Biodiversity Offsets

EFFECTIVE DESIGN AND IMPLEMENTATION

OECD

Biodiversity Offsets

EFFECTIVE DESIGN AND IMPLEMENTATION

OECD
BETTER POLICIES FOR BETTER LIVES

This work is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of OECD member countries or those of the European Union.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Please cite this publication as:
OECD (2016), *Biodiversity Offsets: Effective Design and Implementation*, OECD Publishing, Paris.
http://dx.doi.org/10.1787/9789264222519-en

ISBN 978-92-64-22245-8 (print)
ISBN 978-92-64-22251-9 (PDF)

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Photo credits: Cover © Rusty Dodson.

Corrigenda to OECD publications may be found on line at:
www.oecd.org/about/publishing/corrigenda.htm.

© OECD 2016

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgement of OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to *rights@oecd.org*. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at *info@copyright.com* or the Centre français d'exploitation du droit de copie (CFC) at *contact@cfcopies.com*.

Foreword

Biodiversity loss is one of the major environmental challenges facing humankind today. Despite the invaluable benefits provided by biodiversity and associated ecosystems, current and projected trends show continued decline. It is widely acknowledged that concerted policy efforts will be needed to reverse these trends. The aim of this volume is to provide policy makers and practitioners with good practice insights on how to effectively design and implement one particular instrument that has recently been gaining traction from governments and business alike, namely biodiversity offsets. Typically undertaken as the last step in the mitigation hierarchy (i.e. avoid, minimise and then offset loss), successful biodiversity offset programmes are those that are environmentally effective, economically efficient and distributionally equitable.

This book, prepared under the oversight of the OECD Working Party on Biodiversity, Water and Ecosystems, draws on the literature and on lessons and insights from more than 40 case studies on biodiversity offsets worldwide, including three in-depth chapters from the United States, Germany and Mexico. It examines the opportunities, as well as the challenges, that have been encountered with the design and implementation of biodiversity offset programmes and how they may be addressed. The following questions are examined:

- What are biodiversity offsets and how do they fit within the broader framework of no net loss and the mitigation hierarchy?
- What are the key design and implementation features that need to be considered to help ensure that biodiversity offsets are environmentally effective?
- What are the lessons learned from existing biodiversity offset programmes and what are the good practice insights for existing and future programmes?

Acknowledgements

This publication has been prepared by the OECD Environment Directorate under the oversight of the Working Party on Biodiversity, Water and Ecosystems of the Environment Policy Committee. Participants to these meetings provided valuable comments and suggestions throughout its preparation.

This work has also benefited from the presentations and discussions at the international expert workshop on biodiversity offsets which took place on 6-7 November 2013, in Paris, France.

Chapters 1-4 of this report were prepared by Andrew O'Keefe (formerly OECD) and Katia Karousakis (OECD). Chapter 5 on the US Compensatory Mitigation programme was written by Morgan Robertson and Palmer Hough (University of Wisconsin and United States Environmental Protection Agency, respectively). Chapter 6 on Germany was drafted by Frank Wätzold and Silvia Wissel (Brandenburg University of Technology and University of Amsterdam, respectively). Chapter 7 on Mexico was written by Bernardo Lazo (Ithaca Environmental). All chapters were overseen and edited by Katia Karousakis. Jane Kynaston provided administrative support. Jennifer Allain prepared the manuscript for publication. Comments and feedback on this report were provided by Anthony Cox, Jane Ellis and Simon Buckle (OECD) and notably, comments from delegates of the OECD Working Party on Biodiversity, Water and Ecosystems are gratefully acknowledged.

This document has been produced with the financial assistance of the Netherlands, the European Union, Switzerland and the United Kingdom. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

Table of contents

Acronyms and abbreviations 13

Executive summary 15

Chapter 1. **Biodiversity offsets: Overview and insights for good practice** 19

Biodiversity: An invisible – yet invaluable – life support system 20
Biodiversity offsets and their role in biodiversity conservation and sustainable use 20
Key design and implementation features and good practice insights 24
References 26
Annex 1.A1. Case study overview 29

PART I **Key design and implementation issues** 37

Chapter 2. **No net loss, the mitigation hierarchy and the economics of biodiversity offsets** 39

No net loss 40
The mitigation hierarchy 43
Three types of biodiversity offsets: One-off, biobanking and in-lieu fees 50
The economics of biodiversity offsets 53
Notes 59
References 60

Chapter 3. **Institutional frameworks for biodiversity offsets** 65

Compliance-based or mandatory approaches to biodiversity offset programmes 66
Biodiversity offset requirements as a condition of project finance 70
Voluntary approaches for biodiversity offsets 73
Comparing the institutional architectures for offset schemes 75
Note 77
References 77

Chapter 4. **Design and implementation features of biodiversity offset programmes** 81

Coverage and thresholds 82
Equivalence 87
Additionality 99
Permanence 101

Monitoring, reporting and verification 104
Compliance and enforcement 110
Transaction costs 113
Notes 118
References 119

Part II Case studies 129

***Chapter 5.* Compensatory mitigation and wetland banking in the United States** 131

The environmental and regulatory context of wetland compensatory mitigation 132
Design and implementation of the US Wetland Compensatory Mitigation programme 139
Performance assessment in wetland compensation 150
Insights, best practices and lessons learned 159
Notes 167
References 168

***Chapter 6.* German Impact Mitigation Regulation in Hessen** 175

Introduction 176
The German Impact Mitigation Regulation as the legal framework 177
Key design and implementation features of the Impact Mitigation Regulation in Hessen 178
The Impact Mitigation Regulation in Hessen in practice 184
Insights and lessons learned from the Hessian experience 190
Notes 193
References 194

***Chapter 7.* Mexican Environmental Compensation Scheme for Land-Use Change in Forested Areas** 199

Introduction: Background, rational and objectives of the Mexican Environmental Compensation Scheme for Land-use Change in Forested Areas 200
Key design and implementation features of the Mexican scheme 201
Environmental and cost effectiveness of the CUSTF 212
Conclusions 218
Note 219
References 220

***Annex II.A1.* Summary of offset features in Germany, Mexico and the United States** 221

Tables

Table 1.1. Characteristics of biodiversity offsets in comparison to a selection of other instruments for biodiversity conservation and sustainable use....21
Table 1.2. Examples of sectors in which biodiversity offsets have been used....22
Table 1.3. Finance mobilised by selected biodiversity offset programmes (illustrative)....23
Table 1.4. Key design and implementation features of biodiversity offset programmes....24
Table 2.1. Specification of biodiversity objectives across different programmes....41
Table 2.2. Conditions for approval of projects with adverse impacts on natural and critical habitat under the International Finance Corporation's Performance Standard 6....50
Table 2.3. Guidance material on the mechanisms for avoidance and minimisation of biodiversity loss in British Columbia, Canada....51
Table 2.4. Summary characteristics of the three biodiversity offset mechanisms....54
Table 3.1. Legislation that requires the provision of biodiversity offsets....67
Table 3.2. Biodiversity offset requirements as a condition of finance approval or financial services provision....71
Table 4.1. Coverage of selected biodiversity offset schemes....83
Table 4.2. Criteria or assessing equivalence in the BioBanking Programme in New South Wales, Australia....89
Table 4.3. Replacement ratios for wetlands compensation in Alberta, Canada....92
Table 4.4. Relative time scales for the recreation of a selection of habitats in Europe....96
Table 4.5. Examples of monitoring and inspection approaches for biodiversity offsets....108
Table 4.6. Results of the Government Accountability Office's review of the Army Corps of Engineers' oversight of mitigation banks[1]....109
Table 4.7. Biobanking payment schedules of an offset supply agreement in New South Wales, Australia....112
Table 4.8. Biobanking fees for service, New South Wales, Australia....114

Table 4.9. Distribution of known biodiversity credit prices and total costs to offset a development project....116
Table 6.1. Classification of land use/biotope type with examples of eco points....180
Table 6.2. Eco-points sold by the eco-agency, total payments received and average price per point....185
Table 7.1. Key design elements of the Mexican Environmental Compensation for Land-use Change in Forested Areas Program....204
Table 7.2. Reference cost by ecosystem type....205
Table 7.3. Comparison of activities required in different ecosystems....205
Table 7.4. Technical criteria applicable to determine the equivalence ratio....206
Table 7.5. Area authorised for land-use change by ecosystem type, 2004-13....208
Table 7.6. Limitations, challenges and opportunities of the CUSTF....216

Figures

Figure 2.1. The mitigation hierarchy....44
Figure 2.2. Determining when offsets are an appropriate policy response under the Environmental Offsets Policy in Australia: The role of offsets within the broader environmental impact assessment process....46
Figure 2.3. Likelihood of a biodiversity offset being required under the draft South African Offset Guidelines....49
Figure 2.4. Private vs. socially optimal level of development....55
Figure 3.1. Drivers of biodiversity offsets....66
Figure 3.2. Number of countries that have, are developing or are considering national government policies that require or enable the use of offsets....69
Figure 4.1. Characteristics of native vegetation that determine its biodiversity value....86
Figure 4.2. A general process for creating a biodiversity indicator....88
Figure 5.1. Screenshot of the RIBITS site showing a list of wetlands banks and a map of banks in east-central Wisconsin....149
Figure 5.2. US Wetland Compensation mechanism, 2011-12....153
Figure 5.3. Approval of mitigation bank sites....154
Figure 5.4. Time to permit by compensation mechanism, 2011-12....157
Figure 6.1. Eleven largest registered measures in eco-accounts according to *NATUREG*....186

Figure 7.1. Area approved for land-use changes versus area allocated for compensation....213

Boxes

Box 2.1. Strategic conservation planning for avoiding biodiversity loss in high conservation value areas....48
Box 2.2. Factors influencing biodiversity offset activity....57
Box 3.1. Biodiversity offsets delivered voluntarily and as conditions of financial lending approval....74
Box 4.1. Risk-based regulatory pathways for Native Vegetation Regulation in Victoria, Australia....86
Box 4.2. Reforming the location of compensation projects in US compensatory wetlands mitigation....95
Box 4.3. Mitigating delivery risk with offset replacement ratios and financial products....98
Box 4.4. Securing land for biodiversity offsets in the Western Cape Province, South Africa....103
Box 4.5. Input and performance-based agreements for biodiversity offsets....106
Box 4.6. Contingent payments to increase the compliance rates of offset suppliers....112
Box 5.1. Agriculture, wetlands regulation and compensation....135
Box 5.2. Different forms of compensatory mitigation in the United States' Clean Water Act Section 404 permit system....138
Box 5.3. Section 404 permits....139
Box 5.4. Functional assessment of wetland condition in Ohio using the ORAM....144
Box 5.5. Interactions with other programmes....151
Box 5.6. 2001 National Research Council evaluation of the US Wetlands Compensation programme....152
Box 7.1. Reference costs used in the calculation of in-lieu compensation fee....205

Acronyms and abbreviations

ACOE	Army Corps of Engineers (United States)
BBOP	Business and Biodiversity Offset Program
CFR	Code of Federal Regulations
CONAFOR	Ministry of Environment and Natural Resources (Mexico) *Comisión Nacional Forestal*
CUSTF	Environmental Compensation for Land-Use Change in Forested Areas Programme (Mexico)
CWA	Clean Water Act
EC	European Commission
EH	Ecologische Hoofdstructuur
EIA	Environmental impact assessment
EP	Equator Principles
EPA	Environmental Protection Agency (United States)
EU	European Union
IFC	International Finance Corporation
ILF	In-lieu fee mitigation
IRT	Interagency Review Team
IUCN	International Union for the Conservation of Nature
LEDPA	Least environmentally damaging practicable alternative
MRV	Monitoring, reporting and verification
NGO	Non-governmental organisation
NNL	No net loss
NRC	National Research Council (United States)

NSW	State of New South Wales (Australia)
OECD	Organisation for Economic Co-operation and Development
ORAM	Ohio Rapid Assessment Method
PES	Payments for ecosystem services
PRM	Permittee-responsible mitigation site
RIBITS	Regulatory In-Lieu Fee and Banking Information Tracking System
SEA	Strategic environmental assessment
SEMARNAT	Ministry of Environment and Natural Resources (Mexico) *Secretaría del Medio Ambiente y Recursos Naturales*

Executive summary

Current and projected trends in global biodiversity suggest further decline under business-as-usual scenarios. It is widely acknowledged that renewed efforts are needed to halt and reverse this trend. Governments must seek to reinforce and scale up instruments for biodiversity conservation and sustainable use, and to make existing instruments more environmentally and cost effective. One instrument that has recently been receiving increasing attention from policy makers and business alike is biodiversity offsets.

First used in the United States in the 1970s to mitigate damage to wetlands, biodiversity offset programmes have more recently been introduced in a number of countries. There are today at least 56 countries that have laws or policies that specifically require biodiversity offsets or some form of compensatory conservation for particular sets of impacts (including Australia, Brazil, Canada, the People's Republic of China, Colombia, France, Germany, India, Mexico, New Zealand and South Africa). More than 100 biodiversity offset programmes are currently operating worldwide, with others in various stages of development. It is therefore timely to examine what has been learned from experience with biodiversity offsets to date, including the opportunities and challenges that are associated with them, and how these may be improved. This volume addresses the following questions:

- What are biodiversity offsets and how do they fit within the broader framework of no net loss and the mitigation hierarchy?
- How do they compare relative to other instruments available for biodiversity conservation and sustainable use, and how have existing programmes fared to date?
- What are the key design and implementation features that need to be considered to ensure that offsets are environmentally effective, economically efficient and distributionally equitable?
- What are the lessons learned from existing biodiversity offset programmes and what are the good practice insights for existing and future programmes?

What are biodiversity offsets and how do they work?

Biodiversity offsets are one instrument available within the wider toolbox for biodiversity conservation and sustainable use, and can be used to complement other biodiversity instruments depending on the specific objectives that have been established for different elements of biodiversity. Biodiversity offsets are measurable conservation outcomes that result from actions designed to compensate for significant, residual biodiversity loss that arises through development projects. They are intended to be implemented only after all reasonable steps have been taken to avoid and minimise biodiversity loss at the development site, i.e. they are the last step in the so-called mitigation hierarchy. Offsetting is based on the premise that adverse impacts from development can be offset if sufficient habitat can be protected, enhanced or established elsewhere. Offsets aim to internalise the external costs of development by imposing a cost on the activities that cause biodiversity loss (i.e. when existing strategies or regulations do not adequately do so), and are therefore based on the polluter pays approach.

How do biodiversity offsets compare to other instruments and how do they fare?

Biodiversity offsets have been likened to tradable permit schemes (albeit with additional restrictions) as, in their more traditional forms, a biodiversity target is set (typically no net loss, or net gain), and once developers have undertaken appropriate steps to avoid and minimise damage, they are provided with flexibility to choose how to offset any residual impacts elsewhere. Biodiversity offsets differ, however, from, for example, carbon offsets, as in the former there is no single metric to determine equivalence, and rather than "trading", there are one-off exchanges of biodiversity offsets.

While many offset programmes in place today are mandatory (i.e. regulated), there are also voluntary offset initiatives underway. Biodiversity offsets are classified as economic instruments and are in theory able to achieve a given environmental objective at a lower total cost than more traditional command-and-control approaches to biodiversity conservation and sustainable use. Three types of offsets have evolved over the years, namely, one-off offsets, payments-in-lieu and biobanking.

Compared to other instruments for biodiversity conservation and sustainable use, biodiversity offset schemes are fairly nascent in their application, and there is much to be learned from existing experience. The evidence available to date points to somewhat mixed results in terms of the environmental effectiveness of existing biodiversity offset schemes. This is

likely to be largely attributable not to the instrument itself, however, but rather to how these schemes have been designed and implemented in practice. Biodiversity offset programmes, nevertheless, mobilised between USD 2.4 and 4 billion in 2011 – a non-trivial amount when comparing this to, for example, biodiversity-related aid which was about USD 6.4 billion per year on average in 2012-14 – and have substantial potential to be scaled-up. Ensuring that these programmes are well-designed and implemented is therefore crucial.

What key design and implementation features should be considered?

Key design and implementation features that must be considered to ensure offset schemes are environmentally and cost effective, as well as distributionally equitable include: thresholds and coverage; equivalence; additionality; permanence; monitoring; reporting and verification; compliance and enforcement; transaction costs; and stakeholder participation. It is important to note that in some cases, however, adverse impacts to biodiversity may not be able to be fully compensated – when the affected biodiversity is irreplaceable or extremely vulnerable, there are no available offset sites, or there are no known conservation approaches to achieve the offset outcomes required. In such cases, offsets will not be a suitable instrument and other forms of intervention will be more appropriate (e.g. restrictions on access and/or use, such as protected areas and buffer zones). Establishing thresholds for biodiversity impacts that are able to be offset is therefore a fundamental environmental safeguard for both voluntary and mandatory biodiversity offset programmes.

What lessons and insights can be derived for good practice?

In addition to establishing thresholds for what can be offset, other insights for good practice include the need to establish clear goals and objectives for the programme, and the need for more rigorous and systematic monitoring, reporting and verification of offset programmes. These include regular ecological assessments of offset sites, to enable evaluation of whether the sites are achieving their pre-specified environmental objectives, and to allow for any adjustments to the programme over time to improve performance. Further progress is needed in this area. In addition, mandatory offset programmes are likely to be a much more powerful instrument than voluntary offsets, as they tend to be more stringent, and are associated with greater oversight, controls and the possibility of sanctions for non-compliance.

Chapter 1.

Biodiversity offsets: Overview and insights for good practice

Biodiversity offsets are economic instruments used to allow for some continued economic development whilst simultaneously delivering biodiversity objectives, such as no net loss or net gain. This chapter discusses the role of biodiversity offsets in the broader policy framework for the conservation and sustainable use of biodiversity, summarises their scale and scope, and highlights some important environmental and social safeguards relevant to their use. Drawing on insights from more than 40 case studies of biodiversity offset programmes worldwide, the chapter concludes with good practice insights for their effective design and implementation.

Biodiversity: An invisible – yet invaluable – life support system

Biodiversity and ecosystem loss and degradation continue to pose a major environmental challenge worldwide. Despite the invaluable benefits that biodiversity and ecosystems provide to human health, well-being and our economies, rates of decline continue at a pace that is inconsistent with the Sustainable Development Goals. One of the underlying roots of this problem is that many of the benefits provided by biodiversity and ecosystem services – the supporting, provisioning, regulating and cultural services – are not reflected in market prices, thus creating divergence between the private and socially optimal levels of biodiversity conservation and use.

The *OECD Environmental Outlook to 2050* projects that under a business-as-usual scenario, biodiversity will decline by a further 10% globally by 2050 from 2010 levels (OECD, 2012). These trends are alarming as biodiversity loss can have significant adverse impacts on economic growth and human well-being. Biodiversity loss threatens the resilience of ecosystems to continue to provide fundamental life-supporting services upon which humans rely. Reversing these trends will require concerted efforts by government and the private sector alike to scale-up existing instruments for biodiversity conservation and sustainable use, to ensure that these are as effective as possible, and to mainstream biodiversity into other sectoral policies across the economy. One instrument that has been receiving increasing attention from policy makers – and that has potential to deliver on all three of these aspects – is biodiversity offsets.

Biodiversity offsets and their role in biodiversity conservation and sustainable use

Biodiversity offsets are one instrument available within the wider toolbox for biodiversity conservation and sustainable use (Table 1.1). They are defined as "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" (BBOP, 2009). Thus, typically only used as the final step in the so-called mitigation hierarchy (i.e. avoid, minimise, restore and offset – see Chapter 2), biodiversity offsets allow some continued development within some pre-specified objectives for biodiversity (e.g. no net loss, or net gain), and are based on the premise that impacts from development can be offset if sufficient habitat can be protected, enhanced or established elsewhere (Gibbons and Lindemayer, 2007).

Biodiversity offsets help to address market failure by imposing additional costs on developers whose activities have adverse impacts on biodiversity and are thus in line with the polluter pays approach.

Biodiversity offsets have been likened to tradable permit schemes as, in their more traditional forms, a biodiversity target is set (e.g. no net loss, net gain), and once developers have undertaken appropriate steps to avoid and minimise damage, they are provided with flexibility to choose how to offset any residual impacts elsewhere. Offsets are classified as economic instruments and are, in theory, able to achieve a given environmental objective at a lower total cost than more traditional command-and-control approaches to biodiversity conservation and sustainable use.

Table 1.1. **Characteristics of biodiversity offsets in comparison to a selection of other instruments for biodiversity conservation and sustainable use**

Instrument	Geographical scope of instrument	Type of instrument	Mandatory vs. voluntary	Beneficiary vs. polluter pays	Potential to raise revenue and source of finance
Taxes, charges, fees	Local, national	Economic	Mandatory	Polluter	Yes; private (and public)
Payments for ecosystem services (PES)	Local, national, international	Economic	Voluntary	Beneficiary	Yes; private and public
Biodiversity offsets	**Local, national, supranational**	**Economic**	**Mandatory and voluntary**	**Polluter**	**Yes; private (and public)**
Markets for green products	Local, national, international	Information	Mandatory and voluntary	x	Depends; public (i.e. consumers)
Tradable permits	Local, national	Economic	Mandatory and voluntary	Polluter	Yes, if auctioned; private (and public)
Environmental subsidies	Local, national	Economic	Voluntary	x	No
Standards	Local, national	Command-and-control	Mandatory	Polluter	No

Source: Adapted from OECD (2013), *Scaling-up Finance Mechanisms for Biodiversity*, http://dx.doi.org/10.1787/9789264193833en.

Biodiversity offsets were first used in the 1970s as part of the United States' Compensatory Wetlands Mitigation programme and under German environmental compensation legislation (Darbi et al., 2010; Hough and Robertson, 2009), but have become more widespread over the past decade or so. As of 2013, at least 56 countries had laws or policies that specifically required biodiversity offsets or some form of compensatory conservation for development-related biodiversity losses (i.e. mandatory programmes) and a further 15 countries had policies under development (TBC, 2013). Offset programmes have been introduced by governments at the supranational, national and subnational levels. The EU Birds and Habitats Directives, for example, support the use of biodiversity offsets

across the European Union-wide Natura 2000 network, and in Australia, Canada and South Africa, national programmes are in place alongside multiple state or provincial-based programmes (Madsen, Carroll and Moore Brands, 2010).

It is becoming increasingly common for private sector developers to use biodiversity offsets in a voluntary capacity to compensate for their development-related impacts on biodiversity, particularly in developing countries (Doswald et al., 2012). Firms with voluntary biodiversity offset schemes tend to be those with large, repeated and visible biodiversity impacts from their operations, such as firms in the extractive industries and infrastructure construction. The financial sector is also playing an important role as a catalyst for the provision of biodiversity offsets by requiring them as a condition of project support. The environmental risk management framework that forms part of the Equator Principles, for example, requires funding applicants to adhere to the mitigation hierarchy and includes specific provisions relating to biodiversity offsets. The Equator Principles have been adopted by 79 financial institutions and cover 70% of international project finance debt in developing markets (The Equator Principles Association, 2014).

Biodiversity offsets are applicable to a wide range of sectors (Table 1.2) and can be used to compensate for impacts on a variety of ecosystems. Programmes have been introduced, for example, to offset development-related impacts on wetlands and streams in the United States; fish habitat in Canada; native vegetation in Victoria, Australia; and forests in Brazil, India and Mexico, among other things (Madsen et al., 2011; Morandeau and Vilaysack, 2012).

Table 1.2. **Examples of sectors in which biodiversity offsets have been used**

Sector	Programme or project
Mining	Strongmine Coal, New Zealand and Akyem Coal Mine, Ghana
Wind power	Apennine Wind Farms, Italy
Pulp and paper	Pulp United Pulp Mill, South Africa
Hydropower	Nam Theun 2 Hydropower Project, Lao People's Democratic Republic
Oil and gas	Chad Cameroon Petroleum Development and Pipeline Project
Property development	Bainbridge Island, United States
Agriculture	Queensland, Australia

Sources: BBOP (2009), *Biodiversity Offset Cost-Benefit Handbook*, www.forest-trends.org/documents/files/doc_3094.pdf; Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

Whilst comprehensive data on biodiversity offset schemes are not available, estimates suggest the collective turnover of compliance-based and voluntary biodiversity offset programmes to be in excess of USD 3 billion per year, growing at an annual rate of 10% (Ecosystem Marketplace, 2013). The aggregate figure is dominated by the Compensatory Wetlands Mitigation Scheme in the United States which comprises approximately half of the total value of offset transactions worldwide (Table 1.3). To put the scale of biodiversity offsets programmes into context, bilateral biodiversity-related aid commitments by members of the OECD DAC reached USD 6.4 billion per year on average in 2012-14 (OECD, 2016).

Table 1.3. **Finance mobilised by selected biodiversity offset programmes (illustrative)**

Summary statistics	Compliance	Voluntary
Current market turnover (USD/year)	3 billion	25 million
Potential market turnover by 2015 (USD/year)	3-4 billion	30 million
Potential market turnover by 2020 (USD/year)	5-8 billion	70 million
Current rate of annual growth	10%	10%
Biodiversity offset programme	**Payments (per year)**	
Compensatory Wetland Mitigation in the United States	USD 1.1-1.8 billion (2008 data)	
Compensatory Stream Mitigation in the United States	USD 240-430 million (2008 data)	
Conservation Banking in the United States	USD 200 million[1] (2009 data)	
Pilot habitat banking "Cossure" project in France	EUR 6.1 million (2010-13 data)	
Native Vegetation Regulation, Victoria, Australia	USD 6.4 million (average of 2010 and 2011 data)	
Native Vegetation and Scattered Tree Offsets, South Australia, Australia	USD 2.5 million (2008-10 data)	
Forest Vegetation Restoration Fee in the People's Republic of China	USD 393 million (2003-05 data)	

Notes: These figures were derived using a wide variety of methods, sources, timeframes and approximations, which are not necessarily cross-compatible.

1. This figure does not include species compensation through in-lieu fee funds or one-off offsets, which are also options under US Species Mitigation.

Sources: Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf; Madsen, B. et al. (2011), "2011 update: State of biodiversity markets", www.ecosystemmarketplace.com/reports/2011_update_sbdm; Ecosystem Marketplace (2013), "Innovate markets and market-like instruments for ecosystem service: The matrix 2013", www.ecosystemmarketplace.com/documents/acrobat/the_matrix.pdf.

Despite the proliferation of biodiversity offset programmes, the evidence available on their effectiveness as an instrument to promote biodiversity and sustainable use is mixed. This is likely to be largely attributable not to the instrument itself, however, but rather to how programmes have been designed and implemented in practice. Compared to other instruments for biodiversity conservation and sustainable use, there are

relatively few mature programmes and there is much to be learned from existing experience. Ensuring that offsets programmes are well-designed and implemented is pivotal to their success.

Key design and implementation features and good practice insights

Key design and implementation features that must be considered to ensure offset schemes are environmentally and cost effective, as well as distributionally equitable include: thresholds and coverage; equivalence; additionality; permanence; monitoring, reporting and verification; transaction costs; and compliance and enforcement (Table 1.4). While many of these features are ones that also need to be addressed in other instruments for biodiversity conservation and sustainable use, a distinct issue for offsets is how to ensure equivalence between the biodiversity loss at the development site and the biodiversity gain at the offset site.

Table 1.4. **Key design and implementation features of biodiversity offset programmes**

Design and implementation feature	Description
Thresholds and coverage	Biodiversity offsets will not always be able to deliver equivalent outcomes because biodiversity may be of exceptional high value, irreplaceable or vulnerable. Establishing thresholds for what can and cannot be offset is therefore key. Coverage refers to the type of biodiversity intended to be addressed (e.g. habitats, species, ecosystem services) and the sectors that are included in the programme (e.g. mining, wind power, hydropower, property development, agriculture).
Equivalence	As no two sites are ecologically identical, designing offsets requires assessment of how to achieve biodiversity benefits at the offset site that are ecologically equivalent to losses at the impact site. Determining ecological equivalence necessitates a comparison of the biodiversity loss and offset sites in three dimensions: biodiversity type, location and time.
Additionality	The biodiversity improvements at offset sites should provide new contributions to biodiversity conservation over and above the existing levels. A reference scenario is therefore needed. Biodiversity offsets variously consider protection, restoration, recreation and enhancement measures as additional.
Permanence	Biodiversity offsets should deliver conservation outcomes for at least as long as the biodiversity loss persists at the development site. Land tenure, financial sustainability and appropriate incentives for land management are important components of delivering permanence.
Monitoring, reporting and verification (MRV)	Robust MRV methodologies that are able to assess progress toward an offset's objectives are critical. This includes adequate documentation of management plans, regular monitoring including on-site checks, clear and transparent reporting, and verification by a third party.
Transaction costs	Transaction costs in offset programmes include costs associated with identifying, creating and securing an offset; applying for development permission, and undertaking MRV and enforcement. Reducing these administrative and time costs will increase the efficiency of an offset programme. Biobanks, for example, reduce the search costs of finding appropriate offset sites for developers.
Compliance and enforcement	MRV frameworks must be supported by appropriate compliance and enforcement measures to create the incentives necessary for offset suppliers to deliver conservation outcomes over time.

In some cases, adverse impacts to biodiversity may not be able to be fully compensated. This is because: the affected biodiversity is irreplaceable or extremely vulnerable; there are no available offset sites; or there are no known conservation approaches to achieve the offset outcomes required. In such cases, offsets may not be a suitable instrument and other forms of intervention will be more appropriate (e.g. restrictions on access and/or use, such as protected areas and buffer zones). Establishing thresholds for biodiversity impacts that are able to be offset is therefore a fundamental environmental safeguard for both voluntary and mandatory biodiversity offset programmes.

Good practice insights for effective biodiversity offset programmes include:

- Setting **clear objectives**. These should be established in such a way so as to be measurable and monitorable. Objectives of existing programmes aim to address adverse impacts to habitats, species, ecological status and/or ecosystem services. Whichever type of objective is selected, appropriate indicators must be available so as to enable performance assessment over time.
- Clear guidance on how an offset programme fits into the **mitigation hierarchy for a country or region**. Experience to date suggests several programmes are struggling with how to determine whether sufficient avoidance and minimisation has taken place prior to an offset project being implemented. Guidance material on mechanisms for avoidance and mitigation – such as with respect to location, means and timing of development activity – and requiring developers to demonstrate how avoidance and minimisation has been addressed, can help in this regard.
- Robust **monitoring, reporting and verification** is a critical element in ensuring environmentally effective offset programmes, and a feature that a number of programmes need to improve upon. Sufficient technical capacity and human resources to undertake adequate monitoring and enforcement, including on-site checks, is an important element of this.
- The use of **online databases** to track information on the types and numbers of offset sites, associated documents, mitigation credit availability (in the case of biobanking), among other information have proved to be very helpful in some offset programmes. Such tracking systems are currently being used in the United States' Wetland Compensation programme (i.e. Regulatory In-Lieu Fee and Banking Information Tracking System, RIBITS) and in Germany

(i.e. *NATUREG*). While fully populating the database in the United States was costly, RIBITS has helped credit buyers more efficiently find credit providers (thereby reducing transaction costs), improved regulators' ability to track credit transactions (e.g. credit releases and debits), improve bank oversight and monitoring, and share information with the public creating a more accountable and transparent offset programme.

- Across the three possible offset approaches – **one-off, in-lieu fees, and biobanking –** each offers different advantages and benefits, which can also depend on the specific socio-economic characteristics of the region in which they are introduced. With biobanking, for example, the risk that biodiversity objectives are not met are largely mitigated, as the offset has already been created ***prior*** to the adverse impact at the development site. Biobanking, however, may not thrive in situations where the demand for offsets is too low (such as in sparsely populated areas). In-lieu fee arrangements, whereby developers must pay a third party to undertake offsets, can offer advantages over one-off offset arrangements, if the third party can more strategically invest in offset sites (such as by taking a landscape approach, and identifying priority areas – including corridors – for offset sites).
- **Regular programme evaluations** are critical and should ideally be undertaken by both internal and external reviewers. Allowing and enabling adaptive management of the offset programme, so as to improve it over time, is a natural follow-on step.

References

BBOP (2009), *Biodiversity Offset Cost-Benefit Handbook*, Business and Biodiversity Offsets Programme, Washington, DC, www.forest-trends.org/documents/files/doc_3094.pdf.

Darbi, M. et al. (2010), "Impact mitigation and biodiversity offsets: Compensation approaches from around the world: A study on the application of Article 14 of the CBD (Convention on Biological Diversity)", Naturschutz und Biologische Vielfalt, Federal Agency for Nature Conservation, Bonn, Germany.

Doswald, N. et al. (2012), "Biodiversity offsets: Voluntary and compliance regimes: A review of existing schemes, initiatives and guidance for financial institutions", UNEP-WCMC, Cambridge, United Kingdom and UNEP FI, Geneva, www.unepfi.org/fileadmin/documents/Biodiversity_Offsets-Voluntary_and_Compliance_Regimes.pdf.

Ecosystem Marketplace (2013), "Innovative markets and market-like instruments for ecosystem services: The matrix 2013", Ecosystem Marketplace, Washington, DC, www.ecosystemmarketplace.com/documents/acrobat/the_matrix.pdf.

Gibbons, P. and D. Lindenmayer (2007), "Offsets for land clearing: No net loss or the tail wagging the dog?", *Ecological Management and Restoration*, Vol. 8/1, pp. 26-31, http://dx.doi.org/10.1111/j.1442-8903.2007.00328.x.

Hough, P. and M. Robertson (2009), "Mitigation under Section 404 of the Clean Water Act: Where it comes from, what it means", *Wetlands Ecology and Management*, Vol. 17/1, pp. 15-33, http://dx.doi.org/10.1007/s11273-008-9093-7.

Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", Ecosystem Marketplace, www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

Madsen, B. et al. (2011), "2011 update: State of biodiversity markets", Forest Trends, Washington, DC, www.ecosystemmarketplace.com/reports/2011_update_sbdm.

Morandeau, D. and D. Vilaysack (2012), "Compensating for damage to biodiversity: An international benchmarking study", Collection "Études et documents" of the Economy, Evaluation and Integration of Sustainable Development Service (SEEIDD) at the General Commission for Sustainable Development (CGDD), www.developpement-durable.gouv.fr/IMG/pdf/ED68EN-2.pdf.

OECD (2016), "OECD DAC Statistics: Aid to biodiversity", www.oecd.org/dac/stats/rioconventions.htm.

OECD (2013), *Scaling up Finance Mechanisms for Biodiversity*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264193833-en.

OECD (2012), *OECD Environmental Outlook to 2050: The Consequences of Inaction*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264122246-en.

TBC (2013), "Government policies on biodiversity offsets", The Biodiversity Consultancy, Cambridge, United Kingdom, www.thebiodiversityconsultancy.com/wp-content/uploads/2013/07/Government-policies-on-biodiversity-offsets3.pdf.

The Equator Principles Association (2014), "About the Equator Principles", The Equator Principles Association website, www.equator-principles.com (accessed March 2014).

Annex 1.A1.
Case study overview

Case studies of regulatory-backed schemes					
Country	Jurisdiction	Policy	Description	Biodiversity objective	Type of offsets used
Argentina	National	Environmental Compensation Fund	Based on significance of biodiversity impacts under environmental impact assessment (EIA) law	To compensate for and prevent future losses to biodiversity	Payments in-lieu
Australia	National	Environmental Offsets scheme	Matters of national environmental significance	Offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	One-off and payments in-lieu, exploring biobanking
Australia	State of Queensland	Supported Community Infrastructure Koala Conservation Policy	Planning and development activities in Queensland	Net gain in bushland koala habitat in South East Queensland by 2020	One-off
Australia	State of New South Wales	Biodiversity Banking and Offsets Scheme	State and national priorities relating to threatened species and habitat	Development will improve or maintain biodiversity values	Biobanking

Case studies of regulatory-backed schemes (*continued*)

Country	Jurisdiction	Policy	Description	Biodiversity objective	Type of offsets used
Australia	State of South Australia	Vegetation offsets	Native vegetation in South Australia protected under the provisions of the Native Vegetation Act 1991	Offsets must counterbalance the loss of that vegetation to achieve a significant environmental benefit	One-off or payments in-lieu
Australia	State of Victoria	Native Vegetation Permitted Clearing Regulations	Applications to clear, lop or destroy native vegetation under the Victoria Planning Provisions and all planning schemes in Victoria	No net loss in the contribution made by native vegetation to Victoria's biodiversity	One-off, payments in-lieu and biobanking
Brazil	National	Offsets under the Brazilian Forest Code 1965	Landowners holding more than 50 ha of rural land	To preserve between 20% and 80% of rural land as a Legal Forest Reserve representative of the area, depending on the biome they are located within	One-off
Brazil	National	Industrial offset contribution to conservation units	Developments with a significant environmental impact	To support the funding of the National System of Conservation Units	Payments in-lieu
Canada	National (1986-2012; see below)	Habitat Management Program (Policy for the management of fish habitat)	Projects that could harmfully alter, disrupt or destroy fish habitats	No net loss of productive capacity of fish habitat	One-off
Canada	National (2013-present)[1]	Fisheries Protection Program[2]	Projects that could result in serious harm to fish (death of fish, permanent alteration to or destruction of fish habitat)	Maintain or improve fisheries productivity	One-off; proponent-led banking[3]

Case studies of regulatory-backed schemes (*continued*)

Country	Jurisdiction	Policy	Description	Biodiversity objective	Type of offsets used
Canada	Province of Alberta	Alberta Wetland Policy	Significant impacts on natural wetlands and all restored natural wetlands, as well as wetlands constructed for the purposes of wetland replacement	To conserve, restore, protect and manage Alberta's wetlands to sustain the benefits they provide to the environment, society and the economy	One-off and payments in-lieu
Canada	Province of British Columbia	Policy for Mitigating Impacts on Environmental Values	Trial application on a voluntary basis	Determination of the acceptable amount of residual impact and offsetting measures is the responsibility of the statutory decision maker on a case-by-case basis	One-off and payments in-lieu
China (People's Republic of)	National	Forest Vegetation Restoration Fee	Developments occurring on land zoned as forest area	To restore a forest area no less than that taken up by the developer's operations	Payments in-lieu
Colombia	National	Colombian "Development by Design" pilot	Five pilot landscapes where development is projected to increase over the coming years	To provide a framework to ensure offsets are consistent with landscape level conservation goals and to allow developers to proactively determine future offset requirements	One-off
Egypt	National	Law for the Environment, Environmental Protection Fund	Based on significance of biodiversity impacts under EIA law	None specific to biodiversity offsets, the proceeds of the fund are used to support the work of the Egyptian Environmental Affairs Agency	Payments in-lieu
England	National	Biodiversity offsetting	Voluntary offsets are being trialled under the planning system in six local council pilot areas	The planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible	One-off and biobanking

Case studies of regulatory-backed schemes (*continued*)

Country	Jurisdiction	Policy	Description	Biodiversity objective	Type of offsets used
European Union	Multinational	Biodiversity offsets under the Birds and Habitats Directives	Developments with significant impacts on the Natura 2000 network of protected sites	To avoid adverse effects on the integrity of the Natura 2000 site	Dependent on the country, usually one-off
France	National	Environment Code	Based on significance of environmental impacts under environmental assessment regulations	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	One-off; biobanking is being piloted
Germany	National	Impact Mitigation Regulation	Significant impacts on biodiversity under the Federal Nature Conservation Act. Does not apply to land use from the agricultural, forestry and fishery sectors as where activities are in line with the "code of best practice"	Preservation of the existing ecological situation	One-off and biobanking
India	National	Compensatory Afforestation	Developments that result in the diversion of forest land for non-forest purposes	To compensate for the loss of tangible as well as intangible benefits flowing from the forest lands due to its diversion to non-forest use	Payments in-lieu
Madagascar	National	Malagasy Environmental Charter and Mining Code	Based on significance of biodiversity impacts under EIA law	To leave better conditions than existed before the project began	One-off
Mexico	National	General Law of Ecological Equilibrium and Protection of the Environment	Based on significance of biodiversity impacts under EIA law	Compensation ratio of greater than 1:1 is required, objectives are determined on a case-by-case basis	One-off and payments in-lieu

Case studies of regulatory-backed schemes (*continued*)

Country	Jurisdiction	Policy	Description	Biodiversity objective	Type of offsets used
Mongolia	National	Mongolian "Development by Design" pilot	Central and Eastern Grasslands of Mongolia	To provide a framework to ensure offsets are consistent with landscape level conservation goals and to allow developers to proactively determine future offset requirements	One-off
Netherlands	National	Multiple drivers for offsets: Spatial Development Plan 2007, Fauna and Flora Act 1998, Forest Act 1961 and Nature Protection Act 1998	Development impacts on the Natura 2000 and National Ecological Network (EHS) networks and on protected species outside the networks	For the EHS, biodiversity objectives and implementation are defined at the provincial level. The Dutch government has commenced a No Net Loss initiative to advise on future policy reforms.	One-off, payments in-lieu, exploring the use of biobanking
New Zealand	National	Biodiversity offsets under the Resource Management Act	Biodiversity offsetting is voluntary	Not specific, guidance on best-practice biodiversity offsetting is available	One-off
South Africa	National	Biodiversity offsets under the National Environmental Management Act 1998	Projects that trigger the EIA regulations could be asked to provide biodiversity offsets where significant negative residual impacts on biodiversity are probable	To ensure that residual impacts on biodiversity and ecosystem services are compensated so that a material contribution is made to implementing national, provincial and/or municipal level conservation plans and reaching associated targets, and to safeguarding valued ecosystem services	One-off and payments in-lieu
South Africa	Province of the Western Cape	EIA Guidelines on Biodiversity Offsets	Based on significance of environmental impacts under the EIA process	To ensure that residual impacts on biodiversity and ecosystem services that are of moderate to high significance are compensated for so that ecological integrity is maintained and development is sustainable	One-off and payments in-lieu

Case studies of regulatory-backed schemes (*continued*)

Country	Jurisdiction	Policy	Description	Biodiversity objective	Type of offsets used
Sweden	National	Biodiversity offsets under the Environmental Code	Natura 2000 sites and protected spaces outside the network, such as natural reserves, reserves protected for cultural heritage and biotope protection areas	Determined on a case-by-case basis; however, biodiversity offsets are in-kind and implemented at a very local scale to compensate the local populations affected by development projects	One-off
Switzerland	National	Federal Act on the Protection of Nature and Cultural Heritage 1966	Indigenous animal and plant species and biotopes of national, regional and local importance	To replace the degraded habitats qualitatively and quantitatively, eliminate separation effects and improve ecological connectivity	One-off, exploring the use of biobanking
United States	National	Compensatory Wetlands Mitigation	Applicants filing for permits to drain, fill or dredge a wetland (or stream) regulated under the Clean Water Act (§404)	No net loss of wetland acreage and function	One-off, payments in-lieu and biobanking
United States	National	Conservation Banking	Activities with adverse impacts to species listed as threatened or endangered under the Endangered Species Act 1973	To offset adverse impacts to a species	One-off, payments in-lieu and biobanking

Notes: 1. In Canada, the Habitat Management regime was in place from 1986-2012. Following changes to the federal Fisheries Act, that regime was replaced in 2013 with the Fisheries Protection Programme. 2. Fisheries Protection Policy Statement; Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting. 3. Proponent-led biobanking in Canada refers to habitat banks that are established by proponents of projects that result in impacts, rather than by third parties. As such, there is no exchange of credits amongst various proponents; instead proponents can "bank" their own credits solely for their own future use.

Case studies of biodiversity offsets required as a condition of lending approval				
Financial institution	Policy	Coverage	Biodiversity objective	Type of offsets used
African Development Bank	Operational Safeguard 3: Biodiversity, Renewable Resources and Ecosystem Services	All public and private sector lending operations and project activities funded through other financial instruments managed by the African Development Bank, except for short-term emergency relief, which is specifically exempted	Net benefit or no net loss, only for natural habitats	Usually one-off offsets
Asian Development Bank	Policy Principles and Requirement 8: Biodiversity Protection and Sustainable Natural Resource Management	All sovereign and non-sovereign projects financed and/or administered by the Asian Development Bank, and their components regardless of the source of financing	At least no net loss of biodiversity	Usually one-off offsets
Equator Principles Association	The Equator Principles	All Project Finance Advisory Services where total project capital costs are USD 10 million or more, project finance with total project capital costs of USD 10 million or more and project-related corporate loans, bridge loans	No net loss or net gain, depending on the classification of the biodiversity affected	Usually one-off offsets
European Bank for Reconstruction and Development	Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	All projects financed by the European Bank for Reconstruction and Development	No net loss and preferably a net gain of biodiversity	Usually one-off offsets
European Investment Bank	B.2.4.1. Biodiversity Assessment	All projects financed by the European Investment Bank	No net loss or positive conservation outcome, depending on the classification of the biodiversity affected	Usually one-off offsets

Case studies of biodiversity offsets required as a condition of lending approval (*continued*)

Financial institution	Policy	Coverage	Biodiversity objective	Type of offsets used
Inter-American Development Bank	Policy Directive B.9: Natural Habitats and Cultural Sites	All projects financed by the Inter-American Development Bank	Develop mitigation and compensation measures deemed acceptable by the Inter-American Development Bank	Usually one-off offsets
International Finance Corporation	Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, Protection and Conservation of Biodiversity	All IFC investment activities	No net loss or net gain, depending on the classification of the biodiversity affected	Usually one-off offsets

Case study overview: Voluntary biodiversity offset schemes and corporate policies

Firm	Programme	Coverage	Objective	Type of offsets used
Rio Tinto	Biodiversity Strategy	Land managed by Rio Tinto	Achieve a net positive impact on biodiversity by closure of operations	Dependent on jurisdiction, usually one-off
Compañía Minera Antamina	Polylepis Initiative	Project-specific voluntary offset	Contribute to the restoration of the endangered Polylepis habitat and improve livelihoods of local people	One-off

PART I

Key design and implementation issues

Chapter 2.

No net loss, the mitigation hierarchy and the economics of biodiversity offsets

Biodiversity offsets are used in project planning processes as a mechanism to help compensate for the biodiversity loss caused by development projects. Offset programmes most commonly seek to deliver a neutral outcome on biodiversity from development projects, or no net loss of biodiversity, though some have adopted a more ambitious goal of delivering a positive outcome, or net gain, for biodiversity. Biodiversity offsets are typically only used to deliver compensation for the residual impacts on biodiversity after measures have first been taken to avoid, minimise and then restore adverse impacts on biodiversity at the development site (i.e. the mitigation hierarchy). Biodiversity offsets may be implemented using one-off offsets, biobanks or payments in-lieu. The economics of offsets is also described.

No net loss

The most common environmental objective used in biodiversity offsets schemes is to deliver a neutral biodiversity outcome from development projects, or no net loss (NNL) of biodiversity. Some programmes have adopted a more ambitious goal for an overall improvement in biodiversity outcomes as a result of development projects, or a net gain in biodiversity. The functional definition of NNL and net gain objectives differ among programmes. For example, objectives have been defined to capture biodiversity in its entirety, as is the case for the International Finance Corporation (IFC) performance standards, for types of habitats such as forest conservation in the People's Republic of China (hereafter "China"), for ecosystem services as is reflected in Alberta's Wetland Policy in Canada, and for specific subsets of biodiversity including Queensland's Net Gain in Koala Habitat policy in Australia (Table 2.1). Whatever the objective is, offset programmes should specify these clearly to help guide the design of a programme, facilitate measurement of progress toward its delivery, and to allow stakeholders to form clear and reasonable expectations about a programme's deliverables. Even where NNL objectives are not explicitly stated, programmes often specify objectives relating to the preservation of existing levels of biodiversity which are, in effect, variations on the same concept. The objective of the Impact Mitigation Regulation in Germany, for example, is to preserve the existing ecological situation as a minimum standard (Darbi and Tausch, 2010); the Birds and Habitats Directives in the EU are designed to protect the overall coherence of the Natura 2000 network (European Commission, 2001). In the Environmental Offsets scheme in Australia, offsets must deliver an overall conservation outcome that maintains or improves the viability of the protected aspect of the environment affected by development (Department of the Environment, 2013).

The NNL objective used in biodiversity offset programmes is analogous to the aggregate cap in emissions trading programmes, as it places a quantitative limit of biodiversity loss in covered sectors. Programme objectives should ideally be specified in measurable units and time-bound to facilitate transparent evaluation of progress toward meeting a scheme's aim. In practice, the overall scheme objective is then translated into a biodiversity target at the individual project level. In this way, developers are required to demonstrate that NNL of biodiversity will occur from project-related activities.

Table 2.1. **Specification of biodiversity objectives across different programmes**

Jurisdiction	Policy	Description of the objective of biodiversity offsets
African Development Bank	African Development Bank Operational Safeguard 3	To deliver a net benefit or no net loss for residual biodiversity impacts on natural habitats
Alberta, Canada	Wetland Policy	To sustain the benefits wetlands provide to the environment, society and the economy
Asian Development Bank	Asian Development Bank Policy Principles and Requirement 8	To deliver at least a no net loss for residual biodiversity impacts on natural habitats and critical habitats
Australia	Environmental Offsets scheme	To deliver an overall conservation outcome that improves or maintains the viability of the protected aspect of the environment
Canada	– Fisheries Protection Policy Statement – Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting	Offsets are measures required to counterbalance serious harm to fish by maintaining or improving fisheries productivity after all feasible measures to avoid and mitigate impacts have been undertaken
China (People's Republic of)	Forest Vegetation Restoration Fee	To restore a forest area no less than that taken up by the developer's operations
European Union	Habitats and Birds Directives	To ensure that the overall coherence of the Natura 2000 network is protected
France	National Doctrine on the mitigation hierarchy, and national guidelines on the mitigation hierarchy	No net loss, and ideally, net gain of natural habitats
Germany	Impact Mitigation Regulation	Preservation of the existing ecological situation
International Finance Corporation	IFC Performance Standard 6	To deliver no net loss for residual biodiversity impacts on natural habitats and net gains for critical habitats
Queensland, Australia	Supported Community Infrastructure Koala Conservation Policy	Net gain in bushland koala habitat
United States	Compensatory Wetlands Mitigation	No net loss of wetland acreage and function
United States	Conservation Banking	To offset adverse impacts to a species
Victoria, Australia	Native Vegetation Permitted Clearing Regulations	No net loss in the contribution that native vegetation makes to Victoria's biodiversity

Notes: See also: Environment Canada's Operational Framework for Use of Conservation Allowances at: www.ec.gc.ca/Publications/default.asp?lang=En&xml=58A4AECD-A096-458C-B457-0E67CADF911D.

