cover both concepts. The variety of terminology used to describe these concepts has caused confusion in international discussions and dialogue between government, the private sector and civil society, however, recent publications (for instance, those by the European Commission, BBOP and the IFC) reveal a number of commonalities, as this section will discuss.

A range of definitions of some of these key terms is discussed in Appendix 1. For the purposes of this paper, we shall use the following definitions, in Box 1:

Box 1: Definitions used in this paper	
Term & source	**Definition**
Biodiversity offsets **BBOP, 2012e**	Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development 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.
Mitigation hierarchy **BBOP, 2012e**	The mitigation hierarchy comprises: a. **Avoidance**: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity. This results in a change to a 'business as usual' approach. b. **Minimization**: measures taken to reduce the duration, intensity and / or extent of impacts that cannot be completely avoided, as far as is practically feasible. c. **Rehabilitation / restoration:** measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and / or minimized. d. Compensation or **Offset**: measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimized and / or rehabilitated or restored. Biodiversity offsets are measures taken to achieve no net loss or a net gain of biodiversity for at least as long as the project's impacts. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, where there is imminent or projected loss of biodiversity. Compensation, or compensatory mitigation, is a set of measures that address residual impacts but are not quantified to achieve no net loss or not secured for the long term.  Adapted from Rio Tinto & Govt of Australia
Mitigation measures	The full set of activities covering the entire mitigation hierarchy.
Compensation **BBOP, 2012a**	Measures to recompense, make good or pay damages for loss of biodiversity caused by a project. In some languages 'compensation' is synonymous with 'offset', but in this paper 'compensation' is a more general term of which biodiversity offsets are just one subset. Compensation may achieve NNL/NG (in which case it is an offset), but in other cases compensation can involve reparation that

	falls short of achieving no net loss (and is therefore not an offset). This can be for a variety of reasons, including that: (i) the conservation actions were not planned to achieve no net loss; (ii) the residual losses of biodiversity caused by the project and gains achievable by compensation are not quantified; (iii) no mechanism for long-term implementation has been established; (iv) it is impossible to offset the impacts (for instance, because they are too severe or pre-impact data are lacking, so it is impossible to know what was lost as a result of the project); or (v) the compensation is through payment for training, capacity building, research or other outcomes that will not result in measurable conservation outcomes on the ground. 
No Net Loss and Net Gain **BBOP, 2012e**	A target for a development project in which the impacts on biodiversity caused by the project are balanced or outweighed by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset the residual impacts, so that no loss remains. Where the gain exceeds the loss, the term 'net gain' may be used instead of no net loss. No net loss (or net gain) of biodiversity is a policy goal in several countries, and is also the goal of voluntary biodiversity offsets.
Additionality **McKenney & Kiesecker, 2010.**	The need for a compensation measure to provide a new contribution to conservation, additional to any existing values, i.e. the conservation outcomes it delivers would not have occurred without it.
Ecological equivalence **BBOP, 2012e**	In the context of biodiversity offsets, the term is synonymous with the concept of 'like for like' and refers to areas with highly comparable biodiversity components. This similarity can be observed in terms of species diversity, functional diversity and composition, ecological integrity or condition, landscape context (e.g., connectivity, landscape position, adjacent land uses or condition, patch size, etc.), and ecosystem services (including people's use and cultural values).

The meaning of 'No Net Loss' and 'Net Gain'

Underlying questions that we shall explore briefly in this paper and which are reviewed in ten Kate and Pilgrim (2014, in press) are: what is the meaning of 'No Net Loss' and 'Net Gain' as concepts, and are the two concepts very similar or quite different? As we shall explore during this paper, the policy objective adopted by governments, companies and banks varies: some espouse No Net Loss (NNL), some a Net Gain (NG) or the equivalent concept of Net Positive Impact, and some a looser objective. Some policies call for NNL in certain circumstances and a NG in others. When the balance of loss and gain has only just tipped over in favour of net gain, NNL and NG can be very similar outcomes. In other cases, the conservation gains provided by an offset may be a large multiple of the

residual losses of a project, in which case the difference between the NG outcome achieved and NNL is considerable. Given this variation and the range of possible policy objectives, we shall use 'NNL/NG' throughout this paper, and recommend that the policy goal is at the very least to achieve no net loss of biodiversity, and preferably the level of net gain that can secure the future abundance and function of ecosystems, habitats and species, together with the valuable ecosystems that biodiversity provides. Whether the goal is NNL or a NG, the baseline against which this is measured needs to be specified for the concept to be clear. Different baselines are used in different settings, so that the meaning of NNL/NG can vary considerably in practice.

Mitigation measures, including offsets

The NNL/NG outcome is achieved by the rigorous application of the mitigation hierarchy. In some cases, it may be possible to arrive at NNL/NG by avoidance, minimization and restoration measures in the area affected by the project. In such cases, a biodiversity offset is not needed. Biodiversity offsets are thus only relevant in some cases, and indeed there are situations in which they are simply not possible or unlikely to be successful. Throughout this paper, we focus on the NNL/NG outcome that is achieved by using the full suite of mitigation measures, and hence frequently use NNL/NG since it is important to work across the board on avoidance, minimization and on-site restoration, and not to focus exclusively on biodiversity offsets.

1.3 A brief history of NNL/NG and biodiversity offsets

1.3.1.1

Interest in ensuring NNL/NG continues to grow. Efforts are centred on improving the rigour with which the mitigation hierarchy is applied, and in using biodiversity offsets to address residual impacts (which were generally left uncompensated in most planning processes). There are four main drivers for the increasing commitment to NNL/NG and the use of biodiversity offsets:

- Governments are exploring and introducing NNL/NG policy, including the use of biodiversity offsets;
- Companies are making voluntary corporate commitments to NNL/NG for business reasons and undertaking mitigation measures including biodiversity offsets. (The business case for companies is described in Box 8);
- Banks and investors are requiring NNL/NG of biodiversity (including the use of biodiversity offsets, where appropriate) as a condition for access to credit or investment; and
- NGOs and civil society groups are holding developers and government accountable for demonstrating significant conservation outcomes for biodiversity, and are protesting against poor performance.

1.3.2 Risks and opportunities associated with NNL/NG and particularly with biodiversity offsets

This section outlines some of the principal opportunities and risks associated with policies relating to the mitigation of impacts on biodiversity, NNL/NG and especially the role of biodiversity offsets. It then considers some of the competing and sometimes contradictory views governments may hear from different stakeholders when canvassing society's opinion on policy reform in this area. The task of government is to weigh up the risks and opportunities, taking into consideration stakeholders' views on them, and to arrive at the best solution for sustainable development in its particular context.

Opportunities associated with biodiversity offsets

Policy-makers are exploring biodiversity offsets because of their apparent potential to offer conservation, development and social benefits.

Properly applied, biodiversity offsets can achieve more and better conservation outcomes than typically result from the planning of mitigation measures for development projects, which generally stop after the 'avoid, minimize and restore' stages, lacking the 'offset' and thus leaving residual impacts uncompensated. Mitigation measures including biodiversity offsets are also a tool for companies to manage biodiversity risk and opportunity, and for society to mainstream considerations of biodiversity into economic decision-making, through governments' planning processes, licenses and permits and financial institutions' lending and investment decisions. As mitigation measures including biodiversity offsets involve working with land managers to address underlying causes of biodiversity loss, they enable indigenous peoples and local communities to be involved in project planning and to establish conservation activities that contribute to sustainable livelihoods. The process of designing and implementing mitigation measures, including biodiversity offsets, should involve affected and interested people to ensure they benefit, which builds community support for regional and project development plans.

Mitigation measures including offsets that are planned at the landscape scale can contribute to regional conservation and land-use planning, and to the priorities set out in national biodiversity strategies and action plans. Indeed, NNL/NG measures rest on satisfactory definition of the baselines against which loss and gain are measured; exploring and describing current and probable future baseline trajectories of biodiversity under the existing policy regime can stimulate careful consideration of the entire suite of conservation policy and regulation.

Government policy on NNL/NG can facilitate better relationships between governments and developers with regard to the mitigation of biodiversity impacts. Where developers are operating under clear guidelines, they can plan and implement their mitigation measures to achieve NNL/NG, including biodiversity offsets, in an orderly and efficient way as part of the development project. This certainty can be beneficial not only for development projects, but is also characteristic of a jurisdiction that is a 'good place' in which to invest and do business.

Where the design and implementation of mitigation measures including biodiversity offsets are established as a regular part of project planning, businesses centred on the provision of offsets are likely to evolve. New companies will be set up explicitly to undertake offsets through habitat establishment and restoration. Existing businesses, whether they are farmers, restoration ecologists, or enterprises involved those in the nursery trade or pest and weed control can expand their activities. This can stimulate the rural economy and small and medium-sized enterprises, in particular. Work arises not only for those undertaking the conservation activities on the ground, but also for the professionals involved in assessing the losses and gains, designing offsets, verifying them, and undertaking monitoring and evaluation activities. Governments appreciate that these activities can benefit the economy and local communities by generating employment and revenue. For instance, investments in conservation banking in the USA are estimated at approximately US $1bn per annum.[18]

Improved mitigation measures, including biodiversity offsets, generate additional private sector investments in conservation that add to the available resources, helping to meet governments' overall objectives for biodiversity conservation.

Taken together, these advantages mean that measures for NNL/NG including biodiversity offsets offer not only a risk management tool and potential business opportunity for companies, but a possible source of new and additional funding for biodiversity conservation and sustainable use activities. This provides for the internalization of environmental costs, with public and private sector developers bearing the costs of the conservation actions needed to offset their impacts, supplementing national budgetary support for protected area networks and other *in situ* biodiversity activities.

[18] Madsen et al., 2010.

Risks associated with biodiversity offsets

However, despite these potential advantages, mitigation measures in general and biodiversity offsets in particular should be treated with great caution: care should be taken that mitigation measures are realistic and implemented in practice. They should not be misused to allow inappropriate projects to proceed, and biodiversity offsets are only appropriate in some circumstances, where the mitigation hierarchy has been followed and the residual impacts are capable of being offset. In addition, international evidence suggests that mitigation measures only succeed in certain specific circumstances, namely where there is adequate capacity to design and implement them, and adequate monitoring, evaluation and enforcement. For NNL/NG measures including offsets to make any difference, it is important that the rules set out in associated government policy result in additional investment in conservation, that individual offset measures don't cause 'leakage' by simply displacing the causes of biodiversity loss in the offset area to another location; and that government does not simply reduce public sector commitments to conservation finance, transferring the costs of national conservation priorities to the private sector.

A number of publications illustrate the danger of inappropriate use of mitigation measures including biodiversity offsets and inadequate policy.[19]

Some older and more biologically specialized biodiversity components are particularly difficult or impossible to replicate or replace. There are species whose habitat may be impossible to re-create and some compensatory measures may never succeed.[20] It is generally acknowledged that there are limits to the kinds of impacts on biodiversity that can or should be offset, yet there is a paucity of policy guidance as to what defines these limits and the relative difficulty of achieving a successful offset as such limits are approached[21] The time scales required for restored sites to match the target state may be extremely long, in some cases ranging from several decades to centuries,[22] and this may not result in 'no net loss' in any meaningful timeline.

Offsetting may fail to protect biodiversity when the basis for equating losses and gains uses simple commodities or units of trade and these fail to capture the complexities of biodiversity.[23] The significant limitations of some of the metrics used to quantify losses and gains may be due to a lack of sophistication in the understanding of biodiversity or may reflect the need to limit the complexity of the metrics in order to achieve a process that can be operationally practical.[24] Surrogate measures of biodiversity can also obscure what is exchanged, allowing biodiversity that is rare and difficult to conserve to be lost and replaced by more commonplace biodiversity.

The likelihood that offset areas based on re-creation of biodiversity (for example revegetation) will follow a predicted ecological path has also been questioned, given that outcomes can be influenced by stochastic events.[25]

NNL/NG policies can be compromised by inadequate implementation. Mitigation measures including offset outcomes are heavily dependent on the long-term management and protection of the sites where the activities take place. Adequate standards, monitoring and compliance are critical to success. Non-compliance can lead to significant failure rates for offsets.[26] Indeed, lack of monitoring and enforcement is cited as perhaps the most common reason for the failure of mitigation measures. Sometimes the interests of government agencies can be

[19] Pilgrim et al., 2013; BBOP, 2012d; Maron *et al.,* 2012; Quétier & Lavorel, 2011; Bekessy et al., 2010; Maron et al., 2010; Treweek et al., 2009; Walker et al., 2009; Gardner et al., 2007 ; Gibbons & Lindenmayer, 2007; Morris et al., 2006; Salzman & Ruhl, 2000.
[20] Morris et al., 2006.
[21] Pilgrim et al., 2013.
[22] Wilkins et al., 2003.
[23] Walker et al., 2009.
[24] McCarthy et al., 2004.
[25] Hilderbrand et al., 2005.
[26] Duke and ten Kate, 2013; NRC, 2001; Race and Fonseca, 1996.

more aligned with those of development than those of the environment, resulting in poor compliance and over-simplified biodiversity measurement.

Some feel that another risk associated with NNL/NG policies relates to the potential for such policies to induce complacency among the public and policy-makers, since the baseline against which loss and gain is measured is often defined as the current declining trajectory for biodiversity, thus locking in current trends. Another concern is that policy-makers and the public may feel comforted that biodiversity losses are being adequately compensated when in fact the scope of the NNL/NG system only addresses a subset of biodiversity losses, and the metrics used for measuring losses and gains may be inadequate to account for them properly.

For these and other reasons, over a hundred NGOs and civil society groups recently petitioned against the use of biodiversity offsets.[27]

When deliberating on the introduction of a NNL/NG policy, governments are likely to come across a number of considerations from various stakeholders – their views about planning policy, conservation and mitigation – that may appear to compete and contradict each other. Some of these are summarized in Table 1 below. As governments weigh the risks and opportunities of introducing offsets as part of the mitigation hierarchy (see Section 1.3.2 on risks and opportunities), they will need to take these into consideration. The issues relate both to the question of whether or not to adopt a biodiversity offsetting scheme and in what circumstances (if ever) offsets should be used, and to the options for the structure of the scheme that form the main focus of this paper.

Table 1: Some of the expectations and concerns of civil society and developers about NNL/NG policy

	Civil society	Developers
Concerns	• Licence to trash – offsetting reduces the motivation to avoid and minimize the impacts of developments leading to worse overall biodiversity outcomes. • Cost shifting – governments will reduce their expenditure on conservation programmes as private investment in mitigation and offsets occurs. • Crowding out – investments made in biodiversity offsets will 'crowd out' the motivation for other private investments in conservation initiatives. • The introduction of offset schemes provides disincentives to regulate for biodiversity conservation outside the scope of the NNL/NG policy.	• Cost pressures – more rigorous mitigation measures including biodiversity offsets will increase project costs substantially, putting development and jobs at risk. • Time delays – designing mitigation measures including finding a suitable offset can lead to delays in projects that are costly and can cause uncertainty to project implementation. • Impacts on consumers – the cost of mitigation including offsets are passed on to consumers, raising prices. This is a burden on consumers, e.g. housing affordability could be negatively affected.
Expectations	• Conservation – High conservation value areas will be protected and impacts there not authorized. Adequate investment will be made in conservation. • Compensation – Residual and cumulative impacts are compensated fully. • Access – People's enjoyment and use of biodiversity and ecosystem services are maintained and accessible.	• Streamlined processes – NNL/NG policy and planning policy are integrated so that it is quicker and simpler to obtain necessary permits. • Legal certainty – clear land tenure, permitting processes, legal certainty on long-term mitigation activities, including offsets. • Proportionate and obtainable – costs of mitigation design and implementation are reasonable and proportionate to

[27] http://no-biodiversity-offsets.makenoise.org/

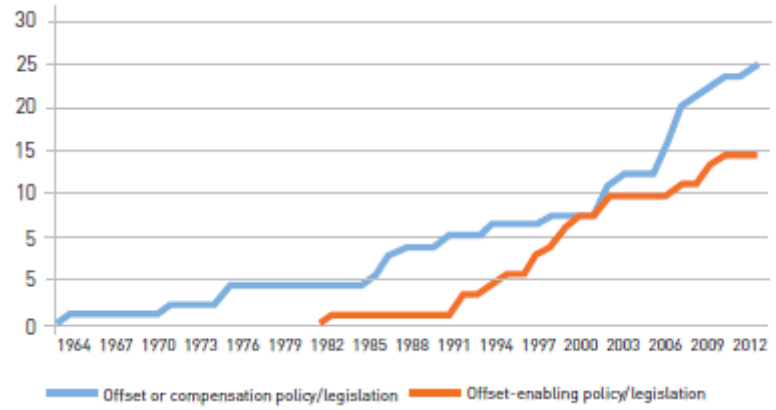
		project costs. Land and organizations willing to undertake mitigation measures (including offsets) can be found and relied on.

1.3.3 Governments with policies on NNL/NG, biodiversity offsets and compensation more broadly

Over 30 countries or states have enacted laws or introduced policies that specifically require biodiversity offsets or compensatory conservation for particular sets of impacts (for instance, on wetlands, on certain nationally listed species, or on biodiversity in its entirety). Some of these make specific provision for NNL/NG as a policy goal.[28] In addition, biodiversity offsets or compensatory conservation are sometimes included in the conditions for project approval as a result of dialogue between the proponent of a project and the permitting authority, typically following an environmental impact assessment process. There is also a growing incidence of companies undertaking biodiversity offsets voluntarily.

Research in 2010 by the Ecosystem Marketplace, updated in 2011, found 45 existing compensatory mitigation programmes around the world, ranging from programmes with active mitigation banking of biodiversity credits to programs channelling development impact fees to policies that drive one-off offsets (see Box 2). In 2011, there were another 27 programmes in various stages of development or investigation. The global annual investment in offsets and compensations in 2011 was estimated as $2.4-$4 billion at a minimum, and probably much more, as 80% of existing programmes is insufficiently transparent for the Ecosystem Marketplace to have included their market size in this estimate. The conservation impact of this investment includes at least 187,000 hectares of land under some sort of conservation management or permanent legal protection per year.[29]

Figure 1: Cumulative rise in number of nations/states/provinces with offset legislation/policies (blue line) or with enabling legislation/policies/guidance (red line). Source: IUCN-ICMM 2012, prepared by TBC.



As Figure 1 shows, NNL/NG and more general compensation systems have evolved and grown in number since the 1970s. NNL and subsequently NG has been a feature of policy in the USA for over two decades, while biodiversity offsets and credit trading are comparatively new in Australia and Brazil. There are recent policy measures in Colombia and France, measures are under development in countries such as South Africa, Peru and England, and

[28] See also Section 2.1.2
[29] Madsen et al., 2011

exploration of policy options is in its early stages in a suite of other countries (e.g. Canada, Uganda, Namibia, Vietnam, Malaysia and Mongolia).

Historically, the nature and scale of biodiversity offsets or compensatory conservation were calculated based on simple metrics such as area, the financial investment involved in the investment project, or some formula identifying a subset of biodiversity values (timber value on the land, for instance), or simply negotiated as a financial package that the developer was prepared to invest, irrespective of whether the amount was adequate to cover the costs of sufficient offsetting activities to achieve NNL/NG. However, the last 10-15 years have seen a growing interest in better metrics that endeavour to assess the nature, amount and quality of biodiversity lost as a result of the project and gained through the offset and to ensure properly quantified approaches to 'no net loss'.

Box 2 shows a rapid analysis of countries where we believe there are existing laws or policies related to compensation and biodiversity offsets, where they are under development, and where individual biodiversity offset or compensation projects are already underway. These countries are listed in Appendix 2.

Box 2: Countries with existing or draft laws and policies on NNL/NG, biodiversity offsets or compensation

- 39 countries have existing laws or policies on NNL/NG, biodiversity offsets or compensation
- 22 countries (some of which already have laws and policies and are numbered in the existing 39) are developing laws or policies on NNL/NG, biodiversity offsets or compensation

See Appendix 2 for more information.

1.3.4 Government multi-year processes for progress towards No Net Loss or a Net Gain

Experience shows that governments tend to approach NNL/NG policy through a series of steps, starting, typically, with a regulatory instrument and putting in place or improving the complementary information, maps, planning tools, strategies, guidance and training for effective implementation of the policy instruments over the following years. Systems in Australia and the USA, for instance, took well over a decade to develop the suite of policy measures, tools and information needed to operate effectively, particularly where implementation is through market-based systems such as conservation banking and biodiversity credits.[30]

This multi-year approach towards policy for NNL/NG can be illustrated by the case of Victoria, Australia, where the approach to NNL/NG, including the use of offsets, has emerged since 1989, and is still being developed today, as the following summary illustrates:

- 1989: Regulation of native vegetation clearing was introduced, in response to the realization that some 80% of native vegetation cover had been lost on private land compared to the pre-1750 state. The regulation led to the end of broad-scale clearing of native vegetation. However offsetting was sporadic and unquantified.
- 1998: Biodiversity mapping was brought in, with mapping of extant vegetation, modelled maps of native vegetation in the year 1750, mapping of bioregions, and mapping of the presence of threatened species. This provided a state-wide information base that supports offset design; however offsets were still not the norm.
- 2000: The (voluntary) auction-based incentive program 'BushTender' was brought in. While this is not an offset system, it introduced site assessment and landowner agreements. This developed key techniques

[30] George Kelly, Wayne White, Palmer Hough, Michael Crowe, pers. comm.

that are core to offsets outside the regulatory environment and allowed the state to gain experience that could then be used for offsets.

- 2002: The Native Vegetation Management Framework policy was introduced. This clarified the basis for determining NNL (through 'like-for-like' or better offsets) and the metrics for offsets (habitat hectares and old trees). However, developers found it hard to find their offsets: identifying suitable locations and landowners prepared to cooperate.
- 2007/8: The offset market based on credit trading was introduced (BushBroker). This provided for third-party suppliers and brokers, and a credit register was set up. Credits used the same units of habitat hectares and old trees.
- 2013: Revisions that introduced a risk-based approach including changes to the like-for-like criteria and a new native vegetation information management system that extends the use of maps for permit assessment and offsetting processes. Offsets for threatened species losses now require like habitat which is identified using spatial modelling and mapping.

Since 2007, Victoria's government-operated broker has conducted more than 400 trades of over Aus$34 million in value. In addition, private brokers have been established. ESLink, for instance, has undertaken more than 50 trades since 2010. The Victorian offset system is still evolving, with the 2013 changes placing a strong emphasis on the use of mapped information for assessment and offsetting, particularly for low-risk impacts.

A similar evolutionary story can be told for the development of mitigation for wetlands and streams in the USA, under the Clean Water Act (of 1973):

- The demand for offsets was initially stimulated by the announcement in 1989 of the policy goal of 'no overall net loss' of wetland acres and functions, also applicable to streams.
- From 1989 to 1995, the mitigation process was ad hoc. Federal guidance was issued in 1995, which promoted increased mitigation through the private sector. Three forms of implementation became possible: (i) permittee-responsible mitigation (where developers take responsibility for delivering their own offsets); (ii) mitigation banks; and (iii) payment to in-lieu funds.
- From 9 June 2008, new regulations promoted one standard for mitigation, with a "Preference" for mitigation banking.[31]

In neither case was the evolution described here planned in detail from the start, and the fact that changes were recommended in recent years and are still working their way through the respective systems suggests that their policy objectives have only been partially met. For instance, when the National Research Council formed the Committee on Mitigating Wetland Losses to evaluate mitigation practice in the USA in 2001,[32] its report of poor ecological outcomes (e.g. only a 7% success rate for developer-led on-site compensation) led to the changes introduced in 2008 in the Final Compensatory Mitigation Rule. Evidence is still being gathered to assess the resulting improvements in practice. Another important point is that offset systems alone are highly unlikely to lead to no overall net loss, since many impacts on biodiversity are not covered by permitting systems that require compensation through offsets. For instance, activities which give rise to losses of biodiversity caused by climate change or by the use of fertilizers and pesticides are generally not within the scope of offset systems. An example of this can be seen in Victoria, where a net loss of biodiversity continued after introduction of the system (see Department of Sustainability and Environment, 2008). Another point is that while no net loss policies take a number of years to design and implement, the political commitment of governments to see these policies through to successful implementation can change over this timeframe.

From these and similar experiences, one can draw the conclusion that it is unrealistic to imagine that passing a law, decree, regulation or other policy instrument to require No Net Loss or a Net Gain will be sufficient to ensure the

[31] George Kelly, pers. comm.
[32] NRC, 2001.

smooth running of the system. Rather, governments are well advised to plan a roadmap for the exploration, design, implementation and improvement of the system over a period of years. The basic elements of such a roadmap are described in Section 5.1.

1.3.5 Lender policies and safeguards with provisions on NNL/NG and biodiversity offsets

This paper has focussed so far on the history of biodiversity offsets within government policy.

The International Finance Corporation's (IFC) revised Performance Standard 6 (PS6) came into effect on 1st January 2012 and is summarized in Box 3.

Box 3: IFC Performance Standard 6

The IFC's updated Sustainability Framework took effect on 1st January 2012, including the IFC's eight Performance Standards. Performance Standard 6: Biodiversity Management and Sustainable Management of Living Natural Resources places certain requirements on clients whose projects will impact 'natural' or 'critical' habitat, among other issues.

'Natural Habitat': The client will not significantly convert or degrade natural habitats, unless:

- no other viable alternatives within the region exist for development of the project on modified habitat;
- consultation has established the views of stakeholders on the conversion and degradation;
- any conversion or degradation is mitigated according to the mitigation hierarchy; and
- mitigation measures are designed to achieve **no net loss of biodiversity** where feasible. Appropriate actions include: avoiding impacts on biodiversity through the identification and protection of set-asides; implementing measures to minimize habitat fragmentation, such as biological corridors; restoring habitats during and/or after operations; and implementing biodiversity offsets.

'Critical Habitat': In areas of 'critical habitat', there shall be no project unless the client has demonstrated that:

- no other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
- the project does not lead to measurable adverse impacts on biodiversity values for which critical habitat is designated and on ecological processes supporting them;
- the project does not lead to net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; and
- a robust, appropriately designed, and long-term biodiversity monitoring and evaluation programme is integrated into the client's management programme.

In cases where a client can meet these requirements, the project's mitigation strategy will be described in a Biodiversity Action Plan and will be designed to achieve **net gains** of those biodiversity values for which critical habitat was designated.

The design of the offset must be carried out in alignment with best available information and current practices. External experts with knowledge in offset design and implementation must be involved. IFC Guidance Note 6 (which accompanies PS6) references the BBOP Principles as an internationally recognized standard in biodiversity offset design.

Clients are also obliged to undertake a systematic review (with the participation of affected communities) to identify priority ecosystem services – i.e. ecosystem services which: (i) the project is likely to impact, resulting in adverse impacts to affected communities; and (ii) the project is directly dependent for operations. The client is to avoid and minimize impacts on priority ecosystem services and implement mitigation measures that increase resource efficiency of their operations.

See: IFC, 2012a and IFC, 2012b.

PS6 is now a condition of project finance from the over 78 financial institutions that have adopted the Equator Principles, and thus apply the IFC's Performance Standards.[33]

In addition to the members of the Equator Principles Association, several other banks have NNL and NG policies. Two examples are the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB), whose policies are similar to PS6.

EBRD's PR 6 ('Biodiversity Conservation and Sustainable Management of Living Natural Resources', which is presently under review) includes similar definitions and requirements for Natural and Critical Habitat as PS6. Differences include EBRD's requirement to take a precautionary approach in the presence of Critical Habitat and an overall objective of no net loss of biodiversity.[34]

EIB, in line with its Environmental and Social Statement, aims to mainstream biodiversity in its own activities and also by ensuring that the projects it finances "do no harm". Currently, EIB does not aggregate such information gathered at project level, but the mitigation hierarchy applies for the protection and conservation of biodiversity. In the case of offsets, principles and standards developed by the Business and Biodiversity Offset Programme, South African Legislation and ICMM amongst other international good practices are applied by EIB. The EIB is currently working with the EU in developing a common approach to offsets under the No Net Loss Initiative.[35]

The World Bank's environmental and social safeguard policies aim to prevent and mitigate undue harm to people and their environment in the development process. They provide guidelines for bank and borrower staffs in the identification, preparation, and implementation of programs and projects.[36] Particularly relevant to NNL/NG is Operational Policy 4.04: Natural Habitats (O.P.4.04), which seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the environmental services and products that natural habitats provide. The policy limits the circumstances under which any World Bank-supported project can damage natural habitats. Specifically, the policy prohibits World Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats. These are defined as including natural habitats that are legally protected, officially proposed for protection, or unprotected but of known high conservation value. In other (non-critical) natural habitats, World Bank-supported projects can cause significant loss or degradation only when there are no feasible alternatives to achieve the project's substantial overall net benefits, and acceptable mitigation measures, such as compensatory protected areas, are included within the project.[37.] The World Bank is presently undertaking a process to review and update its environmental and social safeguard policies.[38] It is understood that this is likely to bring OP4.04 into closer alignment with IFC Performance Standard 6.

[33] http://www.equator-principles.com/
[34] http://www.ebrd.com/pages/research/publications/policies/environmental.shtml
[35] http://www.eib.org/about/accountability/reporting_on_corporate_responsibility/gri/1-3-performance-indicators/3-environmental/3-4-biodiversity/EN12.htm
[36] http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,menuPK:584441~pagePK:64168427~piPK:64168435~theSitePK:584435,00.html
[37] World Bank, 2001.
[38] http://consultations.worldbank.org/consultation/review-and-update-world-bank-safeguard-policies

2. THE BASIC CONCEPTS OF NNL/NG AND BIODIVERSITY OFFSET POLICY

2.1 The basic concepts of NNL/NG

This section introduces very briefly some of the core concepts in biodiversity offset policy, namely:

- the principles that underpin NNL/NG;
- the statement of policy itself, whether this is mandatory or voluntary and how it is established (e.g. through a legal requirement supplemented by guidelines);
- the scope and limits of the policy;
- the exchange rules governing which impacts can be offset by what type of gains;
- the metrics for measuring loss and gain;
- land-use and landscape level planning and the location of mitigation measures (particularly, areas to be avoided and areas suitable for offset activities);
- identification of the set of activities which can deliver the secure and additional long-term gains needed to offset residual impacts;
- clarification of which organizations can undertake the offsetting activities and the standards by which they should abide;
- underlying data and capacity needs;
- how commitments on avoidance, minimization, restoration and offsetting are to be monitored and enforced; and
- the governance of the system for delivering NNL/NG;

2.1.1 The principles that underpin NNL/NG policy

National laws and circumstances vary widely around the world, so there is no single 'correct' approach to designing and implementing mitigation measures (including biodiversity offsets) to demonstrate NNL/NG, or introducing national policy and regulation on this topic. In recognition of this, some laws, policies and standards take a principles-based approach. Provided these principles are adhered to, there is room for flexibility and tailoring the approach to reflect the specific circumstances, and a number of different ways in which mitigation measures including biodiversity offsets can be designed and implemented and their success verified.

Taking stock of principles related to NNL to offer advice to the European Commission on how to develop principles for the EU NNL Initiative, members of the EU NNL Working Group in 2013 considered clusters of principles, as follows:

- Principles related to **operational governance**, such as subsidiarity, proportionality, precaution and participation, and the Polluters Pays Principle;
- Principles related to **avoidance**, including proper consideration of alternatives to project proposals to help to avoid impacts, limits on new obstacles to economic activity, improving implementation and compliance with existing legal obligations, and tackling avoidance during land-use planning.
- Principles related to **minimization and restoration/rehabilitation**, such as not duplicating or interfering with similar provisions in existing legislation, determination of appropriate and proportional measures, that adjustments of the design of a project, plan or activity should precede evaluation of the need for offsets, that the willingness of a proponent to compensate should not affect government's judgement of what is to be considered appropriate minimization and restoration/rehabilitation.
- Principles related specifically to **metrics**, such as being fit for purpose, easily understood, easy to apply and cost effective, commensurate with the nature and significance of biodiversity affected, measured over the appropriate time period, expressed at different scales (from habitat down to genetic groupings), and levels of flexibility of application.

- Principles related to **compensation/offsets**, including: (i) that these should be anchored in a strict and systematic mitigation hierarchy; (ii) ensuring compliance with all existing legal obligations, control and enforcement of effective gain; (iii) clear and transparent rules for assessing ecological equivalency and sizing compensation measures; (iv) dealing with both 'type' and 'amount' of biodiversity in determining NNL/NG; (v) consideration of when 'trading up' as a departure from 'like-for-like' is appropriate; (vi) whether offsets in protected areas are permissible; (vi) a framework providing clear legally binding rules (and security) for offsets; (vii) mechanisms for long term, legal, institutional and financial security; (viii) mechanisms for monitoring and enforcement; and (ix) mechanisms for adaptive management, including to scale offsets up or down if practical realization of the mitigation hierarchy falls short of, or significantly exceeds, what was planned.

The EU NNL Working Group drew upon the set of basic principles developed and agreed by all the members of the Business and Biodiversity Offsets Programme. The BBOP Principles incorporate principles found in international and national law and policy, financial safeguard policies and voluntary best practice from around the world and have subsequently been used and adapted in several other policies and standards. The Principles are set out in Box 4 and provide that: (i) developers must adhere to the mitigation hierarchy; (ii) limits to what can be offset must be recognized; (iii) projects and offsets should be planned within a landscape context; (iv) offsets should be designed and implemented to achieve no net loss or a net gain of biodiversity; (v) offsets should achieve additional conservation outcomes; (vi) stakeholders should be involved effectively in design and implementation; (vii) offsets should be designed and implemented in an equitable manner; (viii) offsets should be planned to secure outcomes that last at least as long as the project's impacts and preferably in perpetuity; (ix) offsets should be undertaken and communicated transparently; and (x) offset design and implementation should be documented, informed by appropriate use of sound science and traditional knowledge.

A particular challenge in offset policy and practice relates to the application of the mitigation hierarchy. The methodologies and metrics applied to designing offsets to address residual impacts are now often very detailed.[39] Depending on the particular policies and approach involved, the nature and scope of the activities needed to achieve NNL using offsets – the thresholds, the metrics, the exchange rules, the site selection criteria etc. – are relatively clear. The same cannot be said for the earlier steps in the mitigation hierarchy, particularly those related to avoidance and minimization. As yet, there is no clear ecological or economic theory that offers a quantified approach to answering the questions 'Which exact steps are required in this situation to avoid impacts? And which exact steps are required to minimize unavoidable impacts?' Law and policy commonly refer to the mitigation hierarchy, but, to the authors' knowledge, have yet to set out a clear methodology on how to quantify each step in a systematic pre-determined manner. As a result, the process of defining avoidance, minimization and restoration measures remains one of case-by-case dialogue and negotiation between the project proponent and the relevant authorities and investors, often conducted in the course of EIA review or planning applications and when seeking project finance. Recent discussions on NNL/NG, for instance under the auspices of the EU NNL Working Group, have remarked on the absence of clear principles and methodologies associated with avoidance and minimization. The question therefore remains whether additional principles and methodologies to define the extent of each step of the mitigation hierarchy can be developed, or whether the optimum outcome is so case-specific that generic principles can go no further than the generalities currently found in law and policy.

[39] In the case of regulated systems, see, for example, the rules and guidelines established under the Clean Water Act and Endangered Species Act in the USA, or the various offsetting policies in Australian states. In the case of voluntary approaches, see the BBOP Standard and Guidelines (BBOP, 2012a and BBOP, 2012b).

Box 4: Principles on Biodiversity Offsets supported by all the members of the BBOP Advisory Group

Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development* 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.

These principles establish a framework for designing and implementing biodiversity offsets and verifying their success. Biodiversity offsets should be designed to comply with all relevant national and international law, and planned and implemented in accordance with the Convention on Biological Diversity and its ecosystem approach, as articulated in National Biodiversity Strategies and Action Plans.

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, minimization 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 be reasonably 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 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, and implementation and monitoring.

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 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 recognized 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 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.

* While biodiversity offsets are defined here in terms of specific development projects (such as a road or a mine), they could also be used to compensate for the broader effects of programmes and plans.

Principles are generally high level and aspirational, so if they are to form the basis of a NNL/NG policy, they need to be accompanied by clear rules. One approach is to embed the principles within the policies, regulations and standards that set out independently verifiable and auditable criteria and indicators that enable government and the developers themselves to tell whether the principles have been applied properly. For example the BBOP Standard on Biodiversity Offsets published in January 2012 and now used in a number of settings around the world was developed along these lines. It sets out criteria and indicators for each of the ten principles in Box 4 above, and can be used by governments, companies and advisers in planning the design and implementation of mitigation measures for projects, or by independent assessors. Governments operating NNL/NG systems frequently promulgate a number of more particular standards to which third parties taking part in the system must adhere, including on use of the exchange rules and metrics for the assessment of losses and gains, and standards for the long-term management and performance of biodiversity offsets (including through conservation banks and provision of biodiversity credits).

2.1.2 The statement of policy

Government policy on the mitigation hierarchy, including biodiversity offsets, would typically comprise a number of elements, handled in a variety of ways by different countries:

- **The policy commitment**, such as the nature of the commitment (including an aspirational goal and more detail on how, programmatically, government will put this into practice);
- **Legal basis:** Clarification as to whether the policy is mandatory or voluntary and (if the former) how it is established in law; and
- **Guidelines** on how to apply the policy, including process and content.

Policy commitment: The policy commitment will typically include an aspirational goal (for instance, to NNL or a NG of biodiversity) and may set out existing commitments in related areas, for instance, compliance with existing relevant laws such as those on EIA, strategic environmental assessment (SEA), planning, protected area law, indigenous peoples' rights and rights of local communities, etc. The policy commitment may also describe how, programmatically, government plans to put the commitment into practice.

Some examples of recent policy commitments related to NNL/NG are set out in Box 5.

Box 5: Some recent examples of policy commitments to No Net Loss or a Net Gain of Biodiversity

Country	No Net Loss/Net Gain commitment	Source
England, 2011	• We will move **progressively from net biodiversity loss to net gain**, by supporting healthy, well-functioning ecosystems and establishing more coherent ecological networks. Our 2020 mission is to halt overall biodiversity loss, support healthy well-functioning ecosystems and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people. • We will work to achieve more, bigger, better and less-fragmented areas for wildlife, including **no net loss of priority habitat and an increase of at least 200,000 hectares in the overall extent of priority habitats**. • The National Ecosystems Assessment[40] identifies land-use change as one of the major impacts on biodiversity in the UK. We want the planning system to contribute	HM Government, 2011. (NB this policy commitment is in addition to existing obligations under EU Law)

[40] UKNEA, 2011.

	to our objective of **no net loss of biodiversity,** to encourage local authorities to promote multi-functional development so that we get the most from land, and to protect our best and most versatile agricultural land.	
France, 2012	• Permits granted on the basis of an EIA must now include the mitigation measures presented in the EIA document, including avoidance, reduction and **compensation or offset** measures. • Government guidance states that "implementation of the mitigation hierarchy is intended to conserve the overall environmental quality of habitats, and if possible to achieve a **net gain**, in particular for degraded habitats, taking into account their sensitivity and general goals for achieving good conservation status of these habitats".	Ministry of Ecology, Sustainable Development and Energy (MEDDE), 2012. (See also Quétier et al., in press) (NB this policy commitment is in addition to existing obligations under EU Law)
Colombia, 2012	Measures of compensation for no net loss of biodiversity: • Actions to **compensate for biodiversity impacts** that cannot be avoided, corrected, reduced or substituted and involving loss of biodiversity in terrestrial ecosystems and natural secondary vegetation. • To ensure effective conservation of an ecologically equivalent area where a strategy for permanent conservation and/or ecological restoration can be achieved, so that in comparison with the baseline, **no net loss of biodiversity** is ensured. • The principle of **no net loss of biodiversity** refers to compensation designed and executed to achieve measurable conservation results *in situ,* which can reasonably be expected to achieve **no net loss** (BBOP, 2012).	Ministry Of Environment And Sustainable Development, Colombia, 2012.
Australia, 2012	• Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment. • Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). • The suitability of a proposed offset is considered as part of the decision as to whether or not to approve a proposed action under the EPBC Act. • Offsets must directly contribute to the ongoing viability of the protected matter impacted by the proposed action, and deliver an overall conservation outcome that improves or maintains the viability of the protected matter as compared to what is likely to have occurred under the status quo, that is if neither the action nor the offset had taken place.	Australia, Commonwealth Government, 2012.

Peru, 2013 (DRAFT)	• Environmental compensation measures are the basis of the Environmental Compensation Plan, which will result in **no net loss, a net gain of biodiversity** and/or an improvement in ecosystem function, to compensate for the affected area with an ecologically equivalent area. • **No net loss of biodiversity and ecosystem function**: the objective of the environmental management is to achieve **no net loss in biodiversity and, as far as possible, a net gain of biodiversity** and/or improving the functionality of ecosystems, through the implementation of prevention, minimization, restoration and rehabilitation activities, complemented by environmental compensation measures, where required.	MINAM, 2013

Legal basis: It is good practice for government to clarify whether the policy is mandatory, voluntary, or 'partially permissive'. An example of how these terms are understood is set out in Box 6. If the offsetting policy requires legal instruments to operate, it is helpful for the policy to describe the laws, regulations, decrees, or other legal instruments that already exist or are under development to give effect to it.

Box 6: Mandatory, partially permissive and fully permissive options for offsetting in the English Green Paper on Biodiversity Offsets.

Options under consultation for the English offsetting system include:

A fully permissive approach: developers could choose whether to use the Government's offsetting metric to assess their project's impacts and could choose the means of securing compensation (i.e. through existing approaches to broader compensation or by obtaining an offset).

A partially permissive approach: developers might be required to use the Government's offsetting metric to assess their project's impacts but would then be free to choose the means of securing compensation (i.e. through existing approaches to broader compensation or by obtaining an offset).

A uniform (essentially, mandatory) approach where developments that exceed a certain threshold would be required to use the Government's offsetting metric to assess their project's impacts and to obtain an offset as the mechanism for compensation. Developments below this threshold would be able to opt-in to using offsetting.

Guidelines: Policy statements and commitments are usually brief. There is widespread recognition that the situations in which the mitigation hierarchy is applied and biodiversity offsets are designed and implemented are so infinitely variable that it is impossible to prescribe all the requirements in detail, upfront. For this reason it is common for policies to be complemented by guidance documents that set out procedures and methodologies for developers to follow, and show how these are integrated with the country's planning system. Such guidelines can come in many forms, can often be quite numerous, and can be revised and updated over time.

In the opinion of the authors, guidelines on the process aspect should clarify how developers are required to navigate through the planning process, to follow the mitigation hierarchy, design and implement offsets, and how their commitment will be monitored and enforced.

Guidelines on the content typically cover principles, exchange rules, metrics, location, the suite of possible offset activities, clarification of which organizations can undertake the offsetting activities and the standards by which they should abide, including accessing and collecting the data involved in these issues. Box 7 outlines the guidelines provided by the Victoria state government in Australia, relating to the BushBroker offset programme.

Box 7: Guidelines and information for developers and offset providers in the BushBroker programme in Victoria, Australia

On its website, the Victorian government provides a number of tools (maps, spreadsheets, guidance documents and factsheets) all designed to help developers planning their mitigation measures and landowners thinking of providing offsets do so in line with the state's policy, using the prescribed metrics, exchange rules and basis for site selection and offset implementation. Guidance includes:

Guidance and information sheets:

For **landowners** (i.e. provider of offsets), information sheets on:

- Introduction to the System, Landowners' Frequently Asked Questions, Process for landowners to follow, explanation of the site visit by government to prospective offset sites, and developing a price (for credits);
- Landowner Agreement;
- Standards for management (separate information sheets on): Rabbits, Weeds, Supplementary planting, Revegetation, Scattered trees, Fencing, Ecological grazing, Ecological burning, Ecological thinning of eucalypts;
- Annual reporting; and
- Photopoint monitoring.

For **permit-holders** (i.e. developers with impacts requiring permits and offsets), information sheets on:

- The process for permit holders to follow, Permit holders' Frequently Asked Questions;
- The 'Over the counter' approach; and
- Fees and services, including information for accredited organizations.

Source: BushBroker website: http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/native-vegetation/native-vegetation-permitted-clearing-regulations/native-vegetation-offsets/bushbroker/publication-and-statistics

2.1.3 The scope and limits of NNL/NG policy

To avoid ambiguity, and particularly so that developers know what is expected of them by government, policy on NNL/NG and mitigation measures including biodiversity offsets should clarify to what it applies, and it should also ensure that the scope of the measures is consistent with the policy commitment. There are two aspects to this: the scope or coverage of the policy, and recognition of impacts that fall outside the policy and how these will be handled.

Scope

Concerning scope, it is helpful if government is explicit as to what is covered by the policy. Part of this can be resolved by clear definitions of the terms used (see Section 1.2 and more detail in Appendix 1), but additional explanations on scope may help. Some of the key issues are as follows:

- Does the policy cover all types of biodiversity, or some subset (e.g. 'Native Vegetation' as in the case of Victoria, Australia)? Does it include not only aspects of biodiversity related to pattern (i.e. species and habitats), or does it also aim to cover ecological processes and functions?
- What scale of biodiversity is to be addressed? Ecosystems, habitats, communities and assemblages, species, sub-species, genetic diversity?

- Does it focus only on particular species (e.g. threatened, listed or priority species) or on all species?
- Does the policy cover just biodiversity, or also ecosystem services?
- Does the policy cover only impacts on the existence or 'intrinsic' values of biodiversity (e.g. impacts on red-listed species), or does it also cover loss and gain of biodiversity of socioeconomic and cultural important to local communities (for instance, subsistence or recreation)?
- Does the policy cover only terrestrial and aquatic systems, or also marine systems?
- Does the policy cover all impacts on biodiversity and thus all losses of biodiversity, or does it only cover impacts above a certain threshold (e.g. 'significant loss' or projects above a certain scale)?
- Are the impacts of all sectors (including agriculture, fisheries etc.) covered, or only certain sectors (e. g., extractives and infrastructure)?
- Does the policy apply equally to public-sector developers (e.g. government, agencies, parastatals and projects procured by government) as it does to private-sector developers?
- Does the policy apply equally on public and private land?
- Does the policy require developers to address only their direct impacts, or also their indirect (or induced) impacts? If indirect impacts are covered, how far do these extend? (Key questions include: To what extent are induced impacts like inward migration the responsibility of the developer? How far down supply chains should companies take responsibility for their impacts? Are the impacts on biodiversity of climate change caused by emissions associated with the project covered?)
- Does the policy require developers to address cumulative impacts?
- Does the policy commitment match the scope of the policy on the issues mentioned here? For instance, if the scope of the policy is limited to the impacts of infrastructure projects on particular listed habitats and species, that should be clearly stated.

Offset and compensation policies around the world differ as to whether they provide answers to these questions and with what level of clarity, and there is also considerable variation in governments' policies as to their scope on these different issues. The scope depends partly on the problem being addressed by the policy (e.g. a history of extensive filling of wetlands in the USA, or dramatic loss of native vegetation in Victoria). It also depends significantly on political will and the balance of views expressed during consultation processes between the public at-large and developers, and the readiness of government to intervene with policy measures such as regulations that will affect productive sectors of the economy. Some systems take an evolutionary approach to the scope of their NNL systems. For instance, as its first stage of NNL policy launched by government, the Colombian Manual on Compensation focuses on the terrestrial biome.[41] The scope will be expanded through subsequent work to marine and freshwater systems.

Limits

The second important issue in terms of scope of NNL/NG policy is a difficult and controversial one, namely recognition that some projects' anticipated impacts on biodiversity are too severe (in ecological and social terms, and in terms of the chances of success for practical delivery of mitigation measures) for NNL/NG to be achievable. This raises significant questions of public policy as to whether such projects should proceed, and if so, what should be the consequences in terms of compensation.

There are three issues at heart:

- How to identify projects whose impacts are so severe that the chances of successfully demonstrating NNL/NG for them are limited? (So-called 'non-offsetable impacts'.)
- What should be the consequences (in terms of compensation) if such projects are authorized to proceed by government? (Compensation for 'non-offsetable impacts.)

[41] Ministry of Environment and Sustainable Development, Colombia, 2012.

- Should there be some areas that are sacrosanct and in which development should not be allowed? If so, can these be determined by class, or only on a case-by-case basis? (So-called 'No Go areas').

The scientific and social bases for answering the first question as to which impacts are non-offsetable are tricky, and are the subject of recent publications discussing the issues and options.[42] They are also discussed in the companion piece to this report (Pilgrim and Ekstrom, 2014). Further work is needed in this area, at the international level and within each country contemplating NNL/NG policy. Not only is the scientific baseline information often lacking, but questions of interpreting it and establishing society's tolerance for uncertainty and risk in achieving NNL/NG deserves discussion as the basis for public policy.

Concerning the second two questions, governments adopt a variety of approaches to assessing whether it is in the public interest for projects to receive consent even when they would have very grave environmental or social impacts, and to balancing social, environmental and economic objectives in such decisions. One common approach (found in the European Union, with fairly similar governance in several other countries) is to require case-by-case approval by Ministers for projects that will have very significant impacts on biodiversity with justification as to why there are imperative reasons of overriding public interest for the project to go ahead. Big questions remain, however, as to the basis for these decisions, the transparency of the decision-making and consultation with the public. When such projects go ahead, the question remains as to what should be the measures required of developers in these cases. Impacts in such exceptional cases generally fall into the 'non-offsetable' category, so it would be often be misleading and unrealistic to suggest a NNL/NG outcome is feasible. Presumably developers should be required to undertake compensation that is a close as possible to a comprehensive NNL/NG approach, and perhaps demonstrates a sizable NG for those biodiversity values affected where this is possible.

Debate started on the third question over two decades ago and continues today. The principal question is whether it is in the public interest to exclude from development entire classes of project (usually identified by their location in certain categories of protected area – such as UNESCO Natural World Heritage Sites) or whether such matters cannot be determined on a blanket basis and need to be considered case by case.[43] These are issues for further international discussion as well as national debate.

2.1.4 Exchange rules

Demonstrating NNL/NG through biodiversity offsets involves exchanging a residual biodiversity loss at one place for a biodiversity gain at another place. An important part of a policy is to define the 'exchange rules' of this process, usually referred to as the 'like-for-like-or-better' criteria, or the basis for 'ecological equivalence'. The biodiversity in one place is never exactly the same as the biodiversity in any other place, so setting like-for-like criteria becomes an exercise in categorizing biodiversity into classes or types within which exchange will be permitted. The design tension here is that high resolution classification with many but narrowly defined types can provide a closer match between the loss and the gain, but will also introduce less flexibility into the offsetting process, so it is more difficult to locate a matching offset.

This dilemma can be eased by grading the like-for-like-or-better criteria according to some measure of the significance of the biodiversity components suffering the impacts. Thus the like-for-like criteria for a very significant biodiversity component may be set such that a close match is required for the offset while for lower significant losses the criteria may be quite flexible, allowing exchange within a wider range of biodiversity types, or different

[42] Pilgrim et al., 2013; BBOP, 2012d; Pilgrim & Ekstrom, 2014.

[43] For example, Recommendation 2.82 of the IUCN World Conservation Congress in Amman (2000) created the "IUCN No Go position on mining in categories I to IV", and recommended "*IUCN Members to prohibit by law, all exploration and extraction of mineral resources in protected areas corresponding to IUCN Protected Areas Management Categories I to IV*". Subsequently Shell and ICMM committed to "No-Go" in natural World Heritage sites. See http://data.iucn.org/dbtw-wpd/html/paps-016/5.%20Using%20the%20categories.html

types of higher conservation value. Governments have taken a range of approaches to defining ecological equivalence and setting out the exchange rules that deliver 'like for like or better'.

'Trading up' refers to the ability to match a loss with a gain in a different kind of biodiversity, provided that it is of higher conservation value than the loss. For example the 'like-for-like or better' rules may allow the clearing of an area of grassy woodland to be offset by gains in an area of lowland forest through a trading-up provision, provided that reliable baseline data shows that the grassy woodland is generally well conserved within its bioregion and the lowland forest is a higher conservation priority. It is important that the level of segmentation of biodiversity types, and the 'trading up' options (for biodiversity types of higher conservation value), are primarily based on conservation drivers rather than on the convenience of locating matching offsets. There are both risks and opportunities to 'trading up'. The risks include that conservation efforts focus exclusively on the highest conservation priority biodiversity components, which arguably should be conserved anyway by other means. Some are concerned that this could serve to 'crowd out' other conservation investments. Another risk is that exchanging biodiversity of different types (essentially 'apples for oranges') through trading up may undermine the rigour of loss-gain calculations that are best applied to similar biodiversity components. On the other hand, if offset policies are restricted purely to 'like for like', this brings its own risks. First, if a project's impacts are on habitat types or species that are ubiquitous throughout the country and very well conserved in good condition, there is little value-added in conserving a few hectares more of the same system and it may be preferable to use the opportunity to secure a better outcome for biodiversity by investing the conservation measures of the offset in more vulnerable and irreplaceable biodiversity of higher conservation priority. Another risk of sticking rigidly to 'like for like' is that it may be difficult to find the same kind of biodiversity available for offset activities near to the impact site. Planners are then faced with the choice of rejecting the planning application altogether, or permitting it to go ahead either with offset activities outside the immediate area or directed instead to different biodiversity components of higher conservation priority.

Policies that define 'like-for-like'-or 'like-for-like or better' exchange rules typically include some or all of the following criteria:

- Type of biodiversity component (e.g. vegetation type, habitat type, species type)
- Vicinity (where the offset can be located e.g. within the same bioregion)
- Timing (to address time gaps between the impact and the offset)
- Ecological function
- Quality or condition requirement

For governments preparing NNL/NG policy and considering 'trading up' to prioritize conservation of the highest biodiversity values, establishing the scientific evidence to justify the prioritization, and communicating it clearly in the offset system is key. Generally the priorities adopted for the trading up rules will reflect biodiversity priorities already established in the relevant national and regional biodiversity strategies and plans. Where existing priorities are not sufficiently detailed to guide trading up, further work will be needed to refine conservation prioritization. In the interim, a precautionary approach is to stick closely to 'like-for-like'.

This section has discussed one of the two key aspects of equivalence, namely the 'kind' of biodiversity exchanged. (The technical issues behind this are discussed more in Pilgrim and Ekstrom, 2014.) The other key aspect of equivalence is the 'amount' of biodiversity exchanged, and thus the metrics for measuring loss and gain. These are discussed in the next section.

2.1.5 Metrics

Quantifying biodiversity loss and gain is core to achieving NNL/NG. It requires a basis for determining equity in type and amount of biodiversity, as well as in space and time. The key steps involved in establishing the basis for measuring losses and gains are as follows:[44]

- choice of biodiversity **components and measures**. This refers to **what** is being exchanged, or lost and gained (e.g., breeding pairs of a threatened bird species);
- choice of one or more **currencies** (sometimes called metrics) to quantify biodiversity exchanges. This is to show **how much** of what is being **exchanged** (e.g. area of vegetation x ecological condition);
- choice of an **accounting model** or system based on the chosen currencies and integrating various other considerations in order to define offset specifications. The resulting accounts show **how much** of what is **needed** to achieve NNL; and
- **spatial information** on patterns of biodiversity at the impact and candidate offset sites. This is to pinpoint **where** gains of the right type and amount may be obtained.