Sources: African Development Bank (2013), "African Development Bank's Integrated Safeguards System: Policy statement and operational safeguards", www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/December_2013_-_AfDB%E2%80%99S_Integrated_Safeguards_System__-_Policy_Statement_and_Operational_Safeguards.pdf; Alberta Government (2013), *Alberta Wetland Policy*, http://aep.alberta.ca/water/programs-and-services/wetlands/documents/albertawetlandpolicy-sep2013.pdf; Asian Development Bank (2009), *Safeguard Policy Statement*, www.adb.org/documents/safeguard-policy-statement; Darbi, M. and C. Tausch (2010), "Loss-gain calculations in German Impact Mitigation Regulation", www.forest-trends.org/publication_details.php?publicationID=2404; DEPI (2013a), *Permitted Clearing of Native Vegetation: Biodiversity Assessment Guidelines*, www.depi.vic.gov.au/__data/assets/pdf_file/0011/198758/Permitted-clearing-of-native-vegation-Biodiversity-assessment-guidelines.pdf; Department of Fisheries and Oceans (2001), *Policy for the Management of Fish Habitat*, Department of Fisheries and Oceans, Ottawa, Ontario, www.gov.pe.ca/photos/original/elj_appendixd.pdf; Department of the Environment (2013), "Matters of national environmental significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999", https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf; IFC (2012), "Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources", www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES; European Commission (2013), "Working Group on No Net Loss of Ecosystems and their Services: Sub-group on the Scope and Objectives of the No Net Loss Initiative: Scope and objectives of the No Net Loss Initiative, final version 12/07/13", http://ec.europa.eu/environment/nature/biodiversity/nnl/pdf/Subgroup_NNL_Scope_Objectives.pdf; Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

The approach to biodiversity offsets in South Africa, whilst being a tool for managing environmental impacts, is closely linked to the objective of securing priority biodiversity as identified in the country's biodiversity plans. Unlike the definition of biodiversity offsets used internationally, offsets do not have a strict "no net loss" goal, as this goal is not deemed to be practicable in a developing country such as South Africa. The trade-off for allowing some reduction in the total "biodiversity area" is through developers securing healthy and viable priority natural areas for conservation in perpetuity (Brownlie and Botha, 2009). The desired outcomes of biodiversity offsets in South Africa are to ensure that (DEA&DP, 2011; EKNZW [2013] as cited in Brownlie [2015]):

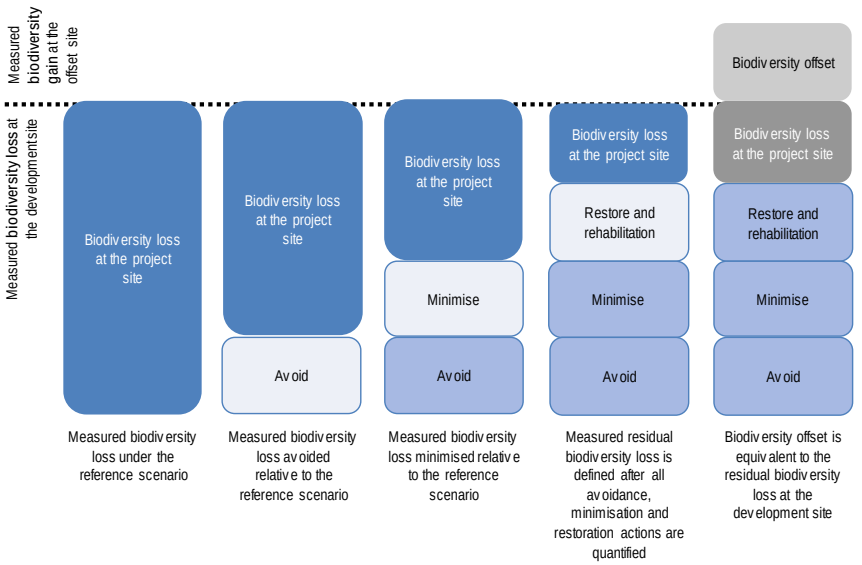
1. The cumulative impact of development authorisation and land-use change does not result in:
   - the loss of priority areas for biodiversity conservation, thus jeopardising the ability to meet the country's targets for biodiversity conservation
   - ecosystems becoming more threatened than "endangered"[1]
   - the conservation status of species and the presence of "special habitats"[2] to decline
   - the loss of ecosystem services on which communities or society is highly dependent and for which there is no substitute.
2. Conservation efforts arising from the development application process, and contributing to improved protection of South Africa's ecosystems and species in perpetuity, are focused in areas identified as priorities for biodiversity conservation. Particular emphasis is given to consolidation of priority areas and securing links between priority areas.
3. Ecosystem services provided by affected biodiversity and on which local or vulnerable human communities – or society as a whole – are dependent for livelihoods, health and/or safety, are at minimum safeguarded, and preferably improved.

The mitigation hierarchy

Biodiversity offsets are typically intended to be carried out during the final step of the mitigation hierarchy – avoid, minimise, restore and offset. This implies that biodiversity offsets are a last resort, and should only be applied to compensate for the residual, project-specific impacts on biodiversity after appropriate efforts have first been made to avoid adverse impacts to biodiversity, then to minimise the unavoidable impacts, and

finally to restore biodiversity on-site at the conclusion of a project (Figure 2.1) (BBOP, 2009). The mitigation hierarchy provides a structured approach to development planning within which the option of biodiversity offsets is only used after reasonable steps have been taken to conserve or enhance already established biodiversity.[3]

Figure 2.1. **The mitigation hierarchy**



Source: Adapted from Rio Tinto (2012), "Rio Tinto and biodiversity: Working towards net positive impact", www.riotinto.com/documents/Rio_Tinto_and_biodiversity.pdf.

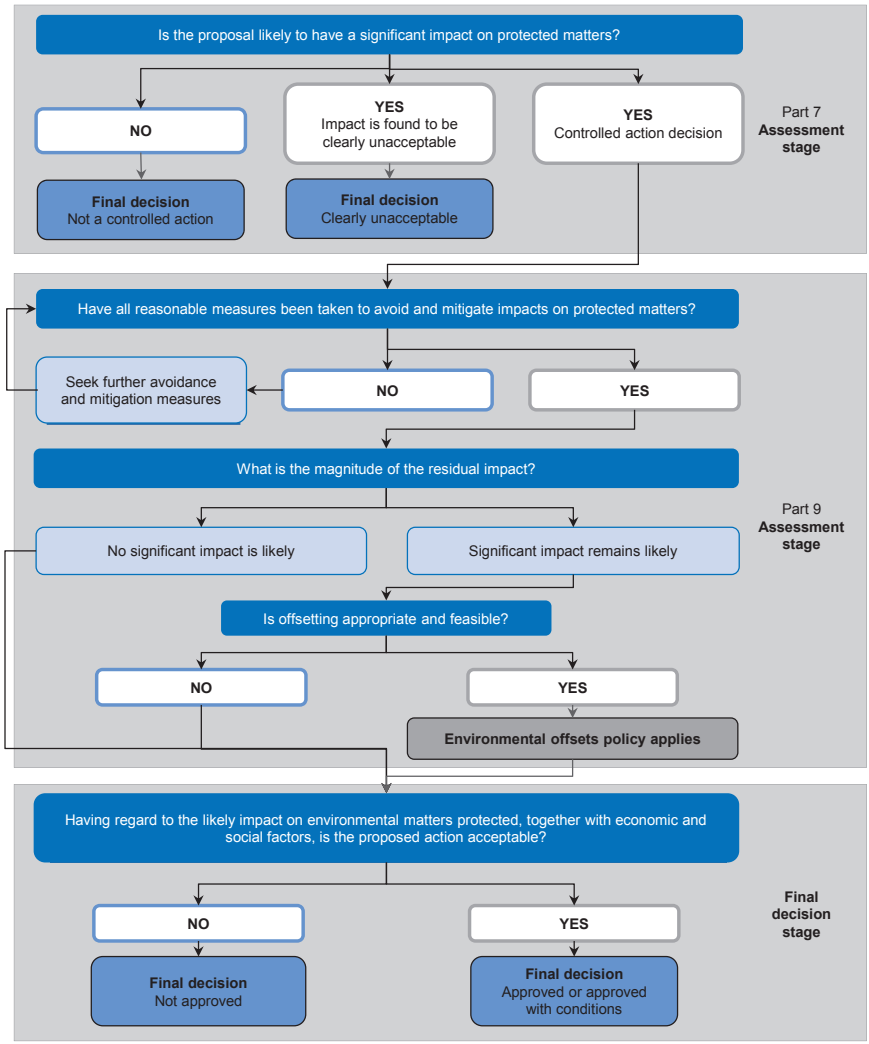
The mitigation hierarchy is intended to function as an important environmental safeguard in biodiversity offset programmes. Its use reflects a precautionary approach to sanctioning the loss of *in situ* biodiversity as a part of a development project. The prevailing scientific understanding of the complex relationships between biodiversity and ecosystem services is imperfect, leading to uncertainties around the projected impacts of development projects on the environment. Uncertainty in the evidence base used to support decision making can be compounded by numerous other factors, including the use of simplified biodiversity measurement techniques in impact evaluation and subjectivity in determinations of offset equivalency (Chapter 5). In recognition of the limitations in the current state of scientific understanding, programmes typically use the mitigation hierarchy as an instrument to help minimise the risk of decision makers approving projects that involve inappropriate trade-offs (Brownlie, King and Treweek, 2013).

The mitigation hierarchy came to prominence in offsets policy in the 1980s as part of the evolution of the United States' Compensatory Wetlands Mitigation scheme (Clare et al., 2011). It is now commonly applied across a range of offset programmes including the Impact Mitigation Regulation in Germany, Biodiversity Offsets in France, the Birds and Habitats Directives in the European Union, the Malagasy Environmental Charter in Madagascar, and as an integral part of the environmental safeguards of multilateral development banks (Darbi et al., 2010; ICCM and IUCN, 2012). The mitigation hierarchy is not a requirement in all offset programmes, however. A small minority, such as the Compensatory Afforestation scheme in India and the Brazilian System of National Conservation Units – both of which use only payments in-lieu offsets – do not require the mitigation hierarchy to be followed as a condition of development approval.

In practice, the mitigation hierarchy is a simplified ordering of project planning decisions that favours some land-use decisions over others. It is typically implemented through an administrative process that evaluates development proposals to determine if sufficient biodiversity loss has been avoided, when enough has been minimised and then the appropriateness of any further compensatory activity. Its implementation requires the definition of a baseline scenario against which NNL is measured, and decision guidelines to assist decision makers to determine what constitute reasonable efforts by developers to comply with each step. Regulations and guidance material relating to the mitigation hierarchy tend to use flexible language that reflects the case-by-case nature of decision making. In the EU, for example, development-related biodiversity loss may be permitted within the network of protected Natura 2000 sites in cases of "imperative reasons of overriding public interest, including those of a social and economic nature" (European Commission, 2001). In the United States' Compensatory Wetlands Mitigation programme, avoidance of wetlands loss is only necessary to the extent practicable after "taking into consideration cost, existing technology, and logistics in light of overall project purposes" (DOA and EPA, 1990). In Australia, the Minister for the Environment must have regard to economic and social factors in addition to relevant matters of national environmental significance when deciding whether or not a proposed project has adequately conformed to the mitigation hierarchy (Department of the Environment, 2013) – the precise decision making process is illustrated in Figure 2.2.

The development of consistent rules to transition between the steps of the mitigation hierarchy has proved challenging in practice (Burgin, 2008; Gibbons and Lindenmayer, 2007; McKinney and Kiesecker, 2010). Decision guidelines seek to balance environmental, economic and distributional outcomes by assessing:

Figure 2.2. **Determining when offsets are an appropriate policy response under the Environmental Offsets Policy in Australia: The role of offsets within the broader environmental impact assessment process**



Source: Environment Protection and Biodiversity Conservation Act 1999: Environmental Offsets Policy (2012), Department of Sustainability, Environment, Water, Population and Communities.

- the significance of the biodiversity and ecosystem services at the prospective development site

- the environmental value of meeting conservation objectives through avoidance and minimisation at the development site compared to meeting them using biodiversity offsets
- the proportionality of the costs to the developer associated with avoidance and minimisation measures relative to the level of project-specific biodiversity impacts
- the level of confidence regulators have about the additionality of the avoidance and minimisation steps nominated by a developer.

An important function of the first step in the mitigation hierarchy – avoidance of biodiversity loss – is to establish limits on what may be offset. Offsets programmes operate on the basis that impacts can be compensated for development-related biodiversity losses with the conservation of equivalent biodiversity at another site. In some circumstances, however, the proposed biodiversity losses are so great that no amount of compensation will be adequate to deliver an overall project outcome that is acceptable to society. The biodiversity at risk may be irreplaceable or extremely vulnerable, there may be no appropriate offset sites available, or there may be no known conservation approaches to achieve the offset outcomes required – avoiding biodiversity loss in these and similar situations is paramount (BBOP, 2012; Treweek et al., 2009). Two frameworks are commonly used to help inform situations where avoidance of biodiversity loss should take precedence:

- strategic conservation planning
- minimum standards for sustaining biodiversity outcomes.

Strategic or landscape-level conservation planning refers to the process of "locating, configuring and managing areas to maintain viability of biodiversity and other natural features" (Saenz et al., 2013a). Conservation planning typically results in the specification of a (minimum) regional conservation portfolio comprising sites that are collectively representative of the biodiversity in the area, combined in such a way as to secure the viability of the biodiversity into the future. Development proposals that would compromise the viability of the conservation portfolio should trigger avoidance measures. The general approach has been used, for example, in Australia, Colombia, Mongolia, South Africa and the United States to help inform the application of the mitigation hierarchy (Box 2.1).

Box 2.1. **Strategic conservation planning for avoiding biodiversity loss in high conservation value areas**

Strategic conservation planning is the process of integrating a landscape-scale plan for biodiversity conservation and sustainable use into the development approvals process. Creating an overarching conservation plan typically involves the spatial analysis of regional biodiversity attributes and the selection of a portfolio of conservation sites capable of maintaining the "biodiversity and ecological processes representative of the region" (Kiesecker et al., 2009).

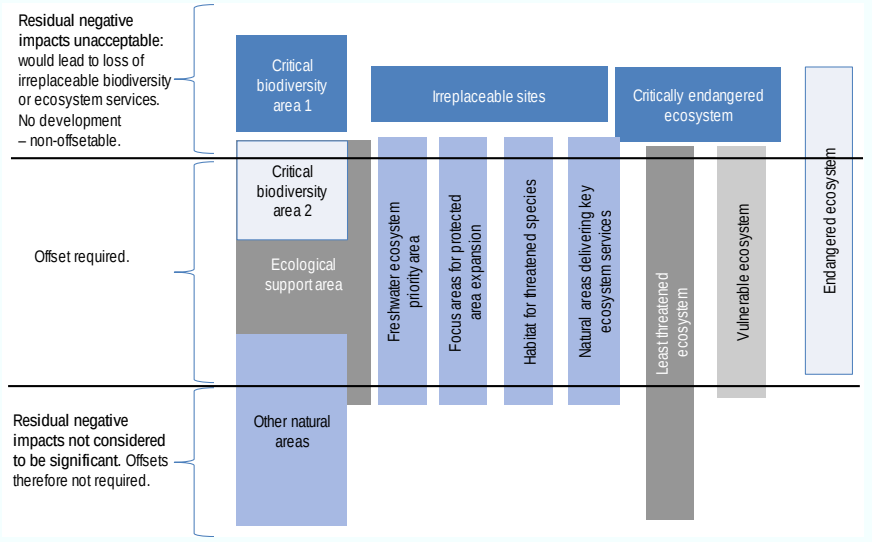
Landscape-level conservation plans enable decision makers to identify situations where strategically important biodiversity outcomes and development applications come into conflict. They are frequently used in biodiversity offsets programmes to inform which step of the mitigation hierarchy is most appropriate given the landscape-level context. If proposed development projects affect the viability of a conservation portfolio in attaining its biodiversity objectives, then further avoidance and/or minimisation measures are typically required. Conservation plans may also be used to guide the location of biodiversity offset projects so that they make important contributions to regional conservation priorities.

Conservation planning is used in a number of countries though the level of sophistication differs across programmes. The guidelines for biodiversity offsets in South Africa, for example, are integrated with national, provincial and municipal biodiversity conservation plans which draw on the South African National Biodiversity Institute's rich data sources. Conservation planning contributes to the assessment of development proposals in South Africa by restricting loss of biodiversity from priority areas which would jeopardise the different jurisdictions meeting their strategic conservation targets. The approach to biodiversity offsetting in South Africa also requires developers to make a material contribution to implementing jurisdictions' conservation plans and safeguarding valued ecosystem services. In particular, the conservation plans inform offset site selection by emphasising the consolidation of priority conservation areas and securing links between priority biodiversity areas.

A systematic, quantitative approach to conservation planning, known as Development by Design, has been developed by The Nature Conservancy and has been piloted in collaboration with multiple countries including Colombia and Mongolia (Girvetz et al., 2012; Kiesecker et al., 2009; Saenz et al., 2013a). The first step in the process is to establish a list of representative biodiversity in a region and nominate conservation targets for each biological component. The approach then uses optimisation techniques to define a regional conservation portfolio that minimises the area needed to meet the minimum viability requirements of the representative biological targets. Development projects can then be assessed for their impacts on the landscape-level conservation portfolio. If prospective development projects impact upon the ability of the conservation portfolio to meet the minimum viability requirements of the target species, and these are unable to be replaced by altering the portfolio or supplementing it with offsets, then further avoidance and minimisation steps are triggered. In Colombia, the Development by Design approach was piloted in collaboration with the Colombian Ministry of Environment and Sustainable Development in five areas of the country, each experiencing different development pressures on biodiversity (Saenz et al., 2013a). Representative biological

Box 2.1. **Strategic conservation planning for avoiding biodiversity loss in high conservation value areas** (*continued*)

Figure 2.3. **Likelihood of a biodiversity offset being required under the draft South African Offset Guidelines**



Source: DEA&DP (2011), "Information document on biodiversity offsets".

targets were selected and corresponding conservation portfolios developed for each of the five pilot areas. The conservation portfolios required to meet the minimum requirements of the biological targets comprised 38-75% of the total area in each pilot region. The analysis further revealed important overlap between areas proposed for development and the proposed conservation portfolios – depending on the pilot region, between 17% and 94% of the total area proposed for development overlaps with the conservation portfolio – highlighting significant challenges for future development in these areas (Saenz et al., 2013b).

Defining minimum standards for sustaining biodiversity outcomes is an alternative, project-oriented approach used in some programmes to set criteria for avoidance of biodiversity loss. Under this approach, project proponents must demonstrate that they meet minimum environmental conditions or performance standards in order to receive project approval. Failure to meet the minimum standards should trigger avoidance measures. The IFC, for example, has developed an influential outcomes-based framework that describes the biodiversity outcomes that must be demonstrated by a project proponent in order to receive IFC project support (Table 2.2); similar decision-making frameworks exist for other multilateral development banks and in numerous countries.

Table 2.2. **Conditions for approval of projects with adverse impacts on natural and critical habitat under the International Finance Corporation's Performance Standard 6**

Habitat type	Conditions for approval of development activity with adverse impacts on biodiversity
Natural habitat	The client will not significantly convert or degrade natural habitats, unless all of the following are demonstrated: – no other viable alternatives within the region exist for development of the project on modified habitat – consultation has established the views of stakeholders, including affected communities, with respect to the extent of conversion and degradation – any conversion or degradation is mitigated according to the mitigation hierarchy.
Critical habitat	The client will not implement any project activities unless all of the following are demonstrated: – 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 those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values – the project does not lead to a net reduction in the global and/or national/regional population of any critically endangered or endangered species over a reasonable period of time – a robust, appropriately designed and long-term biodiversity monitoring and evaluation programme is integrated into the client's management programme.

Source: IFC (2012), "Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources", www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES.

At the project level, measures to implement the avoidance and minimisation steps of the mitigation hierarchy relate to where, when and how a project is implemented. In practice, it is often difficult to differentiate between avoidance and minimisation of biodiversity loss in a project proposal. The types of modifications to project designs that constitute relevant avoidance and minimisation measures in British Columbia, Canada, for example, are summarised in Table 2.3. Some programmes also recognise measures to restore on-site biodiversity after project-related impacts have ceased as contributions to NNL of biodiversity.

Three types of biodiversity offsets: One-off, biobanking and in-lieu fees

Once developers have demonstrated that all reasonable steps to avoid and minimise biodiversity loss have been incorporated into a project's design, they may progress to the final step of the mitigation hierarchy – offsetting – to meet the environmental objectives of the scheme. The residual, project-related biodiversity losses at a development site are first quantified, and then the corresponding biodiversity offsets are implemented using one of three different approaches:[4]

- one-off offsets
- biobanking
- in-lieu fee programmes.

Table 2.3. **Guidance material on the mechanisms for avoidance and minimisation of biodiversity loss in British Columbia, Canada**

Avoidance and minimisation strategy	Description	Project options to consider
Location	Altering or adjusting the location of a project or activity within the permit area to fully avoid impacts on one or more environmental values and associated components	– Is there an alternative location for the proposed project or activity? – Is it practicable to relocate?
Means	Avoiding impacts on environmental values and associated components within the footprint and area of influence of a project or activity through application of alternative project methodologies (including tools, techniques, actions or measures)	– Can alternative development approaches or alternative technology be used to avoid impacts on environmental values and associated components? – Can the proponent collaborate with another operator in the same area to reduce the project footprint? – Can the proponent use existing roads or other infrastructure to avoid impacts on environmental values and associated components? – Will a measure to fully avoid impacts on one environmental value or associated component impact another one?
Timing	Avoiding impacts on environmental values and associated components on the footprint and area of influence of a project or activity through application of alternative timing of the project or specific elements of the project	– Can project-related activities (e.g. construction) be rescheduled to fully avoid impacts on the environmental values and associated components in the footprint and area of influence of a project or activity? – Can short-term timing measures be used, e.g. to avoid sensitive periods within a season, or within a diurnal period through use of in-stream work windows? – Can the frequency of activity be modified to allow for hydrologic recovery in a watershed?
Not proceeding with the proposed project or activity	Fully avoiding impacts on environmental values and associated components on the site of a project or activity by not proceeding with the proposed project or activity as proposed	– Would the impacts if a project or activity proceeds result in not achieving one or more applicable policy or legal targets for an environmental value or associated component? – Will the predicted post-project condition of a component associated with an environmental value fall below the management target if the project proceeds and/or detrimentally shift the conservation status of the environmental value? – Is the environmental value rare, and the reversibility of the impact and/or replaceability of the value, unlikely?

Source: British Columbia Ministry of Environment (2012), "Procedures for mitigating impacts on environmental values (Environmental Mitigation Procedures): Final working draft", www.env.gov.bc.ca/emop/docs/EMProceduresFinalWorkingDraft.pdf.

Biodiversity offsets programmes tend not to rely on just a single type of offset. In some cases, all three options are available to developers (e.g. in the US Compensatory Wetlands Mitigation scheme and the Native Vegetation Permitted Clearing Regulations in Victoria, Australia (DOD and EPA, 2008; DSE, 2012).

One-off offsets are undertaken by the developer themselves or by a third-party provider on their behalf, often a conservation NGO (Doswald et al., 2012). The case-by-case nature of the one-off approach offers the flexibility to deal in a nuanced way with project-specific impacts. In regulatory-based schemes, however, the flexibility may come at the expense of consistency and transparency, which have been criticisms of the one-off approach in the past (OAGC, 2009). A characteristic of the one-off approach is that the compensatory conservation commences at or around the time of the biodiversity loss at the development site. It is therefore associated with a temporal loss in biodiversity until it matures at the offset site and a risk that it may fail to do so as time progresses. The one-off approach is common for offsets that arise from environmental impact assessments and is typically used for the implementation of voluntary offsets.

The biobanking approach relies on pre-existing offsets that are established in anticipation of future development impacts on biodiversity from which developers can purchase offsets directly. Biobanks are a repository of existing offset credits where each credit represents a quantified gain in biodiversity resulting from actions to restore, establish, enhance and/or preserve biodiversity. Biobanks have been established by both the public and private sector.

Biobanking seeks to ensure that biodiversity outcomes from offset projects are known with certainty prior to allowing biodiversity losses to take place at development sites. The offset project therefore has time to mature, and its biodiversity outcomes are able to be verified, prior to it being used as an offset (Bekessey et al., 2010; Wissel and Wätzold, 2010). They are preferable from an environmental perspective as they remove the risk that biodiversity outcomes at offset sites will not develop as expected over time, and they avoid the temporary losses in biodiversity that occur under the one-off approach while an offset is maturing. Relative to one-off offsets, biobank locations are often chosen with greater emphasis on landscape-scale conservation outcomes and also tend to be larger in size as they often provide offsets for multiple development projects.

Biobanking is now used in the Impact Mitigation Regulation in Germany; Compensatory Wetlands Mitigation and Conservation Banking in the United States; BioBanking in New South Wales, Australia; and the Native Vegetation Permitted Clearing Regulations in Victoria, Australia.

Biobanking trials are also underway in Quebec (Canada), France, Switzerland and the Netherlands (Morandeau and Vilaysack, 2012).

Payments in-lieu is an approach to biodiversity offsetting whereby regulatory agencies levy fees on developers for causing adverse impacts to biodiversity. The regulatory agency then arranges for the collected fees to be spent on compensatory biodiversity conservation in a subsequent process. The level of the payments in-lieu is typically based upon a reasonable cost estimate of the financial resources necessary to adequately compensate society for the biodiversity loss. The disconnect between biodiversity loss and compensation means that a key element of payments in-lieu systems is the ability of regulatory agencies to maintain transparency around how the payments in-lieu are set, how the collected fees are allocated and the relationship of the compensation to the biodiversity lost. Allocating the payments in-lieu to compensatory conservation projects in a timely manner has proved problematic in several countries, including India and Mexico (Kohli et al., 2011).

Payments in-lieu are used in a number of countries including Australia, Brazil, China, Germany India, Mexico and the United States. The Forest Vegetation Revegetation Fee in China, for example, is a national regulatory programme used to levy fees on developers that cause biodiversity loss on land zoned for different forestry uses where fees are specified according to the forest-use zoning (Madsen, Carroll and Moore Brands, 2010). In India, developers that divert forest to a “non-forest purpose” are required to pay both a compensatory afforestation fee that represents the cost of afforestation on an equivalent area, and an amount equal to the net present value of the forest that is diverted to non-forest use (Kohli et al., 2011). In both the Chinese and Indian schemes, the fees charged to developers are proportional to the negative impact on biodiversity caused by development projects. The experience of the National System of Conservation Units programme in Brazil demonstrates the risks of establishing payments in-lieu unrelated to the biodiversity loss caused by the development project. The scheme originally used a fee that was calculated as a percentage of the total project development costs that would then be used for conservation purposes elsewhere. Elements of this approach were overturned in 2008 by the Supreme Court which ruled that whilst constitutional, the level of the fee should be proportional to the damage caused by the project (Veríssimo et al., 2011).

The economics of biodiversity offsets

Biodiversity offset programmes help to address production externalities by making it costly for developers to cause biodiversity loss through their business activities, thereby improving the alignment between the private and

social benefits of development. The increase in development costs better reflects the total economic value of biodiversity in developers' decision-making processes and has the potential to reduce the level of biodiversity loss from development projects to the socially optimal level.

Table 2.4. **Summary characteristics of the three biodiversity offset mechanisms**

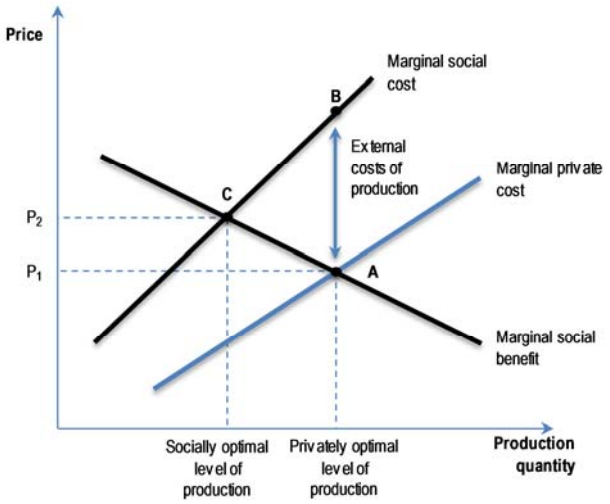
	One-off offsets	Biobanking	In-lieu fees
Driver for participation	Regulatory compliance or voluntary	Regulatory compliance	Regulatory compliance
Who secures the biodiversity outcomes	Developer	Developer	Public body responsible for spending the collected fees
When are biodiversity outcomes delivered	After biodiversity loss occurs at the development site	Before biodiversity loss occurs at the development site	After biodiversity loss occurs at the development site
Risk that biodiversity outcomes do not meet objectives	Present	Largely mitigated	Present
Broad scale or strategic biodiversity conservation	Less likely	More likely	Dependent on the scheme
Who is liable for biodiversity outcomes	Developer	Offset supplier	Offset supplier
Required institutional capacity	Low to medium	High	Low

Source: Adapted from Madsen, B., N. Carroll, K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

The effect of a production externality on output levels and prices is shown in Figure 2.4. A profit-maximising developer will produce at the point where the marginal private benefits of production are equal to marginal private costs – point A in Figure 2.4. At point A, the firm's production level causes a net cost, or welfare loss, to society equal to the area ABC as the marginal social costs of production are greater than the marginal social benefits. In contrast, the socially optimal outcome occurs where a firm makes production decisions inclusive of both its private costs and benefits and the additional external costs to society it causes through the loss of biodiversity – where the marginal social benefits are equal to the marginal social costs – point C.

Biodiversity offset programmes typically use quantity-based environmental objectives such as NNL or net gain of biodiversity. The specification of a quantity-based environmental objective acts as a restriction or cap on

Figure 2.4. **Private vs. socially optimal level of development**



biodiversity loss from development projects. Biodiversity offset programmes allow developers to meet the quantity-based restriction by avoiding and minimising biodiversity loss at a development site, restoring biodiversity at the conclusion of a project or, where permissible, by securing biodiversity offsets to compensate for any residual biodiversity loss. Within the constraints of the mitigation hierarchy, developers are therefore able to minimise the costs of meeting the quantity-based restriction by selecting the most cost-effective mix of conservation actions.

Where the costs and benefits of land development and biodiversity conservation are different across space, the ability to offset can lower the cost of meeting the quantity-based restriction (Wissel and Wätzold, 2010). The cost of conserving on-site biodiversity at a residential development project on the urban fringe, for example, may be very high when compared to the costs of conserving equivalent biodiversity at an offset site located on agricultural land further afield. The flexibility to purchase offsets from off-site suppliers enables developers to seek approval for a more cost-effective combination of on-site biodiversity conservation and permissible offset purchases.

Development projects where on-site biodiversity conservation is expensive because of high opportunity costs may find it more cost-effective to purchase offsets from suppliers who find it relatively less costly to improve biodiversity elsewhere. In a well-functioning offset scheme, offset transactions will transfer the location of biodiversity conservation to the least-cost sources of supply from developers to which it represents the

greatest economic value. In doing so, an offset scheme can simultaneously create economic value from transactions and lower the costs of meeting a given conservation objective.

Whilst repositioning equivalent biodiversity in space can lower the cost of meeting a given environmental objective, it may also have important distributional consequences (Ruhl and Salzman, 2006). Where offsets are located far away from the development site, the local community directly affected by the development will suffer a loss in biodiversity and ecosystem services. Equally, the community proximal to the offset site will experience an increase in biodiversity and ecosystem services. In some programmes, low land prices are a significant driver of the location of biodiversity offsets; low land prices are often correlated with relatively low population densities. Many biodiversity offsets are therefore located in regional areas where lower land prices improve the economic viability of the conservation projects, resulting in a spatial redistribution of biodiversity from urban to regional areas (Hough and Robertson, 2009; Ruhl and Salzman, 2006). Mitigation banks in Florida, for example, are overwhelmingly located in areas with low population density when compared to the development projects that they compensate for. The possible redistribution of biodiversity and ecosystem services from urban to regional areas and its social welfare consequences are important programme design considerations (see also Chapter 5).

In broad terms, there are two possible approaches to achieving a quantity-based environmental objective through an offsets scheme. One is to allow developers to purchase offsets to compensate for residual biodiversity loss directly through the offsets market. This is the approach used for one-off and biobanking offsets where prices are determined through the exchange process. The other is to require payments in-lieu from firms which cause biodiversity loss through development projects and then use the proceeds of the payment to meet the environmental objectives of the scheme. Each approach has different consequences for the evolution of offset prices and the overall cost-effectiveness of outcomes.

One-off offsets and biobanking schemes help to address the production externality at least cost to society where they facilitate offset exchanges between offset suppliers that offer high environmental quality offsets at the most reasonable cost and the developers. In general, the level of competition in the offsets exchange process plays a central role in the cost-effectiveness of outcomes. Barriers to participation and constraints on offset exchanges affect the overall level of competition, and have the capacity to see offset prices rise to levels disproportionate with the social costs of biodiversity loss (DSE, 2012). Additional factors influencing the level of exchange activity in an offsets programme are discussed in Box 2.2.

Box 2.2. **Factors influencing biodiversity offset activity**

The volume of offset exchanges depends on the supply and demand for offsets. The supply and demand for offsets is affected by the first two exogenous economic characteristics of a jurisdiction listed below while decisions about programme design may influence the remaining factors. Although large markets with high volumes of exchanges are preferable, when designing exchange rules, aspects other than sufficient trading activity need to be considered.

- Economic development: In regions with little economic growth, the demand for offsets will be low, reducing transaction frequency.
- Differences in opportunity costs: If opportunity costs are equal among sites there is no incentive to purchase offsets elsewhere. If some sites have a higher economic development potential and others are more suitable for conservation, it is advantageous for landowners to engage in offset transactions. The greater the differences, the higher the gains from offset transactions.
- Combination of tradable offsets with regulation: Additional regulation may restrict trading opportunities (e.g. regulation may prescribe a minimum density of conservation area on each landowner's site, and permits for developing land economically can only be used when this density is secured).
- Regional size of the service area: A larger regional size is likely to lead to higher opportunity cost differences and, hence, higher trading activity.
- Exchange requirements: The more specific the offset exchangeability requirements, the less transactions can be expected.
- Transaction costs of market exchange: High transaction costs may reduce market activity and may arise as a result of overly complicated and time-consuming administrative procedures.

Source: Wissel, S. and F. Wätzold (2010), "A conceptual analysis of the application of tradable permits to biodiversity conservation", http://dx.doi.org/10.1111/j.1523-1739.2009.01444.x.

Whilst the general economic properties of one-off offsets and biobanks are similar, biobanking sites tend to be chosen following greater strategic consideration of ecological values and costs of supply, which influences cost-effectiveness on multiple levels. Relative to one-off offsets, biobanks are:

- often created in more strategically important ecological locations, on larger tracts of land and in areas of low population density, which can lower opportunity costs and help to reduce overall offset costs

- associated with lower transaction costs attributable to monitoring, reporting and verification as the larger size of biobanks allows regulators to exploit economies of scale
- established and approved in advance of development projects so that for developers, the processing time associated with the regulatory approvals attributable to biodiversity offsets is reduced (Hough and Robertson, 2009).

Under payments in-lieu schemes, the regulating authority pre-specifies a fixed price that firms must pay to the regulating authority. In theory, the price is supposed to reflect the external costs of biodiversity loss caused by the development project. The regulating authority then uses the proceeds of the payments in-lieu to procure compensatory conservation in a subsequent process – often aggregating multiple payments in-lieu from developers to generate economies of scale in the procurement process. Jurisdictions operating payments in-lieu schemes therefore accept responsibility, and the risks, for securing equivalent biodiversity outcomes in exchange for the revenue obtained from the developer(s). The overall limit on biodiversity loss from a development project is met in two stages:

1. the steps taken by the developer to avoid and minimise biodiversity loss at the site
2. the procurement of compensatory conservation outcomes by the regulating authority for any residual biodiversity loss at the development site.

The level of the fixed price established by the regulating authority is pivotal to the ability of payments in-lieu to address the production externality at least cost to society. An efficient price will just cover a jurisdiction's costs of securing equivalent biodiversity outcomes from the least-cost offset suppliers, including the administrative costs of completing the process. Fixed prices that are set too high will increase development costs above the socially optimal level and may therefore cause some welfare-enhancing projects to not proceed. Fixed prices that are set too low will result in biodiversity loss at development sites that are above socially optimal levels and will generate insufficient revenue to sufficiently compensate society for such losses.

Payments in-lieu are used in a number of countries including Australia, Brazil, China, Germany, India, Mexico and the United States. The national Forest Vegetation Restoration Fee in China, for example, levies fees on developers that cause biodiversity loss on land zoned for different forestry uses where fees are specified according to the forest-use zoning. There are different fees for impacts to economic forest land, non-mature plantation

forests and national key protected forest land. The fees collected are then used by the government to restore an area of forest "at least as large" as that being lost at the development site (Madsen, Carroll and Moore Brands, 2010). In India, developers that divert forest to a "non-forest purpose" are required to pay both a compensatory afforestation fee that represents the cost of afforestation on an equivalent area, and an amount equal to the net present value of the forest that is diverted to non-forest use. The government, through the Compensatory Afforestation Planning and Management Authority, then allocates the money for conservation activities (Kohli et al., 2011).

Notes

1. The NEM Biodiversity Act 2004 makes provision (s52) for listing threatened ecosystems (critically endangered, endangered and vulnerable) and for listing (s56) threatened species (critically endangered, endangered and vulnerable). Threatened terrestrial ecosystems were gazetted in 2011 and threatened species and species in need of protection in 2007. South Africa's Red Data Books and Red Lists indicate threatened species, the National Spatial Biodiversity Assessment lists threatened ecosystems.

2. As referred to in the National Biodiversity Strategy and Action Plan, and defined in some fine-scale biodiversity plans (e.g. rocky outcrops, wetlands, etc.). The identification of these "special habitats" captures elements of significant biodiversity that would not be covered by considering coarser indicators like threatened ecosystem or species. They could foreseeably include habitats known to be important for migratory species, for particular life-stages of threatened or commercially important species, to support keystone species that "drive" ecosystems, and/or for locally rare or range-restricted species. In addition to being identified in fine-scale biodiversity plans, these features could be identified by Ezemvelo KZN Wildlife or biodiversity specialists.

3. Biodiversity assessments are integrated into the planning approvals process through mechanisms such as the environmental impact assessment process; see Chapter 4 for further details on institutional structures.

4. This is valid in lightly or non-regulated countries, though not in a highly regulated country like France where developers must obtain permission for actions.

References

African Development Bank (2013), "African Development Bank's Integrated Safeguards System: Policy statement and operational safeguards", December, African Development Bank, Tunis, www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/December_2013_-_AfDB%E2%80%99S_Integrated_Safeguards_System__-_Policy_Statement_and_Operational_Safeguards.pdf.

Alberta Government (2013), *Alberta Wetland Policy*, Alberta Government, Edmonton, Canada, http://aep.alberta.ca/water/programs-and-services/wetlands/documents/albertawetlandpolicy-sep2013.pdf.

Asian Development Bank (2009), *Safeguard Policy Statement*, www.adb.org/documents/safeguard-policy-statement.

BBOP (2012), *Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets*, Business and Biodiversity Offsets Programme, Washington, DC, www.forest-trends.org/documents/files/doc_3103.pdf.

BBOP (2009), *Biodiversity Offset Cost-Benefit Handbook*, Business and Biodiversity Offsets Programme, Washington, DC, www.forest-trends.org/documents/files/doc_3094.pdf.

Bekessy, S. et al. (2010), "The biodiversity bank cannot be a lending bank", *Conservation Letters*, Vol. 3/3, pp. 151-158, http://dx.doi.org/10.1111/j.1755-263X.2010.00110.x.

British Columbia Ministry of Environment (2011), "Procedures for mitigating impacts on environmental values (Environmental Mitigation Procedures): Final working draft", Victoria, British Columbia, www.env.gov.bc.ca/emop/docs/EMProceduresFinalWorkingDraft.pdf.

Brownlie, S. (2015), "Biodiversity offsets in South Africa: Experience and lessons learned", unpublished background report prepared for the OECD.

Brownlie, S. and M. Botha (2009), "Biodiversity offsets: Adding to the conservation estate, or 'no net loss'?", *Impact Assessment and Project Appraisal*, Vol. 27/3, pp. 227-231, http://dx.doi.org/10.3152/146155109X465968.

Brownlie, S., N. King and J. Treweek (2013), "Biodiversity tradeoffs and offsets in impact assessment and decision making: Can we stop the loss?", *Impact Assessment and Project Appraisal*, Vol. 31/1, pp. 24-33, http://dx.doi.org/10.1080/14615517.2012.736763.

Burgin, S. (2008), "BioBanking: An environmental scientist's view of the role of biodiversity banking offsets in conservation", *Biodiversity and Conservation*, Vol. 17/4, pp. 807-816, http://dx.doi.org/10.1007/s10531-008-9319-2.

Clare, S. et al. (2011), "Where is the avoidance in the implementation of wetland law and policy?", *Wetlands Ecology and Management*, Vol. 19/2, pp. 165-182, http://dx.doi.org/10.1007/s11273-011-9209-3.

Darbi, M. and C. Tausch (2010), "Loss gain calculations in German Impact Mitigation Regulation", Business and Biodiversity Offset Program (BBOP) Assurance and Guidelines Working Group Meeting, 16-18 March 2010, Cambridge, United Kingdom, www.forest-trends.org/publication_details.php?publicationID=2404.

Darbi, M. et al. (2010), "Impact mitigation and biodiversity offsets-compensation approaches from around the world: A study on the Application of Article 14 of the CBD (Convention on Biological Diversity)", Naturschutz und Biologische Vielfalt, Federal Agency for Nature Conservation, Bonn, Germany.

DEA&DP (2011), "Information document on biodiversity offsets", *EIA Guideline and Information Document Series*, Western Cape Department of Environmental Affairs & Development Planning, South Africa, October.

Department of the Environment (2013), "Matters of national environmental significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999", Commonwealth of Australia, Canberra, https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf.

Department of Fisheries and Oceans (2001), *Policy for the Management of Fish Habitat*, Department of Fisheries and Oceans, Ottawa, Ontario, www.gov.pe.ca/photos/original/elj_appendixd.pdf.

DEPI (2013a), *Permitted Clearing of Native Vegetation: Biodiversity Assessment Guidelines*, State of Victoria Department of Environment and Primary Industries, Melbourne, Australia, www.depi.vic.gov.au/__data/assets/pdf_file/0011/198758/Permitted-clearing-of-native-vegation-Biodiversity-assessment-guidelines.pdf.

DOA and EPA (1990), "Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army concerning the Determination of Mitigation under the Clean Water Act Section 404(b)(1) Guidelines", Department of Army and Environmental Protection Agency, Washington, DC.

DOD and EPA (2008), "Compensatory mitigation for losses of aquatic resources; Final rule", *Federal Register Rules and Regulations*, Vol. 73/70, 10 April, https://www.epa.gov/cwa-404/compensatory-mitigation-losses-aquatic-resources-final-rule.

Doswald, N. et al. (2012), "Biodiversity offsets: Voluntary and compliance regimes: A review of existing schemes, initiatives and guidance for financial institutions", UNEP-WCMC, Cambridge, United Kingdom and UNEP FI, Geneva, www.unepfi.org/fileadmin/documents/Biodiversity_Offsets-Voluntary_and_Compliance_Regimes.pdf.

DSE (2012), *Future Directions for Native Vegetation in Victoria – Review of Victoria's Native Vegetation Permitted Clearing Regulations Consultation Paper*, September, State of Victoria Department of Sustainability and Environment, Melbourne, Australia, www.depi.vic.gov.au/__data/assets/pdf_file/0012/199668/Consultation_paper_NVR.pdf.

EKNZW (2013), *Comprehensive Guideline for Biodiversity Offsets: KwaZulu-Natal Province, South Africa*, Ezemvelo KwaZulu Natal Wildlife.

European Commission (2013), "Working Group on No Net Loss of Ecosystems and their Services: Sub-group on the Scope and Objectives of the No Net Loss Initiative: Scope and objectives of the No Net Loss Initiative, final version 12/07/13", European Commission, Brussels, http://ec.europa.eu/environment/nature/biodiversity/nnl/pdf/Subgroup_NNL_Scope_Objectives.pdf.

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", European Commission, Brussels, http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf.

Gibbons, P. and D. Lindenmayer (2007), "Offsets for land clearing: No net loss or the tail wagging the dog?", *Ecological Management and Restoration*, Vol. 8/1, pp. 26-31, http://dx.doi.org/10.1111/j.1442-8903.2007.00328.x.

Girvetz, E. et al. (2012), "Eastern Mongolian grassland steppe", Chapter 8 in: Hilty, J.A. et al. (eds.), *Climate and Conservation: Landscape and Seascape Science, Planning and Action*, Island Press, pp. 92-103, http://dx.doi.org/10.5822/978-1-61091-203-7_8.

Hough, P. and M. Robertson (2009), "Mitigation under Section 404 of the Clean Water Act: Where it comes from, what it means", *Wetlands Ecology and Management*, Vol. 17/1, pp. 15-33, http://dx.doi.org/10.1007/s11273-008-9093-7.

ICMM and IUCN (2012), "Independent report on biodiversity offsets", prepared by The Biodiversity Consultancy, International Council on Mining and Metals, London and International Union for Conservation of Nature, Gland, Switzerland, http://hub.icmm.com/document/4934.

IFC (2012), "Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources", International Finance Corporation, Washington, DC, www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES.

Kiesecker, J. et al. (2010), "Development by Design: Blending landscape-level planning with the mitigation hierarchy", *Frontiers in Ecology and the Environment*, Vol. 8/5, pp. 261-266, http://dx.doi.org/10.1890/090005.

Kiesecker, J. et al. (2009), "A framework for implementing biodiversity offsets: Selecting sites and determining scale", *BioScience*, Vol. 59/1, pp. 77-84, http://dx.doi.org/10.1525/bio.2009.59.1.11.

Kohli, K. et al. (2011), *Pocketful of Forests: Legal Debates on Valuating and Compensating Forest Loss in India*, Kalpavriksh and WWF-India, New Delhi.

Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

McKenney, B. and J. Kiesecker (2010), "Policy development for biodiversity offsets: A review of offset frameworks", *Environmental Management*, Vol. 45/1, pp. 165-176, http://dx.doi.org/10.1007/s00267-009-9396-3.

Morandeau, D. and D. Vilaysack (2012), "Compensating for damage to biodiversity: An international benchmarking study", Collection "Études et documents" of the Economy, Evaluation and Integration of Sustainable Development Service (SEEIDD) at the General Commission for Sustainable Development (CGDD), France, www.developpement-durable.gouv.fr/IMG/pdf/ED68EN-2.pdf.

OAGC (2009), "The 2009 Spring Report of the Commissioner of the Environment and Sustainable Development to the House of Commons", Minister of Public Works and Government Services Canada, Ontario, www.oag-bvg.gc.ca/internet/English/parl_cesd_200905_e_32544.html.

Rio Tinto (2012), "Rio Tinto and biodiversity: Working towards net positive impact", Rio Tinto PLC, London, Rio Tinto Limited, Melbourne, Australia.

Ruhl, J. and J. Salzman (2006), "The effects of wetland mitigation banking on people", FSU College of Law, *Public Law Research Paper*, No. 179, https://ssrn.com/abstract=878331.

Saenz, S. et al. (2013a), "Development by Design in Colombia: Making mitigation decisions consistent with conservation outcomes", *PloS One*, Vol. 8/12, http://dx.doi.org/10.1371/journal.pone.008183110.1007/s00267-009-9396-3.

Saenz, S. et al. (2013b), "A framework for implementing and valuing biodiversity offsets in Colombia: A landscape scale perspective", *Sustainability*, Vol. 5/12, pp. 4 961-4 987, http://dx.doi.org/10.3390/su5124961.

Treweek, J. et al. (2009), "Scoping study for the design and use of biodiversity offsets in an English context: Final report to DEFRA", Treweek Environmental Consultants, Devon, United Kingdom, www.forest-trends.org/publication_details.php?publicationID=2400.

Veríssimo, A. et al. (2011), "Protected areas in the Brazilian Amazon: Challenges and opportunities", Imazon, Belém and Socioenvironmental Institute, São Paulo, https://www.socioambiental.org/banco_imagens/pdfs/10381.pdf.

Wissel, S. and F. Wätzold (2010), "A conceptual analysis of the application of tradable permits to biodiversity conservation", *Conservation Biology*, Vol. 24/2, pp. 404-411, http://dx.doi.org/10.1111/j.1523-1739.2009.01444.x.

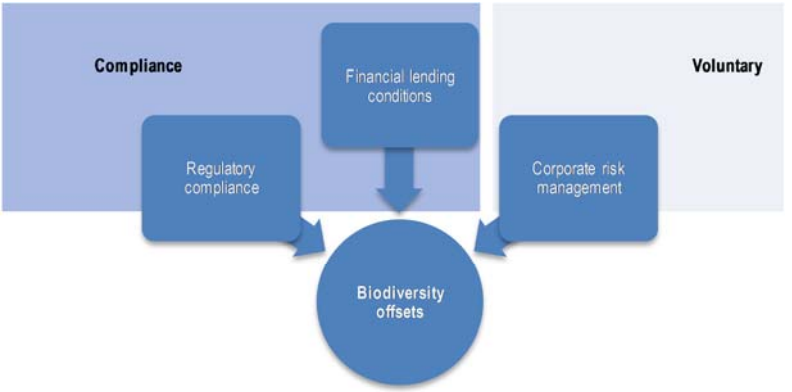
Chapter 3.

Institutional frameworks for biodiversity offsets

This chapter examines the institutional drivers that cause development firms to implement biodiversity offsets. Developers may undertake offsets to comply with a jurisdiction's legislation, as a condition of project lending approval or as part of a voluntary corporate risk management strategy. The institutional frameworks that facilitate biodiversity offsets affect outcomes in each of the environmental, economic and distributional domains. The chapter concludes by contrasting the characteristic outcomes from implementing biodiversity offsets under different institutional frameworks.