The word 'metrics' is sometimes used interchangeably with the word 'currencies', but 'metrics' are sometimes understood more narrowly to be specific individual features measured (e.g. canopy height, density of tree holes etc.), several of which may be combined within a single aggregated currency (such as habitat hectares). On other occasions, 'metrics' are used more broadly, referring to the all the issues covered by the four bullet points above. This is another example of the confusion caused by several different interpretations of the terminology used around the world.

There is a wide range of published and unpublished methods for quantifying biodiversity loss and gain in order to demonstrate NNL/NG.[45] Reviews of metrics reveal a range of approaches from simple area with 'ratios' to more detailed functional assessments. For instance, there are over 100 metrics used in the USA and over 40 in Germany.[46] Despite this variety, metrics can be readily classified into just a few different approaches: area-based, area x condition (which is the core of current best practice), species-based metrics based on measurement of population, and, very occasionally, economic valuation.[47] Selecting appropriate approaches, whether at the project level or for inclusion in policy measures, can be challenging. While there are some useful lessons learned about best practice internationally, it is important to select and adapt metrics that are appropriate to local circumstances.[48.]

Given the complexity of biodiversity and its different aspects, such as species composition and abundance and habitat structure and ecological function, metrics are usually surrogate measures, aimed at capturing some crucial elements of the overall value of biodiversity lost and gained, while keeping the measurement task relatively simple and cost effective. This is a difficult task as surrogate measures can involve problems of scaling and lack of transparency. While there is growing experience on how to handle these challenges, the issues are not well understood and require further research.

Most biodiversity has been affected by human activity to some degree or other. The condition and amount of biodiversity vary enormously, even within the same habitat type. One hectare may be pristine, with high levels of diversity and functionality, and another hectare of the same type may be greatly degraded, depauperate and with few of its ecological functions intact. Because of this variability, area alone makes a poor measure of biodiversity, and loss and gain metrics for habitats often include a quality component. So called 'condition x area' metrics for

[44] See Gardner et al., 2013.
[45] BBOP, 2012c; Gardner et al., 2013; Quétier et al., 2014 in press; Quétier & Lavorel, 2011; Robertson et al., 2014 in press; Caro et al., 2010; Salzman & Ruhl, 2000.
[46] Tucker et al., 2014 in press; BBOP, 2009b; BBOP, 2012f.
[47] BBOP, 2012c; BBOP, 2012f; BBOP, 2009b; BBOP, 2009a; Temple et al., 2012; ICMM and IUCN, 2012.
[48] See Gardner et al., 2013.

habitats (or, more accurately, biotopes) often form the heart of loss-gain calculations. However, there may also be species of conservation concern for which losses and gains will not be well represented by broader changes in the condition and extent of habitat. For this reason, habitat-based metrics are often supplemented by species metrics, although challenges remain as to how to avoid 'double counting' when combining both approaches. In other words, if a habitat condition metric combines a number of individual species attributes and describes overall changes in habitat condition, how can separate metrics designed to suit particular species be used in combination with such a habitat metric? There is a risk that using both metrics together risks counting some changes twice, because they are partly covered by broader changes in habitat condition, and then again more particularly for the species with their own metrics. Another challenge is the simple computational and spatial one of gathering and layering the considerable amounts of data needed to combine numerous species' metrics. Levels of biodiversity and the condition of habitat may also vary with location, for instance due to patch size, edge effects and connectivity. Spatial aspects can also thus form part of a set of metrics, whether as a stand-alone metric, integrated into a habitat metric, or treated more qualitatively in the criteria for site selection. Finally, some interpretations of 'loss of biodiversity' cover the loss of people's socioeconomic and cultural values associated biodiversity.[49] A variety of approaches have been taken to measuring these losses and gains so as to ensure that indigenous peoples and local communities are left no worse off (and preferably better off) as a result of a project and the associated offset activities. While the other types of metrics are based on biodiversity measures, economic valuation can be used to supplement this and take care of the use and cultural values associated with biodiversity.

The technical aspects of these issues are discussed in more depth in the companion paper (Pilgrim and Ekstrom, 2014).

Policy-makers will need to decide whether policy will account for losses and gains of habitats, species, spatial features and people's cultural and use values of biodiversity, and whether there will be separate or combined metrics for these. Another decision is whether to require developers to use a prescribed set of metrics or instead stipulate criteria for metrics and allow developers to put forward their own models, provided they meet the criteria. Most government policies on NNL/NG (or the guidelines associated with them) set out the metrics to be used.

Metrics and currencies for measuring NNL/NG are a topic which definitely deserves further consideration, both at the level of local experts (to help determine the most appropriate metrics for a given setting) and at the level of intergovernmental organizations, such as IUCN (which could help establish international criteria for best practice).

2.1.6 Planning and mitigation

Land-use planning and marine planning lie at the heart of policies for NNL/NG, and represent significant responsibilities for policy-makers.[50] Within this broad ambit, landscape-level planning refers to spatial planning undertaken at a regional scale, using a systematic approach that aims to balance ecological, social and cultural needs with economic activities in the landscape. Planning in a landscape context is important for mitigation measures including offsets because it:

- guides application of the mitigation hierarchy;
- underpins the selection of offset and compensation sites; and
- supports planning for aggregated offsets and conservation banking.

Mitigation measures and offsets may be planned within a variety of contexts and linked with other planning processes. For instance, national conservation or biodiversity action plans that prioritize areas for protection or restoration based on national goals or conservation targets can be used to identify priority sites for offsets or

[49] BBOP, 2009a and BBOP, 2012c.

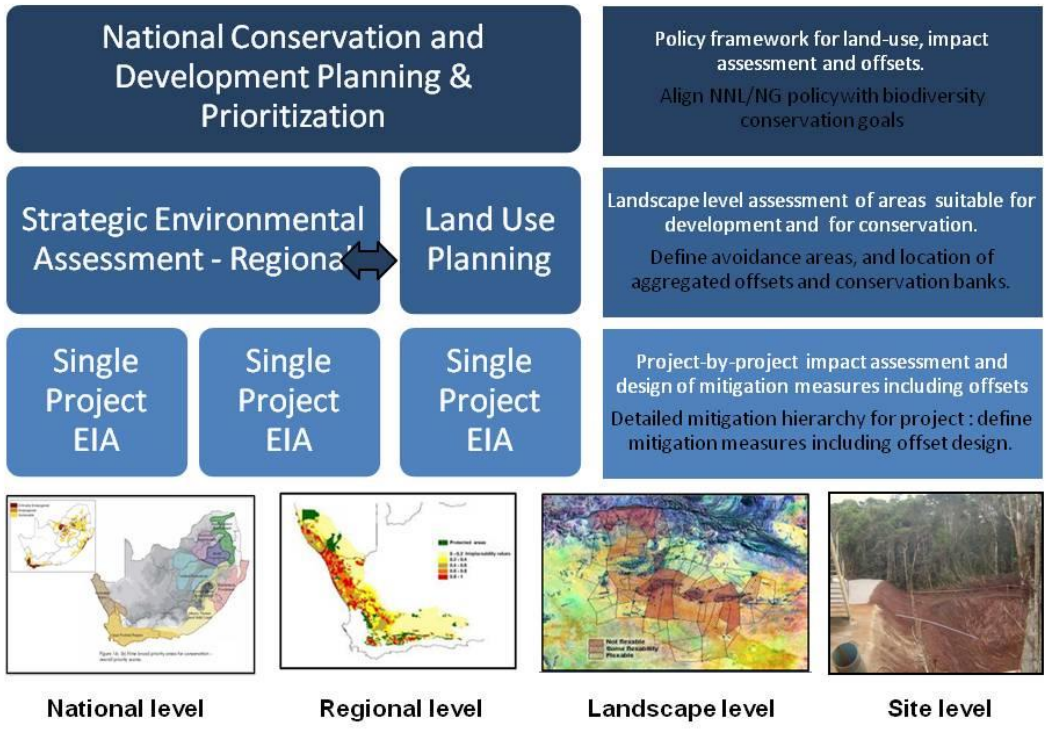
[50] BBOP, 2012b; McKenney & Kiesecker, 2010; Kiesecker et al., 2009; Faith & Walker, 2002; Faith et al., 2001.

compensation activities. At the local, individual project level, the planning mitigation measures, including offsets or compensation, often takes place within environmental impact assessment. Mitigation, offsets and compensation can also be planned as part of regional land-use planning or strategic environmental assessments where conservation and development goals are assessed together and areas suitable for development and protection are identified. Mitigation measures planned in the context of SEA or land-use planning can help deal with cumulative impacts such as 'death by 1000 cuts' and are more likely to be implemented through aggregated approaches or conservation banks. Larger, more strategic offset or compensation sites can offset impacts from multiple development projects.

For the SEA and national conservation planning levels, mitigation measures including biodiversity offsets can be planned ahead of individual projects or development actions as part of strategic land-use planning. In these cases, it may be possible for offset gains to be in place before development impacts occur.

Figure 2 illustrates how planning for NNL/NG can take place at a number of different levels. Mitigation measures and offsets planned with these in mind are likely to address strategic conservation priorities and stand a good chance of long-term success (since they consider other planned developments and land uses).

Figure 2: Relationship of mitigation measures to the planning processes



Source: ten Kate et al., 2011.

Success in practice relies on close coordination between the Ministry of Environment (generally responsible for designing and delivering NNL/NG policy) and other Ministries (particularly those responsible for Planning, Communities and Indigenous People, Housing, Mining, Energy, Transport, Agriculture and Fisheries). Coordination will also be needed between policy-makers, developers, investors and communities, since all have a role to play in planning decisions. Policy-making for NNL/NG requires clarification as to the appropriate baselines, exchange rules, metrics and land-use planning for NNL/NG that work at the different scales illustrated in Figure 2.

Another aspect of coordination concerns the integration of biodiversity planning with other important issues and activities within the landscape, such as carbon sequestration, water provisioning, and economic activities to alleviate poverty and foster development. In addition to mitigation measures focused on biodiversity, Payments for Ecosystem Services Schemes (PES), REDD+ and other activities may be considered within the same landscape. This gives rise to interesting questions that are still being resolved in the international community and in individual contexts. For instance: carbon offsets have a requirement of 'additionality' and so do biodiversity offsets. If an area is already planned for the generation of carbon credits, could biodiversity offsets also be generated on the same land, or would this fail to satisfy the additionality requirement? Policy-makers and companies working on these issues are starting to explore approaches to 'stacking and bundling' and 'layering' that were applied first in the USA, and to consider other approaches to securing 'multiple benefits' within the landscape.[51] Currently, little guidance is available on such integrated planning, and more work at the national and international levels is needed.

2.1.7 Activities qualifying as 'gains'

Most policies on NNL/NG offer guidance on the set of activities which can deliver the secure and additional long-term gains needed to offset residual impacts.

'Gain' is an increase in the extent and/or quality of biodiversity.

It can be useful to distinguish the types of gain because they arise from different actions and commitments. Mitigation and offset activities designed to achieve NNL/NG may be made by different parties in different locations, so this categorization allows the overall gain to be calculated, and parts of it attributed to separate actors. For instance, NNL for a particular housing development might be delivered by a combination of conservation activities on and around the project itself by the management body maintaining the housing estate over the long term, creation of a new conservation area by local authorities, and purchase from a conservation bank of credits for a bird species of particular conservation concern.

By way of example, in Victoria three categories of gain are distinguished – improvement gain, maintenance gain and security gain:

- *Improvement Gain* results from management commitments beyond existing obligations under legislation to improve the current habitat condition and additional to what would have occurred on the land were it not for the offset activities. Typical actions leading to an improvement gain include reducing or eliminating weeds, enhancement planting or the reintroduction of fauna species.

- *Maintenance Gain* results from commitments that contribute to the maintenance of biodiversity quality and condition over time (i.e. avoiding any decline). It includes foregoing entitled activities that could otherwise damage or remove biodiversity, such as grazing or firewood collection.

- *Security Gain* results from actions to enhance the security of biodiversity (i.e. avoiding loss through clearing or conversion), either by entering into an on-title agreement, by transferring private land to a secure public conservation reserve or by upgrading the protected status of public land. (Just as a decision to elevate the security arrangements for a site can generate security gain, a decision that increases the risk of loss through clearing could be considered to generate a security loss.)

Gains can be calculated using the kind of approaches to equivalence (exchange rules and metrics) described in the preceding section. The calculation of security gain requires an estimation, based on evidence, of the annual risk of loss of biodiversity under the status quo, and consideration of the likely gains under improved security arrangements, such as an increase in the formal level of protection of the area. For a more technical discussion, see Pilgrim and Ekstrom (2014).

[51] On stacking and bundling, see, for instance, Cooley & Olander, 2011; Wunder & Wertz-Kanounnikoff, 2009; Deal et al., 2012.

In order to achieve gains, it is not always necessary to purchase the land (or acquire a long lease) where the conservation activities will take place. Offset activities may indeed take place on land acquired for the purpose, for instance, land bought for the offset by a developer and made over to a conservation NGO or a protected area management authority. Conservation banks are often set up on private land purchased as the basis for the bank and issue credits for the gains they create on the land. However, some offset systems (such as those in Australia) allow the original landowner where the offset activities will take place to retain ownership of the land, provided a servitude (or easement or covenant) is registered on the land in perpetuity and contracts are in place to ensure the offset activities are undertaken to the appropriate standard. Some regard this contractual approach as a form of payment for ecosystem services (PES).

Policy documents by government, and accompanying guidelines, can usefully set out the different types of gain that are foreseen for the system and how they are to be calculated and secured for the long term. Governments are also well advised to plan for the adequate supply of offsets prior to the introduction of a NNL/NG requirement, by working with potential implementing organizations, as discussed in the next section.

2.1.8 Implementing organizations

It is typical for NNL/NG policies to set out which individuals and organizations are eligible to undertake offsetting activities – whether they be farmers and other private landowners, local communities, conservation NGOs and Trust Funds, conservation banking companies or local authorities (see, for example the Colombian policy, which envisages new protected areas as well as voluntary conservation agreements between the developer and landowners, rightsholders and local and indigenous communities).[52] Government also needs to determine the standards by which they should abide (for instance, USACE, 2008 and Government of Victoria, 2014). Prior to the introduction of NNL/NG requirements, it is wise for government to work with these potential providers to discuss the opportunities, responsibilities and steps involved in the implementation of offsets.

To be effective, biodiversity offsets need to be secure and in place for as long as the loss exists. Often the loss is permanent, meaning that the offset must also be permanent. A variety of mechanisms and instruments may be needed. In jurisdictions where private property rights are well defined and protected area legislation is in place, security and permanence can usually be established through the use of legal devices such as covenants, easements and new conservation reserves. In other circumstances, for example where customary land is found, more innovative approaches, such as long-term agreements with communities, will be required.

The different ways of implementing biodiversity offsets, and the legal, institutional and financial tools needed to support long-term implementation of mitigation measures, including offsets, are discussed further in Sections 2.4 and 2.5.

NNL/NG policy should spell out the approaches envisaged for implementation and the tools available. Where tools (such as conservation covenants or trust funds) are lacking, new laws or policy instruments may be needed to create them.

2.1.9 Data and capacity needs

It will be clear from the foregoing sections that beneath the core elements of NNL policy described in this section are a number of data and capacity needs. The capacity needed by government and other stakeholders for work on NNL/NG is discussed in Section 4.

An important factor in the development of biodiversity offset policy is the underlying body of biodiversity information. A biodiversity offset scheme is reliant on the information base in a number of ways including:

[52] Ministry of Environment and Sustainable Development, Colombia, 2012.

- To guide the application of the mitigation hierarchy, particularly by identifying areas of the highest conservation significance, where development should be avoided and which could be priority areas for offsets, provided additionality can be satisfied;
- To inform the measures of loss and gain;
- To enable categorization of biodiversity significance (priorities); and
- To enable the 'like-for-like or better' exchange.

Typically the basic information required for biodiversity offsets includes the extent and type of ecosystems, biotopes or habitats, their quality or condition, conservation status (e.g. 'threatened'), evolutionary significance/ centre of endemism, migratory or aggregatory species records and ranges/distributions, and species' habitat requirements, as well as information on business-as-usual trajectories and the trajectories for biodiversity under alternative management interventions which might be employed as offset actions. Some information is required at a regional scale to provide context (for example in order to consider the relative significance of a site, importance of connectivity and corridors in the landscape, priority areas for protection or protected area expansion, etc.), while some may be collected at a site level. In addition, information on national or regional conservation plans, strategies and priorities is invaluable in focusing offset efforts. Information on the cultural and use values of biodiversity is also important.

It is common for governments to lack some or all of the data, maps and capacity needed for NNL/NG policy design and implementation when the topic is first discussed by policy-makers. Generally, it is possible to work with available data and skills on an interim basis, and to set out a plan for improving the data and training key personnel over time. This is addressed in Section 5.1.

2.1.10 Monitoring and enforcement

An important component of policy is the manner in which commitments on avoidance, minimization, restoration and offsetting are to be monitored and enforced. Indeed, evidence suggests that lack of adequate monitoring and enforcement is one of the single biggest causes of failure of mitigation measures including biodiversity offsets.

The governance model for the NNL/NG system needs to clarify by whom and how the following will be monitored and enforced:

- Regulatory requirements to avoid, minimize, restore and offset, in EIA and planning permission;
- Management agreements between offset providers and the State (in the case of third-party offsets);
- Biodiversity Offset Management Plans (in the case of first party or third party offsets);
- Conservation covenants (sometimes known as servitudes or easements); and
- Good governance of conservation trust funds.

Sufficient budgetary provision needs to be made for these activities. Costs and cost recovery are discussed in Section 4.1.

2.1.11 Governance

Governance refers to the way rules are set and implemented. In the context of governments' approaches to establishing and administering systems for NNL/NG, 'governance' covers how governments set out and run the rules on the rights and responsibilities related to delivering NNL. This embraces planning permission, social and environmental impact assessment, conservation prioritization, defining the core elements of an offset system (as described in this section), granting authority to certain organizations to play their part in the system (for instance, delegated authority for local governments, or accreditation of private sector organizations to undertake

assessment and verification of mitigation measures), and verification and enforcement of the performance of mitigation measures (including offsets). Provision may be needed to avoid potential conflicts of interest, given the many potential roles of government in NNL/NG systems. Systems for evaluation independent of government (whether independent committees appointed by government to review significant government decisions, or systems of accreditation of independent verifiers) may be desirable. Good governance of NNL/NG involves ensuring that there is consistent and transparent management of the system, cohesive policies and clear guidance and processes, including coordination between different levels and agencies of government involved in the various roles of the state (which are described in Section 3).

A particularly important aspect of coordination is between different ministries and departments within a government. An illustration can be found in Peru, where some of the authority for regulating environmental impact assessment and now for integrating compensation for the largest projects is being transferred from sectoral ministries (such as the Ministry of Mining and Energy) to a new government agency (the national environmental certification service – SENACE) under the Ministry of the Environment. Sectoral ministries will remain responsible for regulating EIAs for smaller projects. This highlights the need for coordination between the Ministry of Environment and other sectoral Ministries, such as those for mining, energy and roads, etc.

Another equally important aspect of coordination is between different units operating within the same Ministry. To continue the example from Peru, the Ministry of Environment houses the National Environmental Information System (SINIA), which coordinates the Ministry's work on EIA, as well as a unit working on valuation, responsible for developing the Ministry's approach to compensation. Coordination between these two units is important for the development of seamless compensation policy that is workable in practice, as indeed is coordination with the National Service of Natural Areas Protected by the State (SERNANP), an agency under the Ministry of the Environment. Every country presents similar situations that require effective coordination in policy-making and subsequent administration for good governance.

The level of government responsible for regulating and administering relevant policy presents another important aspect of coordination concerns. In both South Africa and Australia, for example, policy requirements on biodiversity offsets at the national level were developed after offset provisions had been developed by a number of states and territories, requiring dialogue and coordination. In state/federal systems where considerable autonomy rests with state or regional levels of government, different approaches to implementing national policy may arise. For example, in Germany, the variation in approaches taken by different states has created confusion and additional costs for business.[53] Even in a highly regulated offset system such as the USA, there are noticeably different approaches to implementing the net gain policy for wetlands under the Clean Water Act within US states.

2.2 Different kinds of offsets

This section will outline the meaning of various different kinds of biodiversity offset that may be found, including voluntary, regulatory, prospective, retrospective, composite and aggregated offsets.

2.2.1 Voluntary and regulatory offsets

There are broadly two kinds of biodiversity offsets or compensatory conservation:

(a) **Voluntary biodiversity offsets or compensation**, which a developer undertakes in circumstances where there is no legal requirement to do so, because it perceives a business advantage (such as license to operate, reputational benefits, access to finance, competitive advantage, market share, etc.); and

[53] Tucker et al., 2014 in press.

(b) **Regulatory biodiversity offsets or compensation**, which are required by law.

Biodiversity offset policy can be implemented in several different ways at a country or state level. In some cases the initiative for offsetting may be left to the private sector, as a voluntary choice (option (a), above). In other situations (option (b)), a government may choose to support the private sector with official policy, which may offer incentives or set out requirements for biodiversity offsets for certain activities or impacts. Each of these approaches will be discussed in turn.

Voluntary offsets

Companies may choose to undertake biodiversity offsets voluntarily, based on a business case. Voluntary offsets are part of corporate responsibility and good environmental practice and can help to secure a license to operate. Good working relationships with government and local communities can save companies time and money through early permit approval. Many large banks place biodiversity conditions on their loans for development projects. These and other elements of the business case are summarized in Box 8.

While it is perfectly possible for companies to undertake voluntary biodiversity offsets in the absence of any formal government intervention, some government policy can be very beneficial. At a minimum, such policy can address:

- General recognition of the goal of attaining NNL/NG and the benefits of following the mitigation hierarchy and using biodiversity offsets to address residual impacts;
- General statement of support for companies undertaking voluntary offsets;
- Facilitation of access to biodiversity information; and
- Government willingness to consult with companies on NNL/NG and applying the mitigation hierarchy, including the facilitation of voluntary biodiversity offsets.

Box 8: The business case for voluntary biodiversity offsets

A company's biodiversity impacts can lead to significant regulatory, financial and reputational risks. Governments, financial institutions, and civil society increasingly expect developers to take full responsibility for such impacts. The business case for companies to address their impacts on biodiversity will vary according to their sector, location and prevailing operating conditions and thus the risks and opportunities involved, but a number of issues that are commonly cited are described here. In many cases, biodiversity offsets offer companies a way to demonstrate no net loss of biodiversity, improve outcomes for local communities, and reduce operational and project development risks. Companies voluntarily developing biodiversity offsets forge good relationships with regulators and stakeholders, which can contribute to securing permits and broader social license to operate. Adherence to internationally recognized best practice principles (e.g. those developed by BBOP), can help businesses build their reputations as leaders, manage biodiversity-related risks, and shape the regulatory requirements increasingly being developed by governments.

Elements of the business case:

License to operate and regulatory goodwill; managing risk and liability; strengthening reputation: Designing and implementing high quality biodiversity offsets can help companies work effectively with local, national and international stakeholders. Showing efforts to achieve no net loss of biodiversity improves a company's reputation and reduces anti-project sentiments and project risk. Adopting best practice helps streamline permit approval, thereby lowering the risk of project delay and significant unanticipated start up and operational costs.

Operational efficiency and cost savings: Biodiversity offsets may provide a more cost-effective solution than a sole focus on on-site mitigation measures. By working through a structured approach to avoidance, minimization,

restoration and offsets, companies may reduce overall costs while achieving greater conservation results. Companies with good relationships with regulators and local communities will also enjoy the financial benefits of operational efficiency, avoiding the costs associated with revoked licenses or blockaded facilities.

Access to finance: Companies seeking project finance from the International Finance Corporation, or from the more than 60 major banks that have subscribed to the Equator Principles, are encouraged to consider biodiversity offsets. Applying best practice can help developers secure credit and investment. (See Section 1.3.5)

Competitive advantage: Through voluntary adoption of best practice on biodiversity offsets, companies can distinguish themselves from competitors who may be bidding for the same licenses or seeking market share. Leadership companies position themselves favourably in an environment where regulator and financier expectations are increasing and competitive advantage may be necessary to win concessions, attract finance and gain market share.

Shape policy: Companies undertaking biodiversity offsets gain 'first mover' advantage and a seat at the table where national policy and international best practice standards on biodiversity offsets and compensation are being developed. They can contribute to the international adoption of policies that work well for business.

Standards: Adopting voluntary standards helps companies demonstrate the quality and effectiveness of their biodiversity offsets, which helps avoid controversy and uncertainty. BBOP worked with a broad range of stakeholders (including companies) to develop the Standard on Biodiversity offsets.[54] IFC's Performance Standard 6 is another example of a voluntary standard related to NNL/NG.[55]

Under a facilitated voluntary approach a government would develop a policy aimed at positively encouraging biodiversity offsetting within its jurisdiction. Such a policy would often be part of a broader biodiversity conservation policy that could also include provisions such as setting aside protected areas and the development of plans for the protection and recovery of threatened species.

An offsetting scheme can be introduced in the absence of highly detailed biodiversity information systems as long as there is sufficient information to enable these mechanisms to function in a basic way, with confidence that this will not undermine existing protections for biodiversity. As time goes on, the information base can be improved and the offsetting mechanisms can be enhanced accordingly.

Beyond the basic biodiversity informational needs for offsetting policy (such as data and mapped classifications of biodiversity, biodiversity condition, threatened species records, and species' habitat requirements), broad land-use plans that include biodiversity conservation can be helpful where there is an objective to locate and aggregate offsets strategically at the landscape scale.

As part of a biodiversity offsetting policy a government may choose to offer incentives for developers to implement offsets according to the policy. These incentives can influence the business case through factors such as an enhanced case to government for project approval, facilitated access to government-held biodiversity information and assistance with local community relations. Alternatively, more direct incentives such as tax breaks and development bonuses could be offered within the policy framework.

An incentive policy could also extend to facilitating third party offsets for developers. This facilitation could include assistance with finding areas that meet to like-for-like criteria, helping with landowner negotiations and addressing any associated land-use planning issues.

[54] BBOP, 2012a and BBOP, 2012b.
[55] IFC, 2012. See Section 1.3.5 of this document.

Regulatory approaches

Under regulatory approaches, biodiversity offsets are made mandatory for certain defined activities or impacts. Regulatory approaches are generally introduced in circumstances where the government concerned recognizes that ongoing biodiversity losses are unsustainable and are compromising the integrity of natural resources and the community benefits flowing from these resources. The aim of regulatory approaches is to provide a response to biodiversity losses within the jurisdiction that sets a level playing field for all entities with impacts on biodiversity, introduces clarity and legal certainty on their rights and responsibilities and achieves a greater and more consistent biodiversity outcome than will occur through purely voluntary approaches.

The regulatory requirement for biodiversity offsets is usually integrated into the development approval processes. Development approval processes can include environmental impact assessments, land-use planning laws and legislation covering permitting for specific industry sectors such as exploration and development within the extractive sectors. The availability of an offset should not be seen as an automatic green light of approval, regardless of the significance of the impacts. Furthermore the unavailability of an appropriate offset may in some cases be sufficient reason to modify or reject a proposal.

The standards and methodologies that back up offset policy can be given a statutory basis in a regulatory approach. In most cases this is done by a basic and very simple reference to the requirement for NNL/NG, using offsets for residual impacts where necessary, within the governing law, so that policy or guidance documents can be prepared and amended from time to time through an administrative process without constant recourse to Parliament. This allows improvements to standards and techniques to be incorporated without the necessity of amending the original legislation.

2.2.2 Prospective and retrospective offsets

A ‘prospective offset’ is one where the decision to undertake an offset is made, and the conditions in the project area are characterized and documented, prior to any impacts associated with the development project. This maximizes the chance that the pre-project conditions can be accurately characterized and the residual biodiversity losses due to the project can be determined with confidence. Most NNL/NG systems, whether regulatory or voluntary, require the biodiversity on the site that will be affected to be documented prior to impact, and are thus prospective.

By contrast, a ‘retrospective offset’ is when the impacts associated with the development project have already occurred prior to the decision to undertake a biodiversity offset, or before pre-project conditions were documented. Retrospective offsets may be used, for instance, where there is no regulatory requirement so that NNL/NG was not a feature of project design at the outset, but some business case or motivation subsequently arises so that the developer wishes to attain NNL/NG after construction. Another scenario is when a project that has already been constructed is taken over by a new investor with NNL/NG commitments. Retrospective offsets increase the uncertainty and risk associated with offsets, but can be undertaken successfully if specific conditions are met. There are two ways in which retrospective offsets could demonstrate NNL/NG. First, if the biodiversity in the area affected by the project was identified, characterized and documented in studies undertaken prior to the project impacts, so the biodiversity present and its condition and trends prior to the impacts are known. For example, biodiversity studies undertaken on the site before the development occurred could provide this information, or an assessment conducted in the area as part of an Environmental Impact Assessment for the project concerned or an unrelated project. Second, in cases where little or no biodiversity data for the area concerned were gathered prior to the project’s impacts, the developer may be able to demonstrate plausibly, using the best available data, that it is possible to infer the pre-project biodiversity condition using information from other similar (‘proxy’) locations, preferably nearby.

2.2.3 Composite and aggregated offsets

Composite offsets

It may be difficult to achieve NNL/NG of biodiversity by identifying a single location where all the biodiversity values affected may be found in the right amount, condition and spatial configuration. As a result, some offsets are planned as 'composites', comprised of activities in more than one location, each of which contributes some but not all of the essential components required to ensure NNL/NG of biodiversity. Together, the offset activities in different locations provide a composite designed to demonstrate NNL/NG. A typical example is where residual impacts on local people's values associated with biodiversity (e.g. amenity, livelihoods, local conservation priorities) are offset through activities close to the project's impacts, while other offset activities a little further afield address the needs of particular species and habitats, for instance, by creating connectivity between isolated areas of habitat, or increasing the size of protected areas.

Aggregated offsets

Aggregated offsets are conservation outcomes from compensation activities carried out to offset the residual impacts of more than one project, usually in a specific area or ecoregion. They are distinguished from individual offsets by compensating for the residual adverse effects of more than one development project. They are distinct from other forms of multiple offsets (such as conservation banks), in that they require coordination on both the demand side and the supply side of the offset.

There are certain circumstances or contexts in which the use of aggregated offsets might be considered particularly appropriate.[56] The most obvious context is where the same ecosystem or eco-region is exposed to cumulative impacts from several operators (particularly those in the same sector) at more or less the same time. In this context, impacts on biodiversity are likely to be of a similar type, and combined investment in an aggregated offset might offer overall economies of scale, as well as several ecological advantages. Other suitable contexts for aggregated offsets include situations where:

- There are several small scale developments which are individually insignificant (individual offsets not justified or very small scale, or where transaction costs for individual offsets would be prohibitive), but which may have significant cumulative impacts;
- Effective coalitions have developed or evolved in/around particular locations, with involvement of companies, government, communities and NGOs;
- Individual developers do not have the skills or resources necessary to deliver effective biodiversity offsets; whereas by collaborating and pooling resources, offsets would be achievable;
- There are a number of developers in the same sector and area of operation with a common set of international certification requirements and/or financing conditions to be met (i.e. help to meet a shared performance standard);
- There are reputable or certified organizations willing and able to supply the necessary conservation services in a co-ordinated and competent fashion; and
- Legislation and planning frameworks are enabling (e.g. there is an established conservation plan for the affected area with clear priorities supported by reliable information on biodiversity).

[56] Treweek et al., 2009.

All these types of offsets (voluntary, regulatory, prospective, retrospective, composite and aggregated offsets) may provide the best ecological and policy outcomes, depending on context. The next section will explore the range of policy and legal provisions that provides their context.

2.3 Different kinds of policy and legal provisions on offsets

The different kinds of regulation

Governments can introduce NNL/NG and biodiversity offsetting policy and regulation in two basic ways. First, through specific provisions on mitigation including biodiversity offsets (and perhaps other aspects of biodiversity conservation). Second, by incorporating provisions on mitigation including offsetting into other laws and policies that deal with environment impact assessment (EIA), land-use planning, strategic environmental assessment, sectoral policies or broader sustainable development or environmental policies.

The decision on which approach to take depends to some extent upon the legal customs of the jurisdiction concerned and the scope of the other laws relative to the intended scope for NNL/NG requirements. For example, in a particular jurisdiction the EIA laws may only cover large projects or projects in particular industry sectors (for instance, construction and extractives, but not agriculture). If the intention is to introduce offsetting for a wider range of projects, it may be necessary to introduce a specific law requiring NNL for the desired scope.

2.3.1 Specific policy and law on NNL/NG and biodiversity offsets

NNL/NG regulation will generally deal with the main matters of offsetting policy (discussed in Section 2.1), either directly or through incorporation by reference. Other provisions that are often included in these laws are:

- Exemptions for certain impacts on the basis that they are very small, the biodiversity is highly degraded or for safety and hazard reduction reasons;
- Situations of temporary loss of biodiversity such as sustainable timber harvesting;
- Reference to entitled or customary uses that do not require approval and hence are outside the offsetting regime; and
- Reference to provisions that establish a 'duty of care' to the environment (such as the control of pests and weeds as these expectations fall below the additionality requirement and do not qualify as offset activities.

Policy-makers will need to give thought to whether the effect of such exemptions and exclusions (which may involve small uncompensated impacts, but which can be significant cumulatively) can be reconciled with an overall NNL/NG goal. Complementary investments in conservation that are not designed to offset specific project impacts within the scope of the policy may help generate additional conservation 'gains' that can balance these uncompensated losses and help attain an overall NNL/NG goal.

2.3.2 Integrating provisions on NNL/NG and biodiversity offsets into impact assessment, planning requirements and other relevant policy and law

There are many different frameworks for biodiversity offset policy and law, depending upon the existing institutional and legal arrangements prevailing in the jurisdiction. The most common settings for biodiversity offset policy are EIA, SEA, planning law, sectoral law and as part of a suite of environmental offset policies. In some cases, biodiversity offsets may be included in broader policy frameworks established to promote sustainable development.

NNL/NG and EIA

In many countries, Environmental Impact Assessments (EIAs) provide the necessary framework for governments to negotiate biodiversity offsets with developers, particularly for larger scale projects. In others, where EIA is not a regulatory tool, or where activities having a significant negative impact on biodiversity do not trigger the need for EIA (typically small projects in some countries), other approaches would need to be used.[57]

From a company's perspective, a project's final design and associated environmental management plan are generally linked to issues and risks identified during the EIA. However, in order for the EIA to act as a trigger for NNL/NG and biodiversity offsets, the requirements of the EIA system itself need to be robust and transparent, to ensure that: (i) the full mitigation hierarchy is followed; (ii) there is a reliable measure of residual impacts on biodiversity and their significance; (iii) biodiversity offset negotiations take place with stakeholders; and (iv) realistic and practicable offset proposals are prepared. Offsets should not be seen as attempts by the developer to 'buy-off' officials.

There are some challenges to integrating NNL/NG goals, including consideration of biodiversity offsets, within the EIA process. Depending on the available information, EIAs may need to be conducted on a timescale that does not synchronize with the biodiversity being studied. For instance, it may take more than a year to understand potential seasonal impacts and to consider which aspects of a site's biodiversity are priorities for conservation efforts. By contrast, EIAs are often completed within a period of six to nine months. In addition, some conservation organizations have expressed concerns that, since EIAs are usually paid for and approved by the companies causing the environmental damage, they may underestimate the damage caused or the offsets needed to compensate for the damage.

However, from an efficiency perspective, and where EIAs are required by law, it can make very good sense from the company, stakeholder and government perspectives to integrate biodiversity offsets with regulatory requirements. For good practice, it is important to ensure that:

- EIA or its supporting policy framework includes targets to achieve 'no net loss' of biodiversity, translated into country and context-specific indicators;
- EIA requires the avoidance and minimization steps for all impacts on valued biodiversity;
- EIA requires that significant residual impacts are offset;
- EIA should address all components of biodiversity affected, including ecological and evolutionary process and functional aspects;
- EIA should address the use of cultural values of biodiversity to affected parties;
- EIA needs to consider impacts beyond the site boundaries, at the landscape scale;
- EIA needs to address indirect and cumulative impacts; and
- EIA should evaluate the effectiveness and risks of proposed measures to minimize and restore/repair impacts; that is, it must provide a reliable measure of residual negative impacts on biodiversity.

An offset can be integrated with the EIA process to deliver NNL/NG, provided that the above requirements are met. Details about implementation of the proposed offset should then be incorporated in an environmental management plan ('offset management plan') or Biodiversity Action Plan.

[57] For instance, see BBOP, 2009e.

NNL/NG and SEA

The purpose of Strategic Environmental Assessment (SEA) is to ensure that the environmental consequences of a proposed policy, plan or programme are appropriately addressed at earlier stages or higher tiers of planning and decision-making than would take place for a project through EIA. Governments can use SEA to establish an analytical framework for assessment of individual project proposals through EIA or other planning processes in a hierarchical model that sets objectives through policy-making and planning, and assesses alternative development options, cascading down to the level of project planning and EIA. SEA may draw on results of other landscape level planning initiatives that might clarify biodiversity, conservation and development objectives and provide a platform for comparing alternative development scenarios and their compatibility with these objectives. Individual projects can then be designed to meet policy goals and plan objectives. When planning for NNL/NG, a tiered system like this, especially if backed up by comprehensive spatial data on the distribution and significance of biodiversity and priority areas for biodiversity conservation in the landscape, can make it much easier to determine how biodiversity offsets might complement policies and contribute to national or regional conservation objectives and to address cumulative impacts.[58]

NNL/NG and planning law

In many countries, the planning process, with its formal system of applications and enquiries, offers another potential trigger for dialogue on NNL/NG including biodiversity offsets between developers and regulators. Indeed, environmental and social works are often required as a condition for planning approval, or as a form of 'planning gain'. For instance, in the UK, section 106 of the Town and Country Planning Act can be used (but rarely is) by local authorities to require developers to undertake compensatory conservation activities. Just as with EIAs, certain underlying conditions may be needed for this trigger to work successfully, such as clear guidelines, tax breaks and density bonuses.

NNL/NG and sectoral policies (mining, oil and gas, fisheries, etc.)

Policy on NNL/NG can be incorporated into national policy relating to particular industry sectors. This could be done with a view to establishing the NNL/NG policy within a sector that was anticipated to generate significant biodiversity impacts, or where the nature of the industry sector required particular policy approaches that would not be appropriate to apply to developments generally. NNL/NG provisions can thus be integrated into sectoral law and policy concerning, for instance, oil and gas, mining, electricity supply, forestry, fisheries, palm oil and other agricultural sectors, and tourism.

Biodiversity offsets and other environmental offsets (e.g. carbon, water, social issues) and Payments for Ecosystem Services

Governments may have policies that provide for offsetting a range of environmental impacts. Some governments (such as Western Australia and Queensland) have a broad, encompassing policy on 'environmental offsets'. Such policies may have subsidiary programmes on particular types of offsets. Other governments may introduce one or more thematic offset policies (e.g. biodiversity offsets, carbon offsets, wetland offsets and even social offsets) without an overarching environmental offsets policy. Other governments have Payments for Ecosystem (PES) Schemes.[59] These schemes may involve a variety of different credits.

[58] Further information about SEA and biodiversity offsets may be found in BBOP, 2009e.

[59] The Economics of Ecosystems and Biodiversity (TEEB, 2009) study defines ecosystem services as the 'direct and indirect contributions of ecosystems to human well-being' and categorizes them into regulating (e.g. water purification, carbon sequestration, flood attenuation); provisioning (e.g. food, fuel, freshwater, timber); cultural services (e.g. for spiritual and aesthetic benefits); and habitat (e.g. maintenance of genetic diversity). Note that 'supporting services' are incorporated under ecological processes, rather than as a category of 'services. The Millennium Ecosystem Assessment (2005) defines four

In any of these cases, questions will naturally arise as to whether biodiversity offsets and other types of offset or PES schemes can co-exist, and particularly whether there can be an 'overlay' of more than one scheme on the same piece of land. Generally speaking, two mechanisms for coordinating such different schemes have been considered, known as 'bundling' and 'stacking'.

'Bundling' refers to regulatory arrangements where credits from a single site are defined to include more than one environmental good or service. Thus a credit might be defined that incorporates both biodiversity gain and sequestered carbon from a revegetation site. 'Stacking', on the other hand, refers to arrangements where different and distinct types of credits can be generated from a single site. In the example above, separate biodiversity credits and carbon credits would be available for offsets from the revegetation site.[60]

Bundling and stacking remain controversial concepts, with concerns raised about 'double dipping',[61] site management incompatibilities and contractual conflicts. A very important topic for consideration is how the 'additionality' needed for a biodiversity offset (and indeed for most other types of offsets) can be ensured. Policy development on 'bundling and stacking' is still in its infancy, and many of the related issues remain to be resolved.

2.4 Ways of implementing biodiversity offsets

The discussion thus far has considered the basics of NNL/NG and biodiversity offsets and the main policy options for government seeking to implement a NNL/NG policy. These considerations have focussed on the processes for specifying mitigation measures including biodiversity offsets in relation to defined impacts. However, specifying avoidance, minimization, restoration and offsets in terms such as size, type, quality and locality is only half of the task. The next challenge is for the developer to discharge the obligation to implement them. There are three main approaches to this task of implementing biodiversity offsets: developer-initiated, in lieu fees and market mechanisms. Whichever approach is used, it will need to address key considerations such as identifying: (i) roles and responsibilities in the governance, management, monitoring and enforcement of the offset; (ii) how risk is assigned; and (iii) how the long-term security of the offset is assured through legal and financial arrangements. These issues are discussed in Section 3 and are also the subject of BBOP's 'Offset Implementation Handbook'.[62]

2.4.1 Developer initiated offset implementation

In this approach, while government may have introduced policy that encourages or requires biodiversity offsets, it generally takes a non-interventionist stance on how offsets should be implemented, and particularly on the task of finding offsets. The onus rests with the developers to find their own offsets (whether the offsets themselves are voluntary or required by regulation). This method can be ineffective in terms of offsets and unpopular with developers for a number of reasons:

- Identifying and securing appropriate offset areas is often outside the core expertise of developers, particularly smaller companies;
- It can be a time- and resource-consuming task;

---

categories of ecosystem services: *Provisioning services*: The goods or products obtained from ecosystems such as food, freshwater, timber, fiber and other goods. *Regulating services*: The benefits obtained from an ecosystem's control of natural processes such as climate, water flow, disease regulation, pollination and protection from natural hazards. *Cultural services*: The non-material benefits obtained from ecosystems such as recreation, spiritual values and aesthetic enjoyment. *Supporting services*: The natural processes such as erosion control, soil formation, nutrient cycling, and primary productivity that maintain other services.

[60] See, for example, Cooley & Olander, 2011; Wunder & Wertz-Kanounnikoff, 2009; Deal et al., 2012.

[61] Double dipping is when the person generating the credit(s) sells the same conservation management intervention to different buyers.

[62] BBOP, 2009c.

- Projects or companies may 'move on' before an appropriate offset has been located and implemented; or
- Lack of oversight by government can lead to inefficient, fragmented and un-strategic offsets.

2.4.2 In lieu fees

Under this system a government agency stipulates a payment from the developer with the intention of deploying the funds at a later date to find a suitable offset. This approach is often favoured by developers because their offset requirements can be resolved quickly and with certainty through a single payment which sheds their liability for the offset. In lieu fees can allow aggregation of individual offsets into larger, more beneficial areas. However from a broader perspective in lieu fees have a number of disadvantages including the following:

- The risks associated with finding the offset are not reduced but merely transferred from the developer to the government agency.
- The agency is required to estimate the cost of the future offset at the time of the in lieu payment. As this cost is not accurately known, the estimate will be either too low (in which case the agency will be short of funds to implement the offset), or too high (in which case the developer has paid an excessive fee).
- In lieu fee schemes can accumulate large funds over time, and sometimes these funds are not released for conservation activities for a long time.[63] For instance from 2000 to 2008, the Environmental Compensation Fund established to receive 'Industrial impact compensation' under Brazil's National Protected Areas System Law (9985/00) totalled approximately R$ 500 million (US$ 214 million) from 300 compensation requests. However, of this R$ 500 million, in 2010, almost R$ 209 million were being held on account, while developers and policy-makers waited for the Supreme Court decision to determine whether past compensation sums would need to be re-assessed based on a new formula for calculating payment amounts[64]. In practice the tendency is for the implementation of offsets through in lieu fee schemes to be incomplete and sometimes for the funds to be diverted away from biodiversity offsetting to other 'good environmental causes'.

2.4.3 Market mechanisms

A third way of implementing biodiversity offsets is to use market mechanisms such as conservation banking and generation and sale of biodiversity credits. However, biodiversity is infinitely variable. Given the philosophy embraced in biodiversity offset policy in many countries of 'like for like or better' (or ecological equivalence), the goal of NNL/NG and the necessity for equity and respect for the rights of indigenous peoples and local communities, biodiversity offsets are essentially a local and bioregional tool. Biodiversity offsets are generally required and planned within the same bioregion as the area impacted, to contribute to conservation of essentially the same biodiversity components and there is often a strong emphasis on ensuring local communities' needs are met. This means that biodiversity offsets are uniquely tailored to local circumstances and cannot be traded internationally, unlike carbon, where there is a single, global metric and unit (i.e. tonnes of carbon dioxide equivalent). Some countries establish conservation banking and designate a set of biodiversity credits as a means of defining offset requirements. These systems generally define the 'service area' within which credits can be purchased and traded, within a watershed or local bioregion and vegetation class.

A developer can provide its own biodiversity offset, for example on land the developer owns. Alternatively, a developer can enter into an arrangement with a third party for the provision of the required offset. These arrangements are generally made by purchasing biodiversity credits from a conservation bank (usually operated by

[63] See Duke and ten Kate, 2014, in press.
[64] Chico Mendes Institute for Biodiversity Conservation, reported in ten Kate et al., 2011.

a company), or from individuals and organizations that can provide biodiversity credits to the requisite standard. The developer pays the third party an agreed price in return for the requisite number and type of biodiversity credits that comprise the offset. In this context, 'credits' are quantified gains in biodiversity generated by actions that increase the extent, quality or security of habitat or species.

A conservation bank is an area of land where biodiversity credits are established in advance of any actual trading of credits for offsets. A conservation bank is thus an entrepreneurial project where an investor establishes credits in anticipation of future sales. Conservation banks are usually large relative to the size of the anticipated individual offsets. Banks have the characteristic of combining a number of individual offsets onto a single site. The banking approach can help reduce offset uncertainties by providing offsets that have already been designed and are under implementation, rather than having to wait for suitable offset locations, activities and willing partners to be found case-by-case, with all the attendant uncertainties.

The generation and supply of biodiversity credits nationally or locally and the use of conservation banks represent one way of implementing biodiversity offsets. Markets can thus be used to supply biodiversity offsets for developers. These markets do not develop spontaneously, but require government intervention to set up the key components and ensure that the mitigation hierarchy is followed and NNL/NG delivered. Properly designed and operated, markets can be very effective in supplying offsets in a timely and cost-effective manner. However, biodiversity offset markets are subject to all the traps and limitations of markets everywhere.

Offset markets have some unusual characteristics which challenge general economic thinking about markets. The primary purpose of an offset market is as a tool for effectively supplying high quality biodiversity offsets as part of a NNL/NG biodiversity conservation policy. Market efficiency is an important but secondary goal.

Furthermore there is no aspiration to expand the offset market for its own sake. After all, every offset is associated with a commensurate biodiversity loss and the overarching policy objective is to reduce impacts on biodiversity altogether. Thus for NNL/NG, there is no biodiversity benefit from more offsetting and a larger offset market.

2.5 The design of biodiversity offset markets

2.5.1 First-party and third-party offsets

In some circumstances, a developer can provide a biodiversity offset on their own land. In this case the developer takes on the responsibility for the establishment, management and ongoing protection of the offset site. This situation is sometimes referred to as a first-party offset. However many developers are reluctant or unable to provide their own offset because:

- They do not own the appropriate land or biodiversity components on which a suitable offset can be based;
- They lack the capacity and expertise required to establish and manage land and biodiversity; or
- Their project has a fixed term and they do not want to be committed to ongoing obligations associated with the project's offset.

The alternative is to reach agreement with another person or company to provide the biodiversity offset – a third-party offset. This is the basis for the offset market, demand for offsets from developers and supply of offsets by other landowners.

The basic elements for an offset market are units of trade (credits), trading rules, standards and credit registers.

2.5.2 Biodiversity credits

Offsetting is a balancing of residual loss and gain. Credits are units of gain that can be traded in an offset market. The key consideration for the utility of credits is that they meet all the requirements for gain as specified in the offset policy of the jurisdiction. So, for example, credits are measured using the same metrics as set out in the NNL/NG policy. If the conservation outcomes are to last for the very long term, then the credits must also be permanent. Generally, whatever standards and processes apply to the establishment, measurement and protection of any offsets must also apply to credits, if they are to be part of the system.

Credits have some characteristics in addition to their need to match the requirements of the offset policy on gain. Credits are generated through investment in conservation activities and sold to developers who need offsets, so they are a form of property. There can be some uncertainty about the status of credits as property in some jurisdictions because biodiversity credits (and other types of credits) are novel and untested. It can be beneficial to establish biodiversity credits formally through legislation to remove any uncertainty. If buyers and sellers are unsure about exactly what rights they are exchanging in a credit trade, this uncertainty can undermine confidence in the market. Governments can engender confidence in the offset market by establishing biodiversity credits in law. Clear land tenure is critical for the satisfactory operation of operation of offsets in general, and clear property rights for credits are similarly important for market based approaches to their implementation.

While it is useful to recognize credits legally as property it is important to restrict their use to the function of providing offsets or contributing to biodiversity conservation more generally. It should not be permissible for credits to be used for security for debt as this could compromise the long-term security that is necessary for their use as biodiversity offsets.

When biodiversity credits are designed to implement and deliver biodiversity offset requirements, they need to be fit for this purpose, meaning that they must comply with the policies and standards that apply to offsets themselves. Compliance with these requirements can be achieved in a number of ways including through: (i) enforcement of mitigation measures including requirements in planning conditions by government (and adequate budgetary provision and this monitoring and enforcement function); (ii) accreditation of certified private sector organizations which can undertake loss-gain assessments and review biodiversity offset management plans according to the rules established by government policy; (iii) government-operated registers for credits that meet these standards. Standards thus serve to minimize the risk to society and the environment from poorly performing offsets and also provide certainty to developers that in purchasing the credits they have responsibly discharged their commitment to provide offsets.

2.5.3 Trading rules

In addition to clarifying the property status of credits, governments can also support an effective use of biodiversity credits to deliver NNL/NG by formulating rules that specify the processes and limitations on how credits can be created and provided. These rules typically address:

- Recognition of processes and standards for establishing and cancelling credits;
- Proof of ownership of biodiversity credits;
- Process for the change of ownership of credits;
- Processes for extinguishing credits that have been used in an offset so they cannot be used again; and
- Accounting, where biodiversity credits with different metrics or management can coexist on the one site.

The need to account for different credits on a single site can arise where offset policy requires more than one metric for biodiversity to be included in the loss and gain calculation, for example where there is a general metric for habitat and another for particular species. In this example, offsets will comprise various combinations of the two metrics. The task of providing offsets is greatly facilitated if the two types of credits can be developed and sold independently. However, if there is any overlap in the metrics for the two credits (for example certain tree species may be part of the habitat metric as well as being a species metric in their own right), there needs to be a rule to cover the separation (unbundling) of the two credit types and for taking into account any double counting of gain.

More broadly. where there are separate management plans for different types of credits(for example biodiversity and carbon), these also need to be examined.

2.5.4 Biodiversity credit registers

Biodiversity credit registers are an important component of implementing NNL/NG policy using market-based instruments. Registers serve two main functions:

- To be the authoritative record of the number, location, characteristics and ownership of biodiversity credits in the jurisdiction; and
- To provide quality assurance for the registration (creation) of credits.

Registers usually provide the documentation for 'proof of ownership' and guard against 'double-dipping' (inappropriate bundling and stacking) by recording credits that have been used for offsets.

A marketplace

Governments can support NNL/NG policies by facilitating the supply of high-quality offsets through a market. To do so, government needs to establish a marketplace, which, in the case of biodiversity credits will be virtual rather than physical. The marketplace will comprise people and organizations providing offsets, developers who need them, and brokers. Brokers arrange trades between buyers and sellers within the 'like-for-like or better' criteria and standards for the quality and long-term management of offsets that are set out in the NNL/NG policy with its associated rules. Governments can build confidence on the part of buyers and sellers of credits by requiring brokers to work through the official credit register and to have probity plans and audits.

2.5.5 The design of markets to deliver NNL/NG

If government wishes to use a market mechanism to help deliver NNL/NG, the market needs to be designed to fit to the nature of the demand and supply of offsets in the jurisdiction and the processes that exist for offsetting. The NNL/NG policy can have a significant influence on the level and nature of demand and supply.

The like-for-like rules (and provisions for trading up) set the number of unique credit types and the degree of segmentation in the market. Where like-for–like rules establish just a small number of credit types, this results in low market segmentation and a simple approach, but this can also mean that different biodiversity types have been combined into one credit. Depending upon the level of variety existing across the jurisdiction, this could result in taking the diversity out of the biodiversity: allowing too loose an exchange. Conversely, if the like-for-like rules establish many different credit types, this will reflect the biodiversity more accurately, but will result in higher market segmentation and make it harder for developers to find the exact type of credits that they need.

The general level of demand for credits is influenced by scope of the offset policy and in particular by the settings for exemptions, the types of habitats and species required to be offset, and any thresholds applying to the size or nature of impacts.

The degree of segmentation and the level of demand interact to influence the types of offset supply mechanisms that evolve in the market. These mechanisms, including conservation banks, aggregated offsets, 'bespoke trades', and 'over-the-counter' arrangements, are briefly introduced here.

A conservation bank is a mechanism where biodiversity credits are established in advance of any losses they may be used to offset. A conservation bank is an entrepreneurial venture that requires up-front investment in the credit site. It is usually designed to supply offsets over time for several or many different projects involving residual losses.

By contrast, a bespoke trade is one where the offset is provided by a third party where no conservation bank or credits were available beforehand, so the offset has to be designed to meet the individual project's needs. The credit site is established to supply the offset for that particular project and is not generally established in advance, but in response to the particular demand. This means that there may be an interval between the agreement to a bespoke trade (between developer and provider) and the actual establishment of the offset through work on the ground by the provider of the offset. Sometimes a project's completion may be delayed until the bespoke trade is completed.

An aggregated offset is similar to a conservation bank except that the offset demand or requirement is known in advance and the aggregated offset can be specifically designed to compensate for a particular set of biodiversity impacts. An aggregated offset draws together the offset requirements of a number of projects where the biodiversity losses are known and supplies the required credits from a large single site or series of connected sites.

Over-the-counter schemes are similar to conservation banks but are designed to supply small offsets where it is particularly important to minimize transaction costs. A government agency with responsibility for approving or permitting small biodiversity impacts can establish an arrangement under which it sells credits for the corresponding offsets 'over-the-counter' at the time of issuing the permit. These credits are established in advance (i.e. a small conservation bank) either by the agency or by through a private supplier.