Policies that require developers to deliver biodiversity offsets have been introduced in one of three ways. Developers may undertake offsets to comply with a jurisdiction's legislation, undertake them as a condition of lending approval or as part of a voluntary corporate risk management strategy (Figure 3.1).

Figure 3.1. **Drivers of biodiversity offsets**



Source: Adapted from TBC (2012a), "Net positive impact forecasting: The case of Rio Tinto Madagascar", http://bbop.forest-trends.org/documents/files/forecasting_npi_at_qmm.pdf.

Compliance-based or mandatory approaches to biodiversity offset programmes

Under mandatory biodiversity offset programmes, governments require developers to provide compensation for certain classes of biodiversity impacts. Regulation may be imposed at the supra-national level (e.g. the Habitat and Birds Directives in the European Union), the national level (e.g. the Mexican Environmental Compensation Scheme for Land-Use Change in Forested Areas) or the subnational level (e.g. the Biodiversity Offsets scheme in Western Cape, South Africa) according to the powers each jurisdiction holds. In some cases, there are multiple schemes in operation in the same location, such as in Australia where the federal programme for environmental offsets under the Environmental Protection and Biodiversity Conservation Act operates alongside various state-based schemes (Department of the Environment, 2013).

The type of legislation used as the basis of an offset scheme may take one of two forms (Doswald et al., 2012):

- Specifically designed legislation that requires developers (public and private) to secure biodiversity offsets where they cause certain types of biodiversity loss. Specific legislation requiring biodiversity offsets is in place in at least 19 countries (TBC, 2013) and has been introduced for a range of different types of biodiversity loss (Table 3.1).
- Enabling provisions of existing legislation relating to land development to facilitate the provision of biodiversity offsets, generally as a condition of development approval (Doswald et al., 2012; ten Kate, Bishop and Bayon, 2004). There are 29 countries with legislation that facilitates the use of biodiversity offsets, most commonly through environmental impact legislation (TBC, 2013).

Table 3.1. **Legislation that requires the provision of biodiversity offsets**

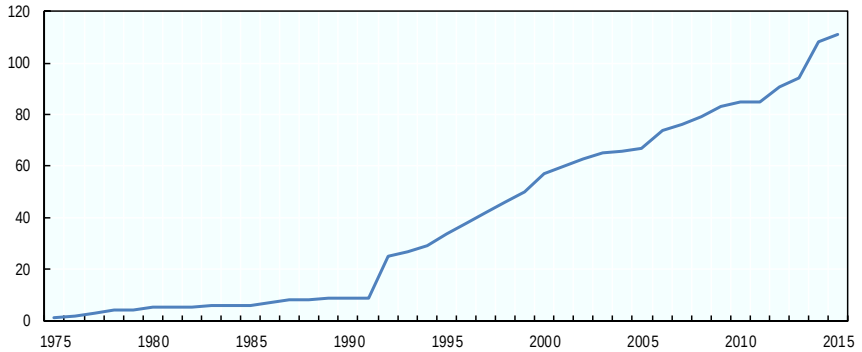
Jurisdiction	Legislation	Description
Brazil	Forest Code (1965) (Law 4 771)	The Brazilian Forest Code requires landowners holding more than 50 ha of rural land to set aside between 20% and 80% of their land in a legal reserve, depending on the biome they are located within. Landowners can reach their quota either by using their own land or through purchasing tradable certificates from landowners within the same micro-region where the vegetation conserved must be representative of the area.
Canada	Fisheries Act (2012)	The objective of the fisheries protection provisions of the Fisheries Act is to provide for the sustainability and ongoing productivity of commercial, recreational and Aboriginal fisheries. Offsets are measures required to counterbalance serious harm to fish by maintaining or improving fisheries productivity after all feasible measures to avoid and mitigate impacts have been undertaken.
China (People's Republic of)	Forest Law of the People's Republic of China (1998)	The Forest Vegetation Restoration Fee programme requires developers impacting lands zoned for forestry to avoid, minimise and then offset any residual developments impacts. Offsets are provided as a payment in-lieu to the government. The fee money is then used by the government for tree planting and forest restoration activities.
European Union	Council Directive 92/43/EEC of 21 May 1992 (Habitats Directive) and Council Directive 79/409/EEC (Birds Directive)	The network of protected sites called Natura 2000 has been established under the Habitats and Birds Directives in the European Union. Biodiversity impacts in these protected areas are controlled; however, they can be allowed in some exceptional cases. Pre-requisites are public participation, predominance of the public interest and the non-feasibility of alternatives. In these cases, offsetting must be undertaken. The implementation of these directives in some countries also requires compensation for damage to habitats of threatened species.

Table 3.1. **Legislation that requires the provision of biodiversity offsets** (*continued*)

Jurisdiction	Legislation	Description
France	Code of Environment: First introduction of the mitigation hierarchy and the obligation to carry out environmental impact assessment studies in 1976, followed by several regulations and updates	Different procedures on environmental impact assessment, water and wetlands, protected species, industrial plants, forest management. The key principles and methodology are summarised in the National Doctrine on the Mitigation Hierarchy (2012) and in the National Guidelines on the Mitigation Hierarchy (2013).
India	Forest (Conservation) Act 1980 and Forest (Conservation) Rules 2003	The Forest Act requires every change of forest land to a non-forest use to be compensated by the proponent through "compensatory afforestation." The cost of compensatory afforestation is a fee that represents the costs of afforestation on an equivalent area and an amount equal to the net present value of the forest that is diverted to non-forest use.
Netherlands	Nature Conservation Act (NB-wet) and Law on Spatial Planning (WRO)	The National Ecological Network policy was implemented to increase the amount of natural areas to 730 000 ha by 2018. Any attempt to develop on these areas requires the use of the mitigation hierarchy with the application of biodiversity offsets as a last resort, in order to achieve no net loss of biodiversity. Nearly all Natura 2000 areas are also part of National Ecological Network (EHS), but on land they constitute only approximately 50% of the network.
Switzerland	Federal Act on the Protection of Nature and Cultural Heritage (1966)	Under Swiss legislation, any party who damages a protected natural landscape, a protected biotope or protected riparian vegetation may, *inter alia*, be required to pay the costs of remedying the damage or to take appropriate compensatory measures if the damage is irreparable.
United States	Clean Water Act (1972)	The Clean Water Act is used to restore and maintain the chemical, physical and biological integrity of wetlands in the United States. It prohibits the discharge of material into water unless a permit is issued by the Army Corps of Engineers or an approved state. Projects that are authorised to discharge material into wetlands must follow the mitigation hierarchy and for all unavoidable impacts, compensatory mitigation is required to replace the loss of wetland and aquatic resource functions in the watershed.

Sources: Bezerra, L.G.E. (2007), "Biodiversity offsets in national (Brazil) and regional (EU) mandatory arrangements: Towards an international regime? – Draft dissertation", www.forest-trends.org/publication_details.php?publicationID=528; eftec et al. (2010), "The use of market-based instruments for biodiversity protection – The case of Habitat banking", http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_technical_report.pdf; Kohli, K. et al. (2011), *Pocketful of Forests: Legal Debates on Valuating and Compensating Forest Loss in India*; Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf; ten Kate, K., J. Bishop and R. Bayon (2004), *Biodiversity Offsets: Views, Experience, and the Business Case*, https://www.iucn.org/sites/dev/files/import/downloads/bdoffsets.pdf.

Figure 3.2. **Number of countries that have, are developing or are considering national government policies that require or enable the use of offsets**



Source: TBC (2016), "Government policies on biodiversity offsets", www.thebiodiversityconsultancy.com/wp-content/uploads/2013/07/Government-policy-2.pdf.

Environmental impact assessment (EIA) is the most common enabling mechanism used to require developers to provide biodiversity offsets. The purpose of the EIA process is to demonstrate that the anticipated environmental impacts of a development project are at a level acceptable to society. EIAs are used to assess projects with significant environmental impacts by "taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse" (Slootweg et al., 2006). Biodiversity offsets become part of the EIA process where a project will have significant residual environmental impacts that are deemed unacceptable in the absence of environmental compensation. The specification of the offsets may be integrated into the EIA approval process itself, or may be designed through a parallel process which is a condition of development consent in the EIA (BBOP, 2009). EIAs are used as the basis of a process to define biodiversity offsets in Argentina, Australia, Chile, the People's Republic of China (hereafter "China"), Egypt, France, Korea, Madagascar and Mexico, among others (Darbi et al., 2010; Doswald et al., 2012).

Strategic environment assessment (SEA) is another tool that is increasingly being used to diagnose the need for biodiversity offsets. SEAs are broader in scope than EIAs, going beyond the individual project level to look at the big-picture environmental consequences of proposed policies, plans or programmes on a large geographic area to assess the cumulative environmental impact before individual projects commence. The primary benefit of SEAs is that they are forward looking such that:

- the cumulative impacts on biodiversity of prospective projects within a region may be jointly considered
- the spatial pattern of development approvals may be adjusted in light of biodiversity impacts
- more options for compensation are available when considering a larger geographic scale and source of finance (BBOP, 2009; Slootweg et al., 2006).

Whilst SEAs are a useful tool for identifying the biodiversity conservation needs of a programme and the possible role of biodiversity offsets within it, they do not specify the offset requirements of individual projects. SEAs therefore require supplementary mechanisms to determine the offset requirements of individual projects and to organise offset exchanges. The supplementary mechanisms require careful design, as the additional information and spatial restrictions contained in SEAs can affect the bargaining position of participants. Where prospective offset suppliers know the extent of scarce offset receiving areas defined through a SEA, for example, then this can affect their approach to transactions and may lead to drawn out price negotiations with high transaction costs.

Lastly, the local planning approvals process is used in some jurisdictions to trigger the need for biodiversity offsets. The Native Vegetation Permitted Clearing Regulations in Victoria, Australia, for example, are implemented through the Planning and Environment Act 1987 (DEPI, 2013), and Section 106 of the Town and Country Planning Act in the United Kingdom has been used to require biodiversity offsets (ten Kate, Bishop and Bayon, 2004).

Biodiversity offset requirements as a condition of project finance

Firms' ability to raise capital for projects that impact upon biodiversity may be influenced by the provision of biodiversity offsets. The environmental safeguard policies of multilateral development banks and other financial institutions seek to ensure, among other things, that minimum levels of environmental performance are maintained as a condition of project lending approval or of other services provision (ICMM and IUCN, 2012; The Equator Principles Association, 2013). It has become commonplace for financial lending conditions to require that developers apply the mitigation hierarchy and also to specify biodiversity offsets requirements where they are needed to meet the conservation objectives for a project (Doswald et al., 2012). Lending conditions relating to biodiversity offsets often depend on the classification of the affected biodiversity as

either natural or modified habitat, and additionally whether or not it is defined to be critical habitat (Table 3.2).[1]

Table 3.2. **Biodiversity offset requirements as a condition of finance approval or financial services provision**

Institution	Offsets policy for residual project impacts on natural habitats	Offsets policy for residual project impacts on critical habitats
African Development Bank Operational Safeguard 3: Biodiversity, Renewable Resources and Ecosystem Services	Projects are eligible for finance if they "include mitigation measures to achieve either net benefit or no net loss of biodiversity – for example, ecological restoration of habitats, measures to reduce fragmentation, and restoration of ecosystem functioning. As a last resort, this can be done by the development of a biodiversity offset programme."	Projects are eligible for finance if "the borrower can demonstrate that the project-related activities will not have adverse effects on critical habitat. The project-related activities must not have adverse effects on the criteria for which the critical habitat was designated and will not have any negative effects on critically endangered or endangered species without the use of offsets."
Asian Development Bank Policy Principles and Requirement 8: Biodiversity Protection and Sustainable Natural Resource Management	In an area of natural habitats, there must be no significant conversion or degradation unless, *inter alia*, "any conversion or degradation is appropriately mitigated" where "mitigation measures will be designed to achieve at least no net loss of biodiversity."	No project activity will be implemented in areas of critical habitat unless, *inter alia*, mitigation measures are implemented with the objective of achieving "at least no net loss of biodiversity."
European Bank for Reconstruction and Development Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	There must be no significant degradation or conversion of the habitat unless, *inter alia*, "appropriate mitigation measures are put in place to ensure no net loss and preferably a net gain of biodiversity value in the habitat concerned, or, where appropriate, a habitat of greater conservation value."	Critical habitat must not be converted or degraded so projects will not be eligible for finance unless, *inter alia*, "there are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its ability to function" and that "all other impacts are mitigated in accordance with the mitigation hierarchy."
European Investment Bank B.2.4.1. Biodiversity Assessment	If a project is expected to significantly alter, degrade or convert natural habitats, "mitigation measures will be designed to achieve no net loss." No net loss includes the "(i) protection of areas within the concession ("set asides"); (ii) measures to minimise habitat fragmentation (corridors); (iii) habitat restoration; and (iv) biodiversity offsets/compensation."	Development in a critical habitat can only go ahead if, *inter alia*, a "positive conservation outcome is achieved through avoidance, mitigation and, as a last resort through compensation measures."

Table 3.2. **Biodiversity offset requirements as a condition of finance approval or financial services provision** (*continued*)

Institution	Offsets policy for residual project impacts on natural habitats	Offsets policy for residual project impacts on critical habitats
Inter-American Development Bank Policy Directive B.9: Natural Habitats and Cultural Sites	Where a project is likely to significantly convert or degrade natural habitats, the borrower must, *inter alia*, develop mitigation and compensation measures deemed acceptable by the Inter-American Development Bank. "This may include minimising habitat loss and/or to protecting and maintaining an area ecologically similar to the one being significantly converted or degraded."	If a project is not likely to significantly convert or degrade the critical natural habitat, but might still negatively impact it, "the borrower shall develop mitigation and monitoring measures, acceptable to the project team, to mitigate such impacts."
International Finance Corporation Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, Protection and Conservation of Biodiversity	Projects must not significantly convert or degrade natural habitats, unless, *inter alia*, "any conversion or degradation is mitigated according to the mitigation hierarchy. In areas of natural habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible."	In areas of critical habitat, a project will not proceed unless, *inter alia*, it does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values… The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated."

Source: African Development Bank (2013), "African Development Bank's Integrated Safeguards System: Policy statement and operational safeguards", www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/December_2013_-_AfDB%E2%80%99S_Integrated_Safeguards_System__-_Policy_Statement_and_Operational_Safeguards.pdf; Asian Development Bank (2009), *Safeguard Policy Statement*, www.adb.org/documents/safeguard-policy-statement; European Bank for Reconstruction and Development (2008), "Environmental and social policy"; European Investment Bank (2013), *Environment and Social Handbook*; Inter-American Development Bank (2007), "Implementation guidelines for the environment and safeguards compliance policy", http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35597106; IFC (2012), "Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources", www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES.

Financial lending conditions may also arise from corporate environmental and social risk management frameworks. A coalition of private sector banks, for example, has created an environmental and social risk management framework based on the IFC's performance standards called the Equator Principles (EPs). The EPs are adopted voluntarily by financial institutions and as of March 2014, 79 financial institutions in 35 countries had officially adopted them. Like IFC Performance Standard 6, when signatories to the EPs are financing or advising on a project with consequences for

biodiversity, they must oversee that their clients apply the mitigation hierarchy. If clients are unwilling or unable to comply with the requirements of the EPs then project support will not be provided (The Equator Principles Association, 2013).

Voluntary approaches for biodiversity offsets

Biodiversity offsets are also increasingly being used by firms as a voluntary measure to compensate for the biodiversity impacts of their operations. The number of voluntary offsets programmes has increased in recent times as firms have sought to enhance their corporate social responsibility credentials (Houdet et al., 2012). As of August 2012, there were 38 published corporate biodiversity policies for "no net loss", "neutrality", "net positive impact" or some other comparable commitment (TBC, 2012b). The size of voluntary biodiversity is difficult to estimate given that they are essentially a series of one-off private transactions that are not publicly reported. According to one estimate, the annual turnover is in the order of USD 25 million (Ecosystem Marketplace, 2013).

Voluntary offsets are generally undertaken by large firms with a significant and repeated impact on biodiversity. These are commonly firms involved in mining, oil and gas extraction and biodiversity-dependent industries including fishing, agriculture and forestry. Firms usually undertake voluntary offset projects with the support of conservation organisations, consulting firms or through partnerships with various organisations such as the International Union for the Conservation of Nature (IUCN) and the Business and Biodiversity Offsets Programme (BBOP) (Doswald et al., 2012).

Voluntary biodiversity offsets are motivated by a range of corporate drivers. Through discussion with corporate practitioners, ten Kate, Bishop and Bayon (2004) report that voluntary biodiversity offsets "can strengthen companies' license to operate by encouraging regulators to grant permission for new operations and by securing the support of local communities and non-governmental organisations." Numerous other private benefits explain why firms carry out voluntary biodiversity offsets including: managing reputational risk, accessing new market opportunities, deriving competitive advantages, and delivering employee satisfaction and retention (Crowe and ten Kate, 2010; ten Kate, Bishop and Bayon, 2004).

Box 3.1. **Biodiversity offsets delivered voluntarily and as conditions of financial lending approval**

The Chad Cameroon Pipeline: Biodiversity offsets as a condition of project financing

The Chad Cameroon Pipeline project involved the construction of 300 oil wells in southern Chad and the construction of a 1 070-kilometre pipeline to the Cameroon coast to an export terminal facility (Breitkopf, 2000). The USD 3.7 billion project is expected to generate USD 12 billion in revenue over a 28-year period, including USD 2.2 billion in aggregate revenue for the two federal governments. The pipeline had significant impacts upon local biodiversity as it was constructed through sensitive rainforests that are home to local indigenous populations. The project affected biodiversity across a total area of around 10 000 ha (BBOP, 2009).

The project was financed by the World Bank and the International Finance Corporation and was therefore subject to their environmental performance standards as a condition of lending approval and of other financial support. Lending conditions included the provision of biodiversity offsets.

Biodiversity offsets were provided through the protection of two "environmental enhancement areas" across 690 000 ha in Cameroon. The sites were selected as they were under severe threat from logging, the overexploitation of wildlife and encroachment of local populations. The 28-year conservation strategy was funded through the establishment of a USD 3.5 million endowment fund (BBOP, 2009).

The Compañía Minera Antamina Polylepis Initiative: Voluntary biodiversity offsets

The Antimina open pit mine is a complex of copper and zinc mines in the Ancach region in the Andean mountains of Peru and is among the largest of its type in the world. The mine is expected to have a life of 20 years and will produce approximately 500 million tonnes of ore and 1.36 billion tonnes of waste rock. The mine will cover an area of 220 ha and its construction requires the draining of a 32-hectare lake which collectively have consequences across 2 221 ha of proximal habitat. The majority of biodiversity affected through the project is common throughout the region, but the environmental impact assessment identified the potential loss of less than 1 ha of endangered shrub species (Biodiversity Neutral Initiative, 2006).

In 2001, the mine commenced production and in 2004 the operators initiated a voluntary biodiversity conservation programme proximal to the mine site motivated by their corporate social responsibility policy. The design of the conservation programme came at a cost of approximately USD 25 000.

The objective of the conservation programme was to contribute to the restoration of the endangered Polylepis habitat by contributing to a conservation corridor between two protected areas. The project also aimed to improve the livelihoods of local populations, in part, by involving them in the conservation management process. In the first five-year phase of the project, the biodiversity offsets aimed to restore 1 000 ha of Polylepis forests at a cost of USD 1 million (Biodiversity Neutral Initiative, 2006).

Sources: Breitkopf, S. (2000) "The Chad Cameroon Petroleum Development and Pipeline Project: Risky business"; BBOP (2009), *Biodiversity Offset Cost-Benefit Handbook*; Biodiversity Neutral Initiative (2006), "Biodiversity offset case study: Compañía Minera Antamina's Polylepis Initiative".

Comparing the institutional architectures for offset schemes

The institutional frameworks that facilitate biodiversity offsets affect outcomes at the environmental, economic and distributional levels. The key issues that should be considered in the design of the institutional architecture for biodiversity offsets include the:

- alignment of biodiversity outcomes with stakeholder priorities
- effects on the incentives for the supply of biodiversity offsets
- coverage and policy coherence with overlapping schemes
- level of business certainty and transaction costs for participants.

Voluntarily provided biodiversity offsets can make an important contribution to conservation outcomes but they are tailored to deliver on firm-specific objectives. The objectives for voluntary offset projects tend to focus more heavily on stakeholders near the biodiversity loss site and the impacts on localised ecosystem services compared to most compulsory offset programmes. From a distributional standpoint, directly affected communities are therefore more likely to be compensated under a voluntary approach which is consistent with corporate risk management drivers such as earning a social licence to operate. The coverage of voluntary approaches is generally expected to be limited to firms who identify private net benefits from implementing biodiversity offsets. The extent or ambition of voluntary conservation activity is also likely to be limited or constrained due to concerns regarding an uneven playing field among competing firms. Indeed, recent estimates suggest that the size of voluntary offset programmes are about one-tenth of compulsory offset programmes (see Table 3.1).

By contrast, biodiversity offset projects that are undertaken as conditions of lending approval have the advantage of being designed to comply with stable and credible frameworks for offset implementation. The revised IFC Performance Standard 6 (IFC, 2012), in particular, is becoming a major driver for biodiversity offsets and is now seen as a reference point for best practice among industry professionals (ICCM and IUCN, 2012; Kapila, 2013).

Whilst the IFC and similar performance standards offer a predictable and evenly applied framework to facilitate biodiversity offsets, the detailed implementation choices are left to the proponent and can vary in quality from project to project. Beyond establishing the biodiversity objectives for projects, the IFC performance standards, for example, only require that proponents “retain external experts with appropriate regional experience to assist in the development of a mitigation hierarchy that complies with this

Performance Standard (IFC PS6) and to verify the implementation of those measures" (IFC, 2012).

Compulsory regimes (i.e. those that are required by regulation) have the capability to both complement and enhance the biodiversity outcomes of voluntary and finance-based compliance offset projects. In principle, the advantages of a regulatory-based system are that it can:

- align conservation outcomes with jurisdictional priorities, and allow strengthening of mainstreaming of biodiversity into development plans, programmes and projects (via EIA and the mitigation hierarchy)
- increase the number of projects covered (i.e. due to the possibility of sanctions for non-compliance), provide certainty and create a more level playing field for the regulated entities
- provide certainty to participants and consequently a stronger incentive for the creation of offsets and the development of the supporting service providers industry.

The co-ordinating function of a regulatory framework for biodiversity offsets, however, is critical if biodiversity outcomes are to be improved over other approaches to implementation. Biodiversity offsets are ultimately about trade-offs with respect to land-use choices and in this context governments may be better placed to make strategic choices about how biodiversity conservation and sustainable use can deliver the best environmental outcomes while weighing up broader, and sometimes competing, societal objectives. The integration of strategic conservation research and planning with compulsory offset programmes can therefore help to deliver scale, increase policy coherence and improve the effectiveness of conservation outcomes from scarce biodiversity offset finance (see also Chapter 5).

Regulatory frameworks for biodiversity offsets should, however, recognise that firms may be subject to overlapping compliance regimes. Depending on the jurisdiction, projects may be simultaneously subject to one or more state or provincial government regulations for biodiversity offsets, federal government regulations and financial lending requirements. Where the compliance requirements differ across jurisdictions, or where conservation actions are not uniformly recognised among jurisdictions, then the transaction costs for developers can increase. Through the Multilateral Financial Institution (MFI) Working Group on the Environment, the MFI has sought to improve and harmonise the environmental and social safeguard requirements among its members to improve consistency and reduce the costs for funding applicants (Asian Development Bank, 2014). Where relevant, jurisdictions may investigate harmonising requirements for

biodiversity offsets or investigating mutual recognition of biodiversity offsets as mechanisms to streamline the approval process for developers.

Note

1. The IFC performance standards define natural habitats as "areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition." Modified habitats are defined as "areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands." Critical habitats are defined as areas "with high biodiversity value, including (i) habitat of significant importance to critically endangered and/or endangered species; (ii) habitat of significant importance to endemic and/or restricted range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes."

References

African Development Bank (2013), "African Development Bank's Integrated Safeguards System: Policy statement and operational safeguards", December, African Development Bank, Tunis, www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/December_2013_-_AfDB%E2%80%99S_Integrated_Safeguards_System__-_Policy_Statement_and_Operational_Safeguards.pdf.

Asian Development Bank (2014), *Sustainability Report*, Asian Development Bank.

Asian Development Bank (2009), *Safeguard Policy Statement*, Asian Development Bank, www.adb.org/documents/safeguard%20policy%20statement.

BBOP (2009), *Biodiversity Offset Cost-Benefit Handbook*, Business and Biodiversity Offsets Programme, Washington, DC, www.forest-trends.org/documents/files/doc_3094.pdf.

Bezerra, L.G.E. (2007), "Biodiversity offsets in national (Brazil) and regional (EU) mandatory arrangements: Towards an international regime? – Draft dissertation", UCL Department of Laws, London, www.forest-trends.org/publication_details.php?publicationID=528.

Biodiversity Neutral Initiative (2006), "Biodiversity offset case study: Compañía Minera Antamina's Polylepis Initiative", Biodiversity Neutral Initiative, www.forest-trends.org/documents/files/doc_539.pdf.

Breitkopf, S. (2000), "The Chad Cameroon Petroleum Development and Pipeline Project: Risky business", *Profiling Problem Projects*, www.ciel.org/Publications/IFCCSChadCameroon.pdf.

Crowe, M. and K. ten Kate (2010), "Biodiversity offsets: Policy options for government", *Forest Trends*, Washington, DC, www.forest-trends.org/publication_details.php?publicationID=3079.

Darbi, M. et al. (2010), "Impact mitigation and biodiversity offsets: Compensation approaches from around the world: A study on the application of Article 14 of the CBD (Convention on Biological Diversity)", Naturschutz und Biologische Vielfalt, Federal Agency for Nature Conservation, Bonn, Germany.

Department of the Environment (2013), "Matters of national environmental significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999", Commonwealth of Australia, Canberra, https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf.

DEPI (2013), "Reforms to Victoria's Native Vegetation Permitted Clearing Regulations: Amendments to the Victoria planning provisions", Victoria State Government, Department of Environment and Primary Industries, Melbourne, Australia.

Doswald, N. et al. (2012), "Biodiversity offsets: Voluntary and compliance regimes: A review of existing schemes, initiatives and guidance for financial institutions", UNEP-WCMC, Cambridge, United Kingdom and UNEP FI, Geneva, www.unepfi.org/fileadmin/documents/Biodiversity_Offsets-Voluntary_and_Compliance_Regimes.pdf.

Ecosystem Marketplace (2013), *Innovative Markets and Market-Like Instruments for Ecosystem Services: The Matrix 2013*, Ecosystem Marketplace, Washington, DC, www.ecosystemmarketplace.com/documents/acrobat/the_matrix.pdf.

eftec et al. (2010), "The use of market based instruments for biodiversity protection – The case of Habitat banking", Technical Report for European Commission DG Environment, London, http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_technical_report.pdf.

European Bank for Reconstruction and Development (2008), "Environmental and social policy".

European Investment Bank (2013), *Environment and Social Handbook*, Environment, Climate and Social Office, Projects Directorate, Version 9.0, Luxembourg.

Houdet, J. et al. (2012), "Understanding changes in business strategies regarding biodiversity and ecosystem services", *Ecological Economics*, Vol. 73, pp. 37-46, http://dx.doi.org/10.1016/j.ecolecon.2011.10.013.

ICMM and IUCN (2012), "Independent report on biodiversity offsets", prepared by The Biodiversity Consultancy, International Council on Mining and Metals, London and International Union for Conservation of Nature, Gland, Switzerland, http://hub.icmm.com/document/4934.

IFC (2012), "Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources", International Finance Corporation, Washington, DC, www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES.

Inter-American Development Bank (2007), "Implementation guidelines for the environment and safeguards compliance policy", Sustainable Development Department, Sector Strategy and Policy Papers Series, Inter-American Development Bank, Washington, DC, http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35597106.

Kapila, S. (2013), "Biodiversity offsets: Challenges and opportunities", Shell Ltd., presentation to OECD Workshop on Biodiversity Offsets, 6-7 November 2013, Paris.

Kohli, K. et al. (2011), *Pocketful of Forests: Legal Debates on Valuating and Compensating Forest Loss in India*, Kalpavriksh and WWF-India, New Delhi.

Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", Ecosystem Marketplace, www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

Slootweg, R. et al. (2006), *Biodiversity in EIA and SEA: Background Document to CBD Decision VIII/28: Voluntary Guidelines on Biodiversity Inclusive Impact Assessment*, Commission for Environmental Assessment, https://www.cbd.int/doc/publications/imp-bio-eia-and-sea.pdf.

TBC (2016), "Government policies on biodiversity offsets", Industry briefing note of The Biodiversity Consultancy, Cambridge, United Kingdom, www.thebiodiversityconsultancy.com/wp-content/uploads/2013/07/Government-policy-2.pdf.

TBC (2013), "Government policies on biodiversity offsets", The Biodiversity Consultancy, Cambridge, United Kingdom, www.thebiodiversityconsultancy.com/wp-content/uploads/2013/07/Government-policies-on-biodiversity-offsets3.pdf.

TBC (2012a), "Net positive impact forecasting: The case of Rio Tinto Madagascar", PowerPoint presentation, The Biodiversity Consultancy Ltd., http://bbop.forest-trends.org/documents/files/forecasting_npi_at_qmm.pdf.

TBC (2012b), "Private sector no net loss commitments", The Biodiversity Consultancy Ltd, Cambridge, United Kingdom.

ten Kate, K., J. Bishop and R. Bayon (2004), *Biodiversity Offsets: Views, Experience, and the Business Case*, International Union for Conservation of Nature, Gland, Switzerland and Cambridge, United Kingdom and Insight Investment, London, https://www.iucn.org/sites/dev/files/import/downloads/bdoffsets.pdf.

The Equator Principles Association (2013), "The Equator Principles June 2013", Equator Principles, www.equator-principles.com/resources/equator_principles_III.pdf.

Chapter 4.

Design and implementation features of biodiversity offset programmes

The design and implementation features of biodiversity offset programmes are critical determinants of environmental effectiveness, cost effectiveness and distributional outcomes. This chapter reviews and discusses some of the key considerations including thresholds and coverage; equivalence; additionality and permanence; robust monitoring frameworks; and compliance and enforcement, as well as transaction costs.

Coverage and thresholds

Coverage refers to the types of biodiversity loss and the sectors that come under a regulatory-based offsets programme. In principle, the coverage of a programme should be as broad as possible to ensure that the value of biodiversity to society is generally reflected in development decisions. Development projects are only covered by an offsets programme when the level of project-related biodiversity loss exceeds a certain significance threshold, but coverage is sometimes restricted to only certain economic sectors (Table 4.1). The scale of development projects included in offsets programmes can vary considerably. In some cases, offsets may be required for relatively small-scale local government planning applications whereas in other programmes, offsets focus only on very large developments with major impacts on biodiversity. The legislative requirements for biodiversity offsets in the European Union, for example, have in recent years covered approximately 10% of the area of land used for development (ICF GHK and BIO Intelligence Service, 2013).

For many programmes, including the Habitats and Birds Directives in the European Union, the Environmental Offsets scheme in Australia, and the Fisheries Productivity Investment Policy in Canada, the significance threshold for residual impacts is not explicitly quantified, which leaves regulators with some discretion over the development projects that will actually be covered (Department of the Environment, 2013; ICF GHK and BIO Intelligence Service, 2013). In the Environmental Offsets scheme in Australia, the significance of a proposed impact on biodiversity depends upon the "sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts." Qualitative definitions of significance mean that jurisdictions' guidelines play a central role in determining actual project coverage – mechanisms to promote regulatory consistency, proportionality and transparency are therefore important. The EU guidelines for environmental assessment of projects affecting Natura 2000 sites, for example, use significance indicators, including the percentage of loss of habitat area, the relative change in key indicative chemical for water quality and the timescale for restoration of population densities, to assist in decision making (European Commission, 2001).

In South Africa, any and all projects that trigger the 2010 National Environmental Management Act and the EIA Regulations could be asked to provide biodiversity offsets where significant negative residual impacts on biodiversity are probable. These regulations include three schedules of listed activities for which either a basic assessment or a scoping and full environmental impact assessment (EIA) must be prepared. The schedules

Table 4.1. **Coverage of selected biodiversity offset schemes**

Jurisdiction	Programme	Coverage
Brazil	Forest Code offsets	Natural vegetation
Brazil	Industrial impact compensation	Major developments
Canada	Fisheries Protection Policy Statement Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting	Commercial, recreational and Aboriginal fisheries
China (People's Republic of)	Forest vegetation restoration fee	Land zoned for forestry
European Union	Habitats and Birds Directives	The Natura 2000 network
France	Mitigation hierarchy including offsets	All natural habitats including water and wetlands, protected species, ecological corridors and functions, protected areas
Germany	Impact Mitigation Regulations	Natural assets
India	Compensatory Afforestation	Forests
KwaZulu-Natal, South Africa	KwaZulu-Natal Draft Biodiversity Offsets Policy	Critical biodiversity areas
Mexico	General Law of Ecological Equilibrium and Protection of the Environment	Significant environmental impacts
New South Wales, Australia	Biobanking	Ecosystems and threatened species
Queensland, Australia	Net Gain in Koala Habitat in Southeast Queensland	Koala habitat
Queensland, Australia	Vegetation management	Native vegetation
South Africa	National Grasslands Biodiversity programme wetlands mitigation banking system	Wetlands
South Australia, Australia	Native Vegetation and Scattered Tree Offsets Policy	Native vegetation and scattered trees
United States	Compensatory wetland mitigation	Wetland and stream ecosystems
United States	Conservation banking	Endangered species
Victoria, Australia	BushBroker	Native vegetation
Western Cape, South Africa	Western Cape Provincial Guideline on Biodiversity Offsets	Critical biodiversity areas

Source: Madsen, B. et al. (2011), "2011 update: State of biodiversity markets", www.ecosystemmarketplace.com/reports/2011_update_sbdm; Morandeau, D. and D. Vilaysack (2012), "Compensating for damage to biodiversity: An international benchmarking study", www.developpement-durable.gouv.fr/IMG/pdf/ED68EN-2.pdf; eftec et al. (2010), "The use of market based instruments for biodiversity protection – The case of Habitat banking", http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_technical_report.pdf; Kohli, K. et al. (2011), *Pocketful of Forests: Legal Debates on Valuating and Compensating Forest Loss in India*; DEA&DP (2011), "Information document on biodiversity offsets".

cover a wide range of activities in diverse sectors (currently 55 activities for "basic assessment", 26 activities for full EIA and additional activities in the various provinces). Projects ranging from agriculture, infrastructure,

housing, energy generation and transmission, water resource development, waste disposal, amongst others, could require an impact assessment, if their scale exceeds specified thresholds. In addition, triggers to undertake EIA are provided for in environmental management frameworks (also declared in terms of the National Environmental Management Act) and through the Biodiversity Act (see Annex 1.A1) if a "threatening process" is involved and/or if activities target endangered or critically endangered ecosystems as listed in terms of that act.

The NEMA and its national environmental management principles, as well as its EIA regulations – and thus biodiversity offsets – apply to state and private sector development. In addition, provision is made in the regulations for developers responsible for illegal developments to apply for "retroactive" environmental authorisations; biodiversity offsets could thus also be required retroactively.

Thresholds to what can be offset

The use of biodiversity offsets are based on the premise that development projects causing biodiversity loss are able to deliver an acceptable environmental trade-off by securing equivalent biodiversity at an alternative site. An acceptable trade-off is not always possible, however, signifying the presence of limits on the type or extent of biodiversity that may be appropriate to include in an offset scheme (BBOP, 2012; ICCM and IUCN, 2012; IFC, 2012; Kiesecker et al., 2010).

The recognition that some categories of biodiversity are too valuable to society to consider within an offsets scheme leads to questions around how to define the threshold between what is and what is not acceptable to include in an offset scheme. More specifically, what types of biodiversity loss is society willing to bear through the course of sustainable development and what are acceptable trade-offs if such loss occurs? Whilst there are also technical limits to what it is possible to recreate as an offset (Gibbons and Lindenmayer, 2007; Morris and Barham, 2007), which prevent certain classes of biodiversity from being compensated with like-for-like offset transactions, like-for-unlike (or out-of-kind) offset transactions may be permitted in countries where strict equivalence is not required in these circumstances provided that an acceptable trade-off is available that will deliver net benefits to society.

Upper limits to biodiversity loss are not present in all schemes (TBC, 2012) and where they are defined it is typically not a binding constraint on the policy (BBOP, 2012). A jurisdiction is usually able to exercise some discretion in permitting developments that cause biodiversity loss in cases where, for example "no practical alternative exists" or "overwhelming

socio-economic benefits occur" (TBC, 2012). Where upper limits are specified, they are based on either:

- qualitative statements around the exceptionality of the biodiversity features
- quantitative thresholds derived from an analysis of irreplaceability and vulnerability (e.g. IFC Performance Standard 6) or
- biodiversity retention targets (e.g. as derived from South African offset policy objectives).

Lower bounds for inclusion

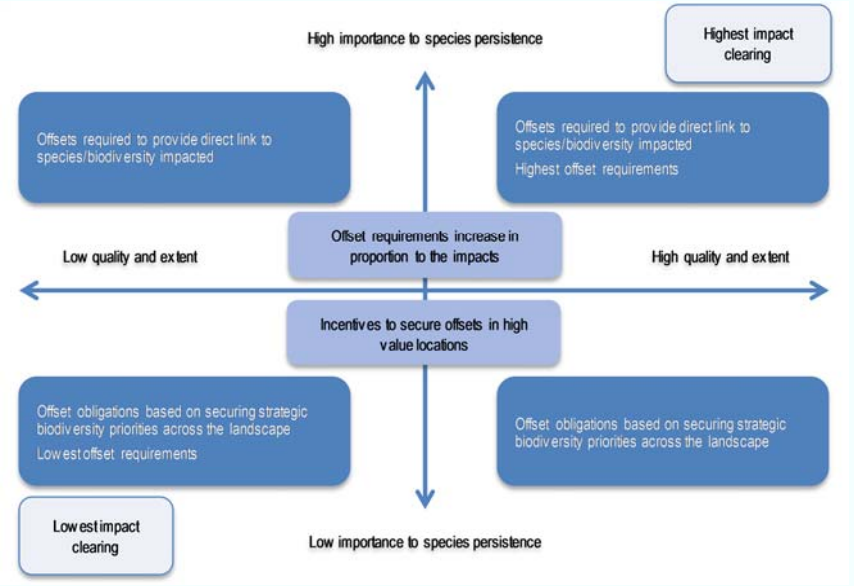
Some programmes exclude certain sectors from liability under biodiversity offset programmes though this should only be done where the costs of including additional sectors are prohibitive. Under the German Impact Mitigation Regulations, compensation requirements do not apply to land-use change in the agricultural, forestry and fishery sectors as where activities are in line with codes of best practice. In the US Compensatory Wetlands Mitigation programme, many routine farming activities are exempted from compensation requirements and wetlands already converted to cropland are generally not subject to regulation. Exemptions in other programmes also apply to projects involving public safety, sustainable timber harvesting and for small projects (Crowe and ten Kate 2010; DPCD, 2013). If a sector is not covered by an offsets programme, policies should be developed to help minimise its net biodiversity impacts, consistent with contributing to the delivery of a jurisdiction's broader biodiversity objectives.

Where projects are in covered sectors, offsets programmes typically reduce the rigour of the assessment process and the offset requirements for projects with less severe impacts on biodiversity (Box 4.1). In the US Compensatory Wetlands Mitigation programme, the overwhelming majority of the 70 000-80 000 annual applications have low risk to biodiversity. Low-risk applications are able to use a simple area-based indicator of the land affected whereas more rigorous analysis is required for projects with a larger environmental impact. Differentiating regulatory compliance in this way also recognises that regulatory costs can disproportionately affect small and medium-sized businesses where the relative impact of costs of complying with regulation can be higher than for larger businesses.

Box 4.1. **Risk-based regulatory pathways for Native Vegetation Regulation in Victoria, Australia**

In Victoria, Australia, 10% of planning applications are responsible for 76% of the permitted clearing of native vegetation (DSE, 2012). The regulatory process differs for developers according to the assessed risk of the proposed biodiversity loss at the development site. Risk is defined by the size of the proposed clearing (extent risk) and the likelihood that it will have an impact on the persistence of rare or threatened species (location risk). Applications to remove native vegetation are classified as low, medium or high risk. Where applications to clear native vegetation fall into the low risk category, the equivalence rules that apply are less specific than in the case for applications in the medium and high risk categories and consequently the costs of compliance are lower for low-risk projects. For certain classes of low-risk applications, comprehensive site assessments are not required and simplified, low-cost, "over-the-counter" offsets are available under a streamlined process (DSE, 2012). The regulatory requirements for applications proposing higher severity biodiversity loss increase in proportion to the proposed impacts where environmental impact assessments may be required.

Figure 4.1. **Characteristics of native vegetation that determine its biodiversity value**



Source: DEPI (2013b), "Reforms to Victoria's Native Vegetation Permitted Clearing Regulations: Amendments to the Victoria planning provisions".

Equivalence

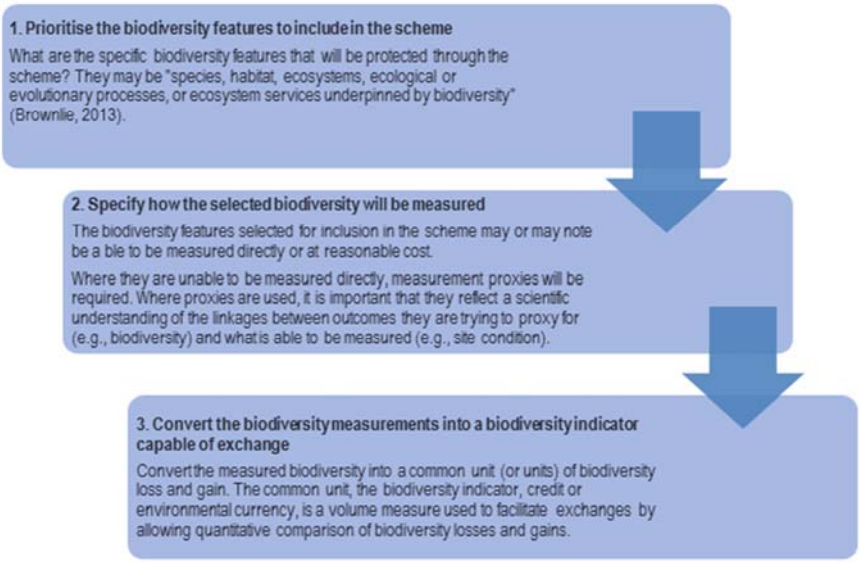
As no two areas are ecologically identical, designing offsets requires assessment of how to achieve biodiversity benefits at the offset sites that are equivalent to losses at the impact site. Evaluating the ecological equivalence between biodiversity loss and offset sites is a two-stage process. Biodiversity is measured at the biodiversity loss site and an offset requirement is then calculated to meet the objectives of the scheme, based on the measured loss. The offset requirement may adjust the size or scope of a biodiversity offset relative to the measured biodiversity at a clearing site, to account for the risk that an offset will not be delivered, time lags and other differences in composition between the clearing and offset sites. Determining the ecological equivalence of biodiversity loss and gain sites therefore requires consideration of how to:

- measure biodiversity
- define acceptable trade-offs between biodiversity of different types and locations
- manage the risk that biodiversity offsets are not delivered in the future
- account for time lags in the delivery of biodiversity offsets.

Measuring biodiversity

The basis for evaluating equivalence is the measurement of biodiversity at the development and offset sites. Biodiversity indicators are used in offsets programmes to provide a representative picture of the environmental conditions at a site (Regan et al., 2002) and to objectively compare sites in prospective offset exchanges. The complexity of biodiversity means that there is “no universal measure or indicator of biodiversity or ecosystem state” (Failing and Gregory, 2003) so jurisdictions must make choices about the types of biodiversity that they will prioritise for measurement and inclusion in an indicator (ICCM and IUCN, 2012). Some programmes prefer the use of coarse measures of biodiversity to facilitate simpler exchanges whereas others have opted for more a detailed representation of biodiversity through more fine-scale measurement of individual characteristics (Thomas, Brandão and Chomitz, 2004). Successful indicators capture the key components of biodiversity that must be protected, according to regulatory requirements, or in the absence of such requirements, that society wants protected. These choices may be informed by the types of biodiversity and ecosystem services that are valued by stakeholders, the latest scientific understanding and the availability of data to populate the indicator at a reasonable cost/benefit ratio (Figure 4.2).

Figure 4.2. **A general process for creating a biodiversity indicator**



Biodiversity indicators used in offset schemes typically try to capture information on ecosystem types, priority species or ecosystem services. Indicators for ecosystem types and species are the most common, owing to the availability of tangible and cost-effective measurement techniques. The area of a particular ecological vegetation class[1] or the area of threatened species habitats, often adjusted for site quality, are biodiversity indicators that may be produced in a reasonable timeframe and cost (Table 4.2). Area-based indicators for ecosystem type and threatened species are used in the Legal Forest Reserve System in Brazil; Compensatory Wetlands Mitigation and Conservation Banking in the United States; Impact Mitigation Regulation in Germany (*Biotopwertverfahren*); the Cossure habitat banking pilot in France; the BioBanking in New South Wales, Australia (Bioindicator); and the Environmental Offsets Policy in Queensland, Australia (Biocondition). It is common to supplement area-based measurements with information on distinctive biodiversity features that are not sufficiently captured in the initial assessment. The indicator used in the Colombian biodiversity offset pilot programme uses a “coarse-filter/fine-filter” methodology that maps vegetation characteristics with the “coarse-filter” then applies a “fine-filter” to capture individual species with specific habitat requirements (Saenz et al., 2013). Similarly, in the English offset pilot programme, the measurement approach is based on habitat area but, additional provisions are made for hedgerow habitats. Hedgerows “contribution to biodiversity in the landscape is far greater per unit of area

than even the most biodiversity rich habitats" and therefore a simpler, area-based assessment would ignore their important and unique contribution (DEFRA, 2012).

Table 4.2. **Criteria or assessing equivalence in the BioBanking Programme in New South Wales, Australia**

Criteria	Description
Area	Site area measured in hectares (ha).
State and national priorities	Determined according to listed threatened ecological communities.
Regional value	Determined according to vegetation type conservation status. Generally vegetation types that are greater than 70% cleared or that are listed as either an endangered ecological community or a critically endangered ecological community cannot be developed. Biobanking uses a classification system for ecological communities incorporating 12 vegetation formations, 99 vegetation classes and more than 1 600 vegetation types.
Landscape value	Assessment of the impacts on the site performed from the spatial configuration of its vegetation based on: – the change in the percentage of native vegetation cover within 1 000 ha and 100 ha assessment circles – the change in connectivity of the site's vegetation with surrounding vegetation – the total adjacent remnant area (i.e. the area of native vegetation that is not in low condition and that is linked to the next area of native vegetation).
Site value	Determined from surveys of vegetation condition on the site. To determine the "site value" score, vegetation condition is assessed from ten habitat ecological attributes and is adjusted against benchmark values.
Threatened species	Assessed according to a targeted survey; their association with vegetation type and other habitat features; their geographical distribution; and information from the *Threatened Species Profile Database*.
Management actions	Tailored for each biobank site and its threatened species, may include: conservation grazing; controlling weeds and feral animals; replanting; and controlling human disturbance.
Calculation of ecosystem credits	Number of ecosystem credits required to offset development: $\left(\frac{Loss\ in\ Site\ Value * Area}{Threatened\ Species\ Response\ to\ Management\ Actions}\right) + (Loss\ in\ Landscape\ Value * Area)$ Number of ecosystem credits created at a biobank site: $(Improvement\ in\ Site\ Value * Area) + (Improvement\ in\ Landscape\ Value * Area)$

Source: DECCW (2009), *The Science Behind Biobanking*, www.environment.nsw.gov.au/resources/biobanking/09476biobankingscience.pdf.

The use of ecosystem services indicators in offset schemes is more limited relative to those based on ecosystem types and threatened species (ICCM and IUCN, 2012). Ecosystem services indicators try to capture information on the flow of benefits that humans receive from biodiversity. The Millennium Ecosystem Assessment (2005) categorises the benefits of ecosystem services as "provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling." Difficulty in measuring many ecosystem services has proved to be an obstacle to their inclusion in biodiversity offset indicators (WRI, 2014). Indicators of ecosystem services are mostly used to provide compensation to local stakeholders affected by biodiversity loss at a development site, particularly in developing countries. Where development negatively affects the level of tangible ecosystem services such as water purification or the level of forest products for local stakeholders, offset schemes sometimes provide compensation for these losses. The Potgietersrust Platinums Limited mine in South Africa, for example, provides local women with access to the offset for the sustainable collection of firewood (Anglo Platinum, 2009). The IFC Performance Standards also contain provisions for identifying priority ecosystem services through a stakeholder engagement process and requirements for compensation under certain conditions (IFC, 2012).

Most offset programmes provide guidance for selecting an indicator for biodiversity assessments; however, only a few jurisdictions, including South Africa and New South Wales, Australia, enforce the use of a specific methodology. Other programmes allow developers some flexibility when selecting an indicator. The Impact Mitigation Regulation in Germany has more than 40 published methodologies available for use (Darbi and Tausch, 2010) and in Canada, the Policy for the Management of Fish Habitat provided little guidance to regulators as to how to calculate impact and compensation, so regional differences have arisen (Madsen, Carroll and Moore Brands, 2010). Regional differences are also present in the Netherlands and Sweden, where the decentralisation of policy implementation details has meant that regional approaches to biodiversity assessments are applied with varying degrees of sophistication (ICF GHK and BIO Intelligence Service, 2013). In the US Compensatory Wetlands Mitigation programme, a simple area-based measure, case-by-case professional judgments, a functional equivalency measure or some combination of the three different approaches are all permissible in different contexts (Kelly, 2013). And in France, the Ministry of Environment, Sustainable Development and Energy has published several guides on equivalence (MEDDE, 2013). More complex biodiversity indicators offer greater insight into the state and significance of biodiversity

at a site whereas simple indicators provide basic, more indicative measures of biodiversity. Simple indicators will usually be easier and less costly to implement but may risk overlooking important biodiversity features that could compromise ecological equivalence. The choice of indicator is informed by a trade-off between the benefits of including more detail in biodiversity measurements and the efficiency gains for transactions of simpler, more fungible indicators (Thomas, Brandão and Chomitz, 2004).

Equivalence in type

Having established a biodiversity indicator, programmes may stipulate additional conditions on offset exchanges that are required to deliver acceptable outcomes for society. Offsets programmes may allow replacement of only the specific type of biodiversity that is lost at a development site or may provide for more flexibility in weighing-up the equivalence of proposed offset exchanges.

So-called in-kind offsets[2] aim to directly replace the provision of habitats, ecosystem functions, values or other attributes that are affected by development whereas out-of-kind compensation[3] allows for more flexibility in the composition of offsets relative to the characteristics of the loss site (McKenney and Kiesecker, 2010). An in-kind offset may require conservation of the same type of biodiversity as measured by a scheme's indicator whereas out-of-kind compensation may, for example, allow for the restoration of valuable upstream water flows rather than recreation of a wetland as is sometimes permissible in Wetlands Compensatory Mitigation in the United States (ten Kate, Bishop and Bayon, 2004). The distinction between in-kind offsets and out-of kind compensation is, however, highly dependent upon the complexity of the biodiversity indicator used in a scheme. Where a simple, area-based indicator is in use, for example, an in-kind offset could comprise quite different biodiversity than the clearing site in reality if it was measured using an indicator that captured more detailed information. It follows that stipulating the use of in-kind biodiversity offsets will not necessarily result in restoring the functional performance of the biodiversity at the development site (Bull et al., 2013).

In-kind offsets are often preferred to out-of-kind compensation where there is a risk of irreversible damage to a species or ecosystem (Quétier and Lavorel, 2011). For this reason, they are frequently observed in schemes whose objectives include the protection of threatened species habitat. The Conservation Banking scheme in the United States, for example, requires offsets to conserve threatened species' habitat "that contributes to the overall conservation strategy of the species, which may be located in a corridor or core area that supports essential breeding habitat" (USFWS, 2003). Similarly in France, the National Doctrine specifies that offsets may only

comprise the same type of habitats, species and/or corridors "in order to generate an ecological gain at least as important the residual impacts" on biodiversity at the development site (Courtejoie, 2013).

Many programmes state a preference for the use of in-kind offsets including those in Australia, Brazil, the United States and the European Union, but implementation permits the use of out-of-kind compensation in limited circumstances. The use of out-of-kind compensation is complicated by the need to compare the relative conservation values of two dissimilar biodiversity sites. To address issues of comparability, programmes frequently require out-of-kind compensation to adhere to the principle of trading-up whereby compensation is limited to biodiversity that is at least as good or more valuable from a conservation perspective than that lost at the clearing site (Quetier and Lavorel, 2011). Under the Environmental Offsets scheme in Australia, for example, offsets for threatened species that contain a different habitat to that being lost at the development site (e.g. breeding habitat for foraging habitat) are only permitted when the proponent is able to demonstrate a greater conservation benefit (Flanigan, 2013). Implementation of the trading-up principle necessitates the classification of biodiversity according to a measure of its conservation significance. In the biodiversity offset pilots in England, biodiversity is classified according to its conservation distinctiveness and offsets must contain habitat in the same or higher distinctiveness band as the loss site. The Wetland Mitigation Policy in Alberta, Canada allows for both trading-up and trading-down through a system of replacement ratios that "seek to provide an incentive to avoid the loss of high value wetlands" (Alberta Government, 2013). The system requires categorisation of the development site's wetland into one of four value bands; it then offers a discount to the size of the required compensation if it is of greater value than the development site and increases the size of the required compensation if it is of lesser value (Table 4.3).

Table 4.3. **Replacement ratios for wetlands compensation in Alberta, Canada**

	Value of replacement wetland			
	D	C	B	A
Value of lost wetland				
A	8:1	4:1	2:1	1:1
B	4:1	2:1	1:1	0.5:1
C	2:1	1:1	0.5:1	0.25:1
D	1:1	0.5:1	0.25:1	0.125:1

Note: The highest value wetlands are classified as A and the lowest value wetlands as D.

Source: Alberta Government (2013), *Alberta Wetland Policy*, http://aep.alberta.ca/water/programs-and-services/wetlands/documents/albertawetlandpolicy-sep2013.pdf.

Whilst biodiversity offset policy is usually based on the conservation of biodiversity on the ground, compensation options for development impacts sometimes allow for non-restorative replacement (ten Kate, Bishop and Bayon, 2004). Non-restorative compensation relies on the indirect impacts of funding to deliver biodiversity benefits rather than the direct benefits that flow from funding conservation activity. They may deliver funding for programmes focusing on such things as biodiversity research and development, capacity building and education. The Environmental Offsets scheme in Australia, for example, allows up to 10% of non-restorative compensation (Department of the Environment, 2013) and Alberta's Wetlands Policy allows them where they support the state of wetlands management and science in the province. To this end, the Albertan policy provides for the funding of "provincial level monitoring of wetlands, specified wetland inventory work and data acquisition public education and outreach programmes" (Alberta Government, 2013).

Programmes may allow non-restorative compensation in circumstances where it is better able to target the limiting factors affecting biodiversity conservation in an area. In Indonesia, British Petroleum (BP) chose to invest in an abandoned environmental training centre as it decided that the local lack of capacity for biodiversity conservation was more important than the environmental footprint of its operations (ten Kate, Bishop and Bayon, 2004). The risk associated with non-restorative compensation is that it may abandon the link between impact and compensation and thereby undermine its efficacy. The implementation of the Compensatory Afforestation programme in India has been criticised on these grounds as it permits the proceeds of certain payments in-lieu to be used for the construction of infrastructure, capacity building and office support at the expense of afforestation activities (Kohli et al., 2011). Transparency and accountability around non-restorative compensation are therefore pivotal.

Equivalence in location

Biodiversity offsets reposition some of the benefits of biodiversity in space from the development site to the location of the offset. Some biodiversity sites are of greater conservation significance than others so locating a biodiversity offset is often a compromise between providing compensation for the directly affected area and optimising conservation outcomes across space.

From an ecological standpoint, the location of a biodiversity offset affects its contribution to the broader landscape as well as the level of risk that it will become depleted or non-viable over time. It may be possible for biodiversity offsets to be strategically positioned in space to enhance existing conservation networks and corridors and thereby improve the

overall portfolio of biodiversity sites within a jurisdiction (Girvetz et al., 2012; Saenz et al., 2013). McKenney and Kiesecker (2010), for instance, argue that the conservation outcomes from an offset may be improved where "losses of a particular common habitat type could be offset in a habitat of higher priority in the region", suggesting that there is potential for investments in offsets to be optimised alongside a jurisdiction's prevailing conservation activities and priorities. Consolidation of offsets into contiguous and larger tracts of land may also offer economies of scale that lower the costs of their creation and maintenance (eftec et al., 2010). From a distributional standpoint, the loss of biodiversity at the development site may be felt more acutely by individuals and the environment closest to the loss. For the individuals or community affected, this is particularly true of the ecosystem services that affect the local amenity and their employment or business prospects (BBOP, 2009; DEA&DP, 2011).

Offset programmes typically require developers to maintain a credible link between the biodiversity loss and gain by requiring offsets to be within a boundary linked to the location of the biodiversity loss rather than providing absolute spatial flexibility (Box 4.2). In the EU, compensation for damage to Natura 2000 sites must occur in the same bio-geographical region in the same member state or the same bird migratory path (McKenney and Kiesecker, 2010). In Brazil, forest offsets must be located within the same watershed as the clearing (Madsen, Carroll and Moore Brands, 2010) and Conservation Banking guidance in the United States supports off-site banks only where they are within a geographically restricted, ecological service area (USFWS, 2003). Some jurisdictions have integrated sophisticated spatial planning tools in scheme designs to assist in selecting sites for biodiversity offsets. In the Western Cape province of South Africa, receiving areas for biodiversity offsets have been defined based on regional or local conservation priorities as determined through a process of biodiversity mapping and threat assessment (Brownlie and Botha, 2009; Treweek et al., 2009). Elsewhere, strategic environment assessments and Development by Design approaches have sought to identify conservation priorities within a landscape in advance of development impacts occurring so that offsets may be designed and located in recognition of the cumulative impacts of planned development activities on biodiversity; these issues are discussed further in Chapter 2.

Spatial restrictions on the location of offsets have an effect on the availability of offsets, in particular, the incentives for the supply of biobanks. If a biobank has greater reach in terms of the possible developments it can service, it may make the project more economically viable and may allow it to be placed in regions where landscape-level biodiversity outcomes are more optimal (Wissel and Wätzold, 2010). Larger

service areas for biobanks may increase the likelihood of biobanks' service areas overlapping, which increases competitive pressures among offset suppliers. Biobanks, however, tend to be concentrated in areas where development pressures are likely to lead to demand for credits (Hough, 2013). The level of competition among offset suppliers will therefore differ across space. In some cases, the combined service areas of biobanks may not overlap at all, leading to the possibility of monopoly suppliers; in other areas, there may be no supply at all. Partly for these reasons, banking the US wetlands mitigation is not mandatory, but preferred (DOD and EPA, 2008), as the ability to use multiple compensation options provides the only option in some areas and additional competitive pressure in others to what could otherwise be a monopoly supply.

Box 4.2. **Reforming the location of compensation projects in US compensatory wetlands mitigation**

The US Compensatory Wetlands Mitigation programme was originally based on the principle of compensating the directly affected area. However, after completing a thorough review of compensation projects, the National Research Council (2001) critiqued the principle of compensating the directly affected area as encouraging "reactive, piecemeal mitigation projects with high failure rates, and for inadequate consideration of the watershed context."

In response, the programme was reformed to require mitigation decisions to be made from a watershed perspective in which the "type and location of compensatory mitigation follows from an analytically based watershed assessment to assure that the proposed compensation furthers watershed goals" in preference to providing compensation for the local area (Madsen, Carroll and Moore Brands, 2010). Assessments now typically involve an "intense regional planning effort" which takes in the views of many stakeholders in order to maximise the environmental benefits to the watershed (USACE, 2008).

Equivalence in time

Evaluating equivalence in time involves comparing the point in time when biodiversity losses occur with when the biodiversity benefits that offset them are realised. Biodiversity offsets that are delivered in 20 or 30 years, for example, are intuitively less valuable to society than if those same biodiversity offsets were already fully functioning today (ICCM and IUCN, 2012). A biodiversity offset is typically defined by the level of ecological functionality that it will have when it reaches ecological maturity. If offsets have not reached ecological maturity when they are used to offset the loss of biodiversity at a development site, there is a risk that the biodiversity outcomes expected at the offset site do not occur as the site

matures; this is known as delivery risk (DEFRA, 2012). Even if offsets prove to be successful in the future, there is a deficit of biodiversity in the landscape until the offset reaches ecological maturity which, for some ecosystem types, may take decades or more (Table 4.4). Temporary reductions in biodiversity can also increase the risk of unintended, irreversible biodiversity outcomes such as species extinction (Evans et al., 2013).

Table 4.4. **Relative time scales for the recreation of a selection of habitats in Europe**

Ecosystem type	Time scale	Notes
Temporary pools	1-5 years	Even when rehabilitated, may never support all pre-existing organisms.
Eutrophic ponds	1-5 years	Rehabilitation possible provided adequate water supply. Readily colonised by water beetles and dragonflies but fauna restricted to those with limited specialisations.
Mudflats	1-10 years	Restoration dependent upon position in tidal frame and sediment supply. Ecosystem services: flood regulation, sedimentation.
Reedbeds	10-100 years	Will readily develop under appropriate hydrological conditions. Ecosystem services: stabilisation of sedimentation, hydrological processes.
Grey dunes and dune slacks	100-500 years	Potentially restorable, but in long time frames and depending on intensity of disturbance. Main ecosystem service: coastal protection, water purification.
Ancient woodlands	500-2 000 years	No certainty of success if ecosystem function is sought – dependent upon soil chemistry and mycology plus availability of propagules. Restoration is possible for plant assemblages and ecosystem services (water regulation, carbon sequestration, erosion control) but questionable for rarer invertebrates.
Blanket/raised bogs	1 000-5 000 years	Probably impossible to restore quickly but will gradually reform themselves over millennia if given the chance. Main ecosystem service: carbon sequestration.
Limestone pavements	10 000 years	Impossible to restore quickly but will reform over many millennia if a glaciation occurs.
Turloughs	10 000 years	Unable to recreate, but will form if a glaciation occurs.

Source: Morris, R. and P. Barham (2007), "The Habitats Directive as a driver for sustainable development in the coastal zone: The example of the Humber estuary".

Some programmes attempt to avoid delivery risk by specifying that offsets must be ecologically mature at the time the development-related loss occurs (Bekessy et al., 2010). Compensation for damage to the Natura 2000 network, for example, must be in place before impacts occur at the development site "unless it can be proved that this simultaneity is not

necessary to ensure the contribution of this site to the Natura 2000 network'' (McKenney and Kiesecker, 2010). Securing biodiversity outcomes in advance of development impacts is the basis of the biobanking approach to offsetting used in Australia, France, Germany, the Netherlands, Switzerland and the United States, and the proponent-led biobanking national programme in Canada.[4] However, biobanking programmes often allow some sales of biodiversity credits to occur in advance of their creation to help finance the project. For example, the regulations for US Compensatory Wetlands Mitigation express a preference for credits not to be sold until full aquatic function is established, but "where there is adequate financial assurance and where the likelihood of the success of the bank is high" a percentage of credits are able to be sold in advance. Typically, around 15% of credits are made available for immediate sale following the creation of the mitigation bank instrument or upon the placing of a conservation easement on the land (Kelly, 2013). The Environmental Law Institute (2002) has estimated that 90% of banks sell credits before achieving any performance standards relating to their aquatic function, meaning that delivery risk remains an important issue.

Where delivery risk is present, various measures may be implemented to mitigate the risk that biodiversity outcomes will not be delivered. The benefits of mitigating delivery risk need to be assessed against their costs, however, as going to significant expense to manage the delivery risk of relatively simple to recreate environments or offsets involving averted risk is unlikely to deliver net benefits and so should be avoided (BBOP, 2012; DEFRA, 2012). The delivery risk associated with more difficult to recreate offsets may justify the implementation of more costly risk mitigation measures, including the application of offset replacement ratios or using insurance or other financial products (Box 4.3).

In addition to accounting for delivery risk, some programmes require compensation for the temporary loss in biodiversity that occurs while an offset is maturing, including in England, Germany and the Netherlands (DEFRA, 2012). The use of time-lag replacement ratios means that it is more expensive to secure biodiversity offsets that mature sometime in the future relative to those that already exist. They increase the relative attractiveness of offsets that are already mature (e.g. biobanking sites) or close to maturity as they will be subject to no, or lower, replacement ratios and decrease the attractiveness of offsets that take a long time to mature as they will be subject to higher replacement ratios. In England, time-lag replacement ratios range between 1.2 for an offset with 5 years to target condition and a maximum of 3 for an offset with 32 years and above to target condition (DEFRA, 2012). In the Netherlands, guidance suggests the use of time-lag replacement ratios only when the time to maturity for the

offset exceeds five years. A replacement ratio of 1.33 is applied for offsets with a time to maturity of between 5 and 25 years and 1.67 for those with time to maturity between 25 and 100 years (de Bie and van Dessel, 2011).

Box 4.3. **Mitigating delivery risk with offset replacement ratios and financial products**

Offset replacement ratios aim to mitigate delivery risk by requiring developers to secure offset(s) that are multiple times the measured size of the biodiversity loss. The size of the replacement ratio applied is usually related to the assessed risk that an offset will successfully mature (McKinney and Kiesecker, 2010). Guidance material for the biodiversity offset pilots in England, for example, recommends multipliers of ten times the measured size of the clearing site for habitats that are classified as having a "very high difficulty of restoration/recreation" (DEFRA, 2012). The level of delivery risk mitigation offered by replacement ratios is contingent upon the correlation between the biodiversity outcomes at offset sites. In reality, biodiversity outcomes are often closely correlated, so it is difficult to eliminate delivery risk using replacement ratios. Creating offsets using different ecological restoration techniques or dispersing offset sites across space may contribute relatively more to delivery risk mitigation (Moilanen et al., 2009).

Insurance and other financial products (e.g. letters of credit, environmental performance bonds) may be used to mitigate delivery risk through financial markets. The party liable for the delivery risk purchases insurance, or a similar product, against the possibility that the offset site fails to deliver the required biodiversity outcomes. If an offset fails, then the insurance pay-out may be used to improve biodiversity at the same or another site in order to meet the original biodiversity objectives (DEFRA, 2012). In Canada's "Fisheries Productivity Investment Policy: A proponents guide to offsetting", letters of credit are required on a case-by-case basis to ensure the completion of offset measures and offset site monitoring over time. Based on a developer's estimated offset costs, the regulator may request financial surety to cover the direct costs of environmental restitution and any additional expenses that the regulator incurs in the event that the financial security is drawn upon. The use of financial instruments is a relatively new concept for biodiversity offsets but is regularly applied in other comparable environmental policy problems. In the mining sector, for example, financial security is generally required to provide a guaranteed level of funding for site rehabilitation at the conclusion of a firm's operations, even if the company collapses (Burgin, 2008). An important consideration when using financial mechanisms to manage delivery risk is that they create time lags between when a regulator becomes aware that an offset has failed and the time of the biodiversity loss at the development site. Where issues of species persistence are present, using financial risk mitigation may need to be tempered as the time lags involved can increase the risk of unintended, irreversible biodiversity outcomes (e.g. species extinction) (Evans et al., 2013).

Additionality

Biodiversity offset programmes rely on ecological improvements at offset sites to compensate for biodiversity losses elsewhere. If these improvements would have taken place anyway, using them to offset biodiversity losses jeopardises the equivalence of an exchange. Conservation measures already required by law, such as noxious weed control, may be required even in the absence of offsets programmes, so allowing them to contribute to an offset overstates their actual contribution to conservation. The principle of ensuring that offsets comprise demonstrably new contributions to conservation is known as additionality (ICF GHK and BIO Intelligence Service, 2013).

Additionality is a widely incorporated principle in biodiversity offset schemes. In the Netherlands, for example, the additionality of biodiversity offsets is a legal requirement under the Dutch Nature Conservation Act (de Bie and van Dessel, 2011) and in England, the Guiding Principles for Biodiversity Offsetting state that "offsets should not being used to deliver something that would have happened anyway." Implementation of the additionality principle requires the:

- definition of a baseline scenario
- specification of conservation actions that may contribute to offset creation.

The baseline scenario

The reference point against which conservation actions are measured is called the baseline or counterfactual scenario. Baseline scenarios seek to plot a hypothetical, plausible trajectory for biodiversity conditions if an offsets policy were not in place. Baseline scenarios for biodiversity offsets are usually informed by looking at the pre-existing land management rights and obligations of a landowner in combination with more general information on biodiversity trends. A number of tools are available to help inform these assessments including land-use regulations, biodiversity maps and national biodiversity strategies and action plans (BBOP, 2009). In New South Wales, Australia, the baseline scenario is defined by the minimum legislative standard for land management required of landowners under different pieces of state legislation. Biodiversity offsets may only include conservation actions that go beyond the legislated minimum requirement[5] (DECCW, 2009). In the Swedish offsets programme, conservation measures required by law or otherwise listed in public management plans for protected areas are normally not counted as additional for biodiversity offsets (ICF GHK and BIO Intelligence Service, 2013). In the US Conservation Banking programme, "land used to establish conservation

banks must not be previously designated for conservation purposes" including sites which provide habitat for federally listed threatened species that are legally protected through other federal, state, tribal or local programmes (USFWS, 2003).

Offset schemes also use the source of funding as a measure of additionality where the use of public funds to finance the creation of a biodiversity offset is usually not allowed. Under German Impact Mitigation Regulations, Environmental Compensation for Land-Use Change in Forested Areas Program in Mexico and Biobanking in New South Wales, publicly funded restoration projects are unable to subsequently become offsets (ICF GHK and BIO Intelligence Service, 2013). In US conservation banking, the use of federal government money to establish a bank does not preclude its participation in the scheme, but the number of credits allocated for sale is made pro rata according to the level of private funding. A conservation bank that creates ten credits but was financed with 30% federal government money, for example, would only be allocated seven credits for sale, reflecting the proportionate contribution of private funding (USFWS, 2003).

Biobanking sites exist prior to development impacts occurring and so owners require assurances that their site will be officially recognised as being additional. In France, the Ministry of Environment, Sustainable Development and Energy has formally recognised the additionality of the habitat banking experiment that was launched in 2008 in Saint-Martin-de-Crau. Biodiversity offset management plans are used as the assurance mechanism in the pilot schemes in England to verify additionality where information on a site's baseline condition and legal and regulatory requirements must be approved by the regulator before the conservation work is started (DEFRA, 2012). The lack of similar arrangements at present in the Netherlands has been identified as a barrier to the development of habitat banks (ICF GHK and BIO Intelligence Service, 2013).

What is additional conservation activity?

Additional land management actions are those that make a measurable contribution to the achievement of a programme's biodiversity objectives relative to the baseline scenario. The types of land management that may contribute to offset creation differ among programmes, but may include:

- conservation of existing biodiversity
- restoration of existing biodiversity
- enhancement of existing biodiversity
- recreation of biodiversity.

A key difference between jurisdictions in defining additionality is the treatment of threats to biodiversity. Some jurisdictions take a dynamic view of the biodiversity baseline scenario, meaning that the biodiversity condition at a site may be projected to deteriorate over time based on an assessment of risk. Risks to biodiversity persistence may include the level of legal protection at a site and the probability that its land-use zoning will change over time. If such risks can be mitigated by protecting the existing biodiversity site, then some jurisdictions recognise the site as a protection or averted risk offset. In the Alberta Wetlands Policy, South African biodiversity offsets, US Wetlands Compensatory Mitigation, Brazil, compensation for impacts on Natura 2000 sites in the EU, New Zealand and several schemes in Australia, protection offsets are allowed (European Commission, 2001; Kelly, 2013; McKenney and Kiesecker, 2010; Norton, 2009). In Germany and England, offsets may only be created by expanding or restoring biodiversity but the use of protection offsets is not allowed as their definitions of additionality do not recognise the protection of existing biodiversity (DEFRA, 2011). Where jurisdictions permit protection offsets, the definition of what constitutes a risk to biodiversity persistence is a critical factor in determining additionality. Loose or generous definitions of risk can lead to a large proportion of sites being eligible for classification as a protection offset where, on balance, it may be difficult to justify them as contributing additional biodiversity protection. In Brazil, simplifying assumptions in the policy design process means that all natural habitats are classified as at risk so all natural habitat sites are eligible for use as protection offsets. The policy design has raised questions about the additionality of offsets in Brazil and consequently how scarce offsets finance may be better targeted (eftec et al., 2010).

Permanence

Biodiversity losses at development sites can be long-lasting, and in some cases permanent. Biodiversity offsets should provide conservation benefits over a time period which is commensurate with the duration of biodiversity loss. To provide certainty over their longevity, offsets should be supported by legal mechanisms that secure site tenure and financial assurances to ensure that the resources will be available to conserve biodiversity for the life of the project.

Security of land tenure

Developers may be required to demonstrate the permanence of offset measures by securing land-use rights at the offset site for the duration of the offset project. Land-use rights may be secured through land acquisition and

ownership, or by contracting with third-party offset suppliers. Land acquisition for biodiversity offsets has proved difficult in a number of jurisdictions where land scarcity is a significant issue (e.g. England, the Netherlands and Switzerland) and in developing countries where development and food security priorities are prohibitive so securing offsets from existing landowners is often favoured (Morandeau and Vilaysack, 2012).

The sustainability of offset measures is often enhanced by the introduction of conservation covenants or easements on the offset site that bind future landowners to retain the offset. In the BioBanking programme in New South Wales, Australia and the Native Vegetation Regulations in Victoria, Australia, offsets are legally secured by amending the land title and recording land-use restrictions in the public Land Registry. Similarly, US conservation banking guidance notes that "the land within the bank … must be permanently protected through fee title or a conservation easement, with any land use restrictions set in perpetuity for the land legally established" (USFWS, 2003). In the biobanking pilot in France, the security of tenure at the Coussouls de Crau site was secured in an innovative way involving two distinct stages. CDC Biodiversité, a private biodiversity services firm, initially purchased 357 ha of land adjacent to a Natura 2000 site and the Coussouls de Crau natural reserve for conversion into a biobank. They then contracted out the land management activities to improve site biodiversity to the non-profit Provence Ecosystem Study Conservatory and the public Chamber of Agriculture for a 30-year period. CDC Biodiversité will reassume land management responsibility for the site after 30 years and has undertaken to guarantee the preservation of the land as a biobank from then on (Morandeau and Vilaysack, 2012).

Another approach sometimes used by developers to demonstrate permanence is to donate offset sites to a (usually) public conservation estate. In Madagascar, the Rio Tinto QMM offsets project converted six offset sites into protected areas, including three on-site offsets that were selected as avoidance zones from application of the mitigation hierarchy. Protection against subsequent land-use change was then delivered through amendments to land title where they financed the legal conversion of the offset sites into protected areas under Malagasy law (ICCM and IUCN, 2012; Temple et al., 2012).

In France, the National Doctrine of 2012 provides that "The term management measures must be justified and determined based on the expected duration of the impact, the type of natural environment primarily targeted by the measure, management arrangements and time deemed necessary to achieve the goals". Specifically, the A65 Pau-Langon motorway is subject to countervailing measures longer than 60 years. For the weaker and more limited in time impact development projects, this period lasts 30 years.

Box 4.4. **Securing land for biodiversity offsets in the Western Cape Province, South Africa**

Developers are able to demonstrate a biodiversity offset's security of tenure in Western Cape Province, South Africa in one of three ways. The first two options for securing tenure are relevant where the proponent is the landowner of the offset site whereas the third is used when the proponent secures an offset from a third-party provider.

1. Donating the site to an approved conservation agency: Where developers own a site that will be used as an offset, they may secure it in perpetuity for biodiversity conservation by donating it to the provincial or national conservation agencies, CapeNature and SANParks, or to an approved public benefit organisation with the capability to manage the site over the longer term. Part of the agreement to transfer the land involves providing a mutually agreed level of funding for the management, monitoring and auditing of the site in perpetuity.
2. Conservation servitudes: Conservation servitudes are legal instruments that act in a similar way to conservation covenants or easements. When placed over a site, a conservation servitude in the Western Cape binds current and future landowners to certain defined conservation obligations by making amendments to the land title. Both on-site and off-site offsets may be secured in this way, and the regulator again requires a funding endowment to accompany the conservation servitude to guarantee the availability of funds for the management, monitoring and auditing of the site in perpetuity.
3. Purchasing or attaining rights to land that contains in-kind habitat: The proponent may demonstrate security of tenure by either purchasing land for conversion to an offset site or by securing certain land-use rights from a third-party offset provider. Where an offset is secured from a third-party provider, the developer must demonstrate with a legally enforceable commitment that the site will become subject to a conservation servitude in the future. In the Western Cape, developers retain the legal liability for the biodiversity outcomes even in the event that they purchase it from a third-party provider.

Source: DEA&DP (2011), "Information document on biodiversity offsets".

Security of finance and management

The permanence of biodiversity outcomes at offset sites is contingent upon land managers having access to adequate financial resources to complete the necessary conservation actions over time. Many offsets programmes therefore require financial assurances from offset suppliers to provide certainty that sufficient funding will be available. The financial

instrument used to fund an offset project normally includes the necessary financial assurances. For programmes where perpetual land management is required, non-wasting endowment funds are a common funding instrument where the annual interest earned on the principal sum is used to fund ongoing land management (DOD and EPA, 2008). Programmes that require only finite periods of land management usually secure land management finance using a wasting endowment or trust fund (see below for a discussion of contingent payments) (DSE, 2012).

In the BioBanking scheme in New South Wales, Australia a biobanking agreement is made between a landowner and the New South Wales Minister for the Environment at the establishment of a biobank site which includes the details of the estimated land management costs in perpetuity. Funds from the sale of biodiversity credits are then paid into the publicly managed BioBanking Trust Fund to establish the principal sum necessary to generate enough interest to cover the future land management costs. Any additional proceeds from the sale of credits are paid to the landowner as a lump sum. The landowner receives annual management payments from the Trust Fund to implement the management actions. In the US Compensatory Wetlands Mitigation scheme, the bank instrument – a broad agreement between the bank owners and regulators – is used to specify how an endowment fund will finance the bank over time (Treweek et al., 2009). At the establishment of a new wetlands bank, the bank instrument must provide evidence of its financial security by:

- Securing an interim investment fund, which must be sufficient to manage the bank for its five-year launch period.
- Establishing a trust fund, that will collect the product of the bank's credit sales, assumed to occur during the bank's launch period. Its size is calculated to sustain the bank's operation.
- Establishing a board of trustees responsible for managing the bank's funds (DOD and EPA, 2008).

Monitoring, reporting and verification

Monitoring, reporting and verification (MRV) are integral parts of biodiversity offsets programmes. At the programme level, MRV is used to evaluate the success of the design in achieving programme objectives and should ideally be undertaken for several elements of an offsets programme, including its ecological, legal and operational, and distributional performance. Regular evaluations informed by MRV may be used to improve a programme design over time. At the project level, the MRV is essential for determining compliance with the conditions of development approval. For

the purposes of evaluating compliance at individual offset sites, an MRV framework should address each of the following (Quétier, 2013):

- Measurement of biodiversity outcomes: what is being monitored and what are suppliers liable to supply?
- Management: who is in charge of undertaking MRV?
- Finance: who is paying for the MRV?
- Auditing: who is validating the MRV?

In addressing each of these elements, an MRV framework should ensure that evidence is provided about what an offset supplier is liable to deliver through the project and a funded mechanism to establish whether or not it has occurred. A shortcoming consistently observed in the early implementation of offset schemes was that their design left regulators with insufficient information on what offset suppliers were supposed to deliver. The Government Accountability Office review (2005) of the US Compensatory Wetlands Mitigation scheme, for example, found that regulators did not have an effective approach to oversight, in part because the requirements of compensatory mitigation in the permits was not always specified. Similarly, in Germany, 23 out of 145 compensation projects subject to independent review were unable to be evaluated for success as they had either vague project objectives or implementation was unable to be verified (Tischew et al., 2010). In Canada, the achievement of no net loss in the Policy for the Management of Fish Habitat could not be assessed for 88% of 124 cases reviewed because the objective was rarely stated in permit authorisations and "performance criteria were often non-existent or too vague to be relevant" (Harper and Quigley, 2005).

The basis of an MRV strategy is the agreement specifying what the offset supplier is bound to do in creating the offset. These agreements may take numerous forms, such as conditions on development permits, and mitigation bank instruments or other forms of landowner contracts, depending on the institutional arrangements on which the system relies (see also Chapter 3). Whatever form they take, offset agreements must be clearly defined, transparent and enforceable in order to provide a robust foundation for MRV and compliance at both the policy and the individual site level.

A crucial element of any offset supply agreement and associated MRV strategy is how biodiversity outcomes are measured for the purposes of compliance. Offset supply agreements may be based on the supply of inputs or outputs that lead to biodiversity outcomes or on the biodiversity outcomes themselves (Box 4.5). Where there are differences between how regulatory compliance is measured and how the environmental success of a

biodiversity offset is evaluated, compliance with an agreement may provide only a poor indication of environmental success (Matthews and Endress, 2008). Such differences have driven many of the documented failures of offset projects in the past (Kenny, 2006). In the Biobanking scheme in New South Wales, Australia and the Native Vegetation Regulations in Victoria, Australia, offset supply agreements define regulatory compliance as the completion of pre-defined land management actions over time (DSE, 2012; NSW OEH, 2012). The land management actions included in these agreements may include the exclusion of livestock from an offset site, the erection of a fence, the planting of saplings and the control of pests and invasive species (NSW OEH, 2012). Delivery of biodiversity outcomes at these sites is therefore dependent upon the relationship between the completion of land management inputs and improvements in biodiversity condition. The bank instruments (i.e. offset supply agreements) used in the US Compensatory Wetlands Mitigation scheme contain pre-specified performance standards that, when met, trigger the release of credits for sale in the offset market. Performance standards are not uniform among all sites and may include such things as the survival rate of planted trees, the proportion of flora made up by native species and the number of exotic and weedy dominant species. Whilst these measures focus more on outputs than in the previous examples, they do not explicitly measure wetlands' functional outcomes and, where poorly specified, may again lead to situations of regulatory compliance but offset failure (Ambrose, 2010; NRC, 2001).

Box 4.5. **Input and performance-based agreements for biodiversity offsets**

Offset supply agreements are intended to reward suppliers based on the incremental impact that their management interventions have on the condition and extent of biodiversity at an offset site. Offset supply agreements that reward landowners based on the delivery of biodiversity outcomes – so-called performance-based contracts – are intuitively appealing as landowners receive payments only after the verification of biodiversity outcomes. Performance-based contracts can be difficult to implement, however, as biodiversity outcomes are often difficult to measure, and even with a reliable measurement approach, attributing the incremental impact of a landowner on biodiversity at reasonable cost can be problematic. Where the linkages between landscape interventions and biodiversity outcomes are poorly understood, landowners could be rewarded or penalised for failings over which they had no control, or rewarded for successes to which they made only a small contribution (Eigenraam et al., 2005). Moreover, where biodiversity offsets take a long time to mature, structuring reward purely on the delivery of biodiversity outcomes can affect the willingness of landowners to create offsets in the first place (Salzman and Ruhl, 2000).

Offset agreements should also specify the parties responsible for managing the MRV activities and make adequate provisions for how these activities will be funded. The MRV provisions used in practice frequently rely on the use of supplier self-assessments and independent third-party verification, though reporting may also be undertaken through public notification (Table 4.5). The Biobanking scheme in New South Wales, Australia, and the Compensatory Wetlands Mitigation and Conservation Banking schemes in the United States, conversely, all require offset suppliers to self-monitor offset progression against agreed performance standards and to submit self-monitoring reports to regulators at periodic intervals (NSW OEH, 2012; DOD and EPA, 2008; USFWS, 2003). Verification by independent site assessors is then used to supplement the supplier-provided information. In Germany, where 80% of compensation pools are managed by the public sector, states must prepare a report for the federal government once every six years on the state of offset projects. Regulators may improve the efficiency of verification efforts by targeting landowners who signal higher likelihoods of non-compliance with absent, incomplete or poor self-reporting. In Mexico, the Environmental Impact and Risk Branch (DGIRA) also promotes the use of satellite data, and has been developing a geographic information system to complement the on-site inspections conducted by the Federal Attorney of Environmental Protection (Morandeau and Vilaysack, 2012).

Whilst MRV is important for the success of biodiversity offset schemes, it is not always carried out in accordance with the conditions specified in offset agreements (Harper and Quigley, 2005; Morandeau and Vilaysack, 2012). The 2005 Government Accountability Office review of the US Wetland Mitigation programme, for example, found that only 24% of required monitoring reports were submitted to the Army Corps of Engineers for one-off offsets, 72% for mitigation banking and 83% for in-lieu arrangements. The report also found that offset site inspections had not been carried out as frequently as intended, with considerable regional variations. For instance, across seven districts, the percentage of mitigation banks inspected ranged from 13-78% (Table 4.6) (Government Accountability Office, 2005). Likewise, under the Policy for the Management of Fish Habitat, a recent audit by the Office of the Auditor General of Canada found that the required self-monitoring was completed in only 38% of cases involving ministerial authorisations and in just 3% of cases involving letters of advice (OAGC, 2009).

Effective MRV strategies require sufficient capacity to conduct site assessment audits and an appropriate level of transparency and participation of stakeholders. This is partly why, in addition to public control measures, some jurisdictions (including France, Germany, Mexico, the Netherlands

and Switzerland) rely on the contribution of non-governmental organisations (NGOs) to supplement the monitoring programmes of regulators.

Table 4.5. **Examples of monitoring and inspection approaches for biodiversity offsets**

Country	Reports from developers	Field visits by the competent authorities	Inspection by civil society
Australia	✓	✓	
Austria		✓	
Brazil	✓	✓	
Canada (Quebec)	✓	✓	
Chile	✓	✓	
Czech Republic	✓		
Denmark		✓	
France	✓	✓	✓
Germany			✓
India	✓	✓	
Japan	Non-existent (law currently being revised)		
Mexico	✓	✓	✓
Netherlands		✓	✓
Poland	✓		
Russian Federation		✓	
Slovenia		✓	
Sweden	No general rules (case-by-case basis)		
Switzerland		✓	✓
United States	✓	✓ (Priority on the banks)	✓

Source: Morandeau, D. and D. Vilaysack (2012), "Compensating for damage to biodiversity: An international benchmarking study", www.developpement-durable.gouv.fr/IMG/pdf/ED68EN-2.pdf.

Biodiversity offset registries are increasingly being used in some programmes as an integral part of MRV (e.g. Australia, Germany, the United Kingdom and the United States). A central and transparent information database can assist regulators and the public to locate offsets, assess their performance over time and contribute to the evaluation of a scheme. In Switzerland, for example, a transparent offset registry is under construction to assist in MRV as the audit of offset projects is largely undertaken by NGOs (Morandeau and Vilaysack, 2012).

Table 4.6. **Results of the Government Accountability Office's review of the Army Corps of Engineers' oversight of mitigation banks**[1]

	Number of mitigation files reviewed	Mitigation banking agreements requiring monitoring reports	Mitigation bank files with evidence of:		
			…at least one monitoring report	… at least one compliance inspection	… either monitoring reports or compliance inspections
Charleston	10	5	4	5	7
Galveston	4	4	3	1	3
Jacksonville	15	14	7	5	8
New Orleans	22	22	16	9	18
St Paul	23	4	2	3	5
Seattle	2	2	2	1	2
Wilmington	9	9	9	7	9
Total	85	60	43	31	52
% of total files reviewed	100%	71%	72%[2]	52%[2]	87%[2]

Notes: 1. The table represents banks approved from November 1995 to December 2003. 2. Calculated as a percentage of the mitigation banking agreements requiring monitoring reports.

Source: Government Accountability Office (2005), "Wetlands protection: Corps of Engineers does not have an effective oversight approach to ensure that compensatory mitigation is occurring", www.gao.gov/assets/250/247675.pdf.

Registry systems are also used to track sales from offset sites and to advertise credit availability. In the United States, the Regulatory In lieu fee and Bank Information Tracking System (RIBITS) is a composite registry that is used for both the Compensatory Wetlands Mitigation scheme and the Conservation Banking scheme. Developed by the US Army Corps of Engineers in collaboration with the Environmental Protection Agency and the Fish and Wildlife Service, the RIBITS website provides civil society with information on the location of offset and compensation sites, their geographical service areas and the availability of credits from the site (USACE, 2014). Like the RIBITS database, the registry system used in England has a strong focus on communicating the availability of credits at prospective offset sites. Developed and operated by a private firm called the Environment Bank, the *Environmental Markets Exchange* is an information repository for developers and planners to search for sites that meet their offsetting requirements (The Environment Bank, 2014). In addition to offset supply information, the *Wetland Database and Reporting Tool* in Alberta's Wetlands Policy provides the public with information on the regulatory approvals process and the links between offset sites in the database and the corresponding biodiversity loss sites (Alberta Government, 2013).

Biodiversity offset registries are also used to help inform due diligence processes so that offset projects do not receive funding from multiple sources (e.g. a payments for ecosystem services [PES] scheme and an offset

scheme) and as an accounting tool to ensure that offsets are not able to be sold twice. Offset registries are therefore particularly important for sites which will be used to supply offsets to multiple projects. In the French habitat banking pilot in the Coussouls de Crau region, the regional office of the Ministry of Environment in the PACA region is responsible for maintaining a register accounting for the use of the credits (Morandeau and Vilaysack, 2012). Likewise, in Victoria, Australia, the government has created a public register that tracks not only its offset programme but also more generally spending on public environmental programmes so it is able to check that sites destined for offsetting are not receiving funding from other sources (DEPI, 2013b).

Compliance and enforcement

Delivery of biodiversity outcomes at an offset site relies on landowners meeting their obligations under offset supply agreements. Where MRV activity finds landowners in breach of their agreement, remedial action may be necessary. Remedial action is only possible, however, where offset supply agreements are enforceable with the possibility of penalties where breaches are apparent. The design of an offset supply agreement heavily influences the likelihood of supplier compliance; important conditions include:

- the specification of the landowner's liability
- the opportunity costs of compliance with the agreement
- the probability being caught in non-compliance
- the penalties for detected non-compliance.

The reasons for non-compliance are varied and the compliance regime should be designed to reflect this. Some landowners may be deliberately in breach of the contract with the intent to minimise costs whereas other, well-intentioned landowners may be in breach of the contract for more innocuous reasons. Where suppliers are found to be non-compliant, requests for remedial action, warning letters and inspections may be an appropriate and low-cost first step in the enforcement process in order to identify the suppliers who are willing to return to compliance quickly and with minimal regulatory intervention. Where there is a continued failure to comply, stronger enforcement actions will be required (OECD, 2013). In France, the authorities first issue warning letters. Where the warning letters do not result in remedial action within a given timeframe, developers are then issued with a fine. If developers remain non-compliant, the regulatory authority itself carries out the offset and requires the developer to cover the costs (French

Code of Environment). Soft compliance measures are also used as the starting point in the Native Vegetation Regulations in Victoria, Australia. If contractual commitments or management actions are not being met by the offset supplier, the regulator will work with them to improve the situation, but if this is unsuccessful, subsequent payments may be withheld until the necessary land management actions are completed. Non-compliance with the land management contract may result in a requirement for payments received by the landowner and associated costs being paid back to the regulator (DSE, 2012). Conditional payments have proved to be a useful tool to align the incentives of the offset supplier and the regulator in order to improve supplier compliance (Box 4.6).

Jurisdictions may also have the power to impose stronger civil, administrative and criminal penalties on liable parties where they are found to be in non-compliance. In Sweden, for example, if repeated compliance orders have not been met, developers may be prosecuted if regulators discover that the conditions of development approval relating to environmental compensation are not being met (ICF GHK and BIO Intelligence Service, 2013). The US Army Corps of Engineers has the power to impose a variety of penalties in the Compensatory Wetlands Mitigation programme, depending upon the style of environmental compensation that was used (i.e. who is legally liable for the compensation). They may issue compliance orders, levy administrative penalties of USD 11 000 per violation up to a maximum of USD 27 500, require security bonds to be forfeited, and suspend or revoke planning permission. In cases where the non-compliance is “wilful, repeated, flagrant, or of substantial impact”, the US Army Corps of Engineers may refer the case to the Department of Justice to seek an injunction and the possibility of civil penalties of up to USD 25 000 per day for each violation (Government Accountability Office, 2005).

Civil society performs important compliance functions in some jurisdictions to supplement and enhance the effectiveness of regulators. In Germany, civil society frequently monitors developments with a large environmental footprint and has been known to challenge the conditions of the project approval. In Switzerland, the government financially supports NGOs to perform the MRV activity and where they have been performing this function for over ten years, the NGOs have a right to appeal to the administrative and federal courts if they detect non-compliance. Penalties for non-compliance in Switzerland include the refusal of planning authorisation, removal or repayment of public subsidies and the imposition of fines. Swiss NGOs are successful in around 90% of the appeals that they lodge (Morandeau and Vilaysack, 2012).

Box 4.6. **Contingent payments to increase the compliance rates of offset suppliers**

Offset supply agreements may progressively release payments to landowners conditional on the completion of pre-specified land management actions, meeting performance standards, or undertaking self-monitoring and reporting. Payments are withheld if a supplier fails to meet the specified conditions. Conditional payments are used in a number of jurisdictions as a compliance mechanism. In the Biobanking scheme in New South Wales, Australia a biobanking agreement is made between a landowner and the New South Wales Minister for the Environment at the establishment of a biobank site which includes the details of the estimated land management costs in perpetuity. On a pro-rata basis, funds from the sale of biodiversity credits are paid into the BioBanking Trust Fund to cover land management costs in the future and any additional proceeds from the sale of credits are paid to the landowner as a lump sum. The landowner receives annual management payments from the Trust Fund to implement the management actions, and submits an annual report detailing the management actions undertaken and monitoring of site conditions. Annual payments from the BioBanking Trust Fund are withheld from a landowner until the regulator assesses the landowner's annual report. In extreme cases of non-compliance, the regulator may apply for a court order to have the land transferred to the Minister for the Environment or another relevant authority (NSW OEH, 2012).

Table 4.7. **Biobanking payment schedules of an offset supply agreement in New South Wales, Australia**

Management cost (establishment phase, years 1-5)	Management cost (maintenance phase, years 6 onwards)	Total Trust Fund deposit
AUD 20 000	AUD 10 000	AUD 375 624
AUD 100 000	AUD 20 000	AUD 998 454

Under the Native Vegetation regulations system in Victoria, Australia, offset sites are legally secured in perpetuity but only managed under contract for a period of ten years according to a land management contract between the landowner and the regulator of the scheme. The offset price (negotiated by the landowner and the developer) is paid into a trust fund administered by the scheme's regulator who then pays the landowner in instalments over the ten-year management period. The payments are contingent upon the completion of land management actions detailed in the contract and self-reporting and are made according to a U-shaped payment schedule. The relatively high payments in the initial years allow for the up-front costs of establishing an offset site that then diminish and subsequently increase toward the end of the management period to provide the landowner with a stronger incentive to complete the ten years of active management (DSE, 2012).

Transaction costs

The transaction costs in biodiversity offset schemes include the costs associated with identifying, creating and securing an offset, applying for development permission and monitoring, reporting and enforcing biodiversity offset commitments. Consistent with good regulatory practice, the processes that give rise to the transaction costs should be subject to a net benefits test and incentives should be introduced to ensure that the regulation continues to be the minimum necessary to deliver on a programme's conservation objectives (OECD, 2012). The level of transaction costs and the timing of when they are levied affect both the economic efficiency of a programme and the willingness of prospective offset suppliers to participate.

How high are transaction costs?

In assessing the size of transaction costs in offset schemes, it is useful to break down the costs into those incurred by the public sector (as a policy maker and regulator) and those incurred by the private sector, usually as regulated entities. The transaction costs borne by the private sector may be classified as either administrative costs, substantive compliance costs or delay costs (VCEC, 2009). Administrative costs are the costs of compliance with the administrative procedures and tend to comprise only a relatively small proportion of transaction costs in biodiversity offset schemes. Substantive compliance costs are the costs incurred by a firm to comply with regulation; they are not directly levied by the regulator, but are at least as important to the efficiency of implementation. Delay costs may be incurred by a firm when profits are delayed or when capital must be kept underutilised from undue delays in regulatory processes.

Detailed analyses of transaction costs are rarely reported by jurisdictions, but the available evidence suggests that substantive compliance costs are the largest drivers of regulatory costs.[6] The costs of environmental assessments, securing rights to land for offsets, entering into legal agreements and financing medium- to long-term monitoring, reporting and verification activities are all material contributors to developers' costs of delivering the environmental benefits of regulation (ICF GHK and BIO Intelligence Service, 2013). The costs of EIA, for example, can be substantial where they are the legal instrument triggering the provision of biodiversity offsets. In the EU, the costs of EIA tend to increase with the capital cost of the project and range from 0.01% to 2.56% of the total development costs (European Commission, 2013). Biodiversity site assessment fees can be many thousands of dollars as is the case in New South Wales, Australia where an intermediate-sized 24-hectare site assessment costs around AUD 20 000 (NSW OEH, 2012) and equivalent costs in Victoria, Australia are up to

AUD 7 000 (DEPI, 2013b). The legal costs to first create a biodiversity offset and second to transfer the property rights attached to it to the developer in the BioBanking scheme are listed in Table 4.8.

Table 4.8. **Biobanking fees for service, New South Wales, Australia**

Fee description	Fee (AUD)
Fees for developers who obtain a biobanking statement	
Application for a biobanking statement	10 800
Application to retire credits within a statement	540
Fees for buying and retiring credits without a biobanking statement	
Application to transfer credits	108
Application to retire credits without a biobanking statement	10 800
Fees for biobank site owners	
Application for biobanking agreement	648
Ongoing compliance assurance	1 118 per year
Occasional fees	
Application to vary biobanking agreement	1 118
Application to modify a biobanking statement	1 118

Source: NSW OEH (2012), *Biobanking Review: Discussion Paper*, www.environment.nsw.gov.au/resources/biobanking/20120062bbrevdp.pdf.

The cost of offsets tends to be the greatest contributor to the reported costs of regulatory compliance, although in 80% of schemes there is insufficient public information available to estimate the costs to developers in a scheme (Madsen et al., 2011). Table 4.9 presents aggregate information on known credit prices and the total costs of offsetting development projects; however, it is aggregated, highly variable data and reflects a general scarcity of quality data on offset schemes around the world. Variation in reported values is attributed to local variations in land values, credit scarcity, management costs and risk management costs (ICF GHK and BIO Intelligence Service, 2013). The listed credit prices are not directly comparable as the composition of biodiversity credits differs markedly across programmes.

For offset suppliers, the timing of when they incur transaction costs is particularly important. The risks around investing in offset supply relating to suppliers' abilities to forecast returns were discussed above, and the timing of transaction costs can magnify these financial risks. Offset suppliers contemplating investing in the creation of an offset, for example, may be reluctant to incur substantial up-front costs where there is significant uncertainty around prospective demand and prices (Hook and Shadle, 2013). Site assessment costs for prospective offset suppliers, for example, can be prohibitive to investment, so The Environment Bank register of suppliers in

the England pilot trials allows for the listing of three classes of offsets which effectively stages the imposition of transaction costs on the supplier. So-called bronze offsets are listed on the registry where a landowner has only submitted an expression of interest, whereas silver offsets require a little more information from a supplier, which allows an estimate of credits to be made; combined with mapping information, these can be useful first steps to engage prospective suppliers and tentatively increase overall offset supply. Only gold offsets are available for sale and so require thorough site assessments to be completed and management agreements to be signed. Landowners usually only progress to the final stage once a developer is interested so the impact of levying of transaction costs on participation is lessened (The Environment Bank, 2014).