A question arises here as to what extent the NNL/NG policy should be formulated to provide a well-oiled offset market, for example by combining many biodiversity types together so the market could be supplied by a small number of large habitat banks. To do this may be to lose sight of the purpose of the NNL/NG policy, which is to contribute to net gains in biodiversity conservation in the jurisdiction. Nevertheless it is important when developing biodiversity offset policy to consider its influence on the likely form and effectiveness of the related offset market.

Biodiversity offset credits should also address other forms of risk for buyers and sellers. Developers are buying credits in the marketplace with a view to presenting the credits to the permitting agency to fulfil the developer's offset obligations. Developers need to be certain that they are buying the correct type and quantity of credits, and that the credits will not be used again. The market design needs to incorporate systems for the developer to obtain confirmation of the acceptability of the proposed credit purchase. This is particularly important in bespoke trades.

Small-scale landowners considering entering the market as suppliers of biodiversity credits can face considerable up-front costs for site assessment, biodiversity management plans and works, and for entering into the covenants (restrictions on land use for conservation) that provide permanent protection. The market design can therefore allow such suppliers to enter the market in a staged manner so that they can manage the financial risk associated with these outlays. They can then make sequential commitments, as demand for their credit types becomes more certain. For example, this can involve a three-step process where a landowner moves towards becoming a credit supplier in the following way:

1. The potential supplier make a free expression of interest to a broker providing preliminary information on the potential credits that could be created on its site;
2. A site assessment confirms the type and quantity of credits that could be created;
3. The potential supplier enters into negotiations with a buyer for the sale of some or all of the potential credits.

Only when the potential supplier has an acceptable sale agreed in principle would it need to make the major commitments associated with the costs of dedicating the site to offset purposes and managing it accordingly.

Whether or not conservation banks arise in an offset market will depend on the investors' assessments of the risks involved with the future demand for the credits that could be established in the banks. The offsetting rules on 'like-for-like or better' define the credit categories and these can have a major influence on investors' assessment of likely demand and thus their willingness to invest in creating a conservation bank. Where credits are defined in broad categories, there is potential for one offset site (bank) to provide matches for a number of impact or loss sites. Conversely, where credit categories are narrowly defined a bank will likely be able to offer matching credits for a smaller range of development projects.

From a financial point of view, banks are likely to be more viable where the like-for-like rules and the credit categories are broad. However broad like-for-like rules can mean that important distinctions between biodiversity values are obscured and subsequently some of these values may be lost in the offsetting process. It is the task of policy-makers to find the right balance.

The viability of conservation banks is not only reliant on the 'like-for-like or better' exchange rules. The demand for offsets varies geographically due to the location of developments needing offsets and the spatial distribution of biodiversity values to match this demand and thus the potential to develop banks. Banks can be feasible in situations even where relatively narrow like-for-like rules prevail, provided land is available where conservation gains of the necessary biodiversity values is feasible. This is typically the case when the planning of a particular development (for instance, a city expansion that will affect particular habitat types) allows impacts to be predicted and banks set up in anticipation to meet the needs that will arise.

2.5.6 The benefits and risks of conservation banks

Conservation banks and aggregated offsets have a number of benefits, but also some associated risks and disadvantages. In summary the main benefits are:

- A number of offsets can be consolidated into a large contiguous site which can have higher habitat and security values;
- The conservation effort can be concentrated into one project which can facilitate more specialist input to offset design and management;
- A conservation bank can have landscape-scale benefits by providing connectivity and pre-empting future fragmentation;
- There can be cost savings from economies of scale and reduced transaction costs; and
- Conservation banks can provide developers with immediate access to credits thus reducing the time required to find the offset for the project.

On the other hand there can be increased risks associated with conservation banks including:

- With a number of offsets at the same location the effect of a natural disaster or other failure of the bank site is magnified; and

- Pressure on the offsetting policy manager to relax the 'rules' to increase the commercial viability of the banks.

3. POSSIBLE ROLES OF GOVERNMENT IN ESTABLISHING AND ADMINISTERING NNL/NG POLICY

3.1 Government as policy-maker/regulator

Making policy and regulating are functions unique to government. The development and implementation of NNL/NG policy or regulations depend on government action. The broad options for implementing such policy are discussed in Section 2.2.

Governments use a variety of processes for policy-making. In considering the process to be used for developing policy on NNL/NG, core principles such as those outlined in Section 2.1 can be helpful, in particular the following that relate to process:

- stakeholder participation;
- equity – consider how risks and rewards can be distributed in a fair and balanced way;
- transparency; and
- science and traditional knowledge –policy informed by scientific knowledge and taking appropriate account of traditional knowledge.

Biodiversity offsets policy is often developed in the context of a broader biodiversity conservation policy. There can be connections between offsetting and other approaches to biodiversity conservation policy such as a protected area system, land use planning and investments in conservation gain. There are also technical links such as common information systems and metrics.

Policy-making usually entails the development of policy options, consultation with stakeholders, assessment of options and finalization of preferred positions. Governments can make formal commitment to final policy through proclamation or legislation.

Plans and adequate arrangements for the implementation of policy are critical to success. As NNL/NG can be a new area of policy, it is prudent to build in a process for monitoring and review so that refinements can be made over time.

3.2 Government as provider, curator and source of authoritative biodiversity information

Government agencies commonly collect data about biodiversity and natural resources. These data may relate to general biodiversity information such as vegetation cover and type or to more specific aspects such as species occurrence and habitat characteristics. Over time, governments often build up significant collection of biodiversity information.

Protocols for the collection, quality assurance and safe storage of these data can be valuable to ensure that authoritative information is available for application to NNL/NG policy. These systems should also enable other (non-government) organizations to contribute data to the national databases.

Biodiversity information needs to be analysed and modelled in specific ways to create the tools necessary for the implementation of NNL/NG policy. This could involve, for example, the delineation of bioregions or ecosystems, the classification of vegetation types by significance, systematic conservation planning to determine the optimum configuration in the landscape of a network of areas to conserve biodiversity, or the spatial variation of habitat quality. An example of the tools, information and maps that governments can make available to support NNL/NG planning is given in Box 9, using the case of Victoria. While this approach has considerable potential to improve processes for threatened species and to reduce transaction costs, its utility depends on its fine-scale accuracy. Such accuracy is a major challenge for such systems, would take some time to develop and would need a rigorous programme of continuous improvement.

Private consultants and companies often play important functions in the design and implementation of mitigation measures including biodiversity offsets, through for example the assessment of impacts and the identification and evaluation of potential offset activities and areas. Access to the relevant government biodiversity information and tools is very important for the participation of the private sector.

Box 9: Information systems - Victoria's Native Vegetation Information Management System (NVIM)

Victoria's NVIM system aims to provide access to native vegetation tools and information including:

- Tools and information to support developers proposing to remove native vegetation and species habitat;
- Native vegetation information, including ecological vegetation classes (EVCs);
- Tools to assess the number and type of credits available on potentially available on landowners' sites and to determine the eligibility of credits to provide an offset for a particular clearing; and
- Tools to manage and track native vegetation projects and agreements.

The system includes strategic biodiversity maps (which provide a representation of the biodiversity at each location in the State), native vegetation condition maps (which indicate how close native vegetation in a location is to its mature natural state) and habitat importance maps (which provide a view of remaining suitable habitat for rare or threatened species: to date; maps are available for 1778 out of 2029 species).

For further information see: http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/native-vegetation/native-vegetation-information-management

3.3 Government as buyer of offsets

Regulations for NNL/NG should naturally apply to the government itself. Governments are often responsible for activities such as road building, water supply and other public infrastructure projects and where these have biodiversity impacts within the scope of the policy or regulation, it will be necessary for the government, or the government agency, to undertake offsets. (It is important that government doesn't exempt itself from its own policies on NNL/NG, but abides by them.)

In these situations the government could provide offsets by creating credits on public land or government-owned land (see below), provided this satisfies the principle of additionality, or, more commonly, acquire a third-party offset.

3.4 Government as seller of offsets

Biodiversity gain can be created by transferring land into publically owned protected areas, or by elevating the level of protection of existing areas of public land. As discussed in Section 2.1, two types of gain can be generated by these interventions: gain from the change of the use of the land (i.e. changes in management to improve conservation status) and gain from the increased security of the biodiversity associated with the land.

Governments make decisions from time to time to create protected areas (and generate gain) within the context of broader biodiversity conservation policy. The principle of additionality requires the conservation outcomes delivered by a biodiversity offset to be demonstrably new and additional and requires that they would not have resulted without the offset. This principle is relevant when governments are considering whether or not the gain generated from new protected areas (or improvements to existing protected areas) can be considered as biodiversity credits that can be used for offsets.

The additionality principle (see discussion of definitions in Section 1.2) indicates that the creation or expansion of protected areas as part of a conservation reserve programme and for general biodiversity conservation purposes should not result in biodiversity credits or be used for biodiversity offsets if government should undertake the work as a matter of public duty. In addition, new protected areas created by offsets should be over and above existing plans for the establishment of protected areas. While the issue remains the subject of controversy and has yet to be discussed in intergovernmental circles, it is conceivable that credits and offsets could result from the establishment or improvement of protected areas where the following conditions apply:

- The creation of the protected area is over and above existing plans and programmes for the establishment of protected areas;
- At the time of its establishment the purpose of the protected area is specifically nominated by the government to be for offsetting; and
- The decision to create the protected area is linked to nominated current or future developments requiring offsets or, in the case of a decision to improve an existing protected area, such an improvement is specifically nominated for the purpose of offsetting a loss within the protected area.

Subject to these conditions, a government could consider allowing the creation of credits from new protected areas and sell them to developers requiring offsets.

In a system where individuals and organizations in the private sector can provide offsets, governments need to consider principles of fair competition when they enter the market as a seller. Governments may have inherent cost advantages (such as those relating to taxation) that should be mitigated so that government-owned credits do not compete unfairly with privately-owned credits in the offsets market.

3.5 Government as broker

Brokers perform the role of intermediaries between developers needing offsets (i.e. buyers) and individuals and organizations willing to provide conservation gain (sellers). Brokers can be particularly useful for matching buyers and sellers where there are no conservation banks available and potential suppliers of specific credit types need to be individually identified and brought into the market. By contrast, owners of conservation banks often sell their credits directly to buyers, without the intervention of brokers. Brokers can also be a source of advice and expertise to help inexperienced and infrequent buyers and sellers who may lack the confidence to deal directly in the offset market.

The brokering role is usually one for the private sector, but there can be circumstances where a government may choose to provide a broker service. This could be, for example, in the start-up period of an offset system when there is uncertainty about the likely demand and supply of offsets, or in areas where there may be too little demand for offsets to support private commercial brokers.

Where there are private sector brokers operating in the market, any government broker should operate on the basis of full cost pricing in order to maintain fair competition.

3.6 Government as operator of register of credits, standard setter

Credit registers record and track ownership information of biodiversity credits and provide quality assurance through the credit registration process.

The establishment and operation of credit registers is a natural function for government. Credit registers can be set up formally through legislation or administratively through a government agency. Indeed, credit registries can offer a vital quality control mechanism for offsets as they provide the opportunity for implementing the standards set for

offsets. Individuals and organizations undertaking site assessments, loss-gain calculations and preparing biodiversity offset management plans need to know very clearly what the relevant standards require, since their credits will not qualify for entry in the register unless their processes meet these standards. And (in regulated systems of offsets) the developer will not gain planning permission until he has purchased registered credits (or undertaken his own offset to the same standards).

Biodiversity credits have the characteristics of property as they are sold by those who generated them through conservation activities and bought by developers, whether or not this form of property is formalized through legislation. Just as land title offices need to manage land registries with great care (so there is no confusion about investments that are of great importance to people), it is important that the biodiversity credit register be established with a high level of accountability and attention to detail. Biodiversity credit registers need to be accurate, authoritative and up to date, with formal rules for their operations including registration of credits, changes of ownership and cancellation of credits.

National laws and circumstances vary widely around the world, so there is no single 'correct' approach to designing and implementing mitigation measures (including biodiversity offsets) to demonstrate NNL/NG, nor to introducing national policy and regulation on this topic. In recognition of this, some laws, policies and standards take a principles-based approach. Provided the principles are adhered to, there is room for flexibility and tailoring the approach to reflect the specific circumstances, and a number of different ways in which mitigation measures including biodiversity offsets can be designed and implemented and their success verified.

Principles are generally high level and aspirational, so if they are to form the basis of NNL/NG policy, they need to be accompanied by clear implementation rules. One approach is to embed the principles within standards that set out independently verifiable and auditable criteria and indicators that enable government and developers themselves to tell whether the principles have been applied properly. Government may therefore set out standards for a range of issues related to mitigation, including offsets. Governments operating NNL/NG systems frequently promulgate a number of standards to which third parties taking part in the system must adhere, including standards on use of the exchange rules and metrics for the assessment of losses and gains, and standards for the long-term management and performance of biodiversity offsets (including through conservation banks and provision of biodiversity credits).

It is worth noting that government is not the only body that establishes standards relevant to NNL/NG. Financial institutions such as the IFC have developed standards on mitigation and offsets (see Box 3) and BBOP as an international, multistakeholder group has developed a Standard on Biodiversity Offsets in 2012 (See Box 4 and BBOP, 2012a).

3.7 Government as provider of the process to ensure permanence of offsets

Biodiversity offsets need to be permanent where the associated losses are permanent. This involves arranging for a permanent institution to make a binding commitment to the ongoing responsibility to maintain the offset. In many jurisdictions, the relevant permanent institutions are landowners (for private land) and government (for public land). That is, it is assumed that there will always be an owner of private land and that there will always be a government.

Government has a role in arranging permanence for offsets on both private and public land. The establishment of third-party offsets on private land involves some form of statutory agreement between government and the current landowner. Permanence requires that future landowners are also bound by this agreement. This is usually achieved by attaching the statutory agreement to the land title along with a legal requirement that future owners are bound by the agreement, using legal instruments that are sometimes called covenants, servitudes or

easements. Government action is required to establish these mechanisms in law and as a party to the individual agreements.

On public land, offsets usually require some elevation of the level of protection (security) of the subject land, for example through the proclamation of a conservation reserve or a national park. These decisions are taken by government and are usually implemented through legislation.

In countries where different forms of tenure prevail (such as leasehold or community ownership), other approaches to ensuring long-term security will need to be considered. The form of these approaches will be strongly dependent on the country's legal framework.

3.8 Government as monitor and enforcer

Governments' role in monitoring the integrity of mitigation measures including biodiversity offsets and managing compliance depends on the nature of the offset. For offsets provided directly by the developer (first-party offsets) there will usually be clauses in the development approval instrument (i.e. the permit or consent often arising from an EIA) that provide for a government agency to monitor the offset site and initiate a series of compliance procedures if certain specified actions are not implemented, or certain specified targets are not met.

Where the offset has been provided through an offset market (i.e. a third-party offset such as a conservation bank or other seller of biodiversity credits) responsibility for establishing and managing the offset is transferred from the developer to the offset provider. This happens at the moment when the permitting authority accepts the registered biodiversity credits purchased by the developer as an offset that satisfies the requirements and standards set out in policy. The credit supplier then takes on responsibility for the offset, and monitoring and compliance is focused on the credit supplier rather than the developer. As described in Section 3.7, the government will have monitoring and compliance responsibilities through the provisions of the statutory agreement with the credit supplying landowner.

Within government, one agency (typically a Planning Department) will be responsible for granting the development approval that requires an offset to achieve NNL/NG and will ultimately be responsible for monitoring the ongoing integrity of the offset. However, another government agency (typically an environmental agency) may be responsible for entering into the agreement with the landowner for delivering the biodiversity credits through agreed conservation activities, and monitoring and enforcing this agreement. In this situation there should be some form of understanding between the different agencies so there is a seamless process for developers and providers of offsets, and clear reporting and compliance responsibilities so that no mitigation measures fall between the cracks.

Generally speaking, the quality of monitoring and enforcement is vital for the reliability of the system of mitigation as a whole. To be effective, monitoring and enforcement must be credible, trusted, and planned for the long term. It is thus very important that the costs of monitoring and enforcement are built into the system so investment in these functions can be ensured. This is often done by including an administrative charge into mitigation costs.

3.9 Identifying and managing conflicts of interest between these roles of government (probity)

Given the various roles for government in NNL/NG policy that have been explored above, it is clear that there is potential for conflicts of interest between the different roles. Examples of potential conflicts of interest include:

- The government as a developer of infrastructure projects and as the regulator specifying and enforcing requirements for biodiversity offsets;

- The government as operator of the biodiversity credit register and as a supplier of offsets seeking registration of its credits on the register; and
- The government as monitoring and enforcement agency and as a supplier of offsets managing and maintaining credit sites.

These potential conflicts of interest do not necessarily mean that governments cannot undertake a variety of roles relating to biodiversity offsets. However they do mean that potential conflicts need to be identified and arrangements put in place to manage and resolve conflicts as they arise. This process is sometimes referred to as 'probity'. Probity is a feature of the design and implementation of an offset system by government that is concerned with integrity in the process and ensuring that all parties are treated with fairness and equity, in a system with good governance.

Probity involves an examination of the processes involved in the various roles, describing and separating responsibilities and identifying issues including conflicts of interest, confidentiality, information handling and decision-making. Usually a probity plan is prepared by an independent probity adviser that sets out in advance how these issues will be handled. Measures included in probity plans include the clear separation of decision-making, secure arrangements for handling information and formal declarations of personal conflicts of interest. The independent probity adviser will generally review operations from time to time and provide a report to the various parties on compliance with the probity principles and the other provisions of the probity plan.

In additional to the points above, which relate to potential conflicts of interest as a result of the distinct roles of government in NNL/NG systems, another type of perceived conflict may arise from how government embeds NNL/NG within public policy. For instance, some would see a conflict between government's obligation to dedicate public funds to conservation and any 'cost shifting' in which the public funding for conservation is reduced because the cost is passed on to private developers through offset requirements.

3.10 The role of government in creating a market

Market-based instruments can offer policy makers a number of benefits, in terms of effectiveness and efficiency, and markets in biodiversity credits are no exception. However, markets of any kinds are dogged by market failures, and markets related to biodiversity are particularly controversial, given the public and open access nature of biodiversity and ecosystem services. With biodiversity, market failures are typically caused by the existence of externalities, imperfect information, and the non-excludability or non-rivalry of biodiversity's goods and services.[65] Any market-based approach to biodiversity offsets will thus need to be developed with great care.

The key actions for government to set up a credit market are to:

- **Establish the biodiversity credits:** Define the credits, the metrics for their measurement and the processes by which they will be measured in the field. Establishing credits as property through legislation can also be beneficial.
- **Set up a credit register:** The register provides certainty to society generally and to buyers and sellers about the quality of the credits and about the ownership of credits.
- **Facilitate the establishment of marketplaces:** Assist buyers and sellers of credits to find each other by encouraging and accrediting brokers, over the counter facilities and conservation banks. In some circumstances, the government may establish a state-operated broker.
- **Identify and deal with risk for buyers, sellers and the environment:** The parties in the market need a reasonable level of confidence in order to participate. Buyers need confidence that the credits they

[65] OECD, 2004.

buy will be accepted as offsets. Sellers need confidence that if they make commitments to establish supply, there will be some demand for their products. The flexibility built into the market should not be at the expense of the environmental outcome.

- **Consider customer service, competition and efficiency in the market design:** The market design needs to be responsive to the needs of customers (e.g. developers will need to procure their offsets within a reasonable time). Facilitating competition and avoiding monopoly supply helps achieve fair prices. Efficiency should also be built into the market design, for example by making credits divisible so that buyers can buy just the number they require.

4. WHAT KIND OF CAPACITY DOES GOVERNMENT NEED TO TAKE ON NNL/NG POLICY?

4.1 Costs and cost recovery

4.1.1 Government and private sector roles

An initial consideration of the requirement for government capacity is the relative role of government and the private sector, particularly in the implementation of NNL/NG policy. In jurisdictions where much of the implementation is undertaken by the private sector through markets, the need for government capacity and resources will be significantly reduced.

However, the task of policy development (and regulation where this is adopted) does fall to government. Costs for government can be considered in two main parts: the development of policy and the operation of the NNL/NG scheme. The main sources of cost in the policy development process are:

- Policy development and preparation of guidelines;
- Regulation making (may require new legislation and amendments to existing legislation);
- Preparation of standard forms and procedures (and their documentation with accompanying guidance in manuals); and
- Biodiversity information systems (collection, storage, analysis). This usually builds on existing information and systems.

The main sources of cost in the operation of the NNL/NG policy are:

- The assessment of individual development proposals, usually using existing processes;
- The specification of offsets based on 'like-for-like-or better' criteria and loss/gain metrics;
- A case management system that documents the flow of applications through the process;
- Monitoring and compliance of on-site mitigation measures (i.e. avoidance, minimization and restoration) and of offset sites; and
- Communications (websites, information sheets, brochures).

In a regulated context where offsets are supplied through a credit market, governments may be involved in establishing and operating the credit register. The main sources of cost in this situation are:

- Establishment of a credit register through legislation;
- Establishment of credit property rights (legislation for credits as property);
- Operation of the register and implementation of trading rules; and
- Development of guidelines for various mechanisms for developers needing offsets and providers of offsets to effect transactions, including 'over the counter' and electronic trading.

In some circumstances, a government may offer a broker service for suppliers of credits and buyers. This option could be adopted as a transitional measure at the start of an offset scheme when there is considerable market uncertainty and the private sector is reluctant to provide broker services. The main sources of cost for brokers are:

- Recruitment of suppliers including site assessment, preparation of management plans and calculation of biodiversity gains;
- Receiving enquiries for offsets from developers and matching these to supply;
- Managing databases of buyers and suppliers;
- Facilitating transactions between buyers and sellers through negotiation or bidding;
- Arranging and executing contracts of sale; and

- Managing contracts for site management and reporting to compliance authorities.

Governments will usually be the only institutions that can make legal arrangements for the permanent security of offset sites, where this is required. These arrangements include on-title agreements (sometimes known as covenants, servitudes or easements), the surrender of private land and its inclusion in a public conservation reserve, and the creation of protected areas on private land or by the reclassification of the status of public land. These processes will usually already exist in the jurisdiction and the costs will be known from previous experience.

The costs associated with the various processes and services described in this section will vary from country to country and need to be estimated on a case-by-case basis. However, experience in jurisdictions that have already established NNL/NG policies of varying design and complexity has demonstrated that these are not trivial tasks. It can be anticipated that it would take several years and the input of a variety of expertise (see below) to develop a policy and establish an operating scheme.

4.1.2 Cost recovery

While there are many costs to be considered as identified above, a government may recover these costs in part or in full. This is done by charging fees for the services provided to the users of the offset scheme. Cost recovery may be particularly appropriate where biodiversity credit markets are established for the supply of offsets. Not only does this ease the burden on the public purse, it also leads to the incorporation of more of the transaction costs into the price of offsets which results in more economically optimal outcomes.

It may be less appropriate to implement full cost recovery for services associated with tasks such as policy development, legislation and policy implementation, which are generally regarded as normal functions of government.

Cost recovery usually involves the following steps:

- Define the services to be provided (such as those outlined for brokers above) and allocate inputs such as labour and other costs to each service;
- Estimate the service levels: that is the numbers of various services provided over each time period;
- Set the cost of services (the fees) to achieve partial or full cost recovery; and
- Consider which parties will pay the fees and when the fees will be collected. It may be advantageous to delay the collection of some fees (for example, associated with credit creation) until the time of credit sales.

Where a government and the private sector are both offering the same services to the market, any requirements of government competition policy will need to be taken into account.

4.2 Skills and capacity

The development and implementation of NNL/NG policy spans a wide range of professional and technical skills. Government employees need the skills and capacities to design, administer and enforce the NNL/NG system, bearing in mind the broad range of potential roles and responsibilities described in Section 2. Developers and their consultants need to be able to apply the rules of the jurisdictions where they operate related to mitigation measures, as well as international best practice in places where national rules are not yet well developed. Financial institutions with project finance and safeguard policies on mitigation and NNL/NG need the skills to apply these, and rely upon consultants with the necessary expertise. Research institutes, universities, NGOs and civil society organizations (including communities) are engaged in NNL/NG in a number of different ways, from baseline

science, design of mitigation measures, including offsets, implementation of offsets and generation of biodiversity credits, and monitoring and enforcement.

This paper focuses on NNL/NG policy, so we concentrate here on the fields of policy-making and regulation, running a credit register and market, and measures for the long-term security of mitigation measures including offsets. Some of the key skills needed are summarized here, while Section 5 outlines the planning and roadmap that can build the necessary capacity.

4.2.1 Policy/regulation (skills needed by government employees and their consultants and researchers)

Staff from government departments and agencies (from central, regional and local government) and the consultants, NGOs and academics they retain to undertake research and prepare options for them or who perform regulated functions will need skills in biodiversity policy, land-use planning, EIA and SEA, administration and enforcement, information technology and field assessments. These are outlined below:

- **Biodiversity policy:** interpretation of biodiversity science, conservation prioritization, protected area planning, policy research, stakeholder consultation, cost-benefit analysis and policy option impact assessment, legal drafting, preparation of guidelines, communications.
- **Land-use planning (and marine planning); EIA and SEA.**
- **Biodiversity science** (including spatial information, modelling and baseline data):
    - Establishing the basis for like-for-like criteria including data and maps on type of biodiversity (e.g. vegetation type, habitat type, species type), biodiversity importance, vicinity (where the offset can be located e.g. within the same bioregion), ecological function and quality or condition requirement.
    - Establishing the basis for metrics including: (i) classification systems (and associated maps and databases) for criteria such as ecological function, provision of ecosystem services, biodiversity, and vicinity; (ii) definition and measurement of baselines against which losses and gains are measured; (iii) definition of priority attributes and benchmarks to serve as a reference to quantify the condition of each biodiversity type or ecosystem type; (iv) definition of a finite, prioritized list of species for which habitat metrics alone (i.e. changes in condition x area of the species' habitat) will not be a good enough proxy for changes in the species' population due to project impacts and offset gains; (v) modelling vegetation and habitat importance; development of separate metrics for these 'species of a concern'; and (vi) research on spatial aspects (e.g., patch size, connectivity, etc.) of conservation effectiveness to generate data that can be used in the offset metric.
    - Obtaining the data necessary can represent a significant cost. In practice some of the work can be done as part of other conservation policy work (i.e. national efforts to develop conservation strategy overall), not just the development of NNL/NG and offsets policy. In addition, some funds can be raised to contribute to these costs by administrative fees levied on users of the system. (See Section 4.1.2).
- **Administration and enforcement**: coordination between different government functions; administration of NNL/NG systems; creation of any accreditation systems for organizations certified to undertake site assessments, conservation banks and/or aggregated offsets; monitoring and enforcement; development and implementation of probity rules to address potential conflict of interest.
- **Information technology:** databases, modelling and mapping to underpin the biodiversity science; database to underpin the registry of biodiversity offsets (including the credit register).
- **Field assessments:** skills in site assessment and in applying the exchange rules and metrics to assess residual losses and anticipated offset gains. Similar skills to monitor the success (or otherwise) of mitigation activities, including offsets.

4.2.2 Credit register and credit markets (skills needed by government employees and organizations they authorize to serve as registries and brokers)

If government policy entails the use of market-based instruments, the capacity to work with credit registers and credit markets is important. In setting up and running the credit register, government may need to draw on legal skills to establish a credit register and also to establish credit property rights, both through legislation. If government chooses to outsource the registry function to an organization that provides registry services, it will at least need the skills to undertake the due diligence on this organization and to monitor its performance over time.

Skills in information technology are needed to develop and operate the databases and online services used by the register.

For the smooth operation of a credit market, legal and economic skills are necessary, as are trained brokers and offset analysts. Legal skills help to draft legislation for establishing credits in law and to prepare contracts, including landowner agreements and contracts between developers and credit suppliers. Economic skills are needed to advise on appropriate market mechanisms such as conservation banks, bidding exchanges and over-the-counter mechanisms.