The costs incurred by the public sector include the policy development and enactment costs and then any costs that are borne through the ongoing administration of regulation. The level of funding allocated to, and collected by, a regulatory body should be sufficient for it to achieve its objectives when operating efficiently (OECD, 2013). Funding may derive from public budgets and regulators may supplement their budgets by charging fees for services where their operations are of direct benefit to particular members of the regulated community in line with the principle of user pays (OECD, 2013). The Biobanking scheme in New South Wales, Australia, for example, was designed to recover 80% of its administrative costs from developers once the scheme achieved medium to high levels of participation, but during 2010-11, the regulator was only able to recover AUD 48 570 out of the AUD 460 000 in administrative costs it incurred (NSW OEH, 2012). Where developers participating in offset schemes do not bear administrative costs that should be recovered by the regulator, such as the costs of MRV and auditing activities undertaken by the regulator, the financial cost of regulation is shifted to the taxpayer at the expense of potentially more meritorious uses.

Table 4.9. **Distribution of known biodiversity credit prices and total costs to offset a development project**

	Credit prices			Project-specific offset costs		
	Average	High	Low	Average	High	Low
BioBanking in New South Wales, Australia	AUD 5 638	AUD 1 100	AUD 15 000	AUD 373 933	AUD 5 754 000	AUD 6 300
Compensatory Afforestation in India[1]	INR 799 722/ha	INR 1 043 000/ha	INR 438 000/ha	Average individual project costs are unknown, but the net present value compensation for a mining project in Orissa was reported at INR 550 000 000		
Compensatory Wetlands Mitigation in the United States	USD 74 535	USD 653 000	USD 3 000	..	..	..
Conservation Banking in the United States	USD 31 683	USD 300 000	USD 2 500	..	..	..
Forest Vegetation Restoration Fee in the People's Republic of China	RMB 7.5/m^2	RMB 20/m^2	RMB 2/m^2	Average individual project costs are unknown, but from 2003-05, the Forest Vegetation Fee collected an annual average of RMB 2 68 billion		
Habitat Banking Pilot in St Martin de Crau, France (all prices pre-tax)	..	EUR 41 380	EUR 37 400	EUR 1 220 700	EUR 1 649 900	EUR 396 800
Native Vegetation Regulation Policy in Victoria, Australia	AUD 117 716	AUD 400 000	AUD 1 318	AUD 94 212	AUD 5 425 000	AUD 500
Other available evidence on substantive compliance costs						
Biodiversity Offset Pilots in England	The first biodiversity offset transacted under the pilot scheme in England was a 2-hectare site of chalk grassland in Oxfordshire. The offset project was priced at GPB 51 000 (GBP 25 500/ha).					
Biodiversity Offsets in the Netherlands	The cost of land management to create biodiversity offsets is estimated at EUR 20 000/ha but the cost of acquiring land is up to EUR 200 000/ha. The total reported costs to a developer of biodiversity compensation are usually around 1% of total project costs.					
Biodiversity Offsets in Spain	The total reported costs to a developer of biodiversity compensation are within the range of 1.8-4.5% of total project costs.					
Biodiversity Offsets in Sweden	The total reported costs to a developer for a 500-hectare wetland compensation project in in the Umeälven delta were EUR 12 500 000, at an average cost of EUR 25 000/ha.					

Notes: .. : not available. 1. Not inclusive of the associated compensatory afforestation costs which can be up to INR 90 200/ha and include additional costs for fencing and regenerating a safety zone around the compensatory afforestation site (INR 40 815/ha). 2. 2008 prices.

Sources: Carpenter, J. (2013), "How we did it: Developer 'offsets' housing's impact on nature", www.planningresource.co.uk/article/1216532/--developer-offsets-housings-impact-nature; DEPI (2013a), "Price history, fees and services", www.depi.vic.gov.au/environment-and-wildlife/biodiversity/native-vegetation/native-vegetation-permitted-clearing-regulations/native-vegetation-offsets/bushbroker/price-history-fees-and-services; eftec et al. (2010), "The use of market based instruments for biodiversity protection – The case of Habitat banking", http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_technical_report.pdf; ICF GHK and BIO Intelligence Service (2013), "Exploring potential demand for and supply of habitat banking in the EU and appropriate design elements for a habitat banking scheme", http://ec.europa.eu/environment/enveco/taxation/pdf/Habitat_banking_Report.pdf; Narain, D. (2012), "Does India need biodiversity offsets?", http://bbop.forest-trends.org/documents/files/india_webinar_presentation_2.pdf; NSW OEH (2012), *Biobanking Review: Discussion Paper*, www.environment.nsw.gov.au/resources/biobanking/20120062bbrevdp.pdf; Madsen, B. et al. (2010), "State of biodiversity markets report: Offset and compensation programs worldwide compendium: Methods appendix", www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf; Morandeau, D. and D. Vilaysack (2012), "Compensating for damage to biodiversity: An international benchmarking study", www.developpement-durable.gouv.fr/IMG/pdf/ED68EN-2.pdf.

Notes

1. Ecological vegetation classes are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each ecological vegetation class includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating (DNRE, 2002).
2. Also known as like-for-like offsets.
3. Also known as like-for-unlike compensation.
4. Proponent-led biobanking in the national programme in Canada refers to habitat banks that are established by proponents of projects that result in impacts, rather than by third parties. As such, there is no exchange of credits amongst various proponents; instead proponents can "bank" their own credits solely for their own future use.
5. In practice, to reduce the complexity of the calculation, the contribution of the conservation actions required by legislation is included in the calculation of the number of biodiversity credits and then a standard discount is applied to the final allocation made available for sale. For example, if the "existing obligation specifies that weed control other than noxious weeds must be undertaken and that native vegetation regrowth must be retained, then the credit allocation for the biobank site is discounted by 15% (that is, 7.5% for each management action). If 1,000 credits were to be created on the site, the number of credits would be reduced to 850 credits".
6. The Victorian Competition and Efficiency Commission commissioned an estimate of the relative breakdown of regulatory costs for the application of Victoria's Native Vegetation Regulations. In 2009, the contributions were 62.9% substantive compliance costs, 25.4% administrative costs and 12.7% in delay costs.

References

Alberta Government (2013), Alberta Wetlands Policy, Alberta Government, Edmonton, Canada, http://aep.alberta.ca/water/programs-and-services/wetlands/documents/albertawetlandpolicy-sep2013.pdf.

Ambrose, R. (2010), "Wetlands mitigation in the United States: Assessing the success of mitigation policies", *Wetlands (Australia)*, Vol. 19/1, pp. 1-27, http://ojs.library.unsw.edu.au/index.php/wetlands/article/viewFile/264/319.

Anglo Platinum (2009), "BBOP pilot project case study: Potgietersrust Platinums Limited (PPRust)", Anglo Platinum, Johannesburg, www.forest-trends.org/documents/files/doc_3121.pdf.

BBOP (2012), *Biodiversity Offset Design Handbook-Updated*, Business and Biodiversity Offsets Programme, Washington, DC, www.forest-trends.org/documents/files/doc_3101.pdf.

BBOP (2009), *Biodiversity Offset Cost-Benefit Handbook*, Business and Biodiversity Offsets Programme, Washington, DC, www.forest-trends.org/documents/files/doc_3094.pdf.

Bekessy, S. et al. (2010), "The biodiversity bank cannot be a lending bank", *Conservation Letters*, Vol. 3/3, pp. 151-158, http://dx.doi.org/10.1111/j.1755-263X.2010.00110.x.

Brownlie, S. and M. Botha (2009), "Biodiversity offsets: Adding to the conservation estate, or 'no net loss'?", *Impact Assessment and Project Appraisal*, Vol. 27/3, pp. 227-231, http://dx.doi.org/10.3152/146155109X465968.

Bull, J. et al. (2013), "Biodiversity offsets in theory and practice", *Oryx*, Vol. 47/3, pp. 369-380, http://dx.doi.org/10.1017/S003060531200172X.

Burgin, S. (2008), "Biobanking: An environmental scientist's view of the role of biodiversity banking offsets in conservation", *Biodiversity and Conservation*, Vol. 17/4, pp. 807-816, http://dx.doi.org/10.1007/s10531-008-9319-2.

Carpenter, J. (2013), "How we did it: Developer 'offsets' housing's impact on nature", www.planningresource.co.uk/article/1216532/--developer-offsets-housings-impact-nature.

Courtejoie, N. (2013), "Biodiversity offsets in France", French Ministry of Ecology, Sustainable Development and Energy, CGDD-SEEIDD-ERNR, presentation to OECD International Expert Workshop on Biodiversity Offsets, 6-7 November 2013.

Crowe, M. and K. ten Kate (2010), "Biodiversity offsets: Policy options for government", *Forest Trends*, Washington, DC, www.forest-trends.org/publication_details.php?publicationID=3079.

Darbi, M. and C. Tausch (2010), "Loss-gain calculations in German Impact Mitigation Regulation", Business and Biodiversity Offset Programme Assurance and Guidelines Working Group Meeting, 16-18 March 2010, Cambridge, United Kingdom, www.forest-trends.org/publication_details.php?publicationID=2404.

de Bie, S. and B. van Dessel (2011), "Compensation for biodiversity loss: Advice to the Netherlands' Taskforce on Biodiversity and Natural Resource", De Gemeynt, Klarenbeek, Netherlands.

DEA&DP (2011), "Information document on biodiversity offsets", *EIA Guideline and Information Document Series*, Western Cape Department of Environmental Affairs & Development Planning, South Africa, October.

DECCW (2009), *The Science Behind BioBanking*, Department of Environment, Climate Change and Water, New South Wales, Sydney, Australia, www.environment.nsw.gov.au/resources/biobanking/09476biobankingscience.pdf.

DEFRA (2012), "Biodiversity offsetting pilots: Technical paper: The metric for the biodiversity offsetting pilot in England", Department for Environment, Food and Rural Affairs, London, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69531/pb13745-bio-technical-paper.pdf.

DEFRA (2011), "Biodiversity offsetting: Summary of responses to discussion material on biodiversity offsetting", Publication No. 13743, Department for Environment, Food and Rural Affairs, London.

Department of the Environment (2013), "Matters of national environmental significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999", Commonwealth of Australia, Canberra, https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf.

DEPI (2013a), "Price history, fees and services", Victoria State Government, Department of Environment and Primary Industries, Melbourne, Australia.

DEPI (2013b), "Reforms to Victoria's Native Vegetation Permitted Clearing Regulations: Amendments to the Victoria planning provisions", Victoria State Government, Department of Environment and Primary Industries, Melbourne, Australia .

DNRE (2002), "Victoria's Native Vegetation Management Framework: A framework for action", Department of Natural Resources and the Environment, State of Victoria, Melbourne, Australia.

DOD and EPA (2008), "Compensatory mitigation for losses of aquatic resources; Final rule", *Federal Register Rules and Regulations*, Vol. 73/70, 10 April, https://www.epa.gov/cwa-404/compensatory-mitigation-losses-aquatic-resources-final-rule.

DPCD (2013), "Victoria Planning Provisions: Particular provisions – Clause 52.17", Department of Planning and Community Development, Melbourne, Australia.

DSE (2012), "BushBroker over-the-counter", Information Sheet Number 16, Department of Environment and Primary Industries, Victorian Government, Melbourne, Australia, www.depi.vic.gov.au/__data/assets/pdf_file/0020/205049/BB-info-16-OTC.pdf.

eftec et al. (2010), "The use of market based instruments for biodiversity protection – The case of Habitat banking", Technical Report for European Commission DG Environment, London, http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_technical_report.pdf.

Eigenraam, M. et al. (2005), "EcoTender: Auction for multiple environmental outcomes", project final report for National Action Plan for Salinity and Water Quality National Market Based Instruments Pilot Program, November, Melbourne, Australia.

Environmental Law Institute (2002), *Banks and Fees: The Status of Off-site Wetland Mitigation in the United States*, Environmental Law Institute, Washington, DC, www.eli.org/sites/default/files/eli-pubs/d12_08.pdf.

European Commission (2013), "EIA: A study on costs and benefits".

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", European Commission, Brussels, http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf.

Evans. M. et al. (2013), "A bird in the hand is worth two in the bush: Ecological time preference and biodiversity offsets", draft paper prepared for the 15th Annual BIOECON Conference, Kings College, Cambridge, United Kingdom, 18-20 September 2013, www.bioecon-network.org/pages/15th_2013/EVANS.pdf.

Failing, L. and R. Gregory (2003), "Ten common mistakes in designing biodiversity indicators for forest policy", *Journal of Environmental Management*, Vol. 68/2, pp. 121-132, http://dx.doi.org/10.1016/S0301-4797(03)00014-8.

Flanigan, M. (2013), "Australian government environmental offsets policy", Australian Department of the Environment, presentation to OECD Workshop on Biodiversity Offsets and Bio-banking, 6-7 November 2013, www.oecd.org/tad/sustainable-agriculture/Presentation%201%20(1510)%20Mark%20Flanigan%20-%20Department%20of%20the%20Environment.pdf.

Gibbons, P. and D.B. Lindenmayer (2007), "Offsets for land clearing: No net loss or the tail wagging the dog?", *Ecological Management and Restoration*, Vol. 8/1, pp. 26-31, http://dx.doi.org/10.1111/j.1442-8903.2007.00328.x.

Girvetz, E. et al. (2012), "Eastern Mongolian grassland steppe", Chapter 8 in: Hilty, J.A. et al. (eds.), *Climate and Conservation: Landscape and Seascape Science, Planning and Action*, Island Press, pp. 92-103, http://dx.doi.org/10.5822/978-1-61091-203-7_8.

Government Accountability Office (2005), "Wetlands protection: Corps of Engineers does not have an effective oversight approach to ensure that compensatory mitigation is occurring", GAO-05-898, Report to the Ranking Democratic Member, Committee on Transportation and Infrastructure, House of Representatives, Government Accountability Office, Washington, DC, www.gao.gov/assets/250/247675.pdf.

Harper, D. and J. Quigley (2005), "No net loss of fish habitat: A review and analysis of habitat compensation in Canada", *Environmental Management*, Vol. 36/3, pp. 343-355, http://dx.doi.org/10.1007/s00267-004-0114-x.

Hook, P. and T. Shadle (2013), "Navigating wetland mitigation markets: A study of risks facing entrepreneurs and regulators", https://www.cbd.int/financial/offsets/usa-offsetmitigationrisks.pdf.

Hough, P. (2013), "Offsetting impacts to wetlands and waters in the United States", United States Environmental Protection Agency, presentation to OECD Workshop on Biodiversity Offsets and Bio-banking, 6-7 November 2013, www.oecd.org/tad/sustainable-agriculture/Presentation%202%20(1530)%20Palmer%20Hough%20-%20US%20EPA.pdf.

ICF GHK and BIO Intelligence Service (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, http://ec.europa.eu/environment/enveco/taxation/pdf/Habitat_banking_Report.pdf.

ICMM and IUCN (2012), "Independent report on biodiversity offsets", prepared by The Biodiversity Consultancy, International Council on Mining and Metals, London and International Union for Conservation of Nature, Gland, Switzerland, http://hub.icmm.com/document/4934.

IFC (2012), "Performance Standard 6. Biodiversity Conservation and Sustainable Management of Living Natural Resources", International Finance Corporation, Washington, DC, www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES.

Kelly, G. (2013), "Wetland/stream and conservation banking in the US: An illustration of biodiversity offsets driven by regulation", Environmental Banc & Exchange, presentation to Business and Biodiversity Offsets Programme and EU No Net Loss Initiative Workshop, 22 May 2013, Brussels.

Kenny, A. (2006), "Ohio study shows mitigation banks not living up to potential", The Ecosystem Marketplace, www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=4485.

Kiesecker, J.M. et al. (2010), "Development by Design: Blending landscape-level planning with the mitigation hierarchy", *Frontiers in Ecology and the Environment*, Vol. 8/5, pp. 261-266, http://dx.doi.org/10.1890/090005.

Kohli, K. et al. (2011), *Pocketful of Forests: Legal Debates on Valuating and Compensating Forest Loss in India*, Kalpavriksh and WWF-India, New Delhi.

Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", Ecosystem Marketplace, www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

Madsen, B. et al. (2011), "2011 update: State of biodiversity markets", Forest Trends, Washington, DC, www.ecosystemmarketplace.com/reports/2011_update_sbdm.

Matthews, J. and A. Endress (2008), "Performance criteria, compliance success, and vegetation development in compensatory mitigation wetlands", *Environmental Management*, Vol. 41/1, pp. 130-141, http://dx.doi.org/10.1007/s00267-007-9002-5.

McKenney, B. and J. Kiesecker (2010), "Policy development for biodiversity offsets: A review of offset frameworks", *Environmental Management*, Vol. 45/1, pp. 165-176, http://dx.doi.org/10.1007/s00267-009-9396-3.

MEDDE (2013), "National guidelines for the sequence to avoid, reduce and offset impacts on the natural environment", Ministry of Environment, Sustainable Development and Energy, France.

Millennium Ecosystem Assessment (2005), *Ecosystems and Human Well-being*, Vol. 5, Island Press, Washington, DC.

Moilanen, A. et al. (2009), "How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat", *Restoration Ecology*, Vol. 17/4, pp. 470-478, http://dx.doi.org/10.1111/j.1526-100X.2008.00382.x.

Morandeau, D. and D. Vilaysack (2012), "Compensating for damage to biodiversity: An international benchmarking study", Collection "Études et documents" of the Economy, Evaluation and Integration of Sustainable Development Service (SEEIDD) at the General Commission for Sustainable Development (CGDD), France, www.developpement-durable.gouv.fr/IMG/pdf/ED68EN-2.pdf.

Morris, R. and P. Barham (2007), "The Habitats Directive as a driver for sustainable development in the coastal zone: The example of the Humber estuary", Chapter 3 in: Larson, B.A. (ed.), *Sustainable Development Research Advances*, Nova Publishers, New York, pp. 109-138.

Narain, D. (2012), "Does India need biodiversity offsets?", PowerPoint presentation, http://bbop.forest-trends.org/documents/files/india_webinar_presentation_2.pdf.

Norton, D. (2009), "Biodiversity offsets: Two New Zealand case studies and an assessment framework", *Environmental Management*, Vol. 43/4, pp. 698-706, http://dx.doi.org/10.1007/s00267-008-9192-5.

NRC (2001), *Compensating for Wetland Losses Under the Clean Water Act*, National Academy Press, National Research Council, Washington, DC.

NSW OEH (2013), "Ecosystem credit transaction report: Transaction date from – 23/05/2007 to 23/05/2013", Office of Environment and Heritage, New South Wales Government, Sydney, Australia.

NSW OEH (2012), *Biobanking Review: Discussion Paper*, State of New South Wales and Office of Environment and Heritage, Sydney, Australia, www.environment.nsw.gov.au/resources/biobanking/20120062bbrevdp.pdf.

OAGC (2009), "The 2009 Spring Report of the Commissioner of the Environment and Sustainable Development to the House of Commons", Minister of Public Works and Government Services Canada, Ontario, www.oag-bvg.gc.ca/internet/English/parl_cesd_200905_e_32544.html.

OECD (2013), *Scaling-up Finance Mechanisms for Biodiversity*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264193833-en.

OECD (2012), *Recommendation of the Council on Regulatory Policy and Guidance*, OECD, Paris, www.oecd.org/governance/regulatory-policy/2012-recommendation.htm.

Quétier, F. (2013), "Biodiversity offsets: Monitoring, reporting, verification, compliance and enforcement", Biotope, presentation to OECD International Expert Workshop on Biodiversity Offsets, 6-7 November 2013, www.oecd.org/tad/sustainable-agriculture/QUETIER_OECD_06november2013.pdf.

Quétier, F. and S. Lavorel (2011), "Assessing ecological equivalence in biodiversity offset schemes: Key issues and solutions", *Biological Conservation*, Vol. 144/12, pp. 2 991-2 999, http://dx.doi.org/10.1016/j.biocon.2011.09.002.

Regan, H. et al. (2002), "A taxonomy and treatment of uncertainty for ecology and conservation biology", *Ecological Applications*, Vol. 12/2, pp. 618-628, http://dx.doi.org/10.1890/1051-0761(2002)012[0618:ATATOU]2.0.CO;2.

Saenz, S. et al. (2013), " A framework for implementing and valuing biodiversity offsets in Colombia: A landscape scale perspective", *Sustainability*, Vol. 5/12, pp. 4 961-4 987, http://dx.doi.org/10.3390/su5124961.

Salzman, J. and J. Ruhl (2000), "Currencies and the commodification of environmental law", *Stanford Law Review*, Vol. 53/3, pp. 607-694, http://dx.doi.org/10.2139/ssrn.206628.

TBC (2012), "Biodiversity offsets: Relative offsetability of impacts", unpublished report to the New Zealand Department of Conservation, The Biodiversity Consultancy Ltd., Cambridge, United Kingdom.

Temple, H.J. et al. (2012), *Forecasting the Path Towards a Net Positive Impact on Biodiversity for Rio Tinto QMM*, IUCN and Rio Tinto Technical Series No. 2, International Union for Conservation of Nature, Gland, Switzerland.

ten Kate, K., J. Bishop and R. Bayon (2004), *Biodiversity Offsets: Views, Experience, and the Business Case*, International Union for Conservation of Nature, Gland, Switzerland and Cambridge, United Kingdom and Insight Investment, London, https://www.iucn.org/sites/dev/files/import/downloads/bdoffsets.pdf.

The Environment Bank (2014), The Environment Bank website, www.environmentbank.com.

Thomas, T.S., A.S. Brandão and K.M. Chomitz (2004), "Creating markets for habitat conservation when habitats are heterogeneous", *World Bank Policy Research Working Paper*, No. 3 429, World Bank Group, Washington, DC, http://dx.doi.org/10.1596/1813-9450-3429.

Tischew, S. et al. (2010), "Evaluating restoration success of frequently implemented compensation measures: Results and demands for control procedures", *Restoration Ecology*, Vol. 18/4, pp. 467-480, http://dx.doi.org/10.1111/j.1526-100X.2008.00462.x.

Treweek, J. et al. (2009), "Scoping study for the design and use of biodiversity offsets in an English context: Final report to DEFRA", Treweek Environmental Consultants, Devon, United Kingdom, www.forest-trends.org/publication_details.php?publicationID=2400.

USACE (2014), Regulatory In lieu fee and Bank Information Tracking System (RIBITS) website, http://geo.usace.army.mil/ribits/index.html.

USFWS (2003), "Guidance for the establishment, use, and operation of conservation banks", memorandum, United States Department of the Interior, Fish and Wildfire Service, Washington, DC, https://www.fws.gov/endangered/esa-library/pdf/Conservation_Banking_Guidance.pdf.

VCEC (2009), *A Sustainable Future for Victoria: Getting Environmental Regulation Right – Final Report*, Victorian Competition and Efficiency Commission, Department of Treasury and Finance, Melbourne, Australia.

Wissel, S. and F. Wätzold (2010), "A conceptual analysis of the application of tradable permits to biodiversity conservation", *Conservation Biology*, Vol. 24/2, pp. 404-411, http://dx.doi.org/10.1111/j.1523-1739.2009.01444.x.

WRI (2014), Ecosystem Service Indicators Database website, www.esindicators.org.

Part II

Case studies

Chapter 5.

Compensatory mitigation and wetland banking in the United States

by
Morgan Robertson, University of Wisconsin and
Palmer Hough, United States Environmental Protection Agency

Established in the 1970s, the Compensatory Mitigation and Wetland Banking programme in the United States is the largest and longest running offsets programme in the world. It protects the waters of the United States by requiring developers to follow the mitigation hierarchy when proposed development projects cause adverse impacts for wetlands and streams. Implementation of the Compensatory Mitigation programme is characterised by strong participation of the private sector in supplying offsets in a market driven context. This chapter summarises the evolution of the Compensatory Wetlands Mitigation programme over its 40 years of implementation. It discusses the challenges faced in the design and implementation of the programme – including in the progression of mitigation banking – how they have been addressed, and concludes with the key lessons learned.

The environmental and regulatory context of wetland compensatory mitigation

Compensation, or offsets, for impacts to wetlands in the United States have been required since the mid-1970s, thus making it the longest-running regulatory compensation programme in the world.[1] Although wetland mitigation banking began to be used in scattered locations in the 1980s, banking only became a widespread compensation option in the mid-1990s. The US approach to wetland compensation has evolved a great deal over time: generally, early attempts at wetland compensation were widely acknowledged as producing unsatisfactory outcomes, and the first generation of wetland banks in the 1990s have also been improved upon based on lessons learned. To understand the emergence of, effectiveness of and obstacles faced by mitigation banking, it is necessary to understand the regulatory architecture that the US Federal Water Pollution Control Act – more commonly known as the Clean Water Act (CWA) – has erected around wetland impacts.

For most of its history, the United States pursued policies that resulted in extensive wetland destruction. Efforts to drain and eliminate wetlands were so successful that by the 1970s over half of the wetlands in the continental United States had been lost, dropping from an estimated 221 million acres in 1700 to approximately 110 million acres today (approximately the size of the state of California) (Dahl, 1990; 2011). These losses were the result of filling, conversion and drainage to facilitate a wide range of activities including: agriculture, ranching, silviculture, navigation, flood control, reservoir construction, and a wide array of residential, commercial and industrial development.

By the 1970s, both scientific and public understanding of wetlands had improved substantially. By that time it was widely recognised that wetlands perform important ecological functions in the landscape including water quality protection and enhancement, floodwater storage, habitat provision for plants and animals, nutrient cycling, shoreline protection, and ground water recharge. Consequently, legislative and regulatory efforts began to reverse the trend of wetland losses. While wetland losses continue to be a problem today, particularly in coastal areas (Dahl and Stedman, 2013), annual wetland loss rates have declined dramatically over the last 40 years, from rates of 458 000 acres per year from the mid-1950s to the mid-1970s to rates of 13 800 acres per year between 2004 and 2009 (Dahl, 2011). One of the important reasons for this was development of effective regulation around a landmark piece of legislation.

Passed by Congress in 1972, the CWA's overall objective is to restore and maintain the chemical, physical and biological integrity of the nation's waters. To help achieve this, the CWA makes illegal the discharge of dredged or fill material into "waters of the United States", a term which includes most wetlands, unless the discharger holds a government permit. Since the permit programme is described in Section 404 of the act, these are often called "Section 404 permits". Discharges regulated under this programme include fill in waters of the United States associated with a variety of activities including: industrial, commercial and residential development; water resource projects (such as dams and levees); infrastructure development (such as highways and airports); and mining projects. Certain activities are exempt from Section 404 regulation (e.g. many farming and forestry activities were exempted from regulation in the 1977 amendments because of the political and practical difficulty in extending regulation over such widespread land uses – see further discussion in Box 5.1). The requirement that permit-holders provide offsets, or compensation, for the proposed impacts has been included as conditions of the permit since the late 1970s, when it became clear that Army Corps of Engineers (ACOE) permit denials and Environmental Protection Agency (EPA) "vetos" were not being used to prevent impacts and that some form of mitigation was necessary.

Jurisdiction and governance

The US EPA and the Department of the Army, operating through the ACOE, share responsibilities for implementing the Section 404 programme.[2] Section 404(a) authorises the ACOE to issue permits for the discharge of dredged or fill material into waters of the United States at specified disposal sites. Section 404(b) directs the ACOE to apply environmental criteria developed by the EPA in making its permit decisions.[3] Section 404(c) authorises the EPA to prohibit or restrict any defined area as a disposal site if the agency determines a discharge would result in "unacceptable adverse effects" on certain environmental resources (often described as the EPA's "veto authority" because it has most commonly been used in the context of active ACOE permit applications to prevent permit issuance).

Since 1972, the CWA has regulated a variety of activities in wetlands and other waters of the United States, including discharges of dredge or fill material under Section 404. But over the past decade, US Supreme Court rulings in Solid Waste Agency of Northern Cook County (SWANCC) v. US Army Corps of Engineers in 2001 and Rapanos v. United States in 2006, have removed some waters from federal protection, and caused confusion about which waters and wetlands remain protected. In response, the EPA and the ACOE are developing new regulations to clarify the scope of jurisdiction of the CWA.[4]

It is important to note that the ACOE operates in a highly decentralised way: the ACOE headquarters issues regulations and other non-binding policies, but each of the 38 districts of the ACOE has discretion to interpret and implement regulations in regionally specific ways; this results in a variegated national landscape of different practices concerning the different aspects of wetlands regulation, including wetlands compensation.

Furthermore, the tradition of co-operative federalism in the United States ensures that the individual states have a very strong role in determining what constitutes appropriate compensation for wetlands impacts: each state is given the power (under Section 401 of the CWA) to prevent the ACOE from issuing a permit for a wetland impact if the state resource agency feels that the impact or the proposed compensation would violate state water quality standards. Until 2001, for example, the state of Wisconsin used this power to prevent most ACOE permits from being issued that required compensation, because the state resource agency was sceptical that compensatory offsets were effective ways to protect wetland resources. There is, therefore, no one "compensatory mitigation system" nor one "wetland banking system" in the United States: rather, there is a patchwork landscape of many overlapping regulatory systems that vary across the 38 ACOE districts, 50 states and even the 10 EPA regions. They all share a foundation in the same federal laws and regulations, but their implementation differences, when combined with the ecological differences in the landscapes they occupy, have resulted in a high degree of geographic heterogeneity in the adoption and flourishing of wetland banking. Innovations in wetland policy, such as wetland banking itself, tend to emerge from these districts and regions and, if they prove successful at the regional level, are eventually formalised in guidance or regulation issued from headquarters in Washington, DC.[5]

The mitigation sequence

Offsets are used to compensate for permitted impacts, but only in strictly delimited circumstances following an analysis of alternatives. Under the EPA's mandatory Guidelines for Permits, no discharge of dredged or fill material may be permitted by the ACOE if: 1) a practicable alternative exists that is less damaging to the aquatic environment so long as that alternative does not have other significant adverse environmental consequences; or 2) the nation's waters would be significantly degraded. Under the guidelines, a project must incorporate all appropriate and practicable measures to first avoid impacts to wetlands, streams and other aquatic resources and to then minimise unavoidable impacts. Only after avoidance and minimisation measures have been incorporated in the proposal will the remaining unavoidable impacts be assessed and offsetting compensatory mitigation

Box 5.1. **Agriculture, wetlands regulation and compensation**

In the United States, farmers can be both purchasers of wetland offset credits and producers of such credits, although in both cases the circumstances are limited for a number of reasons.

Farmers do not generate a large demand for wetland offset credits largely because since 1977, most routine and ongoing farming activities have been exempt from regulation under Section 404(f) of the Clean Water Act (CWA). Exempt farming activities include: normal and ongoing ploughing, seeding, cultivating, harvesting and minor drainage; maintenance (but not construction) of drainage ditches; and construction and maintenance of irrigation ditches, farm ponds and farm roads. Farming is not exempt under Section 404(f) when it brings a wetland (not previously converted to agricultural use) into agricultural production or converts an agricultural wetland to a non-wetland area; such activities are subject to regulation and wetland losses may require compensatory mitigation. Another reason farmers do not generate a large demand for wetland offset credits is that CWA regulations in place since 1993 clarify that "waters of the United States" do not include wetlands which were previously converted to cropland, and as a result, further modifications to these areas are generally not subject to CWA requirements.

Agricultural policy regarding wetland conservation is subject to frequent change because Congress reauthorises expenditures and changes agricultural policy every four years. The 1985 Farm Bill, for example, discouraged agricultural impacts to wetlands through provisions that made farmers who drain certain kinds of wetlands ineligible for government subsidy programmes. Some wetland banks were established to provide offsets to farmers who wished to drain wetlands and continue to receive commodity payments (see Lamunyon, 1994), and some of these banks received financial assistance from national agricultural interests. The rapidly changing structure of agricultural incentive and payment programmes make it difficult to establish a durable compensation policy that serves farmers in this way, however, and therefore difficult to attract a long-term community of compensation providers who will invest in serving farmers' compensation needs.

As large landowners who often own properties which contain historically drained or degraded wetland areas, many farmers have the potential to generate Section 404 wetland offset credits to sell to interested buyers if the farmers restore or enhance these wetland areas consistent with Section 404 requirements. While farmers may be able to provide very low-cost wetland offsets, there are a number of reasons why farmers may hesitate to become involved in wetland offset provision. One reason farmers may be unwilling to provide compensation credits is because doing so means voluntarily entering a relationship with federal regulators in which their land is subject to government monitoring and strong regulatory power. While the industrial and land development sector have become acclimated to such oversight, it remains reflexively and inherently undesirable for farmers in the United States.

Box 5.1. **Agriculture, wetlands regulation and compensation** (*continued*)

When farmers are involved in offset provision they often see themselves as taking advantage of a state-sponsored agricultural support programme, albeit one without the kind of cost-sharing and technical support that usually accompanies participation in such programmes. This makes offset provision compete poorly where other more traditional conservation programmes, or "green payment" programmes (e.g. the Wetlands Reserve Program and Conservation Reserve Program), are available, and it means that farmers providing offsets do not tend to self-organise into a coherent audience for policy messages and direction.

The question of whether farmers can use the technical assistance or conservation payments provided by the US Department of Agriculture (USDA) to develop wetland offsets for sale or use in the Section 404 programme has been consistently raised. The position of the US EPA and the ACOE has consistently been that government monies should not be used to subsidise the creation of offsets that compensate for environmental impacts authorised by Section 404 permits, and this position was codified in regulations issued jointly by the EPA and the ACOE in 2008.

required if appropriate. Thus mitigation exists as a stepwise progression – avoidance, minimisation, compensation – (i.e. "the mitigation sequence"). The third step (referred to as "offsetting" in other countries) is called "compensatory mitigation" in the United States.

The first two steps of the mitigation sequence – avoidance and minimization – are often iterative as project proponents evaluate numerous project alternatives, including alternative project locations and designs. This iterative process ends at what the EPA's guidelines call the least environmentally damaging practicable alternative (LEDPA). An alternative is practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.10(a)(2)). Again, the sequence of events is important: a Section 404 permit can only be issued for an action that has been determined to be the LEPDA. The LEDPA must be determined without considering the benefits of potential compensatory offsets in order to prevent permit applicants from swaying regulatory decisions by promising extravagant and perhaps unrealistic offsets. Only after the LEDPA has been determined are potential compensation measures evaluated.

No net loss goal

In 1989, in response to reports highlighting historic wetland losses and ongoing significant wetland loss rates (Tiner, 1984; Conservation Foundation, 1988), US President George H.W. Bush made "no net loss"

(NNL) of wetlands a national policy priority. Subsequently, in 1990, the ACOE and the EPA incorporated the national NNL goal for wetlands into joint guidance for the Section 404 programme stating that Section 404 permit decisions regarding wetland avoidance, minimisation and compensation "will strive to achieve a goal of no overall net loss of [wetland] values and functions." Although this policy document did not have the force of regulation, it provided a simple and clear overarching goal – NNL, which is critical for successfully communicating the mission of a complex and often controversial regulatory programme. The clear articulation of the "mitigation sequence" (first avoid, then minimise, and finally compensate) was important in light of other ongoing and difficult debates over, for example, what kinds of aquatic resources were protected by the Clean Water Act, and what kinds of metrics should be used to assess wetland quality. These debates continue in various forms, but the NNL had the effect of focusing most attention on compensation within the mitigation sequence, in that it focused on a ''net'' accounting of wetlands loss rather than the simple prevention (or avoidance) of any further losses (Hough and Robertson, 2009). This focus on compensation has been unfortunate in some respects, because strongly articulated principles of avoidance and minimisation are a very important safeguard against potential abuses of the availability of compensation. The strength of the first steps of the sequence has been crucial to the acceptance of the legitimacy of the third step, compensation offsets, by a wide range of stakeholders.

Overview of compensation requirements

In the US context, compensatory mitigation refers to the restoration, establishment, enhancement and/or preservation of wetlands, streams or other aquatic resources conducted specifically for the purpose of offsetting authorised impacts to these resources (Box 5.2). In 2008, the EPA and the ACOE jointly issued revised regulations establishing expanded requirements for compensatory mitigation.[6] These regulations state that "the fundamental objective of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts to waters of the United States authorised by [Clean Water Act Section 404 permits issued by the ACOE]" (40 CFR 230.93(a)(1)). Again, the regulations reinforce that compensatory mitigation enters the analysis only after a proposed project has incorporated all appropriate and practicable means to avoid and minimise adverse impacts to aquatic resources (40 CFR Part 230.91(c)).

Box 5.2. **Different forms of compensatory mitigation in the United States' Clean Water Act Section 404 permit system**

Restoration is the reestablishment or rehabilitation of a wetland, stream or other aquatic resource with the goal of returning natural or historic functions and characteristics to a former or degraded aquatic resource. When it is an option, restoration is generally the preferred method, due in part to its higher likelihood of success as measured by gain in aquatic resource function, area or both.

Establishment, or creation, is the development of a wetland or other aquatic resource where one did not exist previously, with success measured as a net gain in both area and function of the aquatic resource.

Enhancement includes activities conducted within existing aquatic resources that heighten, intensify or improve one or more aquatic resource functions, without increasing the area of the aquatic resource. Examples include improved floodwater retention or wildlife habitat.

Preservation is the permanent protection of aquatic resources and/or upland buffers or riparian areas through legal and physical mechanisms, such as conservation easements and title transfers. Preservation has always been the most controversial method, because it does not replace lost aquatic resource areas or functions. For this reason, the regulations limit the use of preservation to situations in which the resources to be preserved provide important functions for and contribute significantly to the ecological sustainability of the watershed, and those resources are under clear threat of destruction or adverse modification.

When the ACOE requires compensatory mitigation in a permit, it must be based on the following considerations:

- What is "practicable and capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity" (40 CFR Part 230.93(a)(1)).
- The ACOE "must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project" (40 CFR Part 230.93(a)(1)).
- Compensation must be commensurate with the amount and type of impact associated with a particular Section 404 permit (40 CFR Part 230.93(a)(1)).

The regulations recognise that there may be instances when the ACOE cannot issue a permit "because of the lack of appropriate and practicable compensatory mitigation options" (40 CFR Part 230.91(c)(3)); such a determination is usually highly dependent on the particulars of the specific permit application and will be handled differently by each ACOE district office.

Box 5.3. **Section 404 permits**

The Army Corps of Engineers (ACOE) issues different kinds of permits to distinguish between small, frequently proposed impacts and larger impacts that need more structured consideration. An individual permit is required for projects with more than minimal adverse effects. Individual permits are reviewed by the ACOE, which investigates both whether the proposal is in the "public interest", as well as applying the environmental criteria set forth in the US Environmental Protection Agency's (EPA) Section 404(b)(1) Guidelines. However, for most discharges that will have only minimal adverse effects, a general permit may be suitable. General permits are issued on a nationwide, regional or state basis for entire categories of activities that are similar in nature. The general permit process eliminates time-consuming individual review of proposals and allows certain activities to proceed with little or no delay. For example, minor road activities, utility line backfill and bedding are activities that can be considered for a general permit. In 2012, the ACOE had over 73 000 permit evaluations and actions, including nearly 3 900 individual permits, 59 000 general permits (nationwide and regional), 10 700 no permit required determinations and 161 permit denials. Compensation can be required under either kind of permit.

Design and implementation of the US Wetland Compensatory Mitigation programme

Banking as one of three forms of compensatory mitigation

Three mechanisms for achieving compensatory mitigation in the US programme are available: mitigation banks, in-lieu fee programmes (ILF) and permittee-responsible mitigation (PRM).

1. A **mitigation bank** is a site with restored, established, enhanced or preserved aquatic resources, riparian areas and/or upland buffers that the ACOE has approved for use to compensate for losses from future permitted activities. Banks are usually (but not always) operated by a third party who is not the permit holder, and the majority are run on an entrepreneurial basis in which the bank sponsor seeks to make a profit. Single-user banks exist, often run by state agencies or private companies that incur the regular need for wetland compensation (such as state departments of transportation or oil exploration companies). A few non-profit banks also exist: The Nature Conservancy, for example, has been involved in developing mitigation banks and in-lieu fee programmes for over a decade. The bank approval process establishes the number of available compensation credits, which permittees may purchase upon ACOE approval that the bank represents appropriate

compensation. The bank sponsor is responsible for the success of these mitigation sites, and liable in the case of site failure (see section below entitled "Monitoring, reporting and verification").

2. For **in-lieu fee** mitigation, a permittee provides funds to a third-party in-lieu fee programme sponsor. The sponsor aggregates funds and then conducts compensatory mitigation projects consistent with a planning framework approved by the ACOE when the in-lieu fee programme was approved. Typically, specific compensatory mitigation projects are started only after pooling funds from multiple permittees. The in-lieu fee programme sponsor is responsible for the success of these mitigation sites.
3. In **permittee-responsible mitigation**, the permittee undertakes and bears full responsibility for the implementation and success of the mitigation. Compensation may occur either at the site where the regulated activity caused the loss of aquatic resources (on-site) or at a different location (off-site), preferably within the same watershed. All compensation under the CWA was PRM until the development of banking and ILF programmes.

Once compensation has been required by the ACOE, it is the permit applicant's responsibility to propose an appropriate compensatory mitigation option. Nevertheless, mitigation banks are the federal government's preferred compensation option. Of the three compensation mechanisms, only mitigation banks require that the mitigation site be secured, the restoration plan approved and necessary financial assurances provided before the site can be used for compensation purposes, and all credit releases are tied to demonstrated achievement of project milestones. This makes mitigation banks the least risky form of compensation. Mitigation banks and in-lieu fee programmes are preferred by the federal government over permittee-responsible compensation because they can result in "consolidating compensatory mitigation projects where ecologically appropriate, consolidating resources, providing financial planning and scientific expertise (which often is not practical for permittee-responsible compensatory mitigation projects), reducing temporal losses of functions, and reducing uncertainty over project success".[7]

Key elements of a mitigation bank: The bank instrument

To establish a bank or an ILF, the person proposing it must develop an "instrument" in co-ordination with the ACOE. A bank instrument is the legal document that describes the bank, the improvements that will be performed, the number of credits that will be granted and the schedule by which they will be released, as well as the arrangements for long-term stewardship and liability. Federal regulations adopted in 2008 require that

each mitigation bank instrument must contain the following elements. However, individual ACOE districts may issue different regionally specific guidance, establishing different practices and standards, for each element:

- Objectives. A description of the resource type and amount that will be provided, the method of compensation (restoration, establishment, preservation, etc.) and how the anticipated functions of the wetland bank will address watershed needs.
- Site selection. A description of the factors considered during the site selection process. This should include consideration of watershed needs and the practicability of establishing an ecologically self-sustaining project site.
- Site protection. A description of the legal arrangements and documentation of site control or ownership, and demonstration of arrangements for the long-term protection of the bank site.
- Baseline information. A description of the pre-project ecological characteristics of the proposed bank site. This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, and a map showing the locations of the bank site.
- Determination of credits. A description of the number of credits to be provided, including a brief explanation of the rationale for this determination.
- Mitigation work plan. Detailed written specifications and work descriptions for the bank project, including: construction methods, timing and sequence; source(s) of water; methods for establishing the desired plant community; plans to control invasive plant species; proposed grading plan; soil management; and erosion control measures.
- Maintenance plan. A description and schedule of maintenance requirements to ensure the continued viability of the wetland bank once initial construction is completed.
- Performance standards. Ecologically based standards that will be used to determine whether the mitigation bank is achieving its objectives. These are often tailored to the region or even the individual site.
- Monitoring requirements. A description of parameters monitored to determine whether the mitigation bank is on track to meet performance standards, and if adaptive management is needed. A schedule for monitoring and reporting monitoring results must be included.

- Long-term management plan. A description of how the mitigation bank will be managed after performance standards have been achieved, and all credits sold, to ensure the long-term sustainability of the site, including long-term financing mechanisms and identification of the party responsible for long-term management.
- Adaptive management plan. A management strategy to address unforeseen changes in site conditions or other components of the mitigation project.
- Financial assurances. A description of financial assurances that will be provided, and how they are sufficient to ensure a high level of confidence that work at the mitigation bank will be successfully completed in accordance with its performance standards.
- Credit release schedule. A schedule for release of credits (for sale or use by the bank) that is tied to the achievement of specific milestones (e.g. attainment of specific ecological performance standards).
- Service area. The geographic area within which impacts can be mitigated at the mitigation bank.
- Accounting procedures. Provisions requiring the bank sponsor to establish and maintain a ledger to account for all credit transactions.
- Assumption of mitigation responsibility. A provision stating that legal responsibility for providing the compensatory mitigation lies with the bank sponsor once a permittee secures credits from the sponsor consistent with an ACOE permit.
- Default and closure provisions. Provisions describing bank closure when all credits have been released and sold or in the event of default.
- Reporting protocols. Provisions describing protocols for meeting reporting requirements including monitoring reports, financial assurance reports and long-term management funding reports.

The development of this extensive list of required elements in the 2008 rule represents the most comprehensive collection of best practices culled from nearly 20 years of banking policy and from the experience of the EPA regions and the ACOE districts.

Equivalence

A key variable in the design of wetland banking in the United States has been the techniques and metrics used to measure and assess bank credits. While PRM compensation is often assessed idiosyncratically, the rise of

banking and ILF has resulted in increased attention to the issue of generalizable measures of offset quality and equivalence. Bank and ILF credits must meet certain criteria independent of the specific impact they might compensate for. Ensuring quality and equivalence has two distinct components. First, regulators must decide on standards and criteria to determine whether a compensation site meets the goals of policy. These goals are typically both administrative and ecological, and the standards and criteria may take the form of a science-based rapid assessment method,[8] but which may also include social, demographic and economic information relevant to the programme's goals. Second, regulators must decide on the units in which the credit will be sold. That is, a site may be assessed with reference to sophisticated ecological measures, but transacted in units of area, (stream) length, ecosystem service or simply a unitless "credit".

Early in the development of wetland compensation policies in the United States, both the assessment and transaction of offsets was performed using complicated, sometimes custom, metrics finely tuned to the ecology of the ecosystems being managed. Minnesota's state-run wetland banking system in the 1980s relied on many reference tables to determine the amount of credit present at a site, while one bank in Louisiana discounted credits by the amount of time that had passed since the bank site's establishment. These were single-use banks[9] that were designed for use by large organisations with a consistent demand for credits (such as the Minnesota Department of Transportation, or a multinational petroleum company). As small and entrepreneurial bankers began to be licensed to produce wetland credits in the early 1990s, these bespoke systems were abandoned. Simple area- or length-based metrics were adopted to describe the transactible unit; this was recognised as a blunt, but necessary, abstraction which allowed for standardisable practices among diverse producers, while still providing a measure ensuring that the offset was equivalent in some way (wetland area or stream length) to the impact. The ecological status of bank sites selling these credits were usually still assessed using a variety of ecological, physical or hydrologic metrics; the measurement of the ecological status and the definition of the transactable unit were seen as separate.

Over the past decade, with the rise of concepts like "ecosystem services" and the development of function-based assessment, it has been more common to see proposals to develop systems to account for credits in units more closely derived from the measurements of ecological characteristics. In theory, describing a credit in terms of precise ecological functions, rather than in hectares, allows the population of credit providers to differentiate themselves by providing suites of different types of credits which are based on different functions – e.g. a credit provider in Oregon can provide salmon habitat credits, water quality credits and wetland impact credits, each sold in

units of ecosystem service, rather than providing the same area-based product as all other bankers. This may encourage different types of landowners, each with different endowments, costs and opportunities, to become involved in credit production. Describing a credit in terms of precise ecological functions also allows for a more precise matching between the impact and the offset.

However, such proposals have rarely been implemented. With functional metrics, the assessment of any given site may be far more complex with, perhaps, five key attributes (functions) rather than one (area). There is currently a wide range of practices concerning how functional assessment is used to assess a site and to demarcate transactable units of credit. The state of Ohio's system (Box 5.4) is one way that ecosystem science has been used to bridge the science of assessment with the policy-based requirements for easy measures of fungibility and equivalence using a rapid assessment method.

Box 5.4. **Functional assessment of wetland condition in Ohio using the ORAM**

In 2001, the Ohio Environmental Protection Agency released the ORAM, the Ohio Rapid Assessment Method (Version 5.0) (Mack, 2001). The ORAM used functional indices and metrics to arrive at a single score meant to reflect wetland "condition", assessing the ecological state of wetlands in a way that produces simple measures usable in both trade and regulatory compliance. The ORAM user's manual is clear that while any assessment of wetland quality is inevitably incomplete, regulators must comply with a state regulation that gives different levels of protection to wetlands in three different categories reflecting different levels of ecosystem quality or function. Thus, an assessment tool is needed that can determine whether a given wetland is in Category 1, 2 or 3. To the extent possible, the ORAM was designed to put this determination on a scientific footing. Producing a separate score for each wetland function, as other rapid assessment methods have done (Amman, 1991; Adamus, Morlan and Verble, 2010), would have presented the Ohio regulators with a rich set of numbers, but would have complicated, rather than simplified, the task of determining which of three categories the wetland belonged to, and thus what kind of compensation was required.

The ORAM scoresheet, much of which is completed during or after a field visit, requires an assessment of plant species, measures of hydrology, surrounding land use and microtopography. While it does not require a full plant inventory, there has been an exhaustive and decade-long process of calibrating the ORAM's scoring algorithm with intensive study of restored wetlands using tools such as the Vegetative Index of Biotic Integrity (Mack, 2000). The Ohio EPA's work in using a variety of functional indices to arrive at a single final score aims to achieve balance between reflecting ecological complexity and producing a simple assessment that regulatory agencies can use.

However sophisticated the ecological measures at the offset site, there is almost never parallel information collected at impact sites with which to compare to assure equivalence between impact and offset, and therefore to assess the effectiveness of the policy. Area or length measures of impact and offset, while convenient for compensation providers and regulators, makes the ecological outcomes of compensation policy difficult to evaluate.

Siting wetland mitigation banks

There is encouragement, but no requirement, that bank sponsors meet regional or national planning goals in proposing a bank site. Typically, wetland banks are sited where bank sponsors can acquire land cheaply or (more frequently) find a land-holding partner such as a farmer or energy firm; such partners often see a share of the bank profits (Robertson, 2009). The 2008 regulations encourage bank sponsors to take a "watershed approach" in bank site selection and design. A watershed approach is defined as an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs and how locations and types of banks (and other compensation sites) can "maintain and improve the quality and quantity of aquatic resources within watersheds through strategic selection of compensatory mitigation sites" (40 CFR 230.93(c)(1)).

The regulations relevant to bank siting apply to all forms of compensation. They encourage the use of existing watershed plans to inform siting decisions, and where appropriate plans do not exist, the regulations describe the types of considerations and information that should be used to support a watershed approach to compensation decision making. Such information includes current trends in habitat loss or conversion; cumulative impacts of past development activities, current development trends, the presence and needs of sensitive species; site conditions that favour or hinder the success of compensatory mitigation projects; and chronic environmental problems such as flooding or poor water quality (40 CFR 230.93(3)(i)).

Regulators have developed a variety of watershed approaches designed to improve site selection for compensation projects. The range of approaches is best described as spanning a spectrum, from simple and general logic frameworks to the more comprehensive and specific analyses and planning efforts (ELI and TNC, 2014). While selecting a site that optimises environmental benefits is not required, it can improve the chances that it will be approved by regulators.

Service areas

The service area is the area, often a watershed, eco-region, physiographic province, within which a mitigation bank (or an ILF) is authorised to provide compensatory mitigation. Regulations do not dictate a uniform size for service areas across the United States; rather they state that the service area must be appropriately sized to ensure that bank offsets will effectively compensate for adverse environmental impacts across the entire service area. Thus, a great deal of discretion is left to the government staff who review and approve the bank instrument. Service areas create the spatial boundary within which a bank can sell credits and thus determining the service area for a bank can be one of the most important and spirited debates during bank establishment. Bank sponsors generally argue for a larger service area to ensure economic profitability for the bank, while regulators often push to constrain service areas in order to ensure that provided compensation effectively offsets impacts to affected communities. Decentralised decision making allows local regulators to tailor service area determinations in light of various regional ecological and economic factors (see Womble and Doyle, 2010).

Risk management

Several types of risks are associated with the development of offset sites to compensate for permitted impacts. In the wetland offsets policy arena in the United States, these include:

- implementation risk: risk of logistical delays in offset site construction
- maintenance risk: risk that the site will not be protected in perpetuity
- migration risk: risk associated with the distance between the offset and impact sites
- planning risk: risk that plans for site acquisition, implementation and protection are unrealistic
- short-term financial risk: risk that funds will be unavailable to meet design and performance standards
- long-term financial risk: risk that funds will be unavailable to provide for long-term maintenance
- temporal risk: risk of lag in the ecological development of the site
- enforcement risk: risk that the offset provider cannot be forced to complete the site as planned

- secondary and cumulative risks: risks that there may be secondary and cumulative impacts associated with the offset project.

Compensation ratios are therefore commonly applied in the United States to address risk: for example, if an offset site is expected to pose a higher than average risk of ecological failure, the regulator might demote the credit available from that site by a factor of 0.5. Likewise, if the offset developer poses, in the view of a regulator, a lower than average risk of financial default, the regulator might multiply the credit available from their site by a factor of 1.25. The degree to which this is done is a matter of ACOE district custom and may be documented in a local Standard Operating Procedure document or memorandum.

The ratio method could be used to address all potential risks simply by adjusting the compensation ratio. However, if an offset site fails to provide ecological functions at all, requiring twice as many credits from the site achieves nothing. Offset credit ratios can clearly manage the risk of losses due to the slow ecological development of offset sites ("temporal risk"). Other forms of risk listed above may be addressed through other measures, such as performance bonding, the requirement of long-term financing, the legal measures in an offset site instrument or geographic limitations on the "service area" in which impacts are offsettable at the offset site.

Monitoring, reporting and verification

The establishment and management of mitigation banks are overseen by an Interagency Review Team (IRT) composed of various federal and state environmental and natural resource agencies and chaired by the ACOE. The specific composition of the IRT varies region by region. The use of an IRT, rather than giving a single agency sole responsibility for bank approval, recognises that the establishment and management of mitigation banks requires a broad skill set and implicates resources managed by several different agencies. In the US experience, the diversity of government agencies on an IRT brings important technical knowledge and expertise to the team. The kinds of ecological benefits (and impacts) generated by a bank site can be relevant to the programmatic concerns of many different agencies, and the bank sponsor is well-served if all of those agencies are fully involved and consenting parties from the draft prospectus stage onwards. For example, the construction of a wetland bank in the state of Oregon will very likely affect the habitat of endangered salmonids in some way. If the National Marine Fisheries Service (which regulates endangered marine species) is involved in the review of the bank proposal, it is unlikely that it will raise objections later in the life cycle of the bank's use, objections that might dramatically affect the bank's operation and economics. The

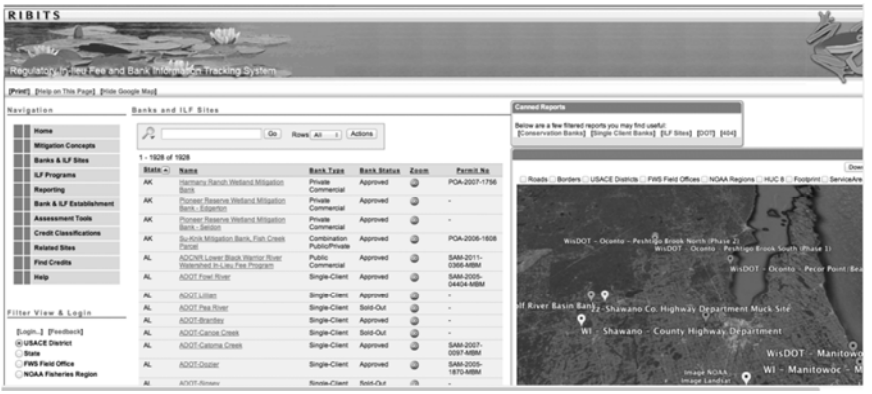
ACOE, as chair of the IRT, is required to co-ordinate with the IRT on all aspects of bank review and oversight. The IRT operates based on consensus; however, final decisions are made by the chair.

Involving multiple agencies in bank approval could have the effect of slowing down approval times. To reduce uncertainties and scheduling problems for bank sponsors, the total review time provided for regulatory review of a proposal is limited to 225 days, during which time certain kinds of review and approval must happen in phases, according to a schedule laid out in federal rule. It is important to note that these 225 days are not consecutive and do not include the time bank sponsors may take between the review phases to prepare and revise their bank proposals. No time limits are imposed on bank sponsors' activities during proposal review.

The banker cannot sell credits until the IRT releases them for sale, releases which usually occur in tranches tied to the bank meeting specific administrative or ecological criteria tied to the demonstrated achievement of project milestones. Full credit release typically takes place in stages over a number of years, as ecological restoration is completed and monitoring verifies desired ecological outcomes. This schedule is set in the instrument when the bank is approved. After reviewing monitoring reports and conducting site visits, regulators will release credits that the bank's sponsor can then sell to permit applicants.

When the bank credits are transacted, the ACOE must be notified so that the credits can be deducted from the bank's ledger. This accounting happens in widely divergent ways in each district, but recently the ACOE and the EPA have begun to keep track of mitigation banks and in-lieu fee programme sites in an online database called *Regulatory In-Lieu Fee and Banking Information Tracking System* (RIBITS). RIBITS allows users to access information on the types and numbers of mitigation bank and in-lieu fee programme sites, associated documents, mitigation credit availability, service areas, as well information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee programme development and operation. RIBITS was pilot tested in three ACOE districts in the early 2000s and based on its initial success was expanded to all ACOE districts by the late 2000s. The different data-keeping technologies and practices of each ACOE district posed distinct challenges in creating a national data architecture well after the establishment of banking, and fully populating the database was a costly challenge. However, RIBITS has helped credit buyers more efficiently find credit sellers. It has also improved regulators' ability to track credit transactions at banks (e.g. credit releases and debits), improve bank oversight and monitoring, and share information with the public, creating a more accountable and transparent offset programme.[10]

Figure 5.1. **Screenshot of the RIBITS site showing a list of wetlands banks and a map of banks in east-central Wisconsin**



Permanence: Lifespan and long-term maintenance

The impacts that compensation is designed to offset are largely permanent, so a fundamental goal of the regulations is the permanent protection of compensation sites. Each site must be protected with a binding real estate instrument. Potential instruments include:

- conservation easements held by government resource agencies or by non-profit conservation organisations
- the transfer of title to such entities
- restrictive covenants.

The Section 404 programme has always operated with the goal that compensatory mitigation projects would be self-sustaining over the long term. However, scientific evaluations of past practice have noted that long-term management is often necessary[11] (NRC, 2001). Thus, the 2008 regulations require that each compensation project have a long-term management plan that identifies ongoing management tasks that must be performed, and a long-term manager identified who is willing to take permanent responsibility for the site and perform the tasks. This task list is used to estimate how much funding needs to be set aside for long-term management, typically in the form of a non-wasting endowment,[12] and various tools exist to estimate appropriate endowments. Bank sponsors may not have interest in being the long-term managers of bank sites, and many entrepreneurial bankers arrange to transfer site control to a third party, usually a land trust. The regulations require that the party responsible for conducting long-term management, and the mechanism for funding it, be identified in the bank instrument at the time of bank approval.[13]

Liability and performance assurance: Making sure the project is completed

When a bank sponsor sells credits to a Section 404 permit applicant, the bank sponsor assumes the legal responsibility for providing compensation required by that permit. Should a bank fail to meet any performance standards, regulations provide a variety of tools to assure compliance:

- Regulators can restrict future release of credits for sale at a bank. If performance at the bank is a concern, regulators can delay the release of credits. If this does not achieve the desired results, regulators can suspend credits, or in more extreme situations suspend bank operations, mobilise financial assurances (see below) or terminate a bank's instrument.
- Mitigation banks (and other compensation projects) must set aside money to ensure that projects meet their performance standards in the event that the bank sponsor is either unwilling or unable to do so. These funds are often set aside in a trust, a letter of credit or a performance bond that can be released for use in improvements to the site if it fails to meet performance standards. Many bank instruments phase out the financial assurances required during bank site development as the bank meets successively higher performance standards.
- Failure to provide compensation for a permitted impact constitutes a violation of an ACOE permit, which can trigger a "compliance action" by the ACOE in which the banker is legally compelled to make the site meet performance criteria.

Performance assessment in wetland compensation

Wetland compensation practices have evolved and improved since compensation was first required, but the overall record has been mixed and there have been some high-visibility failures; the ecological and administrative failures of compensation were increasingly reported by both government agencies and academic ecologists by the mid-1990s. By 1999, the EPA and the ACOE were so concerned about the problematic record of wetland compensation projects that they asked the National Academy of Sciences' National Research Council (NRC) to take a critical look at the ecological effectiveness of wetland compensation. For two years, a team of scientists and experts assembled by the NRC reviewed all of the past field studies of compensation success, conducted site visits to compensation projects across the United States and interviewed regulators, mitigation practitioners and other wetland compensation experts. In 2001, the NRC published its over

300-page evaluation of wetlands compensation. The NRC's principal conclusions are provided in Box 5.6.

Box 5.5. **Interactions with other programmes**

Endangered Species Act credits at wetland banks

In California, there are a limited number of wetland banks that are co-licensed by the Army Corps of Engineers (ACOE) and the US Fish and Wildlife Service (which administers the Endangered Species Act habitat offset programme for terrestrial species). These banks are referred to as "ESA/404 banks", and sell both kinds of offset credits from the same property. However, the credits are physically demarcated on the ground, and if a credit is used to provide an ESA habitat offset, it is retired and cannot be used to satisfy a wetland offset obligation (see Madsen, Carroll and Moore Brands [2010] for further information).

Stacking credits

A somewhat more complicated form of integration is known as stacking, in which multiple offset credit types can be sold from the same physical piece of property (Robertson et al., 2014). This allows the offset developer such as The Willamette Partnership, a non-profit organisation in Oregon, to restore a stream/wetland complex and sell water quality offsets, wetland offsets, carbon offsets and endangered salmon offsets from the same site (The Willamette Partnership, 2010). The Willamette Partnership's bank site at Half Mile Lane is the result of a pilot programme sponsored by the US Environmental Protection Agency and the state of Oregon, and is hoped will form a model for entrepreneurial offset providers. Each management unit contains a set number of each type of credit; to account for the ecological inter-relationships between the credit types, whenever one credit is sold, the number of each other remaining credit type is reduced by one. This reduction is said to prevent "double dipping", or selling the same credit for multiple impacts. Parametrix, a firm in Portland, Oregon, has refined this system for use in offset and ecosystem service accounting systems worldwide: its algorithms suggest the precise relationship between, say, water quality and salmon habitat (Parametrix, 2010). If the two are 30% related, ecologically, then the sale of a water quality credit from a stacked site will result in the elimination of 30% of a salmon credit at the same site. The issue of stacking is the source of much scientific and policy debate and uncertainty, and in the United States has only been piloted at The Willamette Partnership site.

Box 5.6. **2001 National Research Council evaluation of the US Wetlands Compensation programme**

Conclusion 1: The goal of no net loss of wetlands is not being met for wetland functions by the mitigation programme, despite progress in the last 20 years.

- The National Research Council (NRC) provided three recommendations designed to improve data collection and tracking for wetland impact and compensation projects and to encourage partnerships with conservation organisations that could assist with offset project monitoring and management.

Conclusion 2: A watershed approach would improve permit decision making.

- The NRC provided seven recommendations designed to highlight special circumstances where impact avoidance should be emphasised and to encourage a landscape level approach to facilitate selection of the most ecologically meaningful and sustainable offset projects.

Conclusion 3: Performance expectations in Section 404 permits have often been unclear, and compliance has often not been assured nor attained.

- The NRC provided 12 recommendations designed to improve offset project planning, design, construction, performance monitoring, long-term management and compliance enforcement.

Conclusion 4: Support for regulatory decision making is inadequate.

- The NRC provided four recommendations designed to improve and expand wetlands restoration research and training for regulatory staff who work in the wetlands offset programme.

Conclusion 5: Third-party compensation approaches (mitigation banks, in-lieu fee programmes) offer some advantages over permittee-responsible mitigation.

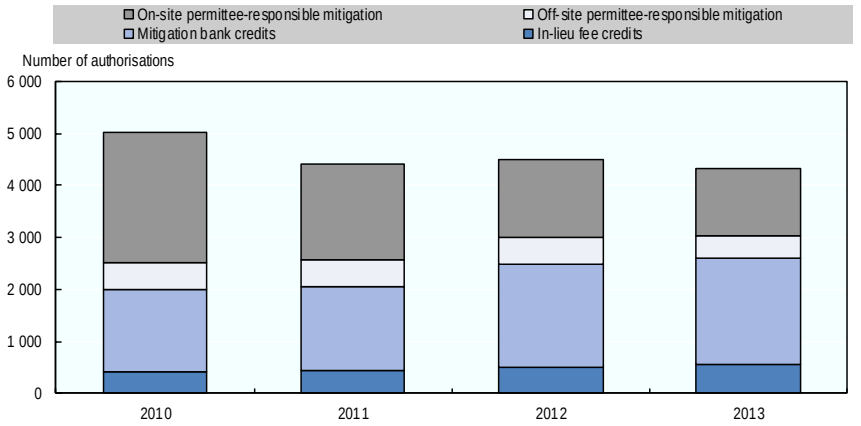
- The NRC provided three recommendations designed to ensure that all offset mechanisms (mitigation banks, in-lieu fee programmes and permittee-responsible mitigation) address a common set of fundamental standards to ensure that all three mechanisms would provide ecologically successful and sustainable wetland offsets.

In 2008, at the end of an eight-year process of revisiting and revising all aspects of compensation policy, the EPA and the ACOE jointly published revised regulations governing compensatory mitigation that were designed to address the key recommendations provided by the NRC to improve the performance and results of wetland offset projects. Many of the new provisions of the 2008 rule have already been discussed above; the rule-making process provided a chance to cull the best practices from

various ACOE districts and EPA regions and distill them into a single mandatory set of general practices. Regional interpretations of the 2008 rule are still evolving, and it is designed to allow a significant amount of local flexibility in implementation.

Data on the use of wetland banks was hard to aggregate nationally before the implementation of RIBITS, but it is now known that a large percentage of wetland compensatory mitigation occurs at wetland mitigation banks (Figure 5.2). In 2005, the proportion of permits for which compensation was provided at wetland banks was around 33% (ACOE, 2006), and the number is higher now. Although the number of mitigation bank approvals has increased dramatically since the early 1990s (Figure 5.3), mitigation banks are not evenly distributed across the country and there are significant portions of the United States that are not covered by a mitigation bank service area. In-lieu fee programmes provide compensation options in many of the areas not covered by banks, but in large parts of the United States, permittee-responsible mitigation is still the only compensation option.

Figure 5.2. **US Wetland Compensation mechanism, 2011-12**

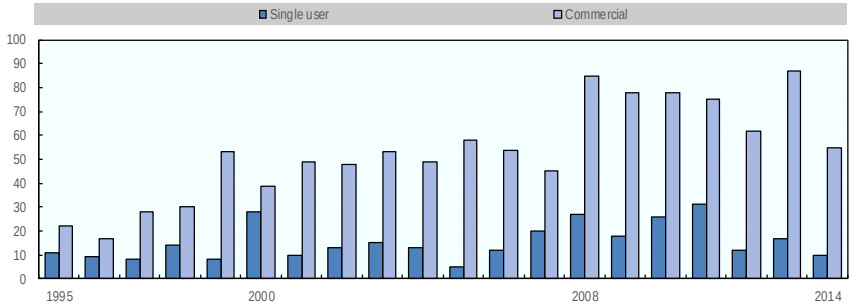


Source: IWR-ACOE (2015), "The mitigation rule retrospective: A review of the 2008 regulations governing compensatory mitigation for losses of aquatic resources", www.epa.gov/cwa-404/mitigation-rule-retrospective-review-2008-regulations-governing-compensatory-mitigation.

Although wetland banking in the United States has often been considered successful (NRC, 2001), there have been relatively few rigorous assessments of the ecological outcomes at wetland bank sites, and even fewer assessments of the economic efficiency of the policy. The development of wetland banking was in part stimulated by concern over the

ecological failures of permittee-responsible mitigations, concerns which were articulated almost immediately after the first uses of wetland compensation in permits in the late 1970s. Studies in California in the early 1980s (Race and Christie, 1982; Josselyn and Bucholz, 1982; Race, 1985) showed substantial evidence that PRM compensation sites were not functioning, both in terms of meeting ecological objectives, and failure to meet the narrow (and arguably inadequate) standards required in the impact permit. A growing number of reports in the late 1980s and 1990s corroborated these findings (Brinson and Lee, 1989; Kentula et al., 1992; Wilson and Mitsch, 1996; Allen and Feddema, 1996; Zedler and Callaway, 1999). Some, such as Erwin (1991), were so-called "file reviews", which simply determined whether or not the ACOE permit file indicated that the compensation had been constructed and met the specifications required in the permit. Erwin examined Florida's PRM sites and found that only 33% of required PRM compensation sites had ever been constructed, and only 6% were meeting their permit criteria.

Figure 5.3. **Approval of mitigation bank sites**



Source: IWR-ACOE (2015), "The mitigation rule retrospective: A review of the 2008 regulations governing compensatory mitigation for losses of aquatic resources", www.epa.gov/cwa-404/mitigation-rule-retrospective-review-2008-regulations-governing-compensatory-mitigation.

Such file reviews allowed the assessment of the ACOE's wetland regulatory system, but did not usually allow assessment of the ecological quality of the compensation sites themselves, and the number of scientifically rigorous ecological assessments of compensation sites is still comparatively small. However, by 2001 there was a large enough set of ecological reports on compensation performance for the NRC to find that PRM offsets were not effective: even when constructed as required, they were often not providing ecological benefits.

Negative assessments of PRM offsets paved the way for wetland banking and ILF to be more widely considered as an alternative to PRM offsets, since banks and ILF sites are more easily monitored and, as larger sites, may be more ecologically stable and beneficial. The Government Accountability Office (1988, 1991, 1998) and NRC (2001) both issued major reports condemning the outcomes of Clean Water Act compensation policies and urging the ACOE and the EPA to take dramatic measures to assure improved compensation outcomes. Among their recommendations was a rather tentative endorsement of entrepreneurial offset banking – "third-party compensation approaches (mitigation banks, in-lieu fee programmes) offer some advantages over permittee-responsible mitigation" (NRC, 2001: 9).

Ecological assessments of compensation sites

In the few direct ecological assessments of wetland compensation sites, and the even smaller number that assess wetland banks specifically, one general finding is that while individual measures of ecological success may or may not be met, there is often a distinction between the physiographic classes or categories of wetlands being impacted and those being restored. Kentula et al. (1992) and Sifneos, Kentula and Price (1992), for example, found that wetland offset sites were more likely to be permanently inundated, open-water sites, while the impact sites were more likely to be seasonal wetlands with an emergent plant community. Moreover, forested sites were often observed to be replaced by sites dominated by herbaceous vegetation. Above all, however, it was almost universally found that wetland scientists lacked sufficient benchmarks and measures to adequately assess whether or not a compensation site was on a developmental trajectory toward being a high-functioning ecosystem (Simenstad and Thom, 1996; Zedler and Callaway, 1999).

In an assessment of wetland banks in the state of Ohio, Mack and Miccachion (2006) found that of nearly 400 ha of offsets, 25% was in an open-water, unvegetated condition, and of the remaining wetland area 58% was considered to be in "poor" condition while only 18% was considered to be in "good" condition. Amphibian communities were significantly less healthy at offset sites than at natural sites. This was one of the earliest studies to focus only on entrepreneurial offset sites, and the banking community responded by claiming that such assessments hold bank sites to higher (ecological) standards than they are required to meet by regulators. The assessment of a single stream offset bank in the state of North Carolina (Moorhead et al., 2006) suggested that at least in the short term, restoration activities can negatively affect soil structure and nutrient processing, while augmenting biodiversity across a range of taxa. Peralta, Matthews and Kent

(2010) found strong reductions in soil microbial activity and soil nutrient cycling at a wetland bank in the state of Illinois. There remain very few ecological assessments of wetland bank sites in the peer-reviewed literature, and there is no consensus on a common set of end-points that can be used to determine ecological success.

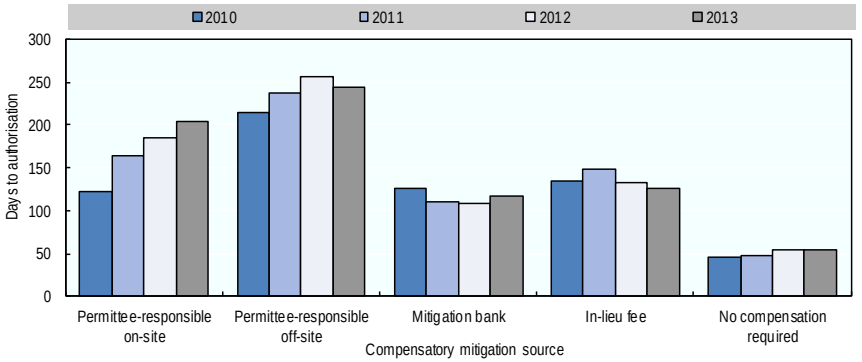
Administrative measures of success

Evaluations of whether compensation sites have met the criteria defined in the bank instrument or permit are easier to perform than field studies of compensation site ecology. Such administrative criteria may be grounded in ecosystem science or fluvial geomorphology, and provide a clear set of end-points on which to evaluate offset success; one example is Erwin's 1991 report discussed above. The state of Florida's 2007 report (Reiss, Hernandez and Brown, 2007) studied bank sites' "ecological success and compliance with permit criteria", where ecological success is determined using rapid assessment methods rather than extended ecological study. By contrast with Erwin's study, in reporting on 29 (out of 45) wetland bank sites, Reiss, Hernandez and Brown found that all 29 had been constructed and had functioning wetland ecosystems present. However, it was also found that a wide range of standards were used to define "success" in the bank's instruments. Because many standards were qualitative, many vague, and some indicated comparison with reference sites that did not exist, it was impossible to determine how many bank sites were in compliance with their permit conditions. The authors of the 2007 Florida report felt it necessary to remind regulators that "Permits and attached or referenced documents should contain the detailed community goals and/or reference conditions the site is anticipated to attain" (p.46). The Florida study's use of ecologically based rapid assessment methods led them to conclude that "wetland assessment areas in banks that had achieved final permit success criteria did not receive the highest attainable scores for the functional assessment methods employed, suggesting full wetland function has not been achieved".

Economic effectiveness

Wetland banking has been successful at reducing the time involved in obtaining a permit (Figure 5.4), and in relieving permit-holders of the responsibility for long-term planning and management at a compensation site. The elimination of this liability and the increased velocity through the CWA regulatory programme are frequently cited by permittees as the most important economic benefits of wetland banking (Robertson, 2007).

Figure 5.4. **Time to permit by compensation mechanism, 2011-12**



Source: IWR-ACOE (2015), "The mitigation rule retrospective: A review of the 2008 regulations governing compensatory mitigation for losses of aquatic resources", www.epa.gov/cwa-404/mitigation-rule-retrospective-review-2008-regulations-governing-compensatory-mitigation.

Private sector bankers are required to divulge neither the prices they charge for compensation, nor the costs of site construction. This makes the evaluation of the actual economic impact of wetland banking very speculative. There exist a few studies in which economists have attempted to model the operation of wetland credit markets (Woodward, 2011; Fernandez and Karp, 1998), but there are just as many (see especially King, 2002) who insist that regulatory markets will fail to behave like free markets and are especially vulnerable to strategic behaviour on the part of both regulators and producers. Robertson and Hayden (2008) is the only study to present a full survey of credit price in a wetland banking market, presenting data on the Chicago market from 1994-2002. Their report shows that credit cost remained stable around USD 50 000 per acre during the eight-year study period, even as demand fluctuated dramatically with changes in the legal requirements for compensation. These data, combined with qualitative interview data (see Robertson, 2007), strongly suggest that bankers adopt a "cost-plus" approach to pricing: they do not engage in market research or extensive negotiations with clients, but rather tend to agree on a standard price in a given region. This price is high enough to keep bankers' businesses viable, but low enough that it does not present the appearance of taking advantage of the larger real-estate industry in which they are deeply embedded as a service provider.

Robertson and Hayden (2008) provide only anecdotal data on producer costs, but note that in the study, one offset purchase amounting to USD 60 000 allowed a housing developer to avoid having to compensate for a wetland

fill using other land in the development project. Had they had to do so, they estimated the foregone value of that land at close to USD 300 000, meaning that the existence of wetland banking as a compensation option provided USD 240 000 in savings to the development company. This remains an anecdote, but the developer's estimate of foregone value would hold true for large sections of suburban Chicago, and it is probable that many permit holders found themselves in similar situations. In general, the fact that wetland bankers in the United States tend to set standard prices rather than to negotiate each sale with each client individually means that wetland banking provides substantial cost savings to permit holders operating in areas with higher than average land values. In economic terminology, this means that there can be large consumer surpluses associated with wetland banking. This will only be true, however, if the permit-seekers are not able to secure an off-site PRM themselves in a much less-costly location. Where bankers are operating in a context in which the permit holder can easily obtain their own off-site PRM, prices may more fully reflect the value of the offset to the permit holder. Much therefore depends on the service area served by the bank: does it encompass areas of low land value where their clients might find low-cost PRM offsets without going to a bank? Does it include areas of rapid development where high land values make cheap PRMs hard to find? The cost-savings potential of wetland banking depends almost entirely on these local and fluctuating factors.

Distributional assessments of wetland banking

There is evidence of adverse social effects from concentrating wetland offsets far from the site of impact. Salzman and Ruhl (2006) find, for example, that for the most part wetland offset banks are likely to be located in far less-populated areas than the wetlands they are compensating for (due to lower land values), meaning there is less opportunity for offset sites to provide social benefits (such as access to natural landscapes and open space) to a nearby populace. Overall, the authors recommend that offsets should be located in an area with the same general demographic characteristics as the impact site. Similarly, other studies (BenDor, Brozovic and Pallathucheril, 2007, 2008; BenDor and Brozovic, 2007) find that wetland offset policy has generated a broad urban-to-rural transfer of wetlands. This is an effect which US wetland regulators are poorly equipped to recognise, much less assess and address, because demographic data on the sites of wetland impacts and compensation are almost never included in permit decisions. Even if it were, CWA regulators do not traditionally make permitting decisions based on changes in social well-being (although it can be argued that they have this authority). BenDor and his colleagues raise several concerns about the social distributional effects of this transformation:

- Using political boundaries to limit the distance between impact and offset may produce more out-of-watershed compensation and other environmentally adverse results.
- Offsets typically move from areas of high population density to areas of low population density, though not always from areas of low affluence to high affluence.
- Different mitigation methods do not all redistribute the social benefits of wetlands from impact to compensation sites in the same way.
- Regulators do not have the data collection capacity to analyse the social distributional effects of their decisions about offsets.

Insights, best practices and lessons learned

Wetland banking in the United States emerged as a single solution to very different problems of administering a regulatory permit programme. It helped to address three problems that were articulated, respectively, by regulators, the regulated community and ecosystem scientists:

1. Regulators: due to understaffing, regulators had few ways to ensure that widely scattered and small PRM offset sites were even built, much less meeting their permit criteria. Erwin's (1991) report on Florida's compensation failures was an extreme case of a general problem.
2. The regulated community: permittees desired some way to avoid the responsibility for building, managing and monitoring a wetland compensation site – this was rarely something in which they had in-house expertise, and the long-term monitoring obligations fit poorly with the typical project timelines of residential, commercial and infrastructural developments.
3. Ecosystem scientists: even when offset sites were meeting permit criteria, they were not providing the same kinds of ecological benefits as natural wetland sites.

In response to these problems, the large consolidated offset sites at wetland banks provided:

- a site that could easily be monitored by regulators and a legal instrument that clearly assigned duties to capable and responsible parties
- accelerated velocity through the regulatory programme for permittees, and the transfer of liability for offsets to third parties

- sites whose location can at least potentially be planned with reference to maximise landscape and watershed environmental integrity.

The historical context of these motivations and goals must be kept in mind when assessing the US wetland banking system, and the Compensation Mitigation programme more broadly. Some lessons learned, that may be relevant to other offset programmes, are highlighted below.

The mitigation sequence has been effective at generating support for policy, but minimisation is a missed opportunity.

The fact that compensation can only be approved after the permittee has demonstrated that they have both avoided and minimised wetland impacts, to the extent "practicable", has proved to be a very important element in securing general support for the CWA permit programme from all sides. Environmentalists feel reassured that regulators are not allowing proposed impacts to proceed solely on inflated promises of compensation, and both wetland bankers and land developers can point to their adherence to "the sequence" to show their business in a more environmentally friendly light. If compensation were the first or only step in the mitigation process, there would not be nearly such public confidence in the banking and compensation programme as exists currently.

However, there are two major challenges to fully implementing the first two steps, avoidance and minimisation. The achievement of avoidance is hard to measure because a great deal of avoidance happens before a project proponent applies for a permit. For example, a project proponent may select a site with no wetlands and avoid the permit programme altogether, or make adjustments in project design to avoid major impacts to wetlands and other waters of the United States, even before submitting an application to the ACOE. Similarly, these adjustments can often be made as a result of pre-application recommendations made by the ACOE and other reviewing agencies through voluntary meetings. Minimisation, for its part, is not well-defined in any rule or policy. Minimisation measures described in the regulations were written well before the advent of low-impact design and the concept of "green building," and focus primarily on the specific impacts associated with disposal of river and dredge spoil. This gap between the spare and somewhat dated minimisation provisions in the guidelines and currently feasible measures has created uncertainty regarding what actions can be required as ''appropriate and practicable'' minimisation under the huidelines (Hough and Robertson, 2009).

The lack of any minimisation policy in the United States represents a lost opportunity, and a valuable lesson. Offsetting an impact through compensation has been proved effective and capable of supporting markets. But it may

also be possible to reduce impacts through minimisation by incentivising these activities through a credit system. At least they could be better specified to increase the overall trust in and effectiveness of an environmental permit programme.

The wetland programme has benefited from a combination of regional autonomy and national consistency.

The wetland banking programme, like many innovations in US environmental management, originated with regional offices of federal agencies working together with the local regulated community to ensure that programme goals were met in ways that did not present intolerable impositions on economic activity. The role of the headquarters offices of the EPA and the ACOE has typically been to formalise ideas that have been shown to work at the regional or district level, and facilitate their spread to other regions or districts. As noted above, this has resulted in a very uneven and variegated patchwork of practices: although the 2008 compensation regulation applies to all wetland banking, in practice each banker has to deal with the elaborations and procedures built on that basic framework that apply in whatever region they operate. As noted above, the effect is to create hundreds of different wetland banking policies rather than a single national one, each adapted to their local economic, environmental and social context.

Compensation policy may require the equivalence of offset and impact, but science-based measurement is difficult to achieve.

The practical challenges associated with ensuring that the ecological functions lost at an impact site are fully offset are daunting. Good information on the ecosystem functions and services lost at the impact site can be hard to obtain: in many cases, development projects must proceed along a schedule that does not allow for any extended study of the site of the proposed impact. And even if impact sites can be thoroughly evaluated, this will add to the staff time required for permit review. Full information on impact sites can also pose new problems: equivalence can be an unachievable goal because the more information that exists about the functions lost at the impact site, the more challenging the search will be to find an offset site that provides equivalent functions.

While full ecological characterisation of both impact and compensation sites is a worthy goal, in practice it has proved an unreachable one. The assessment of both should be science-based, but the grounds for equivalence should take a form that translates easily into metrics maximising the ease of programme assessment rather than maximising scientific accuracy (as in the Ohio programme; see Box 5.4). Difficulty in documenting equivalence of

impact and offset can translate into difficulty in assessing the overall success of the programme.

In general, it is best to use quantitative, ecologically based standards for site assessment and success evaluation. The negative assessments of US compensation practice in the 1980s and 1990s frequently cited the lack of any standing quantitative performance standards or benchmarks against which to evaluate compensation site condition.

It is beneficial to maintain a variety of compensation mechanisms.

Having three different mechanisms for providing compensation can help to ensure that permit applicants in need of compensation have a variety of cost-effective compensation options from which to choose. Wetland banking may not thrive in situations where the demand for offsets is too low. In four situations the demand for credits may be so low that no private sector provider will be able to recoup their investment in a reasonable amount of time through credit sales:

1. in sparsely populated areas
2. in arid areas where wetlands are uncommon
3. in areas where economic development is very slack
4. where service areas are so small that they do not encompass enough wetland impacts

In these situations, in the US experience, the use of in-lieu fees has been found to be a compensation option that provides more stability for permittees seeking third-party offsets. In-lieu fees accumulate money until sufficient funds exist to acquire and develop an offset site, as described above.

Regular programme evaluations are critical.

The advances in wetland banking practice have only been possible due to rigorous and occasionally very critical programme evaluations, from both internal and external reviewers. Government oversight agencies such as the Government Accountability Office, the National Research Council and the Congressional Budget Office, academic work sponsored by universities and government granting agencies, and reviews by non-profit institutions such as Conservation International and the Environmental Law Institute have all proved crucial in improving the wetland compensation programme, including wetland banking and exposing its weaknesses. Starting in the late 1980s and continuing into the 1990s, field investigations of wetland mitigation projects done at the regional and state level were consistently informing the EPA and the ACOE that there were major problems with

compensation projects. These studies raised real concerns regarding whether compensatory mitigation projects were successfully offsetting permitted losses and whether compensation was helping to ensure the national goal for the regulatory program of the NNL of wetlands. By 1999, the EPA and the ACOE were so concerned about the problematic track record of compensation that they jointly asked the NRC to assess the ecological effectiveness of wetland compensation. For two years a team of scientists and experts assembled by the NRC reviewed all of the past field studies of compensation success, conducted site visits to compensation projects across the country and interviewed regulators, mitigation practitioners and others experts. In 2001, the NRC published a 300-page report on wetlands compensation: its primary finding was that despite progress throughout the 1980s and 1990s, wetland compensation had not halted the net loss of wetlands – no matter whether losses were measured in acres or functions. However, the NRC provided the EPA and the ACOE with over 25 recommendations on how to address some of the major problems – and directly stimulated the 2008 regulation in which the ACOE and the EPA were able to codify these recommendations into regulations.

The administrative components of every mitigation plan need to be consistent and explicit.

While ecological criteria for compensation success may vary by region and ecosystem, it is both feasible and important to set administrative criteria at the highest organisational level. One of the most important lessons learned in the growth of the wetland banking programme is the requirement that all compensation plans – whether they are associated with a bank, ILF or PRM – must address the same list of administrative criteria, and this list needs to be comprehensive enough to ensure positive outcomes. If different compensation mechanisms are held to different standards, it creates an uneven playing field in which lower-quality forms of compensation predominate because they are cheaper to create. This principle, of course, exists in tension with the lesson above concerning the need for regional and local flexibility in implementation, but the general components of mitigation plans are nationally consistent. Failures of compensation sites in the past were often linked to the failure to address one or more of these critical planning elements, and each one of these elements represents a major lesson learned for the EPA and the ACOE over the 40-year evolution of the wetland programme. Each compensation site plan must include:

- objectives
- site protection instrument
- baseline information

- work plan
- maintenance plan
- performance standards
- monitoring requirements
- financial assurances
- site selection factors
- credit determination
- long-term management plan
- adaptive management plan.

Since regulators have their maximum leverage before a bank is approved, these administrative requirements are effective ways to secure environmentally positive long-term results. After-the-fact enforcement of a failed bank or other compensation site has proved very difficult, both legally and practically (Gardner and Pulley Radwan, 2005). It is thus far better to ensure upfront, in a legal document like a bank instrument, that sufficient funds must exist to manage foreseeable problems. The requirement for long-term financing and management is particularly crucial in this respect, and regulations require the use of a non-wasting endowment (i.e. one with a large enough principal that site management activities can be funded entirely from the interest earned) and the identification of a long-term manager who is willing to take on responsibility for the site in perpetuity.

Farmer interest in producing offsets may be reduced where other kinds of conservation programme monies are available.

Where offset programmes are managed as part of a larger strategy of targeting farmers to make environmental improvements through different kinds of subsidies, green payments and ecosystem service schemes, offset provision may compete poorly with other more traditional conservation programmes. In a traditional green payments programme, farmers do not have to risk the failure of finding an offset buyer, nor do they have to become knowledgeable about marketing a new kind of product. Where farmer involvement has been successful in wetland banking, it has tended to be where there are a few consistent institutional buyers of credits that provide regular demand. Farmers providing offsets also do not tend to self-organise into a coherent group or audience for policy messages and direction, meaning that they may be slow to respond to needed changes in offset policy. Banking policy in the United States has solved its problems

more quickly in ACOE districts where there is an active pool of self-identified bankers dedicated to producing credits as their primary occupation.

Banking may lead to cost savings, but this depends on a host of local factors.

In economic terminology, banking can produce large consumer surpluses, in which the offset purchaser pays far less money than they would have been willing to. Theoretically, a purchaser and a credit seller should negotiate on price to the point where the credit sells for just less than the purchaser would have had to pay to obtain compensation in some other fashion, but in many cases, the purchaser spends much less for bank credits than they would have had to pay for a PRM if the bank credit had not been available. Price in banking markets is poorly understood, but it is thought that bankers set fixed prices (rather than negotiating) in order to maintain contracting relationships with large firms in the real-estate development sector. Large consumer surpluses will only be present, however, if the permit-seekers are not able to secure an off-site PRM themselves in a much less-costly location. Where bankers are competing with easily obtainable off-site PRM, price competition may occur and prices may more fully reflect the value of the offset to the permit holder. Much therefore depends on the service area served by the bank: does it encompass areas of low land value where their clients might find low-cost PRM offsets without going to a bank? Does it include areas of rapid development where high land values make cheap PRMs hard to find? The cost-savings potential of wetland banking depends almost entirely on these local and fluctuating factors.

Be aware of interference across administrative scales.

Although wetland banking emerged in response to CWA compensation requirements, any wetland bank exists within a complicated set of overlapping administrative and legal forces at several scales. In many cases in the United States, other scales of government (the county, township, drainage district, municipality or the state) can issue regulations, or establish informal practices, that restrict wetland credit transactions. They can also issue a wide array of regulations and practices around zoning, floodplain management, stormwater or transport policies which are formally unrelated to wetlands but which can have dramatic effects on the viability of a wetland banker's plans. In the state of Minnesota, state law has empowered 300 different counties and municipalities to determine whether or not wetlands impacted within their boundaries can be compensated for outside of their boundaries. This has resulted in many of the urban municipalities around the major metropolitan area – where wetland impacts are most common – adopting formal or informal policies preventing the city's loss of

wetlands through compensation elsewhere. As wetlands are increasingly considered to be open-space and recreational amenities, one city does not want to lose wetlands to development that is then offset at a bank in a neighbouring city. A similar situation applies in the Chicago metropolitan area. An offset programme must be designed around existing resource policies, augmenting them where possible, and at minimum not degrading their effectiveness.

Banks have led to efficiencies in permit processing times.

When a mitigation bank is used to provide compensation for permitted impacts, permits are issued much more rapidly than they are in traditional PRM compensation. This is because the mitigation bank sponsor has already done all of the hard work developing a wetland restoration project and securing agency approval for all the details associated with the project. This is also true of ILF programmes, which can sell credits before having even identified a compensation site – although this means that ILF programmes present somewhat greater risk that compensation will not fully replace lost functions, values and area.

There should be a data system for managing information about offset credit availability.

Any agency managing an offset programme should develop a public and transparent tool (e.g. RIBITS) to manage and share mitigation information about the availability and type of offsets prior to the launch of the programme. This ensures that people who need offsets are fully informed of the available offset sources, and ensures that offset producers are fully informed about the nature of demand and supply in their service area. Finally, it ensures that data reporting on the effectiveness and status of the offset programme is comparable across years and across the territorial extent of the programme.

Wetland banking and wetland compensatory mitigation in the United States continue to evolve, more than 40 years after the establishment of the regulations that created them. Its hallmarks have been adaptive learning, co-operation among many agencies and layers of government, and a productive process by which regional innovations are refined and disseminated at the headquarters level. Above all, the effectiveness and legitimacy of the compensation programme has depended on the strength of the presumption that impacts to resources should be avoided, and that compensation, when it occurs, is therefore both necessary and environmentally beneficial.

Notes

1. Although the Clean Water Act was passed in 1972, the practice of requiring compensation for impacts to wetlands and other aquatic resources was an informal practice developed in the mid-1970s among regional regulatory staff, and was not formalised in regulation until 1980.

2. The ACOE was given regulatory authority to maintain the navigability of the nation's rivers and harbors in the Rivers and Harbors Act of 1890, and a permit programme for impacts to navigable waters was established in the Rivers and Harbors Act of 1899. The federal government's control over water stems from its power to regulate interstate commerce under Article III, Section 8 of the US Constitution. In 1972, rather than establish a completely new permitting authority, the CWA's permit programme was added to the administrative apparatus already established to issue Rivers and Harbors Act permits.

3. These criteria are binding regulations known as the "Section 404(b)(1) Guidelines" (40 CFR Part 230).

4. For more on the status of this effort, see: http://water.epa.gov/lawsregs/guidance/wetlands/CWAwaters.cfm.

5. It is almost never the case that headquarters creates new policies *de novo* – programme innovations are almost always developed and incubated in a regional or local context among small groups of experienced regulators and private sector participants united by relations of trust and the mutual recognition of a regionally specific problem to be addressed. The private sector provision of wetland bank credits, for example, emerged from the Chicago, Jacksonville and Savannah ACOE districts: in these districts, a wetlands-rich landscape and rapid real-estate development incentivised permit-seekers to work with regional regulators to develop a new form of compensation to speed permit approvals and provide better ecological and administrative results than standard compensation was providing.

6. 40 CFR §§ 230.91 - 230.98 and 33 CFR §§ 332.1 - 332.8.

7. 40 CFR 230.93(a)(1); see also 40 CFR 230.93(b).

8. Rapid assessment methods are short forms filled out during field visits to compensation sites. They are developed by ecologists and allow non-experts, with brief training, to collect information on a site in a short period of time that allows sites to be scored and ranked. Some rapid assessment methods provide a single overall score for a site, and others

provide a suite of scores. See: www.epa.gov/nheerl/download_files/publications/rapidmethodreview.pdf.

9. Single-use banks are banks developed by a public or private organisation to generate credits solely for their own use. Nearly all of the banks developed in the United States until the early 1990s were public single-use banks developed by the Departments of Transportation of individual states, to compensate for road-related wetland impacts (Short, 1988).

10. See: http://geo.usace.army.mil/ribits/index.html.

11. For example, it is not warranted to assume that once mitigation sites meet their performance standards they will be self-sustaining in the absence of any management.

12. That is, a fund of money invested in such a way that the full costs of site maintenance can be paid for by the interest from the fund, and the fund's principal remains untouched.

13. Long-term stewards may change after initial approval of a bank's instrument; however, such changes must be approved by the ACOE.

References

ACOE (2006), "Draft environmental assessment, finding of no significant impact, and regulatory analysis for proposed compensatory mitigation regulation", US Army Corps of Engineers, Washington, DC, www.usace.army.mil/Portals/2/docs/civilworks/regulatory/Draft_EA_Reg_Analysis.pdf.

Adamus, P., J. Morlan and K. Verble (2010), "Manual for the Oregon Rapid Wetland Assessment Protocol (ORWAP)", Version 2.0.2, Oregon Department of State Lands, Salem, Oregon, https://www.oregon.gov/dsl/WETLAND/docs/orwap_manual_v2.pdf.

Allen, A.O. and J.J. Feddema (1996), "Wetland loss and substitution by the Section 404 permit program in Southern California, USA", *Environmental Management*, Vol. 20/2, pp. 263-274, http://dx.doi.org/10.1007/BF01204011.

Ammann, A. (1991), "Method for the comparative evaluation of nontidal wetlands in New Hampshire", New Hampshire Department of Environmental Services, Concord, New Hampshire, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_015149.pdf.

BenDor, T.K. and N. Brozovic (2007), "Determinants of spatial and temporal patterns in compensatory wetland mitigation", *Environmental Management*, Vol. 40/3, pp. 349-364, http://dx.doi.org/10.1007/s00267-006-0310-y.

BenDor, T.K., N. Brozovic and V.G. Pallathucheril (2008), "The social impacts of wetland mitigation policies in the United States", *Journal of Planning Literature*, Vol. 22/4, pp. 341-357, http://dx.doi.org/10.1177/0885412207314011.

BenDor, T.K., N. Brozovic and V.G. Pallathucheril (2007), "Assessing the socioeconomic impacts of wetland mitigation in the Chicago region", *Journal of the American Planning Association*, Vol. 73/3, pp. 263-282.

Brinson, M.M. and L.C. Lee (1989), "In-kind mitigation for wetland loss: Statement of ecological issues and evaluation of examples", in: Sharitz, R.R. and J.W. Gibbons, *Freshwater Wetlands and Wildlife*, Oak Ridge, Tennessee, USDOE Office of Scientific and Technical Information, Vol. 61, pp. 1 069-1 085.

Conservation Foundation (1988), "Protecting America's wetlands: An action agenda: The final report of the National Wetlands Policy Forum", The Conservation Foundation, Washington, DC.

Dahl, T.E. (2011), "Status and trends of wetlands in the conterminous United States 2004 to 2009", US Department of the Interior, Fish and Wildlife Service, Washington, DC, https://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Wetlands-in-the-Conterminous-United-States-2004-to-2009.pdf.

Dahl, T.E. (1990), "Wetlands losses in the United States 1780's to 1980's", US Department of the Interior, Fish and Wildlife Service, Washington, DC, https://www.fws.gov/wetlands/Documents/Wetlands-Losses-in-the-United-States-1780s-to-1980s.pdf.

Dahl, T.E. and S.-M. Steadman (2013), "Status and trends of wetlands in the coastal watersheds of the conterminous United States 2004 to 2009", US Department of the Interior, Fish and Wildlife Service, Washington, DC, https://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Wetlands-In-the-Coastal-Watersheds-of-the-Conterminous-US-2004-to-2009.pdf.

ELI and TNC (2014), *Watershed Approach Handbook: Improving Outcomes and Increasing Benefits Associated with Wetland and Stream Restoration Projects*, Environmental Law Institute and The Nature Conservancy.

Erwin, K.L. (1991), "An evaluation of wetland mitigation in the South Florida Water Management District", Vol. 1, Methodology, South Florida Water Management District, West Palm Beach, Florida.

Fernandez, L. and L. Karp (1998), "Restoring wetlands through wetlands mitigation banks", *Environmental and Resource Economics*, Vol. 12, pp. 323-344.

Gardner, R.C. and T.J. Pulley Radwan (2005), "What happens when a wetland mitigation bank goes bankrupt?", *Environmental Law Reporter*, Vol. 35/9, pp. 10 590-10 604.

Government Accountability Office (1998), "Wetlands overview: Problems with acreage data persist", RCED-98-150, Government Accountability Office, Washington, DC, www.gao.gov/products/RCED-98-150.

Government Accountability Office (1991), "Wetlands overview: Federal and state policies, legislation, and programs", RCED-92-79FS, Government Accountability Office, Washington, DC, www.gao.gov/products/RCED-92-79FS.

Government Accountability Office (1988), "Wetlands: The Corps of Engineers' administration of the Section 404 program", RCED-88-110, Government Accountability, Washington, DC, www.gao.gov/products/GAO/RCED-88-110.

Hough, P. and M. Robertson (2009), "Mitigation under Section 404 of the Clean Water Act: Where it comes from, what it means", *Wetlands Ecology and Management*, Vol. 17/1, pp. 15-33, http://dx.doi.org/10.1007/s11273-008-9093-7.

IWR-ACOE (2015), "The mitigation rule retrospective: A review of the 2008 regulations governing compensatory mitigation for losses of aquatic resources", Institute for Water Resources and US Army Corps of Engineers, Alexandria, Virginia, www.epa.gov/cwa-404/mitigation-rule-retrospective-review-2008-regulations-governing-compensatory-mitigation.