Organizations proposing to establish themselves as brokers (whether part of government or in the private sector) will need training. They need to be competent to recruit suppliers of credits, undertake site assessment and prepare management plans and calculate biodiversity gains. They also need to deal with the entire process of credit registration. This starts from first receiving enquiries for offsets from developers and matching these to supply. On the supply side, they need training in how to obtain formal expressions of interest from potential providers, to support them in assessing their potential responsibilities and income if they move ahead with offset supply; and in arranging and executing the necessary agreements and contracts of sale if the providers decide to move ahead. Brokers also need to be capable of managing databases of buyers and suppliers.

4.2.3 Offset security

The ability to ensure the long-term security and success of biodiversity offsets requires skills of its own, particularly in law, finance, monitoring and adaptive management.

Governments establishing NNL/NG systems need the legal capacity to establish agreements defining the management responsibilities of any third parties providing offsets. In addition to contract, government will need to develop and apply laws related to land-use planning, including the reclassification of the status of public land (for instance, from agriculture to conservation purposes) for the creation of offsets. It will also need the capacity to generate on-title agreements (i.e. covenants, servitudes or easements) that are tied to the land even if ownership changes hands. If the transfer of land is one option for offsets, measures are needed to include private land into public conservation areas.

Securing NNL/NG outcomes for the long term involves financial skills in budgeting, especially in the assessment of the costs of mitigation measures, including offsets; calculation of the investments needed to establish conservation banks or generate conservation credits; and administration of conservation trust funds, including establishment of investment strategies for these funds.

As has been mentioned throughout this paper, lack of monitoring and enforcement has been particularly responsible for the failure of mitigation measures in the past. This underscores the importance of adequate skills, budget and human capacity for these functions in government.

4.3 Staffing levels

Staffing levels depend on the number and complexity of the offset scheme. The most labour intensive area of work can be associated with the assessment of biodiversity losses and gains, where this involves field work. Increased use of mapped and modelled biodiversity information can reduce the need for intensive field work.

Government staffing levels need to be considered in the context of the size of the offset transaction. Staff costs are part of transaction costs that should be a relatively modest proportion of the overall cost of the offset.

5. LESSONS LEARNED TO DATE AND SOME SUGGESTED WAYS FORWARD FOR GOVERNMENTS INTERESTED IN EXPLORING NNL/NG POLICY OPTIONS

5.1 Lessons learned

Drawing on the material within this report, Box 10 summarizes the authors' opinion as to some key lessons learned from experience with NNL/NG systems, biodiversity offsets and compensation around the world, and the main points are explained in this section.

In the box, points that appear to the authors to have been most important for NNL/NG systems are presented first, whereas in the text, the issues are presented more in terms of chronological order, from system design through implementation to monitoring, evaluation, enforcement and continuous improvement.

Box 10: Features of successful NNL/NG systems, drawing on lessons learned from around the world.

- Measures are in place to improve the application of the mitigation hierarchy, and not simply to plan offsets, which should be the last step in the mitigation hierarchy.(Section 1.2 and Appendix 2)
- Clear, consistent guidance is available, for certainty and to avoid delays. There are clear roles for national, state and local government and good coordination between government departments. (Section 2.1)
- Adequate performance monitoring and enforcement is ensured through good governance and adequate budgetary provision. (Section 2.1)
- Clear principles and standards are in place. (Sections 2.1 and 3.6)
- Legal and financial instruments needed to secure long-term implementation are available. (Sections 2.1.7-2.1.10, 2.4 and 2.5)
- Proportionate approaches are planned, allowing for the possibility of streamlined procedures, simple baseline studies and metrics for the least significant impacts on biodiversity, and full assessments and more sophisticated metrics for more significant impacts. (Section 1.3.2)
- There is a realistic roadmap to develop NNL/NG system and improve it over a few years. Preparation for implementation (including supply side) during policy development phase. (Section 5.1)
- Good baseline data, mapping and landscape level planning are available. (Section 4.2.1)
- Methods that don't deliver NNL/NG (e.g. poor metrics) are avoided. (Sections 2.1.4 and 2.1.5)
- Several options for implementation are possible, provided the standards are met. (Section 2.4)
- Perverse incentives are removed. (Section 5.2).
- Assistance is offered to parties who need to find each other (Sections 2.5.4 and 3.5)

Economic impact analyses of policy options: Some **s**ectors in society (i.e. development sectors with an impact on biodiversity) are likely to pay the costs of a NNL/NG system, while some (e.g. assessors, providers of mitigation activities and offsets and companies providing legal and financial services) will benefit from new income and growth in jobs as a result of NNL/NG systems. Impact assessments and cost-benefit analyses of policy options can help government explore the economic as well as the ecological advantages and disadvantages of different

approaches to NNL/NG.[66] Some cost-benefit studies focus almost exclusively on the costs of undertaking offset activities, but overlook other, financially material costs and benefits of NNL/NG activities associated with uncertainty, delay and legal proceedings. Some also fail to compare the costs and benefits of NNL/NG options with the costs and benefits of the status quo. Experience would suggest that it is worth investing in good studies that explore the main economic impacts and costs and benefits associated with doing nothing as well as the range of policy options for NNL/NG.

Roadmap and adaptive learning: This paper has described experience from a number of countries that shows that governments often start with a relatively simple system which nevertheless contains the essential elements of a NNL/NG system, and then develop the system over a period of years. It is wise to set out a 'roadmap' with a plan for at least five years for developing key parts of the NNL/NG system, such as rules and guidelines, data gathering and capacity building, pilot approaches and market mechanisms. Adaptive learning, based on monitoring of experience, is recommended to help policy design and implementation evolve.

Policy/regulation: If the objective is to achieve a comprehensive NNL/NG policy, then regulation to require offsetting (as well as any new measures to strengthen existing mitigation requirements for avoidance, minimization and restoration) will be required. In the absence of regulation, only a minority of companies is likely to see a business case for voluntary offsets. A clear trigger is therefore needed for developers to deliver NNL/NG, (for instance, through Environmental Impact Assessments and/or the planning requirements). This can be a brief but unambiguous regulatory provision accompanied by guidelines. Any policy and legislation on NNL, NG and biodiversity offsets need to be clear and definitive about the circumstances in which offsets are required, the explicit outcomes desired, and the rules by which the offsets will be specified and measured (i.e. what criteria and indicators). It helps to keep the rules as simple as possible. Successful systems specify the basics necessary to achieve the biodiversity conservation objectives but allow sufficient flexibility for the scheme to provide offsets for developers in an economical and timely manner. Where there are overlapping jurisdictions (e.g. in federal systems) or overlapping policies, it is preferable to have only one offsets scheme or, if this is not possible, to arrange accreditation between levels of jurisdiction so the offsets can be arranged through a single process. If the system uses biodiversity credits, it is important to create legal certainty around the property rights of credits and the security of offset sites to enable people to make investments.

Policy/guidance: An important lesson from international experience is that governments cannot merely provide a basic policy framework and step back to allow organizations and citizens to implement it. Rather, government needs to provide assistance to ensure that offset policy is clear, that buyers and sellers can readily find each other, and that offset commitments are subject to high standards and can be relied upon. To complement any regulatory requirement for NNL, governments need to offer guidance that clarifies the rules of the game, such as: (i) the scope of the NNL requirements; (ii) minimum and maximum thresholds; (iii) exchange rules (to operationalize the 'like for like or better' principle); (iv) metrics for loss-gain calculations; (v) implementation options that developers face; (vi) the range of activities that are acceptable means of obtaining the 'gain' needed for offsets; (vii) guidance on the geographical aspects of offsets, such as landscape level planning, site selection and 'service areas'; (viii) the procedure for integrating the mitigation hierarchy including offsets with various planning and licensing processes (e.g. EIA); and (ix) how temporal issues will be dealt with, for instance through time discounting. Without such guidance, NNL/NG policies may remain on paper and developers will be unsure how to put them into practice. Therefore, a key lesson is to offer guidance and examples through clear and authoritative publications so people know what to do, and what to expect from the system in terms of cost, time and support.

[66] Duke & ten Kate, 2014, in press; Duke et al., 2013; Newey, 2012; Withers, 2012; Tyldesley et al., 2012a; Tyldesley et al., 2012b; GHK, 2011; RSPB, 2010.

Principles and standards: As there is no single 'correct' approach to designing and implementing mitigation measures (including biodiversity offsets), some laws, policies and standards take a principles-based approach, and principles are often the backbone of regulation on NNL/NG. Principles are generally high level and aspirational, so if they are to form that basis of a NNL/NG policy, they need to be accompanied by clear implementation rules. One approach that has been used not only for NNL/NG but for a variety of other environmental and social management issues is to embed the principles within standards that set out independently verifiable and auditable criteria and indicators that enable government and developers to tell whether the principles have been applied properly. The BBOP principles outlined in Section 2.1 and accompanying Standard on Biodiversity Offsets are worthy of consideration for those developing policy on NNL/NG. Underneath the overarching setting of principles and standard, government often develops a series of more specific standards for different organizations involved in aspects of the NNL/NG system, whether for those undertaking loss-gain assessments, those providing offsets through a range of management interventions for each of which there may be standards of practice, or those providing broker services. It may be helpful for governments embarking on the development of NNL/NG systems to outline the range of activities within the system for which standards are needed and to plan for their development as part of the 'roadmap'.

Land-use planning and the broader context: Biodiversity planning seldom takes place in a vacuum: indeed, the business case for biodiversity offsets is usually part of a broader business case for high quality risk management, covering other aspects of social and environmental management, as well as human rights, governance and ethical issues.[67] Mitigation measures have rarely succeeded when their design has not taken into consideration other likely developments (e.g. competing land-use pressures) within the landscape. In addition, governments, the private sector and civil society are preoccupied with other sustainable development imperatives, such as climate change and the conservation and sustainable use of water resources. Activities for NNL/NG of biodiversity have been most successful where they have been designed as part of broader land-use planning for sustainable development, planning activities for the conservation of biodiversity, optimization of ecosystem services (e.g. carbon sequestration, provisioning of water) and economic activities within the landscape. Systems that consider payments for a variety of ecosystem services or the use of different credit types within the same landscape need to consider how to stack, layer and bundle rights associated with biodiversity, water and carbon and avoid 'double dipping' (in order to prevent people selling the same product twice to more than one buyer). Some systems have had to deal with how to do this after piecemeal development of different systems (relating to carbon, biodiversity, water, and social development).[68] This suggests that it may be wise for governments to plan NNL/NG systems so as to layer carbon, biodiversity, water and integrate consideration of livelihoods in a landscape; to support good land-use planning; to develop tools that help landowners to study opportunities and costs from provision of biodiversity credits and other ecosystem services and more traditional goods and services; and to clarify the legal issues inherent in stacking and bundling.

Biodiversity planning: Mitigation measures and biodiversity offsets have been most valuable when they have been planned to contribute to biodiversity conservation priorities identified at the landscape, eco-regional and national levels. There are examples where the priorities established in National Biodiversity Strategies and Action Plans at the national level and in regional plans below this are too broad to contribute to NNL/NG planning, so that complementary work on biodiversity data and mapping is needed. Sometimes this has been developed piecemeal; a lesson for policy-makers in the future is that it is worth undertaking this finer-scale biodiversity planning as part of the NNL/NG efforts.

Supply side: Policy-makers have often concentrated on the triggers and requirements for NNL/NG first, and have not always ensured that those who are expected to provide the offsets are prepared to meet the demand when it arises. This creates frustration and delays for developers. Consequently, a plan and actions are advisable to prepare

[67] Grigg & ten Kate, 2004.
[68] Ingram, 2012; Lau, 2012; Truty, 2010; Carroll et al., 2008.

potential suppliers prior to offset requirements entering into force. This can cover the gain strategy (restoration versus averted risk offsets), finding and preparing suppliers, and testing the process prior to its entry into force with auctions and/or pilots, and can form part of the roadmap for NNL/NG.

Biodiversity data and maps: NNL/NG systems are sometimes established when there are inadequate data to support the planning of mitigation measures, including offsets, in the landscape. Consistent, adequate data sets may not exist at the national or regional levels in countries (to serve as the basis for landscape-level planning, definition of the 'exchange rules' to define 'like for like or better' and to set the benchmarks and attributes for metrics to calculate residual losses and offsets' gains). Some data sets are at a very coarse-scale and need more refinement to support the fine-scale conservation planning needed for NNL/NG. Furthermore, some seasonality data may be missing and individual project timelines are sometimes too short to enable data to be collected over years. Some taxa are poorly known and need further work (a common example is freshwater species). Experiences such as these have shown that it is important to gather existing data sets and maps and to review them to see whether they offer the information needed for NNL/NG planning. Where there are gaps, it is useful to plan how these will be filled, to help avoid situations where rapid decision-making is needed and the required data are missing.

Implementation: An important part of designing NNL/NG systems is to define which implementation options exist for developers (for instance, permittee-led offsets in which developers implement their own offsets, or in lieu fees to government, or the use of conservation banks and biodiversity credits). Part of this is to set the standards for implementing and establish whether there will be a preference for any of the implementation options. An interesting lesson from NNL/NG experience all round the world is to take care with these decisions in order to avoid perverse incentives. For instance, prior to 2008, the requirements and standard for those providing offsets themselves, or through in lieu payments of conservation banks in the USA varied considerably, such that the easy option (with more relaxed standards and comparatively little enforcement) was for developers to undertake their own offset implementation. There is strong empirical evidence that conventional developer-led on-site compensation often led to poor ecological outcomes: one study suggested only a 7% success rate.[69] New regulations were introduced to address this perverse incentive and took effect on 9 June 2008.[70] They seek to promote one standard for offsetting, whichever of the three methods of implementation described above is selected, with a 'preference' for habitat banking. Experiences such as this suggest that care is needed to set a level playing field with equal and standards for all forms of implementation.

Training and capacity building: There have been examples where NNL/NG regulatory requirements have been introduced and yet the relevant governments have not yet had in place the trained staff, guidelines, data and maps to apply the requirements at the national, state and local levels. For some governments (particularly in developing and least developed countries), the regulation of planning and environmental impact assessment, let alone NNL/NG, is a challenge. The capacity of consultants and NGOs to undertake baseline studies, risk assessments for non-offsetability, loss gain calculations and design of feasible offset activities and management plans remains limited. Companies sometimes fail to commission baseline work early enough or to an adequate standard. They can also struggle to coordinate internally or work adequately with joint venture partners, contractors and agents. Banks have limited in-house capacity to assess biodiversity risks or to screen consultants for appropriate skills if they intend to outsource some of this research. Governments will almost certainly need to establish a programme of capacity building to overcome these constraints in order for NNL/NG systems to operate smoothly and successfully. This could cater for the consultants and advisers who will apply the offset guidance and serve as assessors for government; offset providers and brokers as well as for the regulators themselves. In order to kick-start the NNL/NG programme, it may also be necessary for government to undertake some activities initially that would

[69] NRC, 2001.
[70] USACE, 2008.

normally be performed by the private sector, then move aside as private sector capacity and confidence is established.

Legal and financial instruments to secure long-term implementation: This paper has referred to international experience with legal and financial tools that can help give effect to the long-term commitments for land-management inherent in delivering NNL/NG. These include a variety of contracts, on-title agreements (covenants/easements/servitudes), and conservation trust funds. Secure land tenure is vital, as are clear property rights in conservation credits, where these are used. A number of mechanisms are also valuable to ensure the legal and financial certainty needed for people to undertake and invest in the conservation activities involved in NNL/NG. These include registries, to record offsets and biodiversity credits that reach the necessary standard and ensure these are only sold once. In order to ensure that the budgets for mitigation measures, biodiversity offset management plans and the price of credits are adequate, it can help to consider insurance, bonds and provisions for insolvency.

Monitoring and enforcement: Adequate monitoring and compliance with offset requirements is absolutely critical to success. Past failures have often been associated with lack of monitoring and inadequate enforcement of EIA or mitigation measures, including offset requirements.

Evidence on the effectiveness of NNL/NG schemes: To support the work on the issues listed above, more evidence is needed as to the effectiveness of policy measures on the avoidance, minimization, restoration and offsetting of impacts on biodiversity, on No Net Loss and a Net Gain, and on the range of options (including conservation banking) for implementing them. More empirical information on whether the conservation gains on the ground match or have exceeded the corresponding losses would be useful, as there is comparatively little evidence presently about whether instituting such measures and offset arrangements lead to better or worse outcomes than without them. Such studies could review the outcomes from individual transactions as well as the effects of the scheme (or national system) as a whole. In addition to this, it would be useful to undertake studies on whether the scope for NNL/NG schemes is capturing the main losses of biodiversity, or whether significant net loss continues outside the scope of the schemes, noting that such schemes cannot address all sources of biodiversity loss.

5.2 Suggested ways forward for governments interested in exploring NNL/NG policy options

The decision to introduce policy on NNL/NG is a significant step on the road to sustainable development and biodiversity conservation. It is natural that, prior to any commitment, governments will undertake a substantial body of background work that could include information gathering, cost benefit analysis, pilot projects and the development of policy options. The nature of these tasks is outlined below.

- **Fact-finding and gap analysis - policy:** Generally speaking, governments already have in place a range of law and policy that is relevant to NNL/NG, the mitigation hierarchy and conservation prioritization (see Section 2.3). A first step is thus to undertake an analysis of existing relevant policy at the national or regional levels (e.g. EIA, conservation law including protected area legislation, planning regulations, sectoral policies, fiscal policies, liability regimes, land tenure, indigenous peoples' rights, strategic environmental assessments, land-use plans, and the range of economic incentives – for instance in agricultural , fisheries, energy, construction) to explore the extent to which these serve to require, facilitate or even present a barrier to measures for NNL/NG.

- **Fact-finding and gap analysis – biodiversity data:** A certain depth, quality and consistency of biodiversity data are needed in order to assess projects' impacts on biodiversity, to plan appropriate mitigation measures including biodiversity offsets and certainly to establish a regional or national system of biodiversity offsets.

Most countries have at their disposal quite a volume of habitat and species data, in a range of data sets of varying quality and scope, held by government, NGOs, academic organizations and even companies, some up to date and some old. A gap analysis of existing biodiversity data and maps is thus a wise first step. Data is needed for NNL/NG planning to support the classification of habitat types (and condition of such habitat), for the application of 'like-for-like or better' approach, to establish the baselines and trajectories for biodiversity against which the losses of biodiversity caused by projects and the gains caused by mitigation measures including offsets can be measured, to undertake site selection and to designate credit types, if aggregated offsets or conservation banking is considered an appropriate approach.

- **Fact-finding– cost-benefit analysis:** In some circumstances it may be useful to undertake a socioeconomic cost/benefit analysis of introducing no net loss policies.[71] In particular, such an analysis could consider the benefits and costs to the economy, where the benefits could include environmental benefits as well as the economic benefits of sectors that might expand, such as tourism and conservation restoration, and those sectors (e.g. infrastructure developers and extractives industries) that are likely to face an incremental additional cost. A regional impact analysis could also consider local employment effects.

- **Pilot projects:** Practical experience with designing offsets for individual projects can help governments decide what nature and content of NNL/NG policy would be appropriate for the country concerned. Governments can work with potential pilot project partners to agree a description of what is entailed in a pilot project. Government can involve local experts and perhaps some international experts with experience of offset design and implementation in other countries to support the companies concerned in the design of mitigation measures including biodiversity offsets for their pilot projects.

- **Integrating NNL/NG planning with land-use planning at the national or regional levels:** Governments could examine whether any regional land use-plans or strategic environmental assessments are planned, and integrate NNL/NG planning into these. Regional land-use and NNL/NG planning relies on the integration of biodiversity data and data layers concerning the location and nature of development plans (e.g. mines, linear infrastructure, town expansion etc.).These will need to be brought together for NNL/NG to serve as the basis for regional land-use and aggregated offset planning.

- **Identify, analyse and evaluate policy options:** The results of the fact-finding and of the empirical work on individual pilot projects and integrating NNL/NG with land-use planning at the national or regional levels described above can allow government to identify the full set of policy options. These could range from 'business as usual' (no additional policy needed, in which case NNL/NG will be planned according to companies' and lenders' business case for undertaking them voluntarily) right through to the option to implement offsets through 'conservation banking' (requirements for offsets that developers can choose to meet by purchasing the correct number and type of 'biodiversity credits'). The options could include a number of other voluntary and regulatory models in between these two extremes. In each case, the respective advantages and disadvantages of the option can be articulated, as the basis for discussion, together with a description of the legal, financial and human resources needed for the government to implement each option. Consultation with stakeholders will be important throughout.

- **Policy formulation and system design:** Once the government's preferred approach(es) is/are ascertained during the policy evaluation stage above, government will need to draft any policy measures necessary to give effect to the preferred option, and undertake further work to design the system (e.g. exchange rules, mapping, and any system of conservation credits) needed to implement the particular policy option. An important part of this work is to prepare a 'roadmap' and timetable that sets out the plan over a few years for implementing

[71] The Impact Assessment prepared by Defra to accompany its Green Paper on Biodiversity Offsetting is an example (Defra, 2013b), with a supplementary study of other factors that are financially material by Duke & ten Kate (2013).

the NNL/NG system, such as development of policy and guidelines, data gathering and mapping, training and capacity building, and development of the elements of market mechanisms (if desired) such as credit registers and brokers. Again, consultation with stakeholders will be important throughout.

Following steps at the planning stage such as those described here, government would implement its chosen policy, monitor the results and periodically review the policy (scope and details) and associated guidance in order to move more comprehensively and successfully towards NNL/NG. Further information on such a process of continual improvement lies beyond the scope of this introductory paper and is the worthy subject of another paper in due course.

Much of this work needs to be undertaken at the national (or regional) levels, in order to be tailored to the specific ecological, social, economic, regulatory and political circumstances. However, there is also a need for international research. The ability of this paper to review all the evidence from around the world has been limited, but from the evidence covered in the references section of this paper and the authors' experience , it is apparent that more work is needed. Despite at least twenty years of experience in different settings on mitigation, compensation and offsets, comparatively little information and evidence is available in the public domain and in peer-reviewed publications on the effectiveness of these measures. A growing number of governments, financial institutions and companies are taking up NNL, and there is interest on the part of policy-makers in evidence-based policy-making and the ability to learn from earlier successes and failures. Further research is needed on:

- The effectiveness of schemes in achieving their stated goals (e.g. NNL);
- Biodiversity trajectories with and without mitigation measures (i.e. baselines);
- Effectiveness of different measures to secure NNL/NG, including different scopes, metrics, implementation models, monitoring and evaluation; and
- Comparative analysis of policy measures around the world on the topics explored in this paper, especially Sections 2, 3 and 4.

As we noted in the opening paragraphs of this paper, we cannot afford to be complacent that today's approaches to mitigation of projects' impacts on biodiversity are adequate to address the current unprecedented loss of biodiversity (nor indeed to manage companies' and societies' risks). A more rigorous application of the mitigation hierarchy and policies and practices designed to achieve NNL/NG are needed. In order to do this, we have suggested some ways forward for governments interested in exploring NNL/NG policies (see Section 5.2), but this needs to be complemented with a more in-depth and critically rigorous comparative analysis of international experience with mitigation measures.

APPENDIX 1: DEFINITIONS

A.1.1 Biodiversity offsets

A range of different definitions can be found for 'mitigation', 'biodiversity offsets', 'compensation', 'no net loss', 'net gain' and 'net positive impact', together with the core concepts that lie behind these terms, such as 'additionality', 'ecological equivalence', 'metrics' and 'permanence'. These vary according to the political, legal, social and ecological context in which the terms are used, the users (whether government or the private sector, for instance) and the language. For instance, some terms (such as 'mitigation') have different meanings in different countries, while some languages (such as French, Spanish and Swedish) have no separate word for 'offsets' and use 'compensation' to cover both concepts. The variety of terminology used to describe these concepts has caused confusion in international discussions and dialogue between government, the private sector and civil society, however, recent publications (for instance, those by the European Commission, BBOP and the IFC) reveal a number of commonalities, as this section will discuss.

In 2009, after working together for four years to gather experience from around the world on biodiversity offsets, the (then) forty governments, companies, NGOs and financial institutions who were members of the Advisory Group of the Business and Biodiversity Offsets Programme (BBOP) established a set of principles for best practice in using the mitigation hierarchy including biodiversity offsets to achieve no net loss or preferably a net gain of biodiversity. The Principles and the accompanying Glossary set out a number of definitions for key terms, including the following definition of biodiversity offsets, based on definitions found in laws, policies, loan conditions and voluntary corporate commitments around the world:

> "Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development5 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."

In 2012, the International Finance Corporation, in its revised Performance Standard 6, used the following definition:

> "Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimization and restoration measures have been taken."[72]

In 2013, The EU No Net Loss Working Group, in the Glossary developed to facilitate its discussions, reviewed some definitions of offsets and compensation used in Europe and preferred the BBOP definition.[73] Pilgrim et al. (2013), in the companion piece to this report submitted as the other input to the IUCN Technical Study Group, use the following definition:

> "Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for residual adverse biodiversity impacts arising from project development after other appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss (or net gain) in biodiversity."

[72] IFC (2012)
[73] NNLWG (2013a). Page 23.

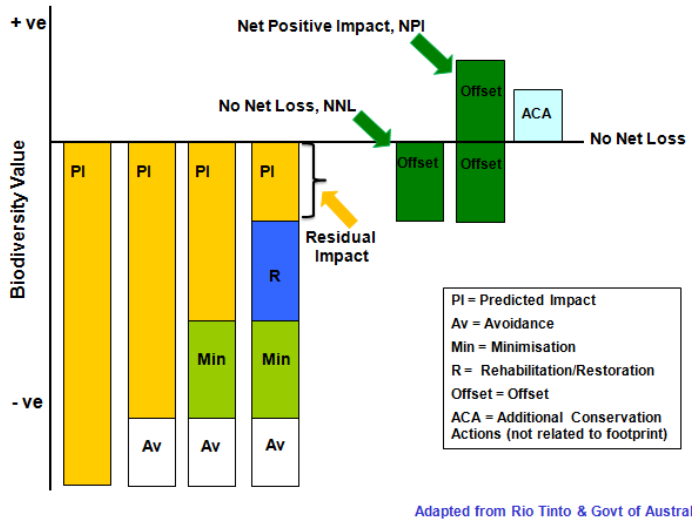
While a range of other definitions of offsets can be found, including some that are more general,[74] for the purpose of this document we will use the BBOP definition, since it is a synthesis of several earlier definitions and has subsequently been used as the basis for others.

The definition of biodiversity offsets raises two fundamental issues which are central to the scope and content of related policy: the role of biodiversity offsets in the context of the mitigation hierarchy, and 'offsets' compared with 'compensation'.

A.1.2. Mitigation hierarchy

It is noticeable that the mitigation hierarchy – or its component parts – are referred to in the majority of definitions of biodiversity offsets. Indeed, the role of biodiversity offsets as the final step in this hierarchy is almost universal in such definitions. Box 1 shows a common illustration of the mitigation hierarchy.

Box 11: The Mitigation Hierarchy. Source: BBOP, 2012a



The graph above schematically illustrates the process that is followed when the mitigation hierarchy is applied to a development project, a coastal diamond mine for example. Biodiversity value, and losses and gains in biodiversity, are shown on the left hand axis. The large yellow bar shows the predicted impacts that result in biodiversity loss.

The first step to limiting the impacts is avoidance. For example, in our mining project this would involve rerouting a pipeline around a wetland system, so that there simply are no impacts on this ecosystem.

If avoidance is not possible, the next best response is to reduce any impacts.

For example: the mine's tailings dam is covered so that when it dries this reduces the amount of saline dust that gets blown inland, and which kills salt-intolerant vegetation.