Josselyn, M. and J. Buchholz (1982), "Summary of past wetland restoration projects in California", in: *Wetland Restoration and Enhancement in California*, California Sea Grant report T-CSGCP-007, pp. 1-10.

Kentula, M.E. et al. (1992), "Trends and patterns in Section 404 permitting requiring compensatory mitigation in Oregon and Washington, USA", *Environmental Management*, Vol. 16/1, pp. 109-119.

King, D. (2002), "Managing environmental trades: Lessons from Hollywood, Stockholm and Houston", *Environmental Law Reporter*, Vol. 32/11, pp. 11 317-11 320.

Lamunyon, J. (1994), "Wetlands and the swampbuster provisions: The delineation procedures, options, and alternatives for the American farmer", *Nebraska Law Review*, Vol. 73/1, pp. 163-186, http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1598&context=nlr.

Mack, J.J. (2001), "Ohio Rapid Assessment Method for Wetlands, Manual for using Version 5.0", *Ohio EPA Technical Bulletin Wetland/2001-1-1*, Ohio Environmental Protection Agency, Division of Surface Water, Columbus, Ohio, www.epa.state.oh.us/portals/35/401/oram50um_s.pdf.

Mack, J.J. (2000), "ORAM v. 5.0 Quantitative Score Calibration", Ohio Environmental Protection Agency, Division of Surface Water, Columbus, Ohio, http://epa.ohio.gov/portals/35/401/oram50sc_s.pdf.

Mack, J.J. and M. Micacchion (2006), "An ecological assessment of Ohio mitigation banks: Vegetation, amphibians, hydrology, soils", Ohio EPA Technical Report WET/2006-1, Ohio EPA Division of Surface Water, Wetland Ecology Group, Columbus, Ohio, www.epa.state.oh.us/Portals/35/wetlands/Bank_Report_Ohio_Final.pdf.

Madsen, B., N. Carroll and K. Moore Brands (2010), "State of biodiversity markets report: Offset and compensation programs worldwide", Ecosystem Marketplace, www.ecosystemmarketplace.com/documents/acrobat/sbdmr.pdf.

Moorhead, K.K. et al. (2006), "Final report: Ecological assessment of a wetlands mitigation bank", CTE/NCDOT Joint Environmental Research Program, Department of Environmental Studies and Biology, University of North Carolina at Asheville, Asheville, North Carolina, https://connect.ncdot.gov/projects/planning/RNAProjDocs/2001-11FinalReport.pdf.

NRC (2001), *Compensating for Wetland Losses Under the Clean Water Act*, National Academy Press, National Research Council, Washington, DC.

Parametrix (2010), "An introduction to EcoMetrix: Measuring change in ecosystem performance at a site scale", Parametrix Inc, Portland, Oregon.

Peralta, A.L., J.W. Matthews and A.D. Kent (2010), "Microbial community structure and denitrification in a wetland mitigation bank", *Applied and Environmental Microbiology*, Vol. 76/13, pp. 4 207-4 215, http://dx.doi.org/10.1128/AEM.02977-09.

Race, M.S. (1985), "Critique of present wetlands mitigation policies in the United States based on an analysis of past restoration projects in San Francisco Bay", *Environmental Management*, Vol. 9/1, pp. 71-82, http://dx.doi.org/10.1007/BF01871446.

Race, M.S. and D.R. Christie (1982), "Coastal zone development: Mitigation, marsh creation, and decision-making", *Environmental Management*, Vol. 6/4, pp. 317-328, http://dx.doi.org/10.1007/BF01875063.

Reiss, K.C., E. Hernandez and M.T. Brown (2007), "An evaluation of the effectiveness of mitigation banking in Florida: Ecological success and compliance with permit criteria", Florida Department of Environmental Protection, www.dep.state.fl.us/water/wetlands/docs/mitigation/Final_Report.pdf.

Robertson, M. (2009), "The work of wetland credit markets: Two cases in entrepreneurial wetland banking", *Wetland Ecology and Management*, Vol. 17/1, pp. 35-51, http://dx.doi.org/10.1007/s11273-008-9096-4.

Robertson, M. (2008), "The entrepreneurial wetland banking experience in Chicago and Minnesota", *National Wetlands Newsletter*, Vol. 30/4, pp. 14-17, 20.

Robertson, M. (2007), "Discovering price in all the wrong places: Commodity definition and price under neoliberal environmental policy", *Antipode*, Vol. 39/3, pp. 500-526, http://dx.doi.org/10.1111/j.1467-8330.2007.00537.x.

Robertson, M. and N. Hayden (2008), "Evaluation of a market in wetland credits: Entrepreneurial wetland banking in Chicago", *Conservation Biology*, Vol. 22/3, pp. 636-646, http://dx.doi.org/10.1111/j.1523-1739.2008.00963.x.

Robertson, M. et al. (2014), "Stacking ecosystem services", *Frontiers in Ecology and Environmental Science*, Vol. 12/3, pp. 186-193, http://dx.doi.org/10.1890/110292.

Salzman, J. and J.B. Ruhl (2006), "The effects of mitigation banking on people", *National Wetlands Newsletter*, Vol. 28/2, pp. 1, 9-14.

Short, C (1988), "Mitigation banking", *Biological Report*, Vol. 88/41, pp. 1-103, US Department of the Interior, Fish and Wildlife Service, Washington, DC, www.dtic.mil/dtic/tr/fulltext/u2/a322932.pdf.

Sifneos, J.C., M.E. Kentula and P. Price (1992), "Impacts of Section 404 permits requiring compensatory mitigation of freshwater wetlands in Texas and Arkansas", *Texas Journal of Science*, Vol. 44, pp. 475-485.

Simenstad, C.A. and R.M. Thom (1996), "Functional equivalency trajectories of the restored Gog-Le-Hi-Te estuarine wetland", *Ecological Applications*, Vol. 6/1, pp. 38-56, http://dx.doi.org/10.2307/2269551.

The Willamette Partnership (2010), "Ecosystem credit accounting", Willamette Partnership, Portland, Oregon.

Tiner, R.W. (1984), *Wetlands of the United States: Current Status and Recent Trends*, US Department of the Interior, Fish and Wildlife Service, Newton Corner, Massachusetts, www.arlis.org/docs/vol2/hydropower/APA_DOC_no._2417.pdf.

Wilson, R.F. and W.J. Mitsch (1996), "Functional assessment of five wetlands constructed to mitigate wetland loss in Ohio, USA", *Wetlands*, Vol. 16/4, pp. 436-451, http://dx.doi.org/10.1007/BF03161333.

Womble, P. and M. Doyle (2010), "The geography of trading ecosystem services: A case study of wetland and stream compensatory mitigation markets", *Harvard Environmental Law Review*, Vol. 36, pp. 229-296, http://harvardelr.com/wp-content/uploads/2012/04/Womble-Doyle.pdf.

Woodward, RT. (2011), "Double-dipping in environmental markets", *Journal of Environmental Economics and Management*, Vol. 61/2, pp. 153-169, http://dx.doi.org/10.1016/j.jeem.2010.07.004.

Zedler, J.B. and J.C. Callaway (1999), "Tracking wetland restoration: Do mitigation sites follow desired trajectories?", *Restoration Ecology*, Vol. 7/1, pp. 69-73, http://dx.doi.org/10.1046/j.1526-100X.1999.07108.x.

Chapter 6.

German Impact Mitigation Regulation in Hessen

by
Frank Wätzold, Brandenburg University of Technology and
Silvia Wissel, University of Amsterdam[1]

Compensation for development-related biodiversity loss in Germany has been required since the 1970s, making it one of the longest running offsets programmes in the world. Compensation measures were originally carried out by the developing firm itself and were required to maintain strong links between the biodiversity lost through the development project and the compensation. This approach led to highly fragmented and costly offsets and caused the system of compensation to be reformed. The resultant Impact Mitgation Regulations are the foundation for the German biodiversity compensation system. The reforms relaxed the requirements regarding spatial, temporal and functional coherence with the objective of improving biodiversity outcomes and streamlining the compensation process. This chapter reviews the progression of German Impact Mitigation Regulations with a focus on the federal state of Hessen. It summarises the design and implementation features of the programme – including the important public sector role in biobanking – and concludes with insights and key lessons learned from the Hessian experience.

Introduction

Germany is one of the few countries with a long history of requiring compensation measures[2] for ecological harm caused by development projects. Legal requirements were introduced in 1976 via the German Federal Nature Conservation Act and were intended to complement the more "traditional" nature conservation legislation in Germany which focuses on protected areas (Ekardt and Hennig, 2013).

During the 1980s and 1990s, compensation measures were usually carried out on a very small scale by the developing firm itself. Regulations required strong functional, spatial and temporal cohesion of the ecological impact of the development project and the compensation measure. This led to little flexibility with regard to the selection of possible sites, and consequently, compensation measures that were highly fragmented and very costly (Kiemstedt, Moennecke and Ott, 1996; Koeppel et al., 1998).

Through a change in the Construction Law in 1998 (BauROG 1.1.1998), opportunities for more flexible compensation were introduced. These opportunities were taken up with the amendment of the Nature Conservation Law in 2002 whereby the new regulation refrained from strict requirements regarding spatial, temporal and functional coherence between impact and compensation measure (Peters, Sievert and Szaramowicz, 2003). The main objectives of the amendments were to improve the ecological effectiveness of compensation, in particular through better spatial cohesion of habitats, and to make it easier and less costly to find appropriate compensation sites (Wende, Herberg and Herzberg, 2005, Jessel, Schöps and Szaramowicz, 2006).

The Nature Conservation Law and the Construction Law form the basis for the Impact Mitigation Regulation (IMR), which is the legal foundation for the German compensation system. The IMR is a national framework legislation and must be implemented by all federal states.

This chapter reviews and evaluates the design and implementation of the German IMR with a focus on the federal state of Hessen. Hessen was selected because: 1) it was among the first states to implement the IMR (for example, the first legally recognised intermediary eco-agency was established in Hessen)[3]; 2) the system in Hessen has many features of a "biobanking" scheme; and 3) in comparison to other federal states, the Hessian experience is better documented in the literature, thus facilitating its evaluation.

The German Impact Mitigation Regulation as the legal framework

The IMR is based on the German Federal Nature Conservation Act[4] and applies to considerable impacts on nature and the landscape. These impacts refer to modifications in the shape of land or its use or upper groundwater table (if it is connected with the biologically active soil layer) which may have a severe impact on the natural environment or landscape scenery (§14 Abs. 1 BNatSchG). Land-use activities from the agricultural, forestry and fishery sector are exempt as long as these activities are in line with the "codes of good practice" (§14 Abs. 2 BNatSchG).

Implementation of the IMR must adhere to the following sequence: 1) avoidance of any impact – which includes comparing the impact with possible alternatives and assessing the commensurability of the impact; 2) compensation of any remaining adverse impacts that occur through "compensation measures"; and 3) as a last resort, when no compensation measures are possible payments may be required to compensate for the remaining adverse impact.[5] These payments are earmarked for use by the authorities for nature conservation purposes.[6]

The 2002 amendment of the Nature Conservation Law also allows for opportunities to divide and consolidate compensation measures for adverse impacts caused by development projects (Peters, Sievert and Szaramowicz, 2003). This enables third parties to offer compensation measures which developers can then use to compensate for their impacts.[7]

The concepts of land pool and eco-account were also introduced. Land pools are sites that are held aside for any future compensation measures that may be needed (and are thus available prior to the occurrence of an impact). An eco-account is a type of registry in which compensation measures that may be used in the future to compensate adverse impacts from development projects are recorded (Ekardt and Hennig, 2013).

Germany has a federal system and in many policy domains only a framework legislation is provided at the national level. This framework legislation must be implemented by the German federal states, which are given some flexibility with regard to how to implement this. This is also the case with the IMR, and consequently it is applied differently across Germany (Koeppel et al., 1998). More specifically, the federal states must provide the legal framework for the rules concerning: 1) the documentation of compensation measures in eco-accounts; 2) the evaluation of impacts and compensation measures; and 3) the fungibility of compensation measures (§16 Abs. 2 BNatSchG). The detailed organisational procedures and responsibilities for the IMR implementation must also be defined at the federal state level (§17 Abs. 11 BNatSchG).

Key design and implementation features of the Impact Mitigation Regulation in Hessen

The legal basis for the implementation of the IMR in Hessen is the 2005 compensation regulation. The Hessian Ministry of Environment, Climate Protection, Agriculture and Consumer Protection is the administrative body that is largely responsible for its implementation. With the IMR, the Hessian government aimed to make nature protection "modern, sustainable and marketable". More specifically, the objectives of the IMR were to strengthen the spatial integration of compensation measures in an existing network of conserved areas (in particular Natura 2000), to make it economically profitable to provide "nature conservation", to secure the provision of compensation measures, to simplify economic investments, to facilitate monitoring and enforcement, and to halt the practise of using productive farm land for compensation measures (HMULV, 2006).

Administrative procedure to develop a compensation measure

For a restoration project to be used as a compensation measure in Hessen, the following process is required (HMULV, 2007). First, the landowner who intends to provide an offset must first develop a plan for the compensation measure which must include, among other things, the size of the land, the existing land use, a detailed description of the intended compensation measure, and, if necessary, long-term management measures. The landowner must also evaluate the ecological value of the land in its original state (i.e. prior to the compensation measure). This evaluation is undertaken in units of "eco-points" (see below for further details). The landowner must also estimate the expected value (in eco-points) of the land after the completion of the planned compensation measure. The plan, together with these two evaluations, is then submitted to the responsible regional lower nature conservation authority for review and, subject to any modifications, approval. The conservation authority also verifies whether the area proposed for the measure is not pre-designated as a planned compensation measure or registered as a completed measure or as part of a land pool.

The number of eco-points generated by the particular compensation measure is the difference between the eco-points associated with the land, before and after the compensation measure has been completed. The lower nature conservation authority subsequently inputs this information into the eco-account, and registers the compensation measure and the area on which it is supposed to be carried out as "planned" (Hessian Implementation Act to the Federal Nature Conservation Act of 20 December 2010). Once the compensation measure has been carried out, the lower nature authority

registers its status as "completed". The authority may also re-evaluate the measure if necessary.

When the landowner uses the eco-points, either to compensate an impact made by himself as a developer[8] or to sell them to other firms or individuals who use it to compensate for an impact, the authority registers the compensation measure as "used". Before it does so it may again re-evaluate the measure in terms of the amount of eco-points generated. The compensation measure is then linked to a specific impact, for example, through a notification in the context of a licensing procedure, and taken out of the eco-account. The individual or firm that causes the impact is liable for compensation for a duration of at least 30 years. The number of eco-points required to compensate for an impact is the difference between the value of the land before the adverse impact has occurred and the value of the land after the impact has occurred (both of which are evaluated in terms of eco-points).

For adverse impacts that cannot be compensated, a payment of EUR 0.35 per eco-point is required (Kompensationsverordnung, §6). The payment must be used by the authorities for nature or landscape-enhancing measures in the nature area in which the impact occurs (of which there are seven in Hessen).

The metric to measure biodiversity loss and gain

In order to compare the impact and the compensation measure, a non-monetary grading system has been developed with the measurement unit of eco-points. This system is derived from the normative valuation and objectives of the nature protection laws at international, national and federal level (Beratungsgesellschaft für Flächen Informations Systeme mbH, 1991). It includes functionally descriptive indicators, i.e. succession stage, degree of nativeness, structural richness, diversity of species and normative indicators (including rarity of biotope, rarity of species, sensitivity and unfavourable tendency of endangerment).

These indicators are used to classify land use and biotope types into 11 categories (Table 6.1). Each category is further divided into sub-classifications, to which a certain number of eco-points are assigned per square metre, ranging from 3 to 80 points. The highest value (80) is assigned to raised bog, and the lowest value (3) to sealed surfaces such as streets.[9]

If the proposed evaluation procedure leads to an inaccurate or incomplete evaluation of an impact or compensation measure, an additional evaluation may be carried out by the lower nature conservation authority (Kompensationsverordnung Annex 2, Abs. 2). Reasons why an additional evaluation may be needed include, for example, a positive or negative impact on fragmentation or the local climate. The additional evaluation may

lead to a reduction or addition of up to 10 points per square metre in the evaluation of a specific land use.

Table 6.1. **Classification of land use/biotope type with examples of eco points**

Land use/biotope type	Number of sub-classifications	Example of land use/biotope (points per square metre)
Forest	47	Oak-hornbeam forest (56)
Shrubbery and hedges	7	Newly planted shrubbery and hedges next to roads (20)
Horticulture, specialised crops and orchards	12	Vineyard, intensive cultivation, with undersown crops (25)
Single trees or group of trees	9	Single tree, non-native, exotic species (26)
Water bodies and edges, marshes	40	Reed mace marsh (53)
Grassland	13	Extensively used fresh meadows (44)
Dwarf shrub heath	2	Scotch heather (56)
Moor	2	Raised bog (80)
Ruderal areas and fallow land	15	Arable land, left fallow for more than one year (23)
Land with little vegetation and barren land	30	Roof area, without greenery (3)
Arable land and garden	12	Intensively used lawn, for example for sports (10)

Guidelines have also been established on how to calculate payments for some adverse impacts which cannot be compensated for. These include, for example, the landscape impact of poles from wind turbines or power lines (Kompensationsverordnung, Annex 3), whereby payment levels for poles depend on the size of the pole and the recreational value of the landscape on which the pole is to be erected.

A few compensation measures exist which cannot be evaluated with the general metrics prescribed in the compensation regulation. These include, for example, single measures for species listed in Annex 2 or 4 of the EU Habitats Directive, such as the restoration of breeding grounds for bats, measures to support the crossing of streets by animals and fish passes. There are no precise rules to determine the value of such measures in terms of “eco-points” but rather general recommendations such as, for example, that the valuation may be based on restoration costs (HMULV, 2007).

Spatial considerations

There has been some concern in the literature that offsetting may lead to the destruction of habitat networks, and instead create new isolated, and hence less valuable, habitats (Hartig and Drechsler, 2009). If habitats also have a high recreational value but incentives (e.g. through differences in

land prices) are such that these habitats are lost in one area and restored in another area, this may also have distributional implications as certain communities will lose recreational benefits (Wissel and Wätzold, 2010). The Hessian compensation regulation contains several provisions related to the spatial allocation of compensation measures which partly address these (and other) concerns:

- If the same compensation objective can be achieved by a measure within and outside a Natura 2000 area, preference shall be given to the measure within the Natura 2000 area (§2 Abs. 2 Kompensationsverordnung). If a compensation measure has a positive impact on a nature reserve, a national park or a Natura 2000 area, up to an additional ten points per square metre can be allocated to the compensation measure. This rule is intended to increase the spatial coherence of habitats and prevent their isolation.
- An impact must be compensated within the same nature area or the same area of a regional plan (§17 Abs. 11 BNatSchG).[10] This is to ensure that the compensation measure is carried out near the impact. Otherwise, regional disparities would most likely emerge such that adverse impacts would occur predominantly in the financial and industrial centre in Southern Hessen, whereas compensation measures would be carried out predominantly in the more rural areas of Northern Hessen.
- Compensation measures shall only be carried out on arable land if they have no negative impact on agricultural use or if the soil productivity of the land is not high (§2 Abs. 3 Kompensationsverordnung). This rule is not related to the concerns mentioned above but is intended to minimise the use of agriculturally productive land for compensation measures (see the discussion below on “Distributional issues”).

Temporal considerations

With respect to the temporal dimension of offsetting, concerns have been raised that there may be a time delay between the impact and when the compensation measure is completed (Burgin, 2008; OECD, 2013). The compensation regulation takes this concern into account but also contains several other provisions with respect to the temporal dimension of the impact and the compensation measure.

- As described above, a compensation measure must be carried out before the eco-points generated by the measure can be used to compensate an impact (see also Diederichsen, 2010). This

effectively eliminates any possible time delay between impact and outcomes of compensation measures.

- To incentivise the early provision of compensation measures, a kind of "interest" is provided. Each compensation measure which is registered as completed in an eco-account and has a value of more than 25 000 eco-points receives an additional 4% of the original number of eco-points awarded on an annual basis for the compensation measure until the measure is used for compensation purposes (§3 Abs. 2 Kompensationsverordnung).
- If a compensation measure requires continuous management measures to secure its long-term existence, the provider must secure that these are carried out for 30 years. The responsibility to provide these management measures lies with the landowner, but can be transferred to another individual or organisation (§2 Abs. 5 Kompensationsverordnung).

The role of the Hessian eco-agency as an intermediary

The legal basis to set up a special intermediary agency called eco-agency is provided in the Hessian Kompensationsverordnung (§5) and the Hessian implementation law of the German Nature Conservation Law.[11] Established in January 2006, the Hessian eco-agency was the first legally recognised intermediary agency related to the IMR in Germany (Steinmetz and Ebert, 2013). Its main tasks and responsibilities are:

- To set up a land pool (areas usable for compensation measures) and to carry out compensation measures to provide eco-points so that developers are able to directly compensate their impacts.
- To act as an intermediary agent for providers of eco-points and developers seeking eco-points to compensate for their impacts. However, the eco-agency shall only act on behalf of the sellers if they commission it to do so.
- To help to secure the continuous execution of management measures (over a period of 30 years) if they are needed to maintain the value of compensation measures. In principle, the legal responsibility (liability) to provide these management measures lies with the landowner who carries out the impact (HLG, n.d.; §2 Abs. 5 Kompensationsverordnung). This is different with the eco-agency: if a developer buys eco-points from the agency, the agency takes over the liability of the continuous execution of management measures, and it may do so if a developer buys eco-points mediated by the eco-agency.

The tasks of the Hessian eco-agency are carried out by the "Hessische Landgesellschaft mbH", a not-for-profit company, with the majority of its shareholders coming from the public sector (federal state of Hessen, Hessian cities and counties). Its overall task is the land management for public purposes in Hessen.

Monitoring, reporting and verification

If a compensation measure or a payment is required for an adverse ecological impact of a project, the developer must prepare a document describing the expected changes in the ecological value of the development site, including their calculation in eco-points. A compensation plan is also required to explain how the adverse impact shall be compensated for. Guidance on what must be reported in each of these is specified in the Hessian compensation regulation (§7 and Annex 4). The lower nature conservation authorities have some autonomy to adjust the detail of reporting, i.e. the compensation regulation (§7 Abs. 2) states that the lower nature conservation authority can require simplified or more detailed documents depending on the complexity of the adverse impact or the compensation measure).

An important element of monitoring and verification of the Hessian system is a GIS-supported nature conservation information system called *NATUREG*.[12] The database was created to provide easy access to information related to nature conservation to the general public and authorities.[13] *NATUREG* combines geological and biological information as well as data on the legal status of areas in terms of nature protection. The development of the database started in 2003 and is not yet completed. The legal basis for *NATUREG* is §55 of Hessen's Nature Conservation Law (§55 Hessisches Naturschutzgesetz of 4 December 2006).

One module of the database also contains information on the land on which compensation measures are planned or carried out. The information is available to the lower nature conservation authorities, and some information is made accessible to the public via a website.[14] To date, however, information about compensation measures and eco-accounts is not yet available on the public website despite this being an explicitly stated aim in the compensation regulation (§4 Abs. 3).

The administrative responsibility for evaluating impacts, determining the required compensation, and monitoring of the project over its duration, lies with the lower nature conservation authorities at the municipal level.

Finally, non-compliance with the requirements of the compensation regulation is considered an administrative offence and can be sanctioned with a monetary penalty. In case of non-compliance, the lower nature

conservation authority can demand the subsequent submission of eco-points. It is, in principle, possible to include additional eco-points as a kind of interest payment.

The Impact Mitigation Regulation in Hessen in practice

Demand, supply and prices of eco-points

Eco-points can be bought and sold and their price is determined by the buyer and the seller through negotiations. In Hessen, demand for eco-points is driven mainly from traffic infrastructure projects (road, dike, railroad and airport construction projects) as well as from the development of industrial parks and housing projects (HLG 2007-2012). An example of a development project which requires a large amount of eco-points is the extension of Frankfurt Airport, for which 9.1 million eco-points were bought from the eco-agency in 2011 (HLG, 2011).

In comparison to the 1990s, the growth rate in construction activities and the resulting demand for areas for industrial parks and housing projects has declined, leading to a lower than expected demand for eco-points than that projected when the compensation regulation came into force (Battefeld, 2012). It is estimated that 1 000-1 500 ha are needed annually for compensation measures but this is likely to decrease in the future (Battefeld, 2012). Recently, increasing demand for eco-points has come from the construction of wind turbines (HLG, 2012; Steinmetz and Ebert, 2013).

The supply of eco-points stems mainly from public organisations such as the eco-agency, municipalities and public foundations which own land such as the “Stadtwaldstiftung Laubach” and “Hessen Forst”, a state-owned company which owns more than 40% of forest land in Hessen and has provided slightly more than 50 million eco-points (Hessischer Landtag, 2013; Steinmetz and Ebert, 2013). Farmers and private forest owners play only a minor role in the supply of eco-points. Within Germany, it is estimated that only 8% of land pools are privately owned (Boehme et al., 2005).

The size of individual compensation projects varies substantially. An example of a small project is the restoration of a riparian forest on an area with the size of 0.19 ha which generated 22 200 eco-points (Heberling, Nitsch and Weinrebe, 2011); an example of a large project is the restoration of the nature monument of an old sand dune and the surrounding area which is expected to generate approximately 800 000 eco-points (HLG, 2010).

While precise information on how many eco-points have been generated (i.e. the overall supply) since the enactment of the compensation regulation does not exist, a reasonable indication might be provided by Battefeld

(2012), according to whom approximately 220 million eco-points are registered in the *NATUREG* database.

While information on the prices of eco-points is not publicly available, according to Kolb (2013), many suppliers consider a price of EUR 0.35 per eco-point plus value added tax of 19% as a reasonable guideline. This estimate is roughly confirmed by an evaluation of the annual reports of the eco-agency that provide aggregate data on the amount of eco-points sold within a specific year and the total payment received for eco-points (Table 6.2).

Table 6.2. **Eco-points sold by the eco-agency, total payments received and average price per point**

Year	Eco-points sold	Total payments received (thousands EUR)	Average price per point (EUR)
2007	5 500	..	..
2008	627 540	219	0.349
2009	1 973 048	700	0.355
2010	1 700 000	600	0.353
2011	10 900 000	4 500	0.413
2012	2 400 000	900	0.375

Source: Data based on HLG (2007-2012), own calculations.

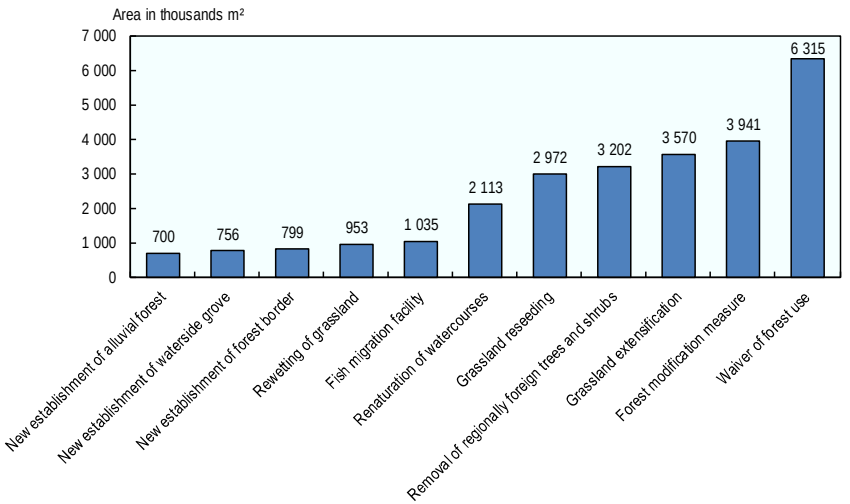
Ränsch (2011) reports that in exceptional cases, when eco-points were urgently needed, prices reached as high as EUR 1 per eco-point. There are also regional variations in the prices of eco-points with those used for compensation in nature areas in the economically booming South of Hessen being more expensive than eco-points which are used in the more rural North (see the section below on “Distributional issues”).

Ecological effectiveness

There are no studies available which investigate the ecological effectiveness of the implementation of the IMR in Hessen, i.e. whether compensation measures are successfully established and maintained to the extent required by the law. There is, however, some literature available which provides an indication of the type and scope of compensation measures and challenges encountered in this regard.

An overview of the type of compensation measures registered in eco-accounts, according to the *NATUREG* database, is provided in Figure 6.1. This covers the 11 largest measures in terms of area used. As can be seen, a large proportion of compensation measures is related to improving the value of forests.[15]

Figure 6.1. **Eleven largest registered measures in eco-accounts according to *NATUREG***



Source: Battefeld, K.-U. (2012), "Hintergründe zum Kompensationsflächenmanagement – aktuelle Entwicklungen und Probleme in Hessen".

Information on the type of habitat or land use that is adversely affected by development projects is not publicly available. It is therefore not clear to what extent this represents a like-for-like compensation (i.e. that measures related to forest conservation are used to compensate for forest destruction or degradation) or whether destruction in one type of habitat (such as agricultural land) is compensated by compensation measures related to another type of habitat (such as forest).

An important issue in terms of ecological effectiveness is the long-term viability of compensation projects, as many require ongoing management measures. The responsibility to carry out these management activities lies with the provider of the compensation measure, though this can be transferred to the eco-agency. The lower nature conservation authority may require evidence from the compensation provider on how the long-term management is ensured (§2 Abs. 5 Kompensationsverordnung). To what extent this is done, and how the long-term management is carried out, is unclear however.

The eco-agency makes explicit provisions for long-term management. In 2011, for example, a total of EUR 3.6 million were allocated for future costs associated with long-term management measures as well as other costs such as land purchase (HLG, 2011).

The ability to assess the ecological effectiveness of compensation measures depends heavily on adequate monitoring of whether the execution (including the long-term management) of a compensation measure has been undertaken in compliance with the legal requirements. Moreover, in cases of non-compliance, appropriate enforcement activities must be carried out (OECD, 2013).

Prior to the implementation of the compensation regulation in 2005, lack of appropriate monitoring and enforcement was found to be a severe problem. A report by Hessen's audit court (Präsident des Hessischen Rechnungshofs, 2004) found that only 38% of the audited compensation measures were carried out in a good manner, whereas 17% were not carried out at all and 42% were of poor quality or incomplete. The report also found that the lower nature conservation authority had only monitored whether measures were realised in 40% of the cases. Small-scale projects in particular were not well monitored, whereas monitoring and enforcement for large projects was usually relatively thorough (Vader and Gaaff, 2007).

The extent to which there is still a substantial enforcement gap is unclear. There have been some institutional improvements, such as the development of *NATUREG* which, in principle, provides a good overview of compensation measures, thus facilitating their monitoring. It can also be expected that it is in the interests of large providers (i.e. such as the eco-agency, Hessen Forst, and foundations such as the "Stadtwaldstiftung Laubach" as well as large buyers such as Frankfurt Airport), to ensure successful completion of compensation measures, due to reputational risks if they are found in non-compliance with the law.

There is evidence that enforcement issues still exist for small-scale projects. Heberling, Nitsch and Weinrebe (2011) for example, investigated forest compensation measures and found substantial enforcement gaps for some. For instance, transformation of a part of the forest to an improved conservation status was not done on 1.5 ha as declared but only on 0.8 ha. There is little information available regarding the measures authorities take in cases of non-compliance, but it seems that penalties are only infrequently applied.

Cost-effectiveness and transaction costs

While studies analysing the cost-effectiveness of the compensation regulation are not available, other indicators do offer insight on this issue. In principle, the ability to purchase and sell eco-points helps to attain the environmental objective in a more cost-effective manner. Those producers that can provide an eco-point at lower than average costs are able to sell their eco-points profitably and those who are not able to produce eco-points

that cheaply will not produce it (Drechsler and Wätzold, 2009). In order to understand whether the ability to buy and sell eco-points generates the desired cost-effective provision of compensation activities, it is relevant to examine whether any distortions are present which hinder the price mechanism from generating the cost-effective provision of eco-points.

A key problem in this context is that many compensation measures are undertaken by public companies (e.g. Hessen Forst) or public bodies (e.g. municipalities). There is a risk therefore that they do not always calculate the full cost of these measures in the same way that private companies would (Kolb, 2013). For example, when deciding about a compensation measure, public companies or bodies may calculate the costs for purchasing the land, but may not include the personnel and/or overhead costs, as these are covered by the administrative coffers anyway.

This implies that a private firm which can provide eco-points at lower total costs than a public body may still not be able to do so because the public body may not take into account all costs and, as a consequence, can offer eco-points at a lower price. This, in turn, leads to a provision of eco-points which is not cost-effective.

The transaction costs associated with setting up a compensation measure include costs for identifying and securing suitable land, identifying a compensation measure, going through the administrative processes related to setting up an eco-account, identifying a buyer, selling the eco-points and all related administrative work including monitoring and enforcement activities of the nature conservation administration. For an offsetting scheme to work successfully these costs should be as low as possible (OECD, 2013; Wissel and Wätzold, 2010).

One of the tasks of the eco-agency is to reduce some of the above-mentioned transaction costs, in particular by facilitating the selling and buying of eco-points. For this purpose, the agency provides a register where potential sellers and buyers of eco-points can register their interest in buying and selling eco-points, thus also enhancing transparency (Kompensationsverordnung, §5, Abs. 2). It also provides advice to landowners who are interested in using their land for generating eco-points and to developers who are interested in buying those eco-points. The eco-agency also offers an “all-inclusive package”, where all tasks in relation to compensation requirements are taken over by the agency, thus reducing transaction costs for developers who have little experience with compensation requirements.

The eco-agency has established a website[16] to facilitate access to its services, such as brokering of eco-points. The service is not free, however. The fee for its brokerage activities is 6% of the total amount paid for the

eco-points (with a minimum fee of EUR 50), and the fee for consultancy work is EUR 500 per person day.[17]

Many suppliers like local communities and Hessen Forst also (partly) use the eco-points they generate through compensation measures for compensating adverse impacts of their own development projects (Hessischer Landtag, 2013). This reduces transaction costs. At the same time, these organisations forego the (potential) opportunity to purchase eco-points at lower costs from other suppliers. However, it is unclear to what extent these opportunities exist.

Distributional issues

Distributional impacts of an environmental policy instrument may be of concern if it favours or burdens specific income or wealth groups of a population, particular economic sectors or regions. Two types of distributional issues in relation to the implementation of the compensation regulation in Hessen have been raised in the literature and public debate. One is an issue between economic sectors, in particular the agricultural sector; the other is a regional issue between the economically more dynamic South of Hessen and the more rural North of Hessen.

In Hessen, as well as in other parts of Germany, the agricultural sector is concerned about the loss of agricultural land to other sectors in general, but also with respect to the IMR in particular (Battefeld, 2012; Czybulka et al., 2009; Wende, Herberg and Herzberg, 2005). Agricultural land may come under pressure from both sides of an impact: first, the impact itself may lead to a transformation of agricultural land to other purposes, and second, compensation may be carried out on farmland.

The Hessian compensation regulation (§1 Abs. 3) takes this concern into account by stipulating that compensation measures shall not be carried out on highly productive arable land. An approach to handle the pressure on agricultural land is seen in integrating compensation measures into the agricultural production. This could facilitate ongoing production on fields with low agricultural productivity that can be of high ecological value (Czybulka et al., 2009). This approach is also successful to some extent with respect to measures with the purpose of enhancing grassland biodiversity.

Distributional issues arise also in a regional context, namely between the North and South of Hessen. The South is economically stronger and there is also more economic development, which requires more compensation measures and eco-points. This is, of course, not an effect of the IMR, but the IMR feels the consequences: in terms of prices for land, difficulty to find adequate compensation measures and demand for credits.

A report by Hessen's audit court (Präsident des Hessischen Rechnungshofs, 2004) documents the strong regional variations of adverse impacts from economic development and consequently demand for compensation measures. While in the rural area of Vogelsberg the share of area where impacts are caused, compared to available areas for compensation (arable land, forest and other areas) was 2.2% (averaged over some years), this share amounted to 26.8% in Offenbach, a densely populated area, where the share of area used for infrastructure and housing is already about seven times higher than in the area of Vogelsberg. However, the supply of eco-points is also much higher in the South. The number of points available in eco-accounts is approximately eight times higher in South Hessen than in North Hessen (Battefeld, 2012).

Insights and lessons learned from the Hessian experience

The implementation of the compensation regulation in Hessen points to a number of innovations in the design and implementation of the programme over time, but also to some remaining challenges. For example, while spatial and temporal concerns associated with compensation measures have been largely addressed, issues such as robust monitoring, reporting and verification frameworks still require further attention.

More specifically, the implementation of the compensation regulation in Hessen considers spatial aspects in two ways. First, compensation measures must be carried out in the same nature area. This rule prevents the loss of nature in the prospering South of Hessen and the concentration of compensation measures in the rural North, and thus helps to minimise any adverse distributional implications in terms of loss of recreational values in the more densely populated South of Hessen (Wissel and Wätzold, 2010). Second, compensation measures must be carried out preferably near or in Natura 2000 areas. This rule serves to strengthen the integration of new habitat into existing habitat networks, which is beneficial for biodiversity conservation and is meant to avoid isolation of compensation measures – an issue which had been a key problem of the IMR prior to 2005.

With respect to the temporal dimension, compensation measures in Hessen must be completed prior to the development project. Moreover, in principle, there is an obligation to ensure that continuous management measures are undertaken if they are needed for habitat maintenance.

However, a key challenge that merits further attention is how to address an enforcement gap, in particular for small compensation projects. Although there has been some progress in this regard since 2005, further efforts are needed. A key limitation is a lack of sufficient personnel in the lower nature

conservation authorities, which limits their ability to undertake adequate monitoring and enforcement, in particular on-site checks. Even without additional personnel, one option to improve this is to institute stricter reporting requirements for compensation measures, for example by demanding regular reports on the implementation of management measures (Heberling, Nitsch and Weinrebe, 2011).

Improvements in enforcement could also be expected if information on compensation measures were made publicly available. Information on the area on which a measure is carried out and the type of compensation measures would enable interested parties, such as local non-governmental organisations, to verify whether compensation measures are carried out and to report if this is not being done. This type of information is supposed to be provided through the *NATUREG* database and a related public website according to the compensation regulation (§4 Abs. 3). This has yet to be undertaken, however.

Rewarding the up-front provision of eco-points with an annual interest rate of 4% until the eco-points are used to compensate for adverse impacts from development projects is certainly an effective option to incentivise a sufficient supply of eco-points. A key problem, however, is that providing interest violates the idea of "no net loss". Through interest the generated eco-points accumulate additional value and can be used to compensate for a development project which destroys a higher ecological value than the ecological value generated through the original compensation measure (Wissel and Wätzold, 2010).[18] An option to reduce this "net-loss" effect is to modify the compensation ratio of eco-points from 1:1 to a compensation ratio of 1:(>1).

A concern in the literature on offsetting is that there is sufficient demand and supply of compensation measures for trading to work efficiently (Pirard, 2012; Wissel and Wätzold, 2010). There is clearly a high amount of trading in Hessen. A key reason for this is that a development project which has an adverse impact on a particular type of habitat does not need to be compensated by the restoration of the same habitat type but that trade between different types of habitat is feasible (enabled by the generic metric of eco-points). However, if trade is allowed between types, there is the danger that one type of (already endangered) habitat becomes even more endangered at the expense of a more common habitat type. There is no evidence available to suggest this is taking place. If such a process were discovered, however, the system of calculating eco-points could be reviewed and the more threatened habitat could receive more points, making it more attractive to restore this particular habitat type.

Public bodies in Hessen are important suppliers of eco-points. Some of these bodies, such as the eco-agency, have amassed ecological expertise compared to the situation before 2005. One of the main reasons why public bodies are strongly involved is, however, not related to conservation. A key purpose is to ensure that sufficient eco-points are always available to compensate for impacts so that economic development is not hindered (HMULV, 2006). However, as outlined above, public bodies may provide compensation measures at costs lower than total costs and in this way a cost-effective provision of compensation measures is jeopardised.

A key issue which has not yet received much attention in the literature is the interplay of offsetting with other environmental and nature conservation policies. This issue is relevant in Hessen as a few compensation measures, such as grassland extensification, are also subsidised under agri-environment schemes. There may also be overlaps between compensation measures and measures that must be carried out in the context of the EU Water Framework Directive. For example, one of the planned compensation measures of the eco-agency is the restoration of a small brook (Weschnitz) whose restoration is also planned in the context of the implementation of the Water Framework Directive in Hessen (HLG, 2012).

This raises the general question of which measures should be carried out in the context of which policy instrument. More importantly, it also raises the issue of additionality (OECD, 2013). The question here is whether measures which are supposed to be financed in the context of other policy instruments are financed through the Hessian compensation regulation. If this were the case, it would mean that those compensation measures actually do not fulfil the criterion of additionality as they replace measures which are supposed to be financed by the government. This issue is clearly under-researched and important, as a lack of additionality will, in the long run, undermine the effectiveness of the compensation regulation in Hessen.

Notes

1. The authors are grateful to Jan-Eike Krämer for literature research and editorial support.
2. "Compensation measure" is the term widely used in the German context, and refers to offsets – i.e. restoration measures that aim to compensate for the ecological damage of an impact.
3. Today there are more than 20 agencies of this type in Germany (Steinmetz and Ebert, 2013).
4. Gesetz über Naturschutz und Landschaftspflege – Bundesnaturschutzgesetz; BNatSchG.
5. In the case of wind turbines, for example, while it may be possible to compensate for adverse impacts of roads that lead to the wind turbines, of construction work for transmission lines, etc., it is not possible to compensate for the negative impact on the landscape. For this impact, payments may be required.
6. This payment is similar to an "in-lieu arrangement" (OECD, 2013).
7. This change in the Nature Conservation Law may be interpreted as a shift from a system with many features of a "one-off approach" to a system which is more like a "biobanking scheme" (OECD, 2013).
8. This is the case with, for example, municipalities which generate eco-points through compensation measures and use them (or parts of them) for infrastructure projects.
9. The full list of land-use types and associated eco-points per square metre can be found in the attachment to the compensation regulation (Kompensationsverordnung, Anlagen 2 and 3).
10. The corresponding seven nature areas for Hessen are defined in §2 Abs. 1 and Annex 1 of the compensation regulation.
11. For example, Hessisches Ausführungsgesetz zum Bundesnaturschutzgesetz – HAGBNatschG (§11).
12. http://natureg.hessen.de/Main.html?role=default.
13. Available at: www.geoportal.hessen.de/irj/Geoportal_Internet?cid=77ed65b9fdcdfc775590204acc0a382a.
14. http://natureg.hessen.de/Main.html?role=default.
15. This is not surprising given that Hessen Forst is a large supplier of eco-points.
16. www.hlg.org/oekoagentur/leistungsspektrum.

17. www.hlg.org/oekoagentur/entgeltverzeichnis.

18. For purpose of illustration, consider a compensation project which generates 100 000 eco-points and receives an interest of 4 000 eco-points after one year. At this point in time, the eco-points may be used to compensate for a development project which generates a damage of 104 000 eco-points. While there has been an additional ecological benefit of 100 000 eco-points for one year after the use of eco-points for compensation, there is a "net loss" of 4 000 eco-points.

References

Battefeld, K.-U. (2012), Hintergründe zum Kompensationsflächenmanagement – aktuelle Entwicklungen und Probleme in Hessen, Seminar der Naturschutz-Akademie Hessen, 5 March.

Beratungsgesellschaft für Flächen Informations Systeme mbH (1991), Biotopwertverfahren nach Aicher und Leyser, Bericht im Auftrag des Hessischen Ministerium für Landwirtschaft, Forsten und Naturschutz.

Boehme, C. et al. (2005), Flächen- und Maßnahmenpools in Deutschland, Bundesamt für Naturschutz.

Burgin, S. (2008), "BioBanking: An environmental scientist's view of the role of biodiversity banking offsets in conservation", *Biodiversity and Conservation*, Vol. 17/4, pp. 807-816, http://dx.doi.org/10.1007/s10531-008-9319-2.

Czybulka, D. et al. (2009), "Integration von Kompensationsmaßnahmen in die landwirtschaftliche Produktion", *Naturschutz und Landschaftsplanung*, Vol. 08/2009.

Diederichsen, L. (2010), "Rechtsfragen der Ökokontierung und des Ökopunktehandels", *Natur und Recht*, Vol. 32, pp. 843-847.

Drechsler, M. and F. Wätzold (2009), "Applying tradable permits to biodiversity conservation: Effects of space-dependent ecological benefits and cost heterogeneity on habitat allocation", *Ecological Economics*, Vol. 68/4, pp. 1 083-1 092, http://dx.doi.org/10.1016/j.ecolecon.2008.07.019.

Ekardt, F. and B. Hennig (2013), "Chancen und Grenzen von naturschutzrechtlichen Eingriffsregelungen und Kompensationen", *Natur und Recht*, Vol. 35, pp. 694-703.

Hartig, F. and M. Drechsler (2009), "Smart spatial incentives for market-based conservation", *Biological Conservation*, Vol. 142, pp. 779-788, http://dx.doi.org/10.1016/j.biocon.2008.12.014.

Heberling, T., J. Nitsch and H. Weinrebe (2011), Ökokonto im Wald als Zielgenaues Instrument des Naturschutzes, Projektabschlussbericht.

Hessischer Landtag (2013), Kleine Anfrage der Abg, Gremmels und Lotz (SPD) vom 5.3.2013 betreffend Ökopunkte des Landes Hessens und der Landesbetriebe und Antwort der Ministerin für Umwelt, Energie, Landwirtschaft und Verbraucherschutz, http://starweb.hessen.de/cache/DRS/18/4/07094.pdf.

Hessisches Naturschutzgesetz vom 4. Dezember 2006, www.rv.hessenrecht.hessen.de/lexsoft/default/hessenrecht_rv.html?p1=0&eventSubmit_doNavigate=searchInSubtreeTOC&showdoccase=1&doc.hl=0&doc.id=jlrNatSchGHE2006rahmen&doc.part=R&doc.price=0.0&amptoc.poskey=%22%20\\l%20%22focuspoint%22#default:0.

HLG – Hessische Landgesellschaft mbH (2012), Geschäftsbericht für das Jahr 2012, Kassel.

HLG – Hessische Landgesellschaft mbH (2011), Geschäftsbericht für das Jahr 2011, Kassel.

HLG – Hessische Landgesellschaft mbH (2010), Geschäftsbericht für das Jahr 2010, Kassel

HLG – Hessische Landgesellschaft mbH (2009), Geschäftsbericht für das Jahr 2009, Kassel.

HLG – Hessische Landgesellschaft mbH (2008), Geschäftsbericht für das Jahr 2008, Kassel.

HLG – Hessische Landgesellschaft mbH (2007), Geschäftsbericht für das Jahr 2007, Kassel.

hlg (n.d.), Freistellungserklärung – schnell und unkompliziert bauen, www.hlg.org/oekoagentur/freistellungserklaerung.

HMULV – Hessisches Ministerium für Umwelt, ländlichen Raum und Verbraucherschutz (ed.), (2007), Arbeitshilfe zur Verordnung über die Durchführung von Kompensationsmaßnahmen, Ökokonten, deren Handelbarkeit und die Festsetzung von Ausgleichsabgaben (Kompensationsverordnung – KV), Hauseigene Druckerei, Wiesbaden.

HMULV – Hessisches Ministerium für Umwelt, ländlichen Raum und Verbraucherschutz, (2006), Presseinformation. Wiesbaden, 3.Januar 2006 Nr.2, www.hmulv.hessen.de/irj/HMULV_Internet?rid=HMULV/HMULV_Internet/nav/538/538c53a0-9a47-01be-5926-3b5005ae75d5,41159dc2-ce49-8013-3e2d-c44e9169fccd,,,11111111-2222-3333-4444-100000005004%26_ic_uCon_zentral=41159dc2-ce49-8013-3e2d-c44e9169fccd%26overview=true.htm&uid=538c53a0-9a47-01be-5926-3b5005ae75d5.

Jessel, B., A. Schöps and M. Szaramowicz (2006), Flächenpools in der Eingriffsregelung und regionales Landschaftswassermanagement als Beiträge zu einer integrierten Landschaftsentwickelung am Beispiel der Mittleren Havel, Abschlussbericht zum E+E-Vorhaben "Entwicklung und modellhafte Umsetzung einer regionalen Konzeption zur Bewältigung von Eingriffsfolgen am Beispiel der Kulturlandschaft Mittlere Havel" des Bundesamtes für Naturschutz, Bonn-Bad Godesberg.

Kiemstedt, H., M. Moennecke and S. Ott (1996), Methodik der Eingriffsregelung. Teil III: Vorschläge zur bundeseinheitlichen Anwendung der Eingriffsregelung nach § 8 Bundesnaturschutzgesetz, Schriftenreihe LANA (Länderarbeitsgemeinschaft für Naturschutz, Landschaftspflege und Erholung).

Kolb, R. (2013), Vermarktung von Ökokontomaßnahmen, Seminar der Naturschutz-Akademie Hessen, 5 March.

Koeppel, J. et al. (1998), Praxis der Eingriffsregelung, Schadenersatz an Natur und Landschaft? Verlag Eugen Ulmer.

OECD (2013), "Biodiversity offsets", in: *Scaling-up Finance Mechanisms for Biodiversity*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264193833-7-en.

Peters, W., W. Sievert and M. Szaramowicz (2003), Folgenbewältigung von Eingriffen im internationalen Vergleich, BfN-Skripte Nr. 82.

Pirard, R. (2012), "Market-based instruments for biodiversity and ecosystem services: A lexicon", *Environmental Science and Policy*, Vol. 19-20, pp. 59-68, http://dx.doi.org/10.1016/j.envsci.2012.02.001.

Präsident des Hessischen Rechnungshofs (2004), Dreizehnter Zusammenfassender Bericht, Hessischer Landtag 16/2590.

Ränsch, S. (2011), Öko-Punkte-Handel blüht im Verborgenen, Main Netz, der Main Echo Online-Dienst, 8.8.2011, www.main-netz.de/nachrichten/regionalenachrichten/hessenr/art11995,1750817.

Regierungspräsidium Kassel, NATUREG, Naturschutzinformationssystem des Landes Hessen, www.hessen.de/irj/RPKS_Internet?cid=af624600f502cbf95da826089a6dca2c.

Steinmetz and Ebert (2013), Ökopunktehandel und Kompensationsflächenmanagement durch die HLG als Ökoagentur für Hessen. NAH-Tagung 05.03.2013, Wetzlar.

Vader, J.R.P.S.T.A. and A. Gaaff (2007), Natuurcompensatie over de grens; Een analyse van natuurcompensatie in het buitenland, LEI, The Hague.

Wende, W., A. Herberg and A. Herzberg (2005), "Mitigation banking and compensation pools: Improving the effectiveness of impact mitigation regulation in project planning procedures", *Impact Assessment and Project Appraisal*, Vol. 23/2, pp. 101-111, http://dx.doi.org/10.3152/147154605781765652.

Wissel, S. and F. Wätzold (2010), "A conceptual analysis of the application of tradable permits to biodiversity conservation", *Conservation Biology*, Vol. 24/2, pp. 404-411, http://dx.doi.org/10.1111/j.1523-1739.2009.01444.x.

Chapter 7.

Mexican Environmental Compensation Scheme for Land-Use Change in Forested Areas

by
Bernardo Lazo, Ithaca Environmental

The Environmental Compensation for Land-Use Change in Forested Areas Program is an important tool in Mexico for incorporating the value of biodiversity into development projects. Introduced in 2003, it is a compensation programme whereby developers causing biodiversity loss in forested areas are charged an in-lieu fee which is paid into the Mexican Forest Fund, managed by the National Forestry Commission. The fees are then used by the commission to carry out the compensatory restoration activities. This chapter reviews the design and implementation features of the Compensation for Land-Use Change in Forested Areas Program. It discusses the key reforms to the programme over its ten years of implementation, the lessons learned and concludes with a discussion of the challenges and opportunities that exist for the future of the programme.

Introduction: Background, rational and objectives of the Mexican Environmental Compensation Scheme for Land-use Change in Forested Areas

Mexico is one of the most important countries globally in terms of biological diversity. It is home to 10-12% of the world's biodiversity, and is one of 17 "mega-diverse" countries (OECD, 2013). Mexico is also one of the five most species-rich countries on earth and a relatively high percentage of these species are classified as threatened (Bovarnick, 2010). Many socio-economic challenges generate pressure on Mexico's biodiversity and ecosystems such as rapid urbanisation, population growth and rising income.

In this respect, Mexico has a wide set of policy instruments to promote the conservation and sustainable use of biodiversity and forests, largely dominated by subsidies, many of which also aim to improve the conditions of local and indigenous communities living in forests. The country has also pioneered several economic instruments such as the national programme on payment for ecosystem services (PES) under ProArbol (the federal umbrella programme that promotes sustainable forestry), which covers 3.25 million ha of forests and represents one of the largest PES programmes in the world (OECD, 2013).

Other examples of economic instruments include the environmental impact assessment (EIA), a major tool for addressing biodiversity compensation issues in the context of project development (Darby, 2009). The Environmental Compensation for Land-Use Changes in Forested Areas Programe (Programa de Compensación por Cambio de Uso de Suelo en Terrenos Forestales, CUSTF) is also a compensation scheme involving payment of in-lieu fees into a fund to finance restoration and reforestation projects.

The need for an EIA is established in the General Law of Ecological Equilibrium and Environmental Protection, the main piece of environmental legislation in Mexico. The Ministry of Environment and Natural Resources (SEMARNAT) implements this law and determines if an EIA is required for any given development project. If an EIA is required, an environmental management plan is issued, consisting of separate mitigation, compensation and follow-up measures for development activities, and distinguishing on-site and off-site actions. The compensation actions are defined as a one-off approach. For projects located in wetlands or protected natural areas, affecting endemic threatened and endangered species, or lands benefiting from specific protection, the General Law of Ecological Equilibrium and Environmental Protection requires the project developer to arrange for insurance or pay a deposit that guarantees compensation "in-kind" to be carried out (Mexican Government, 1988).

In terms of forestry protection, the General Law on Sustainable Forestry Development that came into effect in 2003 introduced the concept of environmental compensation in forested land. It mandates project developers to obtain authorisation from SEMARNAT for land-use changes in forested areas. In addition, the law requires project developers to pay an in-lieu environmental compensation fee to the Mexican Forest Fund, which is managed by the National Forestry Commission (CONAFOR). The fees are used to carry out the compensation and restoration activities through the CUSTF. This chapter reviews the CUSTF, an environmental compensation programme that has been operating in Mexico for almost a decade and has been adjusted over the years in an effort to better meet its intended objectives.

Key design and implementation features of the Mexican scheme

An overview

Established in 2005, the objective of the CUSTF is to compensate and restore the environmental services and vegetation affected by land-use change in forested areas. This includes land-use change due to mining, energy transmission, agriculture, tourism and service infrastructure, among other activities. The programme is intended to take action specifically by restoring soils, reforesting and maintaining forest ecosystems that were deteriorated. This is done through compensation agreements with landowners in forested areas. The compensation activities are aimed to: 1) promote the restoration of degraded land and the development of reforested areas throughout Mexico; and 2) compensate for the damaged vegetation due to land-use changes in forested areas.

The programme originated as a result of the introduction of the General Law on Sustainable Forestry Development that came into effect in 2003, although the specific application of environmental compensation in forested areas did not occur before 2005, when the norms of this law were released. Prior to this, the approval for land-use changes only required project developers to enter into compensation agreements directly with forest landowners or provide the compensation themselves (i.e. a one-off compensation approach). Limited enforcement of this approach, however, resulted in a smaller total area of land being compensated than the area approved for land-use change in forested areas, prior to 2005 (SEMARNAT, 2006).

The General Law on Sustainable Forestry Development applies an environmental impact hierarchy of prevention and mitigation to land-use changes in forested areas. Article 117 stipulates that a land-use change is

authorised by exception, and only after assessing and approving the corresponding technical studies to justify that the change does not compromise biodiversity, cause soil erosion or adversely affect water quality on site. Furthermore, Article 121 of the norms requires proponents to demonstrate, through these technical studies, that prevention and mitigation measures in relation to the forest resources, flora and fauna are undertaken during the implementation of the land-use change.

The most common sectors applying for land-use change in forested areas are mining, oil and gas, electricity transmission and distribution, urban development and tourism. These sectors are therefore also the main financial contributors to the CUSTF through the payment of in-lieu compensation fees.

The compensation activities developed under the CUTSF consist of environmental restoration (e.g. soil erosion control measures, reforestation, implementation of water collection works and reforestation), as well as maintenance actions to control the spread of plagues and diseases, fire, and fencing for containing cattle from grazing in forested areas. Activities are undertaken through compensation agreements between CONAFOR and landowners of deteriorated forested land who apply and meet the requirements of the CUSTF programme.

The compensation mechanism of the CUSTF is a payment in-lieu fee for the implementation of the compensation activities by third-party landowners. This arrangement is between the developers requesting authorisation of land-use changes in forested areas and the government, which operates the compensation scheme. This enables a more efficient process for granting authorisations of land-use changes that is less onerous to the project developer while at the same time ensuring that appropriate compensation measures are implemented by a third party by paying an in-lieu fee into the Forest Fund. As the fees are consolidate into this fund, CONAFOR is able to achieve economies of scale by co-ordinating the implementation of a portfolio of compensation activities throughout the country.

The programme implementation involves two distinct processes:

1. Approval process for land-use change. SEMARNAT is responsible for assessment and approval of the applications requesting land-use changes. It also determines the in-lieu compensation fees that are paid into the Forest Fund by the proponent of the land-use change. These funds are used to finance the compensation activities carried out by third parties.

2. Compensation process. CONAFOR is responsible for the selection and supervision of eligible compensation projects implemented by landowners of degraded forested areas so as to restore their land. It

is also responsible for the management of the funds earmarked for this programme.

3. This two-pronged approach separates the responsibilities of the authority granting the approval for the land-use change and determines the fees (i.e. SEMARNAT), from the authority managing the implementation of the compensations (i.e. CONAFOR), thus enabling impartiality and independence between the approval granting process and the corresponding compensation. The key design and implementation features of the CUSTF programme are summarised in Table 7.1.

Approval process for land-use changes and determination of the in-lieu fee

To obtain approval by SEMARNAT, the developer must prepare a technical study to justify the need for the land-use change and to identify any expected adverse environmental impacts as well as actions to mitigate these. The Forest and Soil Management Branch of SEMARNAT evaluates project applications and technical studies, and undertakes on-site visits to assess the projects. If an application is satisfactory, SEMARNAT determines the in-lieu fee to be paid for compensation. Once the interested party has paid the fee, the authorisation for the land-use change is then granted.

The in-lieu fee to compensate for land-use changes in forested areas is calculated based on two main factors (Article 123 of the General Law on Sustainable Forestry Development's norm), namely:

1. reference average costs of reforestation and restoration, as established by CONAFOR (CONAFOR, 2011)
2. an equivalence ratio, determined by SEMARNAT.

The reference costs used in the calculation of in-lieu compensation fees are based on the methodology summarised in Box 7.1. This methodology specifies the calculation based on the average costs of labour, equipment and supplies for a set of standard works and activities required per hectare for the restoration, reforestation and maintenance to compensate changes in land use.

Table 7.1. **Key design elements of the Mexican Environmental Compensation for Land-use Change in Forested Areas Program**

Feature	Key design element
Mechanism	Changes of land use in forested areas require approval by SEMARNAT and payment of in-lieu fees for compensation into the Forest Fund Annual call for project proposals by CONAFOR for environmental compensation in degraded forested land
What is compensated	Land-use change in forested area
Who sponsors the compensation	Proponent of the land-use change in forested areas (i.e. the developer)
Metric to measure environmental loss	Based on an assessment of the conditions on the site where the land-use change would take place and using a equivalence ratio greater than 1:1, determined by SEMARNAT
Calculation of compensation fee	Based on multiplying reference reforestation and compensation costs published by CONAFOR (see Box 7.1) and the equivalence ratio as calculated by SEMARNAT
Who carries out the compensation	The landowners of forested areas selected through the call for proposals of the CUSTF (i.e. the third party)
Application to the compensation programme	Project proponents submit a detailed project proposal, conducted by the project proponent with support from an external technical advisor approved by CONAFOR
Proposal selection	Project proposals are evaluated by a regional technical committee using point-based criteria and include a site visit to short-listed proposals
Eligibility criteria of compensation areas	Compensation activities on degraded forested land or land with forest vocation with a minimum area of 50 ha and a maximum area of 300 ha The proposed project area should not already be receiving support from other programmes of CONAFOR and the activities should be additional to what is required by existing regulation
Budget limits	Based on the amount of in-lieu fees paid into the Forest Fund in the particular federal state and type of ecosystem where the change in land use took place
Scope of activities	Reforestation, soil restoration, water capture and maintenance works on restored forested areas
Project's duration	Up to three years (up to five years for projects before 2012)
Payments	Defined on an individual basis and specified in the agreement between CONAFOR and the compensating entity The disbursement percentages are defined based on the activity type to be implemented and often include an upfront payment with follow-up payments linked to achieving agreed project milestones
Ongoing monitoring, reporting and evaluation	Periodic reviews throughout the project duration by local CONAFOR personnel to ensure milestones are met. Technical advisors to the project are required to report to CONAFOR on the project's progress. However, there is no monitoring or reporting once projects are completed.

Source: Author's review based on programme rules (CONAFOR, 2013).

Box 7.1. **Reference costs used in the calculation of in-lieu compensation fee**

To simplify the calculation of the restoration and reforestation costs, the methodology groups specific vegetation types and predominant climatic categories into four broad ecosystem types (temperate-cold forest, tropical, arid/semi-arid and wetlands). The reference cost associated with each ecosystem type is presented in Table 7.2.

Table 7.2. **Reference cost by ecosystem type**

Concept	Temperate-cold	Tropical/ rainforest	Arid and semi-arid	Wetlands or other land-sea transition ecosystems	
				Mangroves	Other wetlands
Activities and works of restoration, reforestation and maintenance	MXN 17 300	MXN 12 396	MXN 7 513	MXN 40 336	MXN 167 186

Note: Costs in Mexican pesos based on the reference costs published in 2012 by CONAFOR (1 USD = 13.16 Mexican pesos as of 26 March 2014).

The methodology assigns a different set of works and activities required for compensation for each ecosystem type, taking into account: the amount and complexity of works required, density of reforestation, plant costs for reforestation, among many other variables, in order to reflect likely costs of compensation. This explains the big difference in compensation costs between each ecosystem type presented above. To illustrate, Table 7.3 compares the breakdown of activities required as per the methodology to compensate in arid/semi-arid ecosystems and those required in wetland mangrove ecosystems.

Table 7.3. **Comparison of activities required in different ecosystems**

Activity type	Specific activity: Arid/semi-arid ecosystem	Specific activity: Wetland (mangrove)
Soil restoration	Construction of ditch(es) to capture rainwater and control surface runoff	Opening of channel(s) in the mangroves
Reforestation	Preparing terraces	
	Plant production (minimum of 400 units)	Plant production (minimum of 2 500 units)
	Plant transportation	Plant transportation
	Planting	Planting
Maintenance	Plant production for replacement of dead plants that did not survive the first reforestation (minimum of 160 units)	Plant production for replacement of dead plants that did not survive the first reforestation (minimum of 1 000 units)
	Plant transportation of replacement plants	Plant transportation of replacement plants
	Plantation of replacement plants	Plantation of replacement plants
		Dredging of channels in mangrove
	Technical support	Technical support

Source: CONAFOR (2012), "Progress report on the Environmental Compensation Programme 2012".

The reference costs methodology specifies unit costs for each specific activity and the minimum number of units per hectare that must be implemented. The sum of these costs results in the total reference cost per hectare for each particular ecosystem type which is then used to calculate the corresponding in-lieu fee.

The equivalence ratio must be greater than 1:1, and ranges from 1.3 to 6 as specified in the programme rules. It is calculated based on an assessment of several criteria, each of which is based on a point system whereby a higher score is given to land-use changes that represent a higher conservation value or greater ecosystem services or that cause a greater environmental impact (Table 7.4).

Table 7.4. **Technical criteria applicable to determine the equivalence ratio**

Criteria		Points
Type of ecosystem	Semi-arid, tropical dry	1
	Wetlands without mangrove, temperate cold except mountainous cloud forest, humid tropic, except high-altitude evergreen tropical forest	3
	Wetlands with mangrove, mountainous cloud forest and high-altitude evergreen tropical forest	5
Conservation condition of vegetation	Secondary vegetation in degradation process	1
	Secondary vegetation in recovery process or in good conservation condition	2
	Primary vegetation in degradation process	3
	Primary vegetation in recovery process or in good conservation condition	4
Presence of flora or fauna species listed in any risk category according to Norm-59-SEMARNAT-200 158	Subject to special protection	1
	Threatened	2
	In danger of extinction	3
	* If any of the species is endemic	(+1)
Environmental services as specified in the LGDFS affected by the land-use change	When up to four ecosystem services ceased to be provided due to the land-use change	1
	When more than five ecosystem services ceased to be provided due to the land-use change	2
Presence of the project in conservation areas	Areas of importance for the conservation of birds, priority land regions or priority hydrological regions	1
	Natural protected areas considered for restricted use	2
	Natural protected areas considered for conservation or protection	3
Characteristics of the works or activity to be implemented	Linear outline that does not involve confinement of an area	1
	Polygonal outline that does not involve confinement of an area	2
	Polygonal outline that involves confinement of an area	3
	Linear outline that involves confinement of an area	4
Impact to soil or vegetation	Temporary impact to vegetation	1
	Permanent impact to vegetation	2
	Impact to vegetation including sealing of the ground (e.g. construction works)	3
Project benefits	Environmental	0
	Social	1
	Private	2

Source: SEMARNAT (2005), "Agreement establishing equivalente levels for the environmental compensation for the change in land use in forested land", www.dof.gob.mx/nota_detalle.php?codigo=2093163&fecha=28/09/2005.

The sum of the score assigned to each criterion equals a corresponding equivalence ratio to be applied to the project, based on a scale system defined in the compensation calculation rules. For instance, the maximum score (27) equals an equivalence ratio of 6, whereas the minimum score (6) equals an equivalence ratio of 1.3. The total compensation fee to be paid by a project proponent is then determined as follows:

$$In - lieu\ compensation = (Reference\ costs\ for\ reforestation\ and\ restoration\ per\ hectare) * (Equivalence\ Ratio) * (Land\ area\ affected\ in\ hectares)$$

This means that, for example, a land-use change located in an area with well-preserved vegetation and soil which provides several ecosystem services would result in a higher ratio, and thus require a higher compensation fee to be paid. Transparency of the in-lieu fee calculation is ensured as it is based on published reference costs (CONAFOR, 2011) and clear criteria to determine the equivalence ratio. However, one drawback of this calculation method is that it assigns a lower score for land-use changes occurring in degraded land, therefore the equivalence ratio and, by extension the fees, would be relatively low while the costs to restore an equivalent land could be high. Given that the in-lieu fees are based on reference average costs for restoration and reforestation activities, and on an equivalence ratio, the area of land-use change does not equal the area of land restored and/or reforested. SEMARNAT estimates that, on average, for each authorised hectare of land-use change, sufficient financial resources to restore or reforest three hectares are made available through in-the lieu fees collected for the CUSTF[1] (SEMARNAT, 2013a). The in-lieu fees collected in the Forest Fund for compensation of land-use change in forested areas in a given year in each federal state represents the budget available to CONAFOR to conduct the compensation and restoration activities in the federal state where the fees were collected. The funds must therefore be used for compensation activities located in areas near where the land-use change takes place.

More specifically, the programme rules were designed to take into account the location and the ecosystem type where the land-use change occurs. This is aimed to ensure preference of compensation activities within the same federal state and within the same ecosystem type. Based on the types of ecosystem that require compensation for a given year and a recommendation from the forest council in each federal state, CONAFOR publishes priority areas where the projects are encouraged to take place. This approach ensures a certain degree of geographical and ecosystem equivalence of the compensation while retaining flexibility on where the compensation takes place within a given state.

Since the programme started and up until 2013, SEMARNAT had granted 3 745 authorisations for land-use change, representing a total area of 108 209 ha. These authorisations involved payments of in-lieu fees into the Forest Fund of a total of MXN 2.7 billion, representing enough resources to compensate 319 603 ha (SEMARNAT, 2013a). Table 7.5 summarises the breakdown of land-use change and fees paid by ecosystem type. As can be seen, most of the land-use changes have been authorised in semi-arid ecosystems. Also, the equivalence ratio applied varies depending on the ecosystem type.

Table 7.5. **Area authorised for land-use change by ecosystem type, 2004-13**

Ecosystem type	Number of authorisations for change in use of land in forested areas	Total area authorised (ha)	Equivalence ratio (average)	Equivalent compensation area	In-lieu fees collected (MXN million)
	(A)	(B)	(C)	(D)=(B*C)	(E)
Forest	651	13 345	3.1	42 541	518.9
Wetland	53	1 187	3.4	4 041	54.3
Tropical/rainforest	934	25 269	3.1	79 118	793.8
Arid/semi-arid land	2 107	68 408	2.8	193 904	1 376.7
Total	3 745	108 209	3	319 603	2 742.9

Source: SEMARNAT (2013a), "Change in use of land in forested areas: Mechanics and opportunities".

Selecting the compensation projects

CONAFOR issues a call for projects on an annual basis for owners of degraded forested land or land with forest vocation needing or willing to carry out restoration and reforestation activities on their lands. This call has specific technical requirements and conditions to be met by applicants. This includes a proposed project design and an evaluation of applications on a point-based system against a set of clear criteria published by CONAFOR. All projects should demonstrate technical and economic feasibility of the proposed activities. Applications to the programme are evaluated regionally by a state technical committee consisting of local representatives from SEMARNAT, CONAFOR, local authorities and other technical experts, and include a site visit to the proposed project location of shortlisted applications. Applications attaining a required minimum score are eligible to obtain funds from the programme, and priority is given to those projects with a higher score and in priority areas. This means that if insufficient applicants apply or meet the minimum criteria to obtain funds from the CUSTF in a given federal state, the compensations of that particular year in that federal state will be lower than the funds available destined for that purpose. However, the rules of the Forest Fund allow, unlike the federal

budget, for unused funds to be carried over and used to finance new project applications in the following years.

The requirements to apply to the CUSTF are more stringent than most of the subsidy-based programmes operated by CONAFOR (García, 2014). This means that the technical capacities required to ensure adequate project design and implementation are higher. Though inherently a good thing, this has, however, led to an insufficient number of applications being received over the years, or these not being successfully approved in some federal states.

Additionality and timing of compensation

Only those activities in forested areas that are not receiving funds or subsidies from other programmes, or that are not mandated to comply with existing regulations, are eligible to apply to the CUSTF. These conditions ensure that the activities carried out under this programme are additional and would not occur otherwise. Since compensation activities under the CUSTF are not combined with other programmes, it allows evaluating the outcome of the programme independently from other restoration and reforestation programmes from CONAFOR. However, the programme has faced several deficiencies in monitoring and reporting (see discussion below).

The rules of the CUSTF require in-lieu fees to be transferred to the Forest Fund before the land-use change occurs. However, the timing for the actual compensation and restoration is subject to the annual call for project applications by CONAFOR and the assumption that sufficient applicants for a given state apply and meet the programme's criteria. Unlike the mandatory nature of the in-lieu payment by the developer requesting the authorisation for land-use change, application to the CUSTF programme by landowners interested in undertaking compensation and reforestation activities is voluntary. CONAFOR therefore has no direct control of the number of applicants (and therefore the land area offered for compensation) in each state. In practice, this has resulted in a portion of the funds available not being allocated over the course of the years since the programme started and therefore in a delay of when a portion of the compensation activities takes place (SEMARNAT, 2012).

Monitoring and evaluation

The programme rules require each compensation project to submit progress reports based on the schedule of activities to be implemented as specified in the compensation agreement. The frequency of progress reports varies from project to project, depending on the type of activities implemented in each project, although projects must comply with at least a 50% progress report and final report.

For reforestation activities, progress indicators are based on the numbers of trees planted as well the survival rate of at least an 80% at the end of the agreement period. For restoration activities, monitoring is based on the progress of the works achieved (for example measured in m^2 for area covered by ditches or water collection systems or in metres for the length of fencing). Once the progress reports are submitted to CONAFOR, local CONAFOR officers visit the project site to conduct a visual verification of the progress on restoration and reforestation activities, assess the quality of the works implemented, and indicate corrective actions, if needed. Payment instalments of the compensation funds are made only once a progress report is submitted and a satisfactory site visit is carried out by field officers, therefore incentivising the compensating entity to meet the milestones specified in the contract and to submit the progress reports.

However, the monitoring of the restoration and reforestation activities officially stops after the contract period between CONAFOR and the compensating entity ends. There are limited obligations for the project entities to ensure continuity and maintenance of the reforestation afterwards. Some limited actions are required, such as avoiding the introduction of cattle in the project area during the agreement duration and for two years afterwards. However, since payments for compensation and restoration stop once the project is completed, there is little incentive for the compensating entity (i.e. third party) to ensure its continuity. In addition, CONAFOR has no mandate to continue supervising or monitoring the restorations and reforestations of completed projects. The permanence of the environmental compensation is therefore not ensured afterwards. Furthermore, as the scheme is only funded by the Forest Fund, CONAFOR has limited resources for field officers to carry out the supervision of projects (García, 2014).

In terms of the overall programme reporting and evaluation, CONAFOR publishes results of the programme on an annual basis. These reports are limited in scope, however. They specify the name of applicants to the programme by federal state, the amount of resources requested, the area covered by each intervention, as well as the list of successful applicants, the amount of funds and area approved for each project. There is, however, limited assessment regarding the overall environmental effectiveness of the scheme. Moreover, since the environmental impacts from land-use change are estimated based on a score that is translated into financial terms during the determination of the compensation fees by SEMARNAT, it is not possible to compare specific environmental impacts directly with the outcomes obtained through the compensation activities of the CUSTF programme. This set up limits the ability to compare like-to-like environmental impact and services between the impact and the compensation.

Given these limitations and shortfalls with respect to monitoring, reporting and verification, the ability to measure and assess the overall environmental effectiveness of the scheme is restricted to a few indicators, such as number of projects supported, funds disbursed and land area being compensated by federal state and ecosystem type. A few attempts have been made to use geographic data systems to map precise project locations and track progress of existing and completed projects, for instance by including the co-ordinates of a selection of compensation projects in Google Earth (García, 2014). While this approach would not by itself replace the need to carry out inspections on site, it could allow building a database or registry of compensated areas to aid in the evaluation of the programme effectiveness in the future.

One possible approach to enhance the evaluation of the CUSTF scheme would be to also report on the progress of the compensation activities already supported and the progress towards allocating all the funds available for compensation. Moreover, establishing a baseline with respect to the environmental conditions of the degraded land where the compensation activities will take place would enable one to review progress and measure, in more detail, the environmental services and attributes achieved through the compensation activities of the CUSTF in the future.

Contractual structure, costs and administration features

As mentioned earlier, the party interested in making a land-use change is required to obtain approval from SEMARNAT and pay the corresponding in-lieu fee, and has no further responsibility for the required compensation activities. This arrangement transfers the responsibility to CONAFOR, which manages the CUSTF and oversees the development of compensation and restoration activities by landowners of degraded forested land.

CONAFOR, through its local offices in each federal state, enters into compensation agreements with forest landowners that have successfully applied to the call for projects by the CUSTF programme. The agreement establishes specific activities and works to be implemented by the compensating entity and are based on the proposed actions during the application process. The length of the agreement is based on the project duration, which is often up to three years.

The payment structure is specified in the agreement and is linked to meeting specific milestones, thus incentivising the compensating entity to ensure these milestones are met. However, the payment disbursements schedule also varies depending on the type of activities being implemented. For instance, for reforestation activities that require purchasing plants and seedlings, payments are made up front. In cases when the compensating

entity fails to meet the agreed milestones, further payments are stopped until corrective measures are implemented. Failure to do so involves a legal procedure by CONAFOR to claim the completion of the works agreed or refunding the payments made. Also, projects that fail to meet the commitments stated in the agreement are banned from receiving financial support from any other CONAFOR programme during the subsequent five years. Local representatives of the programme are responsible for managing the agreements and making routine on-site visits to verify that the actions stated in progress reports have been carried out, evaluating the quality of the works and identifying corrective actions if needed.

The programme rules require an external technical advisor approved by CONAFOR to be hired by the project proponent to assist in the project design and application process. The service fees from the advisor are included in the overall project cost and financed by the programme. Technical advisors are only paid if and when the applications are successful, therefore incentivising them to meet all the requirements from the call for projects. Projects that enter into a compensation agreement with CONAFOR must also enter a services agreement with the technical advisor, who should be involved during the project implementation and should also support the preparation and submission of progress reports to CONAFOR.

The project selection, evaluation and management require local staff and resources with sufficient technical capacity to assess the needs of projects, raise awareness of the programme, and help identify land with potential for restoration and reforestation activities. However, since the programme is funded solely by the Forest Fund, it has budget constraints for administrative and transaction costs to run the scheme, resulting in stretched capacity of the personnel managing the programme locally (García, 2014).

Environmental and cost effectiveness of the CUSTF

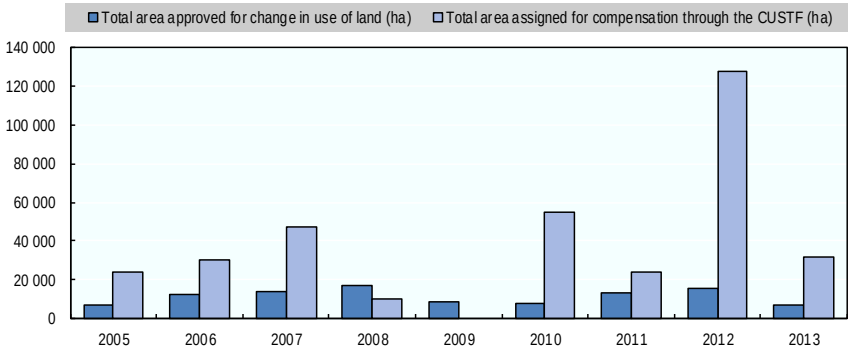
The programme's effectiveness depends to a large extent on the ability of CONAFOR to allocate all the funds assigned by the Forest Fund to restoration and reforestation projects. This, in turn, depends on whether there have been sufficient applications by owners of degraded forested land to the call for projects in each of the federal states where land-use change takes place. Given the voluntary nature of the call for projects, the participation in each state in turn depends on local awareness of the programme, technical capacities available for applying to the programme and on the opportunity costs of carrying out restoration activities through the CUSTF versus other programmes or activities available to landowners (García, 2014).

Environmental effectiveness

Since its introduction, the CUSTF has managed to increase considerably the proportion of hectares compensated versus the hectares approved for land-use change. Prior to 2005, the number of hectares of land compensated were, on average, lower than the area being authorised for land-use change (SEMARNAT, 2006). This can be mainly attributed to the requirements by the General Law on Sustainable Forestry Development norms introduced in 2005 that require payment of in-lieu fees into the fund prior to the granting of approval for any land-use changes and the use of an equivalence ratio higher than 1:1 to calculate the in-lieu fees.

Up to 2013, CONAFOR had supported more than 3 180 compensation and restoration projects and assigned up to MXN 3.2 billion (CONAFOR, 2012). Figure 7.1 compares the total area approved for land-use changes by year versus the area assigned for compensation projects through the CUSTF. The area assigned for compensation has fluctuated considerably over the years, although for most of the years it is larger than the area approved for land-use changes. However, it does not represent the actual compensated area achieved by year, but only the total area of projects participating under the scheme (as the compensation activities are conducted over three or more years). Metrics of actual area compensated by year though the CUSTF is not published by CONAFOR, limiting the ability to evaluate the overall performance of the scheme.

Figure 7.1. **Area approved for land-use changes versus area allocated for compensation**



* In 2009 there was no call for project proposals for compensation, thus no data are available on planned or actual area compensated.

Source: Own analysis based on data from CONAFOR and SEMARNAT (2013a).

Over the years, the criteria for disbursement of the project funds have been gradually adjusted. For instance, by increasing the funds paid initially in order to match the initial financial requirements of projects and setting of a payments schedule based on the type of activity or works implemented by the compensation entity. This approach allows compensating parties to carry out initial works and reforestation activities and remain incentivised throughout the duration of the project by being paid upon demonstration of the milestones achieved. Other changes have involved reducing the minimum land areas applicable in some states from 50 ha to 20 ha. Furthermore, the maximum duration allowed for projects was reduced from five to three years. This was mainly due to the cost implications and local resources available for managing and supervising agreements and projects.

It is important to note that the rejection rate of projects during the application process is considerably high, with about 50% of the proposed projects rejected. The two most common reasons cited for this are that proposals do not meet the level of technical detail required to carry out the compensation activities, and the non-eligibility of the land where the compensation would take place. The latter is often due to failure to prove that the land proposed for compensation activity has been degraded or else failure to demonstrate the legal ownership or tenure of the land.

CONAFOR has increased efforts in recent years to raise awareness of the programme and to build local capacity through the preparation and publication of technical manuals, online training courses, as well as workshops in order to increase the application levels and approval rates of compensation projects.

In terms of measuring the effectiveness of the scheme, the performance measurement used is based on hectares compensated, which is not necessarily equivalent to the restoration of the ecological attributes and environmental services that the scheme intends to compensate. Furthermore, the existing setup does not allow tracing a specific compensation project back to a particular land-use change, thus limiting the ability to assess the environmental effectiveness of the overall scheme. A clear shortfall of the scheme is that compensation projects have a duration of only up to three years, without mechanisms in place to ensure continuity and permanence of the measures implemented.

In addition, given that not all the funds for compensation activities have been able to be allocated, a delay between the approval of land-use changes and the actual compensation has occurred, the environmental impact of which has not yet been assessed. Furthermore, the scheme design does not allow incorporating a time delay factor in the calculations for determining the compensation fee, as the proponent of the land-use change is not given

the possibility to set the timing of the compensation and as such, should not be penalised for any time lags of the activities.

Cost effectiveness

The existing regulations governing the programme provide no alternatives to obtain an approval for land-use change in forested areas other than to pay the in-lieu fee (which, as discussed above, is determined by SEMARNAT based on a fixed set of rules and criteria and on reference reforestation and restoration costs). Therefore, there is no option or incentive available to the proponents to use other means of compensation, such as biobanking, or to carry out the compensation themselves, which could potentially be more cost effective than the compensation fee set by SEMARNAT.

However, the in-lieu arrangement allows economies of scale by aggregating the compensation fees into a fund which, in turn, reduces transaction costs by enabling CONAFOR to make a general call for proposals of compensation and restoration projects at a national level and manage a portfolio of multiple restoration activities in each federal state.

Nevertheless, the current programme rules provide limited incentives to reduce costs at a project proposal level, since there is no competitive bidding process in place and the prices for compensation activities are based on average reference reforestation and restoration costs published by CONAFOR. Furthermore, the scoring system during project proposal evaluation is focused on quality of the application and impact of the activities, rather than on its cost-effectiveness. Therefore, applicants receive no benefit or incentive to bid with a lower cost proposal.

Limitations, challenges and opportunities

The CUSTF has faced during almost a decade in operation a number of challenges to achieve its desired objectives and outcomes. Its design and operation have some limitations that have required gradual adjustments and changes to the programme's operating rules over the years to improve its efficacy and efficiency. Table 7.6 summarises the main limitations, key challenges and opportunities identified of the CUSTF scheme.

Among the key limitations of the CUSTF is the lack of a mechanism to ensure continuity and permanence of the ecosystem services and environmental attributes that can be attributed to the compensation activities. One potential improvement currently being considered by CONAFOR is assigning additional financial resources to completed projects for maintenance for a further five- to six-year period, thus incentivising compensating entities to ensure continuity of the ecosystem services achieved and survival of reforestations carried out during compensation.

Table 7.6. **Limitations, challenges and opportunities of the CUSTF**

Feature	Description
Limitations of the programme	– No mechanism to ensure permanence of compensations once the project is completed. – Limited monitoring and evaluation of the environmental effectiveness of the scheme once projects have been implemented. – Budget restrictions for managing and supervising the scheme. – Limited technical capacity of potential project proponents where compensation projects could take place.
Key challenges	– Ability of CONAFOR to allocate all the funds available for compensation in restoration and reforestation projects (matching available supply of compensation projects with demand for changes in land use). – The CUSTF competes with other subsidy-based reforestation and restoration programmes by CONAFOR.
Opportunities	– Synergies with local technical agents from other government programmes to build technical capacities locally and plan activities at a territorial and watershed level. – Potential synergies with existing payment for ecosystem services (PES) schemes by CONAFOR to include areas already compensated by the CUSTF into these schemes to ensure continuity and preservation of the restoration and reforestation achieved

Source: Author's analysis.

Another existing limitation of the programme design and operation is the monitoring, reporting and evaluation (MRV) of projects, in particular regarding their ability to measure and track the equivalence of the compensation activities with respect to the changes in land use that they were intended to compensate. The monitoring and reporting of the projects is based on the activities proposed by the compensating entity and approved by CONAFOR in each project and the results of the project are measured against its project design. However, the environmental attributes of these activities have no direct link to a specific change in use of land approved by SEMARNAT, thus there is no possibility of tracking whether the environmental impacts or attributes aimed to compensate are being achieved by the projects.

Furthermore, the current reporting and evaluation of the overall programme could be enhanced by incorporating additional indicators, such as project completion rates, actual disbursement of compensation funds versus targeted disbursement, among others that would allow to track the programme effectiveness and to identify areas for future improvements.

One key challenge faced throughout the operation of the CUSTF is that the programme has not achieved the annual targets of total land area compensated or full disbursement of compensation fees received through the

Forest Fund, as not enough compensation project applications to the CUSTF have been submitted or successfully approved over the years. One way to partially redistribute available funds is to assign the interests accrued by the Forest Fund to those federal states with additional successful applications but that have reached their assigned budget. Despite this challenge to place all the funds destined to compensation, the land area compensated in most of the years since the programme's inception in 2005 has been greater than the total area approved for land-use change. This can be attributed to the equivalence ratio greater than 1:1 used during the calculation of compensation fees, so for each hectare approved for change in use of land, resources to restore and reforest an average of three hectares are available through the fund (SEMARNAT, 2013a). However, further efforts are required to increase the allocation of available compensation funds in order to achieve the desired compensation levels that the programme was designed to reach.

In terms of opportunities for expansion of the CUSTF, its scope is clearly defined by the regulations upon which it is based, focusing only on compensating for changes in use of land in forested areas at a national level, therefore the opportunities for its expansion are limited. However, it could benefit from creating synergies with the current programmes for payment for ecosystem services from CONAFOR to include completed compensation project areas under the payment schemes for ecosystem services, therefore securing the continuity and preservation of these services in restored and reforested land for an additional period. Also, there could be an opportunity to build upon the existing efforts by CONAFOR and other government agencies of establishing local technical agents, tasked to advise, build capacities, and help on programme and project planning at a territorial or watershed level. As the restoration activities developed by the CUSTF are often in line with other reforestation and restoration efforts, increasing the technical capacities locally could enhance and increase the applications to the CUSTF programme.

Also, there is an opportunity to explore collaboration agreements with other conservation funds or non-governmental organisations (NGOs) to jointly incubate and develop biobanks as potential alternative sources of biodiversity offsets in strategic regions that ensure continuity in the long term and integration with the regional and watershed planning (Fernandez, 2014). Such a scheme would need to address issues around the additionality of such activities in case that multiple sources of financing are involved. These projects could be developed in priority conservation areas where there are strong networks of NGOs, universities and government actors and landowner-managed conservation projects (Bovarnick, 2010).

Finally, the General Environmental Liability Law, published in June 2013, specifies requirements and procedures to assign responsibilities for environmental damage or deterioration caused by a given party, and includes the creation of an Environmental Liability Fund aimed at collecting funds destined for compensation of environmental damage. Although the norms of this law are not yet published and the Environmental Liability Fund not yet established, it could increase the funds available for compensating activities and open an opportunity to design and establish biobanks or other environmental restoration and compensation programmes in Mexico. CONAFOR has accumulated experience and lessons learned through the CUSTF that place it in a good position to actively participate in new environmental compensation or biodiversity offsetting schemes in the future.

Conclusions

The CUSTF programme analysed here showcased the progress made in Mexico in the design and implementation of environmental compensation schemes after almost a decade since its inception. The CUSTF has achieved lessons learned by operating through a specific fund that consolidates the compensation fees to finance restoration and reforestation actions implemented by third parties. The operation through a fund has allowed achieving economies of scale by enabling CONAFOR to issue calls for projects at a national scale. However, the programme rules and design present limitations to establish and assess the equivalence of the environmental attributes that are being compensated on an individual project basis and as a whole. Therefore, the scheme does not yet create direct, attributable offsets for environmental impacts on a “like-for-like basis”. Furthermore, while the monitoring, reporting and evaluation of projects on an individual basis is relatively detailed, the overall reporting and evaluation of the scheme is limited, resulting in reporting restricted to broad metrics such as hectares compensated and funds disbursed, without the ability to measure and assess in more detail the effectiveness and performance of the programme.

The programme has also faced a number of limitations and challenges. In particular, the scheme design has resulted in an insufficient supply of compensation and restoration projects, as the application to the funds are voluntary and limited local technical capacities or awareness of the scheme often results in an imbalance on the location where the supply exists and the location of the funds available to compensate. Also, since the proponent of the change in use of land no longer holds the responsibility for the compensation once the in-lieu fee is paid, the assurance of the compensation outcome and its permanence is diluted through the implementation process.

One positive outcome from the CUSTF is that the scheme design has allowed establishing the demand for environmental compensation for changes in use of land in forested areas, through regulation and enabling an efficient process to obtain the approval that is not too onerous to the applicant, while ensuring a detailed evaluation of the potential environmental impacts is conducted and assessed before approval. Also, the use of a transparent calculation process of the compensation fees and reforestation costs allows to further fine tune to gradually improve the equivalence of the environmental attributes to be compensated and to monitor these during the offsetting activities in the future.

The CUSTF could benefit from developing more local technical capacity and build upon the use of local technical agents from CONAFOR to raise awareness of the programme and build technical capacities that help identify eligible and viable land to apply to the programme. Another recommendation for the scheme is to enhance its MRV systems and evaluate what has happened with the land covered at some point under this environmental compensation scheme to assess environmental and economic effectiveness after the projects have concluded. It could also gradually introduce measures and incentives to secure the continuity and permanence of the environmental services and attributes achieved through the compensation actions, such as enrolling the compensated lands into existing payment for ecosystem services schemes operated by CONAFOR and other entities.

Finally, the accumulated institutional experience of CONAFOR from managing a compensation fund and operating the scheme, along with evolution of the legal framework in Mexico regarding environmental liability and compensation, could open opportunities to explore the incubation and development of biobank pilots as potential alternative sources of biodiversity offsets that ensure continuity in the long term of the compensation actions and integration with the regional and watershed planning.

Note

1. This ratio has fluctuated over the years.

References

Bovarnick, A. (2010), "Habitat banking in Latin America and Caribbean: A feasibility assessment", United Nations Development Programme.

CONAFOR (2012), "Progress report on the Environmental Compensation Programme 2012", National Forestry Commission, Guadalajara.

CONAFOR (2011), "Costos de referencia para reforestación o restauración y su mantenimiento para compensación ambiental por cambio de uso de suelo en terrenos forestales y la metodología para su estimación", *Diario Oficial de la Federación*, http://dof.gob.mx/nota_detalle.php?codigo=5179472&fecha=25/02/2011 (accessed 3 May 2014).

Darby, M. (2009), "International approaches to compensation for impacts on biological diversity: Final report", Leibniz Institute of Ecological and Regional Development, Dresden and Berlin, www.forest-trends.org/documents/files/doc_522.pdf.

Fernandez, J. (2014), Interview conducted on 14 March 2014 by B. Lazo as part of the case study

García, J. (2014), Interview conducted on 27 February 2014 by B. Lazo as part of the case study.

Mexican Government (1988), "General Law of Ecological Equilibrium and Environmental Protection", Mexico City.

OECD (2013), *OECD Environmental Performance Review: Mexico 2013*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264180109-en.

SEMARNAT (2013b), "Anuario estadístico forestal 2012", Ministry of Environment and Natural Resources, Mexico City.

SEMARNAT (2013a), "Change in use of land in forested areas: Mechanics and opportunities", Ministry of Environment and Natural Resources.

SEMARNAT (2006), "Yearbook of national forestry production in Mexico 2005", Ministry of Environment and Natural Resources, Mexico City.

SEMARNAT (2005), "Agreement establishing equivalente levels for the environmental compensation for the change in land use in forested land", *Diario Oficial de la Federación*, www.dof.gob.mx/nota_detalle.php?codigo=2093163&fecha=28/09/2005.

Annex II.A1.
Summary of offset features in Germany, Mexico and the United States

	US Compensatory Wetlands Mitigation	German Impact Mitigation Regulation applied in the state of Hessen	Mexican Environmental Compensation for Land-Use Change in Forested Areas
Objective	No net loss of wetland acreage and function.	Preservation of the existing ecological situation.	To compensate and restore the environmental services and vegetation affected by land-use change in forested areas.
Coverage	Regulations apply to waters of the United States. Regulated sectors include: industrial, commercial and residential development; water resource projects; infrastructure development and mining. Many farming and forestry activities are exempted.	Significant impacts on biodiversity under the Federal Nature Conservation Act. Does not apply to land use from the agricultural, forestry and fishery sectors as where activities are in line with the Code of Best Practice.	Land-use changes in forested areas. The most common sectors applying for land-use change in forested areas are mining, oil and gas, electricity transmission and distribution, urban development and tourism.
Jurisdiction	Federal framework legislation implemented in region-specific ways in each of the 38 Army Corps of Engineers (ACOE) areas. Individual states are given the power to prevent the ACOE from issuing a permit for a wetland impact.	Federal framework legislation which must be implemented by the federal states which are allowed some flexibility.	Federal.
Mitigation hierarchy			
Applied	Yes	Yes	Yes
Criteria for moving between steps	A project must incorporate all appropriate and practicable measures to first avoid impacts to wetlands, streams and other aquatic resources and to then minimise unavoidable impacts.	Not applicable.	Proponents are required to demonstrate that prevention and mitigation measures in relation to the forest resources, flora and fauna are undertaken during the implementation of the land-use change.
Severance of liability	When a bank sponsor sells credits to a Section 404 permit applicant, the bank sponsor assumes the legal responsibility for providing compensation required by that permit.	The individual or firm that causes the biodiversity loss is liable for the compensation for a period of at least 30 years but may transfer this to another individual or organisation.	After payment of fee.

	US Compensatory Wetlands Mitigation	German Impact Mitigation Regulation applied in the state of Hessen	Mexican Environmental Compensation for Land-Use Change in Forested Areas
Types of biodiversity offsets used			
One-off	✓	✓	
Biobanking	✓	✓	
In-lieu fees	✓	✓	✓
Equivalence			
Measurement	A wide range of functional assessments are used to assess an offset site and to define units of credit, depending on the jurisdiction.	Eco-points are used as the basis of offset transactions. A certain number of eco-points per square metre depending on the land classification.	The in-lieu fee to compensate for land-use changes in forested areas is calculated based on reference average costs of reforestation and restoration and an equivalence ratio.
Type	The information collected at offsets sites is usually more detailed than at development sites so comparisons in type are difficult.	None required, requirements are nominated in generic eco-points.	Preference is given to compensation projects within the same ecosystem type.
Location	Banks are supposed to take a "watershed approach" in site selection and design and are encouraged to use existing watershed plans to inform siting decisions.	Offsets must be in the same nature area or same area of a regional plan. Preference is given to compensation within the Natura 2000 network and bonus eco-points are awarded to offsets close to nature reserves, national parks and Natura 2000 sites.	Preference is given to compensation projects within the same federal state. CONAFOR publishes priority areas where conservation projects are encouraged to take place.
Time	Offset credit ratios are used to manage the risk of losses due to the slow ecological development of offset sites. Banks usually cannot sell credits until specific administrative or ecological criteria are achieved.	Compensation must be carried out before the eco-points can be used to compensate for an impact.	The timing of compensation and restoration is subject to the annual call for project applications by CONAFOR and the assumption that sufficient applicants apply and meet the programme's criteria.
Offset supply agreements			
Permanence	Each bank must be protected with a binding real estate instrument. Banks are required to have a long-term management plan that identifies a liable, long-term land manager. Long-term funding is set aside, typically in the form of a non-wasting endowment.	Supplier must secure outcomes for 30 years.	Up to three years (up to five years for projects before 2012).
Additionality	Offsets must be additional. Preference for restoration but allowance is made for establishment, enhancement and preservation offsets.	No formal definition of additionality. Measures resulting from other legal requirements or public funds cannot be used as compensation measures. Protection of existing habitats is not considered an offset.	Only activities in forested areas that are not receiving funds or subsidies from other programmes, or that are not mandated to comply with existing regulations, are eligible to apply to the CUSTF.

	US Compensatory Wetlands Mitigation	German Impact Mitigation Regulation applied in the state of Hessen	Mexican Environmental Compensation for Land-Use Change in Forested Areas
Monitoring, reporting and verification	Mitigation banks are overseen by an Interagency Review Team. Self-reporting is supplemented by site visits by regulators. The ACOE and Environmental Protection Agency have begun to keep track of mitigation banks and in-lieu fee programme sites through the online RIBITS database.	Self-reporting, dependent on the severity of the biodiversity loss can be augmented to require further actions. Supported by the publicly accessible *NATUREG* database.	Compensation projects must submit self-assessments; the reporting frequency varies with the type of activities implemented in each project. CONAFOR officers may visit the project site to conduct a visual verification and indicate corrective actions, if needed.
Compliance and enforcement	Failure to provide compensation can trigger regulators to restrict the future release of credits for sale at a bank, suspend bank operations, mobilise financial assurances or terminate a bank's instrument.	Non-compliance is considered an administrative offence and may be sanctioned with a monetary penalty supplemented by a requirement to submit further eco-points.	Payments may be stopped until corrective measures are implemented. Failure to do so involves a legal procedure by CONAFOR to claim the completion of the works agreed or refunding the payments made.
Contract length	Perpetuity.	Not applicable.	Up to three years.
Assessment and review			
Programme revisions	Significant reform package in 2008 introduced stricter regulatory controls at the federal level where previously only guidance was issued. The reforms also introduced the watershed approach to siting biobanks in place of the preference for offsets to be located close to the development impact site. Reforms amended the administrative requirements for one-off offsets, biobanks and in-lieu fees to level the playing field among the competing compensation options.	Reforms in 2002 removed the need for strict spatial, temporal and functional coherence between loss and offset sites and allowed for the use of third-party offset suppliers, leading to the introduction of biobanking.	The programme was introduced in 2005 to overcome problems with the previous policy. Formerly, the approval for land-use changes only required project developers to enter into compensation agreements directly with forest landowners or provide the compensation themselves. Limited enforcement of this approach resulted in a smaller total area of land compensated than the area approved for land-use change in forested areas.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where governments work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Union takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

OECD PUBLISHING, 2, rue André-Pascal, 75775 PARIS CEDEX 16
(97 2014 48 1 P) ISBN 978-92-64-22245-8 – 2016

Biodiversity Offsets

EFFECTIVE DESIGN AND IMPLEMENTATION

Contents

Chapter 1. Biodiversity offsets: Overview and insights for good practice

Part I. Key design and implementation issues

Chapter 2. No net loss, the mitigation hierarchy and the economics of biodiversity offsets

Chapter 3. Institutional frameworks for biodiversity offsets

Chapter 4. Design and implementation features of biodiversity offset programmes

Part II. Case studies

Chapter 5. Compensatory mitigation and wetland banking in the United States

Chapter 6. German Impact Mitigation Regulation in Hessen

Chapter 7. Mexican Environmental Compensation Scheme for Land-Use Change in Forested Areas

Consult this publication on line at ***http://dx.doi.org/10.1787/9789264222519-en***.

This work is published on the OECD iLibrary, which gathers all OECD books, periodicals and statistical databases.
Visit ***www.oecd-ilibrary.org*** for more information.

OECD*publishing*
www.oecd.org/publishing

With the financial assistance of the European Union

ISBN 978-92-64-22245-8
97 2014 48 1