[74] For instance, Defra uses the following definition in the Green Paper on Biodiversity Offsetting in England: "Biodiversity offsets are conservation activities that are designed to give biodiversity gain to compensate for residual losses. They are different from other types of ecological compensation as they need to show measurable outcomes that are sustained over time" Defra (2013), and the Commonwealth Government of Australia defines offsets as "measures that compensate for the residual adverse impacts of an action on the environment" (Australia, 2012).

Restoration then involves measures that reverse the impacts of the project on biodiversity and bring an area back to a pre-disturbance biodiversity state. Based on our current ecological knowledge, this can be difficult to achieve in many complex ecosystems.

Even after following these steps, however, a residual impact on biodiversity usually remains – which is shown in the graph by the orange arrow. This is where compensation and offsets, shown in dark green, become relevant. Offsets are intended to achieve either a zero net loss, or a gain in biodiversity following development impacts. Compensation generally has a less specific goal.

In its recent work, the EU No Net Loss Working Group observed that nearly all definitions of the mitigation hierarchy include the three basic steps of avoidance, minimization and then compensation. Although this is applied as a general principle, the terminology varies considerably from one country to another. Some definitions divide the sequence in a different way and introduce explicit, additional steps (such as rehabilitation/restoration). Nevertheless, the basic idea of "avoidance, minimization and then compensation" is always included and the terms always refer to the order in which these steps should be considered. Several definitions (e.g. BBOP, IFC Performance Standards) break the MH into more steps – with both BBOP and IFC including a step titled 'restoration/rehabilitation' before offsets and distinguishing between offsets and compensation as a last resort.

In this report, 'mitigation measures' will be used to describe the full set of activities covering the entire mitigation hierarchy. For the purposes of this report, we define the mitigation hierarchy as follows:

a. **Avoidance**: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity. This results in a change to a 'business as usual' approach.

b. **Minimization**: measures taken to reduce the duration, intensity and / or extent of impacts that cannot be completely avoided, as far as is practically feasible.

c. **Rehabilitation / restoration:** measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and / or minimized.

d. Compensation or **Offset**: measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimized and / or rehabilitated or restored, Measures to achieve no net loss or a net gain of biodiversity for at least as long as the project's impacts are biodiversity offsets. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, where there is imminent or projected loss of biodiversity. Measures that address residual impacts but are not quantified to achieve no net loss or not secured for the long term are compensation, otherwise known as compensatory mitigation.

The last sentence of this definition raises another key concept to explore: the distinction between 'offsets' and 'compensation'.

A.1.3. Compensation, compared with offsets

Some policies refer to biodiversity offsets, while others refer to compensation. What is the difference? As we have noted, in some languages there is no separate word for 'offset', and 'compensation' is always used.

Compensation is a very flexible term that can mean a number of different things. Dictionary definitions often refer to something, typically money, awarded to an individual as recompense for loss, injury, or suffering. This has the connotation of damages or some kind of award to victims. Occasionally, compensation is defined more in terms of 'making good' specific damage, in which case it become closer to the definition of 'offset' above (except that it lacks the specific requirement for achieving 'no net loss').

Specifically, in terms of biodiversity, compensation involves measures to recompense, make good or pay damages for loss of biodiversity caused by a project. In some languages 'compensation' is synonymous with 'offset', but according to several definitions, compensation is contrasted with a biodiversity offset.

While several countries have requirements for compensation, the term is often defined only in a general way. For instance, Article 6.4 of the European Habitats Directive provides that:

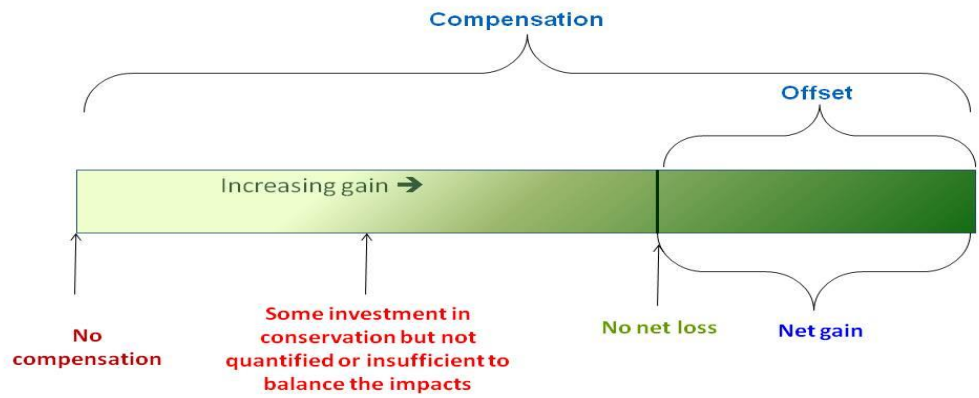
> *'If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.'*[75]

The term *'compensatory measures'* is not defined in the Directive. According to the European Commission, experience would suggest that 'compensatory measures are, strictly speaking, independent of the project (including any associated mitigation measures). 'They are intended to offset the negative effects of the plan or project so that the overall ecological coherence of the Natura 2000 Network [a network of priority protected areas in Europe] is maintained.' (European Commission, 2007).

Sometimes, compensation is defined by reference to certain formulae established in regulations as the basis for calculating it. Requirements for compensation sometimes arise in the context of land-use change, and are quantified relative to the loss of particular natural resources. For instance, the General Law of Sustainable Forest Development in Mexico[76] establishes that the Secretariat of Environment and Natural Resources (Semarnat) can 'define compensation mechanisms for environmental goods and services provided by forest ecosystems'. Semarnat can authorize land use change on forest land, provided there are technical studies which justify this change. In such a situation, the developer must make a deposit in advance with the Mexican Forest Fund for 'environmental compensation for reforestation or restoration activities'[77] In cases such as this, common in several countries, compensation is often calculated based on certain costs associated with reforestation or restoration, such as obtaining and planting seedlings. Typically, such costs address only a part of the overall losses of biodiversity arising from the land-use change.

Some regard compensation as a broad term that covers a spectrum of possibilities, with offsets comprising a subset of compensation in which the objective is no net loss or a net gain. This is illustrated in Figure 3.

Figure 3: Offsets and compensation compared



As a result, BBOP and others contrast the terms 'compensation' with 'offset' as defined in the preceding section. Compensation can involve reparation that falls short of achieving no net loss, for a variety of reasons, including that the conservation actions were not planned to achieve no net loss; that the residual losses of biodiversity caused by the project and gains achievable by the offset are not quantified; that no mechanism for long term implementation

[75] European Council, 1992.
[76] Semarnat, 2005, updated 2013.
[77] Colin (undated).

has been established; that it is impossible to offset the impacts (for instance, because they are too severe or pre-impact data are lacking, so it is impossible to know what was lost as a result of the project); or that the compensation is through payment for training, capacity building, research or other outcomes that will not result in measurable conservation outcomes on the ground.

A.1.4. No Net Loss, and a Net Gain or Net Positive Impact

Good practice in offset policy is to set out the desired end result of following the mitigation hierarchy. While there are exceptions, many policies refer to a goal of No Net Loss, Net Gain or a Net Positive Impact, so this section will review definitions of each.

Definitions in the literature of No Net Loss and Net Gain share a common element of balancing losses and gains, but differ in their precision and detail. For instance, BBOP defines 'no net loss' as:

> "A target for a development project in which the impacts on biodiversity caused by the project are balanced or outweighed by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset the residual impacts, so that no loss remains. Where the gain exceeds the loss, the term 'net gain' may be used instead of no net loss. No net loss (or net gain) of biodiversity is a policy goal in several countries, and is also the goal of voluntary biodiversity offsets."[78]

The European Council adopted a 'working definition' of no net loss, which is that:

> "conservation/biodiversity losses in one geographically or otherwise defined area are balanced by a gain elsewhere provided that this principle does not entail any impairment of existing biodiversity as protected by EU nature legislation"

The government of Victoria in Australia states that:

> "Net Gain is the outcome for native vegetation and habitat where overall gains are greater than overall losses and where individual losses are avoided where possible. Losses and gains are determined by a combined quality-quantity measure and over a specified area and period of time."[79]

IFC defines the terms as follows:

> "No net loss is defined as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional)"[80].
>
> "Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. Net gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements [of paragraph 17] of this Performance Standard without a biodiversity offset, the client should achieve net gains through the implementation of programs that could be implemented in situ (on-the-ground) to enhance habitat, and protect and conserve biodiversity"[81].

In addition to commitments by groups of organizations and individual governments, some 37 companies have also made voluntary commitments related to No Net Loss, Net Gain or related concepts[82]. In its Biodiversity Strategy launched in 2004 at the IUCN World Congress in Bangkok, mining company Rio Tinto describes its goal as:

[78] BBOP, 2012e.
[79] DSE, 2002.
[80] IFC, 2012.
[81] IFC, 2012.
[82] ICMM & IUCN, 2012.

> "to have a "net positive impact" (NPI) on biodiversity. This means minimizing the impacts of our business and contributing to biodiversity conservation to ensure a region ultimately benefits as a result of our presence." [83]

These definitions suggest the 'net gain' (or a 'net positive impact') can be just marginally more than 'no net loss' so that the outcome lies just beyond the balancing point when there is a net positive outcome. This raises a question: how significant is the distinction between No Net Loss and Net Gain? The answer may be very little, and indeed the difference between the two may be swamped in terms of order of magnitude by the uncertainties involved in calculating and delivering either in practice. Some offset requirements distinguish between circumstances when one outcome as opposed to the other is needed. For instance, IFC Performance Standard 6 (see section 1.3.5) requires No Net Loss, where feasible, for impacts on natural habitat, and a Net Gain (in all circumstances) for impacts on critical habitat. Some policies seem to confuse two different things: on the one hand, setting a clear policy goal (as either NNL or NG) and dealing with risk and uncertainty in achieving either. We believe that it is not good practice to set NG as a goal just because of doubts that NNL will be achieved in practice. Better practice is to address the specific risks and uncertainties inherent in succeeding with either: the policy context, the clarity of the requirements, the thresholds, the quality of the metrics and exchange rules, the practicability of the implementation options and the provisions for monitoring and enforcement.

A.1.5. Additionality

Core to offset policy is to ensure that the activities undertaken through the offset make a difference to the conservation outcome and wouldn't have happened anyway. This is the principle of 'additionality'. McKenney and Kiesecker (2010) define additionality as:

> "the need for a compensation measure to provide a new contribution to conservation, additional to any existing values, i.e. the conservation outcomes it delivers would not have occurred without it".

Similarly, BBOP defines the terms additionality as:

> "A property of a biodiversity offset, where the conservation outcomes it delivers are demonstrably new and additional and would not have resulted without the offset".

The challenge lies in establishing the baseline against which the offset's additional results are to be measured: what would have been the conservation outcome without it? Recent discussions (for instance, in the EU No Net Loss Working Group)[84] have distinguished two aspects:

- The ecological component of additionality: ensuring the offset activities provide an ecological improvement at the offset site, and, as part of this:
- The policy component of additionality: ensuring the offset activities do not fall within existing policy commitments, including present government activities and future activities that are already covered by existing government commitments.

The creation of new protected areas through offsets appears to be relatively uncontroversial as a proposition, but a thorny and unresolved question is whether offset activities within existing protected areas can satisfy the second bullet point and thus count as additional. Some policy-makers, particularly in developing countries, point out that current public funding is insufficient to cover the full set of activities desirable for biodiversity conservation in existing protected areas. They suggest that specific offset activities that are over and above activities already set out in existing protected area management plans could qualify, provided they meet 'like-for-like or better' exchange rules and are based on metrics that show they are adequate in scale to achieve No Net Loss. These new

[83] Rio Tinto, 2008.
[84] NNL WG, 2013c.

activities would be covered by additional funding made available through offsets, and not taken from current protected area budgets. However others, particularly in developed countries, argue that governments have assumed international commitments for conservation, particularly in protected areas (e.g. CBD Aichi targets, EU 2020 Strategy), and should be responsible for funding these activities adequately. They fear 'cost shifting', in which the public sector cuts its budget for conservation and makes up the difference from private funding by requiring developers to finance offsets.

Further work is needed to define the application of the additionality principle in public policy.

A.1.6. Ecological equivalence

When applied to offsetting, ecological equivalence can have a policy dimension, particularly in regulated systems where governments need to set the like-for-like rules that will apply. Developers typically suggest that government should adopt broad definitions of equivalence so that offsets are easier and cheaper to find and implement. Conservation interests will tend to support tighter rules of equivalence so that specific biodiversity values are not lost in the offsetting exchange. The role of policy-makers is to determine where the balance should lie, to clarify the terminology and to set the rules.

As the EU NNL Working Group found, there is no single, shared or legally based definition of equivalence. In the scientific field of ecology, the term "equivalence" refers to the possible substitutability of species (within a biotic community). In the field of compensation, "equivalence" is generally understood to refer to or to assess the relationship between the losses at impacted site and the gains at the compensation site. A number of different methodologies to assess ecological equivalence in biodiversity offset schemes were reviewed by Quétier and Lavoral (2011). In some of these methods, equivalence signifies that losses and gains should be of the same type, quality, and from comparable value (example DERM, 2011). In others, equivalence has the more general meaning that compensation measures are sized in such a way as to provide the same amount of biodiversity (as defined by particular biodiversity components and metrics) than the quantified losses.

According to BBOP (2012e):

> 'In ecology, the term ecological equivalence generally refers to species that occupy similar niches in different geographical regions. In the context of biodiversity offsets, the term is synonymous with the concept of 'like for like' and refers to areas with highly comparable biodiversity components. This similarity can be observed in terms of species diversity, functional diversity and composition, ecological integrity or condition, landscape context (e.g., connectivity, landscape position, adjacent land uses or condition, patch size, etc.), and ecosystem services (including people's use and cultural values).'

Related concepts are defined by BBOP as follows:

> 'Like-for-like: Conservation (through the biodiversity offset) of the same type of biodiversity as that affected by the project. Sometimes referred to as in-kind. Several biodiversity offset policies are based on a principle either of 'like-for-like' or of 'like-for-like or better'.'
>
> 'Like-for-like or better: A common approach to biodiversity offsets is to require conservation (through the biodiversity offset) of the same type of biodiversity as that affected by the project. This is known 'like-for-like'. This is sometimes modified to 'like-for-like or better', in which the offset conserves components of biodiversity that are a higher conservation priority (for example because they are more irreplaceable and vulnerable) than those affected by the development project for which the offset is envisaged. This is also known as 'trading up''.

'Trading up: Conserving through an offset components of biodiversity that are a higher conservation priority (for example because they are more irreplaceable and vulnerable) than those affected by the development project for which the offset is envisaged.'

In the European Union, guidance to compensation measures under the Habitats Directive states that it should correspond *'precisely to the negative effects on the species or habitat concerned', 'have to ensure the maintenance of the contribution of a site to the conservation at a favourable status of one or several natural habitats 'within the bio-geographical region concerned''* and *'ensure overall coherence of Natura 2000'*. [85] According to Annexe II of the Environmental Liability Directive[86]:

a. Article 1.2.2. *"When determining the scale of complementary and compensatory remedial measures, the use of resource-to-resource or service-to-service equivalence approaches shall be considered first. Under these approaches, actions that provide natural resources and/or services of the same type, quality and quantity as those damaged shall be considered first. Where this is not possible, then alternative natural resources and/or services shall be provided. For example, a reduction in quality could be offset by an increase in the quantity of remedial measures."*

b. Article 1.2.3. "*If it is not possible to use the first choice resource-to-resource or service-to-service equivalence approaches, then alternative valuation techniques shall be used…."*

France's guidance on the mitigation hierarchy in its 'Doctrine' of 2012[87] defines 'equivalence' as a set of criteria, methods and participatory processes that aim to compare ecological losses (residual impacts of a project) with the gain delivered by compensation measures in order to design and size the compensation measures. Four sets of criteria should be considered to assess equivalence: ecological criteria, geographical/functional criteria, criteria related to time scale, and societal criteria. There is currently no recognized and shared methodology available in France for such an integrated assessment of equivalence and the definition itself was the result of a consensus[88].

The German approach refers to 'functional equivalence' and takes a sequential approach. The first priority is to compensate with the same habitat type and/or target species, but following amendment to the Federal Nature Conservation Act, there is some scope for a looser approach to like for like, bearing in mind that full functional equivalence may be unachievable (particularly, for some specific habitats like peat bog).[89,90]

The looser European approach can be compared with more recent approaches in Australia that set out criteria for equivalence in some detail. For example under the Policy for Vegetation Management Offsets and Biodiversity Offsets Policy in Queensland[91], 'land-based offsets must achieve or exceed ecological equivalence with the respective clearing/impact area. Information must be provided to demonstrate this'.

Demonstrating ecological equivalence on the proposed clearing/impact area and offset area in Queensland requires an ecological equivalence assessment of both areas, and ecological equivalence comprises of two components: ecological condition and special features. Ecological equivalence between the proposed clearing/impact area and offset area is demonstrated when an ecological equivalence assessment is undertaken against the ecological equivalence indicators, the proposed offset area achieves a level of ecological condition the same as or higher than the clearing/impact area and the proposed offset area achieves a level of special features the same as or higher than the clearing/impact area. Ecological equivalence can be assessed either using the

[85] European Commission, 2007.
[86] European Parliament and Council, 2004.
[87] MEDDE, 2012.
[88] NNLWG, 2013c.
[89] NNLWG, 2013c.
[90] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2009; NNLWG, 2013c.
[91] http://www.ehp.qld.gov.au/management/environmental-offsets/measuring-ecological-equivalence.html

department's Ecological Equivalence Methodology (EEM) or using the 28 ecological equivalence criteria and indicators listed in Box 12.

Box 12: Ecological equivalence criteria and indicators in Queensland, Australia[92]

Criterion 1 – Ecological condition indicators

1. Recruitment of woody perennial species
2. Native plant species richness
3. Tree canopy height
4. Tree canopy cover
5. Shrub canopy cover
6. Native perennial grass cover
7. Organic litter
8. Large trees
9. Coarse woody debris
10. Weed cover
11. Size of patch (fragmented landscapes)
12. Connectivity (fragmented landscapes)
13. Context (fragmented landscapes)
14. Distance from water (Intact landscapes)

Criterion 2 – Special features indicators

1. Centres of endemism
2. Wildlife refugia
3. Disjunct populations
4. Taxa at limits of geographic range
5. High species richness
6. Relictual populations
7. Regional ecosystems with distinct variation in species associated with geomorphologic and other environmental variables
8. Artificial water body of ecological significance
9. High density hollow bearing trees
10. Breeding or roosting areas used by significant number of individuals
11. Priority species within the bioregion
12. Strategic ecological corridor
13. Significance of patch within a one kilometre buffer
14. Protected area estate buffer

[92] http://www.ehp.qld.gov.au/management/environmental-offsets/measuring-ecological-equivalence.html

APPENDIX 2: GOVERNMENTS WITH POLICIES ON BIODIVERSITY OFFSETS OR COMPENSATION MORE BROADLY (SEE SECTION 1.3.3)

Table 2 shows a rapid analysis of countries where we believe there are existing laws or policies related to compensation and biodiversity offsets, where they are under development, and where individual biodiversity offset or compensation projects are already underway.

Table 2: Countries with existing laws, policies or projects related to NNL/NG, compensation and biodiversity offsets, and where they are under development.

Note: This table was compiled by the authors from available literature such as Madsen et al. (2011) and other sources covered in the references section to this paper, as well as their own experience of working with governments and companies in a variety of countries. It will inevitably contains errors of omission and inaccuracy, and the authors would be grateful to any readers that can suggest corrections.

	Law or policy on compensation or offset			**Offset projects or experiences in design or implementation phase**	
	Existing	Early discussions	Notes	Existing (design or implement-tation)	Early discussions
Argentina	1	1			
Australia	1		Federal Law (EPBC) and law and policy in various states and territories (Victoria, New South Wales, Queensland, Western Australia, South Australia).	1	
Austria	1		EU*		
Belgium	1		EU*		
Botswana					1
Brazil	1		SNUC law and exchange of areas under Forest Code set-aside	1	
Bulgaria	1		EU*		
Cameroon					1
Canada	1	1	Existing fisheries law (No net loss of fisheries habitat in Canada under the Fisheries Act - see ten Kate et al 2004); policy under discussion in Alberta and Ontario and at federal level	1	
Chad				1	
Chile		1			
China	1		Eco-compensation required in various laws		
Colombia	1		Manual for determination of compensation for loss of biodiversity launched in August 2012 under Policy on Integrated Management of Biodiversity and Ecosystem Services.		1
Costa Rica	1	1			1
Croatia	1		EU*		

Czech Republic	1		EU*		
Denmark	1		EU*		
Ecuador		1			
Estonia	1		EU*		
Finland	1		EU*		
France	1		EU*	1	
Gabon		1			
Germany	1	1	EU*	1	
Ghana				1	
Greece	1		EU*		
Guinea					
Hungary	1		EU*		
India					
Indonesia					
Ireland	1		EU*		
Italy	1		EU*		
Japan		1			
Laos				1	1
Liberia					
Lithuania	1		EU*		
Luxembourg	1		EU*		
Madagascar		1		1	
Malaysia		1	NNL policy has been discussed in Sabah and is a principle for a GEF project there.		
Malta			EU*		
Mexico	1		Program for Environmental Restoration and Compensation		
Mongolia		1		1	
Mozambique		1			1
Namibia		1			
Netherlands	1		EU*		
New Caledonia (France)		1			1
New Zealand		1		1	
Norway					
Panama				1	
Papua New Guinea		1			1
Paraguay	1				
Peru		1			
Poland	1		EU*		
Portugal	1		EU*		
Qatar	1		No net loss of mangroves		
Romania	1		EU*		1

Sierra Leone				1	
Slovakia	1		EU*		
Slovenia	1		EU*		
South Africa	1	1	Draft guidelines for some Provinces. Federal guidance under development.		1
Spain	1		EU*		
Sweden	1		EU*	1	
Switzerland	1		Federal Law for the Protection of Nature and Landscape in Switzerland (ten Kate et al., 2004). Offsets have been applied to existing native grasslands harbouring protected species (Dalang and Hersperger, 2010). (See Quétier, 2011)	1	
Uganda		1			
United Kingdom	1	1	EU*	1	
United States	1			1	
Uzbekistan		1			
Vietnam	1	1	Decree on Compensation		
Yemen				1	
TOTALS:	Existing	Early discussions		Existing	Early discussions
	39	22		18	10
*EU: In the Member States of the European Union, several Directives relevant to compensation are applicable, including the Birds and Habitats Directives, the European Liability Directive, and the EIA and SEA Directives.					

REFERENCES AND SOURCE MATERIALS

Australia, Commonwealth Government (2012). Environmental Offsets Policy. October 2012

Bekessy, S.A., Wintle, B.A., Lindenmayer, D.B. et al. (2010.) The biodiversity bank cannot be a lending bank. Conserv.Lett., 3, 151–158.

Business and Biodiversity Offsets Programme (BBOP) (2013). Updated Overview on Biodiversity Offsets. Forest Trends, Washington D.C., USA. http://www.forest-trends.org/documents/files/doc_3319.pdf

Business and Biodiversity Offsets Programme (BBOP) (2012a). Standard on Biodiversity Offsets. Forest Trends, Washington D.C., USA. ISBN (paperback) 978-1-932928-45-7; ISBN (pdf) 978-1-932928-44-0. http://bbop.forest-trends.org/guidelines/Standard.pdf

Business and Biodiversity Offsets Programme (BBOP) (2012b). Guidance Notes to the Standard on Biodiversity Offsets. Forest Trends, Washington D.C., USA. ISBN (paperback) 978-1-932928-46-1; ISBN (pdf) 978-1-932928-47-1. http://bbop.forest-trends.org/guidelines/Standard_Guidance_Notes.pdf.

Business and Biodiversity Offsets Programme (BBOP) (2012c). Resource Paper: Limits to What Can Be Offset. Forest Trends, Washington D.C., USA. ISBN (pdf) 978-1-932928-48-8. Available from http://bbop.forest-trends.org/guidelines/Resource_Paper_Limits.pdf.

Business and Biodiversity Offsets Programme (BBOP) (2012d). Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets. Forest Trends, Washington D.C., USA. ISBN 978-1-932928-49-5 (pdf). http://bbop.forest-trends.org/guidelines/Resource_Paper_NNL.pdf

Business and Biodiversity Offsets Programme (BBOP) (2012e). 2009 Glossary with updates. BBOP, Washington, D.C. http://bbop.forest-trends.org/guidelines/Updated_Glossary

Business and Biodiversity Offsets Programme (BBOP) (2012f). Biodiversity Offset Design Handbook-Updated. Forest Trends, Washington D.C., USA. http://www.forest-trends.org/documents/files/doc_3101.pdf

Business and Biodiversity Offsets Programme (BBOP) (BBOP 2012g). Case studies: Forest Trends, Washington D.C., USA. http://bbop.forest-trends.org/pages/pilot_projects

Business and Biodiversity Offsets Programme (BBOP) (2009a). Biodiversity Offset Design Handbook: Appendices. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/odh-appendices.pdf.

Business and Biodiversity Offsets Programme (BBOP) (2009b). Biodiversity Offset Cost-Benefit Handbook. BBOP, Forest Trends, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/cbh.pdf. ISBN 978-1-932928-33-4

Business and Biodiversity Offsets Programme (BBOP) (2009c). Biodiversity Offset Implementation Handbook. BBOP, Forest Trends, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/oih.pdf. ISBN 978-1-932928-34-1

Business and Biodiversity Offsets Programme (BBOP) (2009d). The Relationship between Biodiversity Offsets and Impact Assessment: A BBOP Resource Paper. BBOP, Forest Trends, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/eia.pdf. ISBN 978-1-932928-36-5

Business and Biodiversity Offsets Programme (BBOP) (2009e). Biodiversity Offsets and Stakeholder Participation: A BBOP Resource Paper. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/participation.pdf

Business and Biodiversity Offsets Programme (BBOP) (2009f). Business, Biodiversity Offsets and BBOP: An Overview. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/overview.pdf ISBN 978-1-932928-29-7 (paperback)

Business and Biodiversity Offsets Programme (BBOP) and UNEP Finance Initiative (2010). Biodiversity offsets and the mitigation hierarchy: a review of current application in the banking sector. A study completed on behalf of the Business and Biodiversity Offsets Programme and the UNEP Finance Initiative by PricewaterhouseCoopers LLP, March 2010. www.unepfi.org/fileadmin/documents/biodiversity_offsets.pdf

Bull, J W, Suttle, B, Gordon, A, Singh, N J and Milner-Gulland, E J (2013). Biodiversity offsets in theory and practice. *Oryx*, No 47, (3) pp369-380.

Burgin, S (2010). "Mitigation banks" for wetland conservation: a major success or an unmitigated disaster? *Wetlands Ecology and Management*, No 18, pp49-55.

Bushbroker (2013). Bushbroker website: http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/native-vegetation/native-vegetation-permitted-clearing-regulations/native-vegetation-offsets/bushbroker/publication-and-statistics

Business and Biodiversity Offsets Programme (BBOP). (2009a). Biodiversity Offset Cost-Benefit Handbook. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/cbh.pdf. ISBN 978-1-932928-33-4 Business and Biodiversity Offsets Programme (BBOP). (2009b). Biodiversity Offset Design Handbook: Appendices. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/odh-appendices.pdf. ISBN 978-1-932928-32-7

Business and Biodiversity Offsets Programme (BBOP). (2009c). Biodiversity Offset Implementation Handbook. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/oih.pdf. ISBN 978-1-932928-34-1

Business and Biodiversity Offsets Programme (BBOP). (2009d). Biodiversity Offsets and Stakeholder Participation: A BBOP Resource Paper. BBOP, Washington, D.C. www.forest-trends.org/biodiversityoffsetprogram/guidelines/participation.pdf. ISBN 978-1-932928-35-8

Business and Biodiversity Offsets Programme (BBOP). (2009e). The Relationship between Biodiversity Offsets and Impact Assessment: A BBOP Resource Paper. BBOP, Washington, D.C.www.forest-trends.org/biodiversityoffsetprogram/guidelines/eia.pdf ISBN 978-1-932928-36-5

Business and Biodiversity Offsets Programme (BBOP). (2012a). Standard on Biodiversity Offsets. ISBN (paperback) 978-1-932928-45-7; ISBN (pdf) 978-1-932928-44-0. Available from http://bbop.forest-trends.org/guidelines/Standard.pdf

Business and Biodiversity Offsets Programme (BBOP). (2012b). Guidance Notes to the Standard on Biodiversity Offsets. ISBN (paperback) 978-1-932928-46-1; ISBN (pdf) 978-1-932928-47-1Available from http://bbop.forest-trends.org/guidelines/Standard_Guidance_Notes.pdf

Business and Biodiversity Offsets Programme (BBOP). (2012c). Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets. ISBN 978-1-932928-49-5 (pdf). Available from: http://bbop.forest-trends.org/guidelines/Resource_Paper_NNL.pdf.

Business and Biodiversity Offsets Programme (BBOP). (2012d). Resource Paper: Limits to What Can Be Offset. ISBN (pdf) 978-1-932928-48-8. Available from http://bbop.forest-trends.org/guidelines/Resource_Paper_Limits.pdf.

Business and Biodiversity Offsets Programme (BBOP). (2012e). 2009 Glossary with updates. BBOP, Washington, D.C. Available from http://bbop.forest-trends.org/guidelines/Updated_Glossary (The update was written by Kerry ten Kate, building on the 2009 Glossary.)

Business and Biodiversity Offsets Programme (BBOP). (2012f). 2009 Biodiversity Offset Design Handbook - Updated. BBOP, Washington, D.C. ISBN 978-1-932928-50-1 (pdf) Available from http://bbop.forest-trends.org/guidelines/Updated_ODH.pdf

Caro, T.M. (2010). Conservation by proxy: Indicator, umbrella, keystone, flagship, and other surrogate species. Island Press, Washington, D.C., USA.

Carroll, N, Fox, J and Bayon, R (2007). *Conservation and Biodiversity Banking: A Guide to Setting Up and Running Biodiversity Credit Trading Systems.* Earthscan, London.

Carroll, N., J.Fox and R.Bayon (eds.) (2007).Conservation and Biodiversity Banking: A Guide to Setting Up and Running Biodiversity Credit Trading Systems. Earthscan Publications Ltd.

Clare, S, Krogman, N, Foote, L and Lemphers, N (2011). Where is the avoidance in the implementation of wetland law and policy? *Wetlands Ecology and Management*, No 19, pp165-182.

Colin, M. (undated). “Compensación Ambiental por Cambio de Uso de Suelo en Terrenos Forestales en el caso de humedales con mangle” CEJA. Available at: http://www.ceja.org.mx/IMG/Estudio_para_determinar_la_compensacion_ambiental_caso_manglar.pdf

Cooley, D. & Olander, L. (2011). Stacking Ecosystem Services Payments Risks and Solutions. Nicholas Institute Working Paper. September 2011. http://nicholasinstitute.duke.edu/sites/default/files/publications/stacking-ecosystem-services-payments-paper.pdf

Conway, M, Rayment, M, White, A and Berman, S (2013). *Exploring Potential Demand for and Supply of Habitat Banking in the EU and Appropriate Design Elements for a Habitat Banking Scheme*. Final Report submitted to DG Environment. ICF GHK, London.

Darbi, M and Tausch, C (2010). *Loss-Gain calculations in German Impact Mitigation Regulation*. Forest Trends, Washington.

Darbi, M, Ohlenburg, H, Herberg, A, Wende, W, Skambracks, D and Herbert, M (2009). *International approaches to compensation for impacts on biological diversity*. Final Report.

Deal, R.L., Cochran, R. & LaRocco, G. (2012). Bundling of ecosystem services to increase forestland value and enhance sustainable forest management. Forest Policy and Economics 17: 69-76.

Defra (2013a). Biodiversity Offsetting in England Green paper, September 2013.

Defra (2013b). Biodiversity Offsetting Impact Assessment, August 2013. IA No Defra 1126.

Defra (2012). Report of the Habitats and Wild Birds Directives Implementation Review. Department for Environment, Food and Rural Affairs, London.

Defra and Natural England (2012). *Biodiversity Offsetting Pilots*. Technical Paper: the metric for the biodiversity offsetting pilot in England. Defra, London.

Department of Sustainability and Environment (2008). Native Vegetation Net Gain Accounting: First Approximation Report, State of Victoria, Department of Sustainability and Environment, East Melbourne.

Dickie, I, McAleese, L, Pearce, B and Treweek, J R (2013). *Marine Biodiversity Offsetting - UK Scoping Study*. The Crown Estate, London.

Dickie, Ian; Tucker, Graham; Bishop, Joshua; Brans, Edward; Cranford, Matthew; Chapman, David; Donovan, Colleen; Ekstrom, Jon; Fortuijn, Droogleever; Ohlenburg, Holger; Ozdemiroglu, Ece; Rijcken, Pels; ten Kate, Kerry; Treweek, Jo and Wende, Wolfgang (2010). The use of market-based instruments for biodiversity protection –The case of habitat banking – Technical Report for European Commission DG Environment http://ec.europa.eu/environment/enveco/index.htm

DSE (2002). Victoria’s Native Vegetation Management: A Framework For Action. http://www.dse.vic.gov.au/

Duke, G and ten Kate, K. (2014, in press). Exploring lessons learned from biodiversity offsetting markets in other countries that could inform appraisal of options for delivering offsets in England. Final report to Defra. Forest Trends, Washington D.C.

Duke, G., Conway, M., Dickie, I., Juniper, T., Quick, T., Rayment, M., Smith, S., (2013). EMTF Second Phase Research: Opportunities for UK Business that Protect and/or Value Nature. Final Report. ICF GHK, London. http://www.defra.gov.uk/ecosystem-markets/work/evidence/

EFTEC and IEEP (2010). *The Use of Market-based Instruments for Biodiversity Protection - the Case of Habitat Banking*. Technical report for European Commission DG Environment, Eftec and IEEP, London.

Environmental Law Institute (ELI) wetlands research reports (http://www.elistore.org/reports_list.asp?topic=Wetlands).

Environmental Law Institute (ELI) (2007). Mitigation of Impacts to Fish and Wildlife Habitat: Estimating Costs and Identifying Opportunities

Environmental Law Institute, (ELI) (2006). The Status and Character of In-Lieu Fee Mitigation in the Unites States .

Equator Principles Association, 2011. http://www.equator-principles.com/index.php/all-ep-association-news/ep-association-news-by-year/83-ep-association-news-2011/254-revised-ps

European Commission (2000). *Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. Office for Official Publications of the European Communities, Luxembourg.

European Commission (2001). *Assessment of plans and projects significantly affecting Natura 2000 sites*. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Luxembourg.

European Commission (2006). *Nature and Biodiversity cases. Rulings of the European Court of Justice*. European Commission, Brussels.

European Commission (2007). *Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC*. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission. European Commission DG Environment, Brussels.

European Commission (2008). *Implementation of Article 6(4), first subparagraph, of Council Directive 92/43/EEC during the period 2004-2006. Summary Report*. European Commission DG Environment, Brussels.

European Commission (2011b). *Roadmap to a resource efficient Europe*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2011) 571, 20.9.2011b, European Commission, Brussels.

European Commission (2013a). *Implementation of Article 6(4), first subparagraph, of Council Directive 92/43/EEC (Habitat Directive) period 2007-2011. Summary Report*. European Commission DG Environment, Brussels.

European Commission (2013b). *Guidance on Incorporating Climate Change and Biodiversity into Strategic Environmental Assessment*. European Commission.

European Commission (2013c). *Incorporation of Climate Change and Biodiversity into Environmental Impact Assessment*. European Commission.

European Council (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora http://ec.europa.eu/environment/nature/legislation/habitatsdirective/.

European Parliament and Council (2004) Directive 2004/35/CE of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0056:0056:EN:PDF

Faith, D. P., and P.A. Walker (2002). The role of trade-offs in biodiversity conservation planning: linking local management, regional planning and global conservation efforts. J.Biosci Vol 27 No.4 Suppl.2 pp393-407.

Faith, D. P., Walker, P. A. and Margules, C. R., (2001). Some future prospects for systematic biodiversity planning in Papua New Guinea – and for biodiversity planning in general. Pacific Conservation Biology 6:325-343.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2009). Act on Nature Conservation and Landscape Management (Federal Nature Conservation Act – BnatSchG), 29 July 2009. http://www.wipo.int/wipolex/en/text.jsp?file_id=234517

Forest Europe, UNECE and FAO (2011). *State of Europe's Forests 2011*. Status and Trends in Sustainable Forest Management in Europe. Forest Europe, Madrid.

Gardner, T A, Von Hase, A, Brownlie, S, Ekstrom, J M M, Pilgrim, J D, Savy, C E, Stephens, R T T, Treweek, J R, Ussher, G T, Ward, G and ten Kate, K (2013). Biodiversity offsets and the challenge of achieving no net loss. *Conservation Biology*, *Volume 27, Issue 6, pages 1254–1264, December 2013.*

Gardner, T and von Hase, A (2012) *Key ingredients for biodiversity offsets to achieve No Net Loss.* Unpublished report to the New Zealand Department of Conservation.

Gardner, T.A., Barlow, J., Parry, L.T.W. et al. (2007). Predicting the uncertain future of tropical forest species in a data vacuum. Biotropica, 39, 25–30.

.GHK (2011). Costing potential actions to offset the impact of development on biodiversity – Final Report - Annexes. GHK, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/218688/110714offsetting-technical-costing-potential-annex.pdf

Gibbons, P and Lindenmayer, D B (2007). Offsets for land clearing: No net loss or the tail wagging the dog? *Ecological Management & Restoration*, No 8, (1) pp26-31.

Government of Victoria (2014). Publication and Statistics. http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/native-vegetation/native-vegetation-permitted-clearing-regulations/native-vegetation-offsets/bushbroker/publication-and-statistics

Grigg, A and ten Kate, K. (2004). Protecting shareholder and natural value. Biodiversity risk management: towards best practice for extractive and utility companies Insight Investment, London. http://www.insightinvestment.com/Documents/responsibility/protecting_shareholder_and_natural_value.pdf

Hannis, M and Sullivan, S (2012). *Offsetting Nature? Habitat Banking and Biodiversity Offsets in the English Land Use Planning System*. Green House, Weymouth, UK.

Hansjügens, B, Schröter-Schlaack, C, Tucker, G and Vakrou, A (2011). Addressing the losses through regulation and pricing, in Patrick ten Brink (ed) *The Economics of Ecosystems and Biodiversity in National and International Policy Making,* pp299-343. Earthscan, London and Washington.

Hilderbrand R. H., Watts A.C. and Randle A. M. (2005). The myths of restoration ecology. Ecology and Society 10. 19.

HM Government (2011). White Paper on the Natural Environment: The Natural Choice: Securing the value of nature. HM Government. CM 8082. ISBN: 9780101808224. www.official-documents.gov.uk

Hossler, K, Bouchard, V, Fennessy, M S, Frey, S D, Anemaet, E and Herbert, E (2011). No-net-loss not met for nutrient function in freshwater marshes: recommendations for wetland mitigation policies. *Ecosphere*, No 2, (7) article 82.

International Finance Corporation (2012a). 1 Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. 1 January 2012. http://www.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES

International Finance Corporation (2012b). Guidance Notes to Performance Standards on Environmental and Social Sustainability - 2012 Edition . Available from: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_policy_gn-2012

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

Ingram, Jane Carter (2012). Bundling and Stacking for Maximizing Social, Ecological, and Economic Benefits: A Framing Paper for Discussion at the "Bundling and Stacking Workshop", April 5-6, 2012 Convened by the TransLinks Partnership with support from USAID http://rmportal.net/library/content/translinks/translinks-2012/Wildlife%20Conservation%20Society/2012%20PES%20Bundling%20and%20Stacking%20Workshop%20(Washington,%20DC,%20USA)/Paper_PESBundlingandStacking.pdf

Kiesecker, J M, Copeland, H, Pocewicz, A and McKenney, B A (2010). Development by design: blending landscape level planning with the mitigation hierarchy. Frontiers in Ecology and the Environment, No 8, pp261-266.

Kiesecker, J M, Copeland, H, Pocewicz, A, Nibblelink, N, McKenney, B A, Dahlke, J, Holloran, M and Stroud, D (2009). A Framework for Implementing Biodiversity Offsets: Selecting Sites and Determining Scale. *Bioscience*, No 59, pp77-84.

Lau, Winnie (2012). Stack them? Bundle them? Just get the investment for ecosystem services – as many as possible. 27 April, 2012. http://ecosystemcommons.org/soapbox/Lau

Madsen, Becca, Nathaniel Carroll, Daniel Kandy, and Genevieve Bennett (2011) Update: State of Biodiversity Markets. Washington, DC: Forest Trends, 2011. Available at: http://www.ecosystemmarketplace.com/reports/2011_update_sbdm.

Madsen, R.; Carroll, N,; and Moore Brands, K. (2010). State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Available at: http://www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf

Maron, M, Hobbs, R J, Moilanen, A, Matthews, J W, Christie, K, Gardner, T A, Keith, D A, Lindenmayer, D B and McAlpine, C A (2012). Faustian bargains? Restoration realities in the context of biodiversity offset policies. *Biological Conservation*, No 155, pp141-148.

Maron, M., Dunn, P.K., McAlpine, C.A. et al. (2010). Can offsets really compensate for habitat removal? The case of the endangered red-tailed black-cockatoo. J. Appl. Ecol., 47, 348–355.

McCarthy M. A., Parris K. M., van der Ree R. et al. (2004). The habitat hectares approach to vegetation assessment: An evaluation and suggestions for improvement. Ecological Management & Restoration 5, 24-27.

McCarthy, M A, Parris, K M, van der Ree, R, McDonnell, M J, Burgman, M A, Williams, N S G, McLean, N, Harper, M J, Meyer, R, Hahs, A and Coates, T (2004). The habitat hectares approach to vegetation assessment: An evaluation and suggestions for improvement. *Ecological Management & Restoration*, No 5, (1) pp24-27.

McKenney, B A and Kiesecker, J M (2010). Policy development for biodiversity offsets: a review of offset frameworks. *Environmental Management*, No 45, (1) pp165-176.

McKenney, B and Kiesecker, M. (2010). Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. Environmental Management. 2010 Jan;45(1):165-76. doi: 10.1007/s00267-009-9396-3.

MEDDE (2012). Doctrine relative à la séquence éviter, réduire et compenser les impacts sur le milieu naturel. Ministère de l'Écologie, du Développement Durable et de l'Energie, Paris, France.

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC. Copyright © 2005 World Resources Institute www.millenniumassessment.org/documents/Morris R. K. A., Alonso I., Jefferson R. G. and Kirby K. J. 2006. The creation of compensatory habitat – Can it secure sustainable development? Journal for Nature Conservation 14,106-116.

Ministry of Environment and Sustainable Development, Colombia (2012). Manual for the Allocation of Compensation for Loss of Biodiversity. Vice Ministry of Environment and Sustainable Development Forest Management, Biodiversity and Ecosystem Services. http://www.minambiente.gov.co/documentos/normativa/020812_manual_compensacion_biodiversidad.pdf

MINAM (2013). Ministry of the Environment, Peru. Ministerial Resolution No 68-2013, Ministry of the Environment, Peru, 27 February 2013 and accompanying 'Guidelines for the elaboration and implementation of the environmental compensation plan in the framework of the system for evaluation of environmental impact'. http.//www.minam.gob.pe/consultas_publicas

Morandeau, D and Vilaysack, D (2012). *Compensating for damage to biodiversity: an international benchmarking study*. 68, General Commission for Sustainable Development, Paris.

Morris, R K A, Alonso, I, Jefferson, R G and Kirby, K J (2006). The creation of compensatory habitat - Can it secure sustainable development? *Journal for Nature Conservation*, No 14, (2) pp106-116.

Morris, R.K.A., Alonso, I., Jefferson, R.G., Kirby, K.J., (2006). The creation of compensatory habitat – can it secure sustainable development? J. Nat. Conserv. (Jena) 14, 106–116.

Newey, G. (2012). Nurturing nature. Policy to protect and improve biodiversity. Policy Exchange, London. http://www.policyexchange.org.uk/publications/category/item/nurturing-nature

NNLWG (2013a). *Scope and Objectives of the No Net Loss Initiative*. European Commission / Working Group on No Net Loss of Ecosystems and their Services, Brussels, July 2013.

NNLWG (2013b). *Development of Operational Principles of Any Proposed EU No Net Loss Initiative*. European Commission / Working Group on No Net Loss of Ecosystems and their Services, Brussels, July 2013.

NNLWG (2013c). *EU No Net Loss Working Group Glossary*. European Commission / Working Group on No Net Loss of Ecosystems and their Services, Brussels, July 2013.

NRC (2001). *Compensating for wetland losses under the Clean Water Act*. National Academy Press, Washington, D.C. http://www.nap.edu/openbook.php?isbn=0309074320

OECD (2004). Handbook of Market Creation for Biodiversity: Issues in Implementation. ISBN 92-64-01861-1. http://www.peblds.org/files/Publications/OECD/OECD_Handbook%20of%20Market%20Creation_implementation.pdf

Parkes, D, Newell, G and Cheal, D (2003). Assessing the quality of native vegetation: The 'habitat hectares' approach. *Ecological Management & Restoration*, No 4, pp29-38.

Pilgrim, J D and Ekstrom, J M M (2014). *Technical conditions for positive outcomes from biodiversity offsets. An input paper for the IUCN Technical Study Group on Biodiversity Offsets*. Gland, Switzerland: IUCN.

Pilgrim, J D, Brownlie, S, Ekstrom, J M M, Gardner, T A, von Hase, A, ten Kate, K, Savy, C E, Stephens, R T T, Temple, H J, Treweek, J R, Ussher, G T and Ward, G (2013). A process for assessing offsetability of biodiversity impacts. *Conservation Letters*, No 6, (5) pp376-384.

Quétier, F and Lavorel, S (2011). Assessing ecological equivalence in biodiversity offset schemes: Key issues and solutions. *Biological Conservation*, No 144, (12) pp2991-2999.

Quétier, F., Regnery, B. Levrel, H. (2014, in press). No net loss of biodiversity or paper offsets? A critical review of the French no net loss policy. Environmental Science & Policy.

Quigley, J T and Harper, D J (2006). Effectiveness of fish habitat compensation in Canada in achieving no net loss. *Environmental Management*, No 37, (3) pp351-366.

Race M. S. and Fonseca M. S. (1996). Fixing compensatory mitigation: What will it take? Ecological Applications 6,94-101.

Rio Tinto (2008). Rio Tinto and biodiversity: Achieving results on the ground. http://www.riotinto.com/documents/ReportsPublications/RTBidoversitystrategyfinal.pdf

Robertson, M., BenDor, T., Lave, R., Riggsbee, A., Ruhl, J.B., and Doyle M. (2014, in press). Stacking ecosystem services. Frontiers in Ecology and Environment, in press.

Robertson, M and Hayden, N (2007). Evaluation of a market in wetland credits: entrepreneurial wetland banking in Chicago. Conservation Biology, No 22, pp636-646.

RSPB (2010). Financing nature in an age of austerity. RSPB, Sandy http://www.rspb.org.uk/Images/Financingnature_tcm9-262166.pdf

Ruhl, J B and Salzman, J (2006). The effects of wetland mitigation banking on people. *National Wetlands Newsletter*, No 28, (2)

Salzman J. and Ruhl J. B. (2005). No net loss – Instrument Choice in Wetland protection. Duke Law school Research Paper No. 1.

Salzman, J and Ruhl, J B (2000) Currencies and the commodification of environmental law. *Stanford Law Review*, No 607, pp607-694.

Secretariat of the Convention on Biological Diversity (2010a). Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets "Living in Harmony with Nature. http://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-EN.pdf

Secretariat of the Convention on Biological Diversity (2010b). Global Biodiversity Outlook 3, Montréal. http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf

Secretariat of the Convention on Biological Diversity (2013). Provisional agenda of the Twelfth meeting of Conference of the Parties to the Convention on Biological Diversity, Pyeongchang, Republic of Korea, 6-17 October 2014 http://www.cbd.int/doc/?meeting=COP-12

Semarnat. (2005, updated 2013). General Law of Susstainable Forest Development. Mexico. http://bch.cbd.int/database/record.shtml?documentid=8591

Suding, K N (2011). Toward an era of restoration in ecology: successes, failures, and opportunities ahead. *Annual Review of Ecology, Evolution, and Systematics*, No 42, (1) pp465-487.

TBC and FFI (2012). Oyu Tolgoi Net Positive Impact Forecast. Unpublished draft report of The Biodiversity Consultancy Ltd and Fauna & Flora International, May 2012.

TEEB (2010a). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations.* Earthscan, London and Washington, DC.

TEEB (2010b). *The Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers.* Earthscan, London and Washington, DC.

TEEB (ed) (2011). *The Economics of Ecosystems and Biodiversity in National and International Policy Making. Edited by Patrick Ten Brink.* Earthscan, London and Washington.

Temple, H, Bob Edmonds, Bill Butcher and Jo Treweek (2012). Biodiversity Offsets: Testing a Possible Method for Measuring Biodiversity Losses and Gains at Bardon Hill Quarry, UK.

Temple, H, Edmonds, R, Butcher, W and Treweek, J (2010). Biodiversity offsets: testing a possible method for measuring biodiversity losses and gains at Bardon Hill Quarry, UK. *In Practice*

Temple, H.J., Anstee, S., Ekstrom, J., Pilgrim, J.D., Rabenantoandro, J.,Ramanamanjato, J.-B., Randriatafika, F. & Vincelette, M. (2012). Forecasting the path towards a Net Positive Impact on biodiversity for Rio Tinto QMM. Gland, Switzerland: IUCN.

ten Kate, K. and Pilgrim, John. (2014, in press). Biodiversity offsets technical study paper: A product of the IUCN Technical Study Group on Biodiversity Offsets. With contributions from Tom Brooks, Philip Gibbons, Jonathan Hughes, Brendan Mackey, Jeffrey Manuel, Bruce McKenney, Swapan Mehra, Fabien Quétier and James Watson. IUCN, Gland.

ten Kate, K., von Hase, A., Boucher, J., Cassin, C. and Victurine, R. (2011). Oportunidades para los Fondos Ambientales en Esquemas de Compensación y Offset. Proyecto de Capacitación de RedLAC para Fondos Ambientales. http://www.redlac.org/images/PDFs/workshopmaterials/5%20-%20oportunidades%20para%20los%20fondos%20ambientales%20en%20esquemas%20de%20compensacin%20y%20offset.pdf [Also available in English.]

ten Kate, K., Bishop, J., and Bayon, R. (2004). Biodiversity offsets: Views, experience, and the business case. IUCN, Gland, Switzerland and Cambridge, UK and Insight Investment, London, UK. ISBN: 2-8317-0854-0 http://www.insightinvestment.com/Documents/responsibility/Biodiversity_Offsets_Report.pdf; http:www//biodiversityeconomics.org/offsets

The Biodiversity Consultancy Ltd (TBC) and Fauna & Flora International – Net Positive Impact Forecast for the Oyu Tolgoi project- May 2012 The Biodiversity Consultancy Ltd (TBC) (2012). Government policies on biodiversity offsets.

The Biodiversity Consultancy (2012). Independent report on biodiversity offsets for ICMM and IUCN TBC doc http://www.icmm.com/biodiversity-offsets

The Economics of Ecosystems and Biodiversity (TEEB) (2009). TEEB for policy-makers. http://www.teebweb.org/ForPolicymakers/tabid/1019/language/en-US/Default.aspx

Treweek, Jo; Brownlie, Susie; ten Kate, Kerry; Stephens, Theo (2009). Aggregated biodiversity offsets: a preliminary evaluation of their potential and factors affecting success in implementation. 22 June 2009. BBOP.

Treweek, J. ; ten Kate, K.; Butcher, B.; Venn, O.; Garland, L.; Wells, M.; and Thompson, S. (2009). Scoping study for the design and use of biodiversity offsets in an English context: Final report to Defra. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/218689/BiodiversityOffsets12May2009.pdf

Truty, Jay (2010). Payments for Ecosystem Services: Stacking vs Bundling. http://www.slideshare.net/jtruty/pes-stacking-v-bundling-presentation-carbon-trade-ex-america-conference-09282010

Tucker, Graham; Allen, Ben; Conway, Mavourneen; Dickie, Ian; Hart, Kaley; Rayment, Matt; Schulp, Catharina; van Teeffelen, Astrid (2013, in press) *Policy Options for an EU No Net Loss Initiative*. Report to the European Commission. Institute for European Environmental Policy, London.

Turbé, A, De Toni, A, Benito, P, Lavelle, P, Lavelle, P, Ruiz, N, Van der Putten, W H, Labouze, E and Mudgal, S (2010). *Soil biodiversity: functions, threats and tools for policy makers*. [Contract 07.0307/2008/517444/ETU/B1], Report for European Commission (DG Environment), Bio Intelligence Service, IRD, and NIOO, Luxembourg.

Tyldesley, D. et al. (2012a). Planning Policy and Biodiversity Offsets. Report on Phase II Research. Effectiveness of the application of current planning policy in the Town and Country Planning system. Report to the Department for Environment, Food and Rural Affairs.

http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17509

Tyldesley, D., Lomax, P., Pape, D., and Oxford, M. (2012b). Application of a New Biodiversity Offsetting Metric to an Existing Sample of Real-Life Historic Cases. Appendix 1 to the Report to the Department for Environment, Food and Rural Affairs. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17831

UK National Ecosystem Assessment (2011). http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx

USACE (2008). *Compensation Mitigation for Losses of Aquatic Resources; Final Rule*. Federal Register, Part II Department of Defense, Department of the Army, Corps of Engineers.

Villaroya, A and Puig, J (2010). Ecological compensation and environmental impact assessment in Spain. *Environmental Impact Assessment Review*, No 30, (6)

Villaroya, A and Puig, J (2013). A proposal to improve ecological compensation practice in road and railway projects in Spain. *Environmental Impact Assessment Review*, No 42

Walker S., Brower A. L., Stephens R. T., and Lee W. G. Conservation Letters 2 (2009). 149-157.

Walker, S, Brower, A L, Stephens, R T T and Lee, W G (2009). Why bartering biodiversity fails. *Conservation Letters*, No 2, (4).

Wende, W, Herberg, A and Herzberg, A (2005). Mitigation banking and compensation pools: improving the effectiveness of impact mitigation regulation in project planning procedure**s**. *Impact Assessment and Project Appraisal*, No 23, (2)

Wilkins S., Keith D. A. and Adam P. (2003). Measuring success: Evaluating the restoration of a grassy eucalypt woodland on the Cumberland Plain, Sydney, Australia. Restoration Ecology 11, 489-503.

Willemen, L, Verburg, P H, Hein, L and van Mensvoort, M E F (2008). Spatial characterization of landscape functions. *Landscape and Urban Planning*, No 88,

Wischmeyer, W.H., Smith, D.D. (1978). Predicting rainfall erosion losses - a guide to conservation planning.

Withers, J. (2012). Planning policy and biodiversity offsets. Report of Phase I Research. Defra. London. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17509

World Bank (2001). Operational Policy 4.04: Natural Habitats; Annex A: Definitions; and Bank Procedure 4.04: Natural Habitats. http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543920~menuPK:1286576~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html

Wunder, S. & Wertz-Kanounnikoff, S. (2009). Payments for Ecosystem Services: A New Way of Conserving Biodiversity in Forests. Journal of Sustainable Forestry 28: 576-596.