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State of Biodiversity Mitigation 2017

Markets and Compensation for Global Infrastructure Development

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Foreword

The last two decades have seen humankind go on the biggest infrastructure building spree in history. Around the world, new roads, dams, mines, and other major development projects have rapidly proliferated, primarily in developing countries and often in wilderness areas with high biodiversity values and little management of environmental impacts. There is still more on the way: by 2030, we'll need to roughly double current infrastructure spending to keep pace with demand (Mercer and IDB 2017).

This infrastructure boom has been devastating for biodiversity values worldwide (Laurance et al. 2015). Habitat destruction and loss, often linked to new roads, dams, mines, and other large-scale infrastructure projects, is a major driver of this decline.

The trouble is that traditional approaches to biodiversity conservation can only do so much to address this problem. In the Andes-Amazon region, for instance, significant progress in establishing protected sites and recognizing indigenous territories in recent years has been all too easily undermined by infrastructure development outside of these areas (Hardner et al. 2016).

The *State of Biodiversity Mitigation 2017* report focuses on a new set of tools beyond traditional approaches to conservation. It reviews the scale, scope, and performance of a new class of policy mechanisms, biodiversity offsets and compensation, that use market instruments to respond to negative impacts of infrastructure development. Such market instruments can help us meet the ambitious goals set out in the Convention on Biological Diversity Aichi Targets (Convention on Biological Diversity n.d.) and UN Sustainable Development Goals (United Nations n.d.). They will also be indispensable in maintaining biodiversity values in the face of rapid infrastructure development.

These tools include biodiversity offsets and compensation mechanisms, which channeled at least $4.8 billion (B) toward ecological rehabilitation and protection in 2016—representing roughly a doubling of transaction value in five years. The majority of funding comes from the private sector, with the energy, transportation, and mining/minerals sectors dominating demand. On the supply side, the private sector is also a key actor. We find signs of a flourishing ecological restoration industry in the United States, for instance. Meanwhile, private investors report that 87% of mitigation banking investments are on track to meet or exceed projected internal rate of return.

At the same time, the public sector remains as important as ever for biodiversity conservation. Traditional tools like protected areas are still essential to safeguard biodiversity values. But the public sector must take the lead on mainstreaming biodiversity conservation goals and mitigation frameworks into sectoral strategies and infrastructure development planning outside protected areas and Indigenous Territories. Also, as this report illustrates, market mechanisms such as offsets and compensation require clear guidance and strong public oversight to deliver on their promise.

I want to thank project developers and investors who have contributed data to Forest Trends' Ecosystem Marketplace, and the donors and sponsors who continue to support our work. Tracking and transparency is an indispensable undertaking in this field—not only to catalyze growth in environmental markets and conservation finance, but also to serve the public interest in making information about these mechanisms freely available.

Michael Jenkins
Founding President and CEO
Forest Trends

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Acronyms

BIOFUND	Foundation for the Conservation of Biodiversity (Mozambique)
BBOP	Business and Biodiversity Offsets Programme
CAR	Rural environmental registry (Brazil)
CBD	Convention on Biological Diversity
COP20	20th Conference of the Parties
EIA	Environmental impact assessment
IFC	International Finance Corporation
ILF	In-lieu fee
IRR	Internal rate of return
NCFF	Natural Capital Financing Facility
NNL	No net loss
NGO	Non-governmental organization
NPI	Net positive impact
PS6	Performance Standard 6
SANBI	South African National Biodiversity Institute
SWOT	Strengths, weaknesses, opportunities, threats
UNFCCC	United Nations Framework Convention on Climate Change
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WCS	Wildlife Conservation Society

Glossary

Additionality: Additionality refers to whether a project or activity has had a positive benefit against an established baseline, compared to what would have occurred in the absence of the project or activity.

Advance mitigation: Mitigation activities implemented prior to development impacts.

Advance offsets: Offsets developed for future use, transfer, or sale, typically in anticipation of mitigation requirements from one or more development projects. In contrast to mitigation banks, advance offsets are generally developed by the impacting party themselves rather than a third party.

Avoidance: Measures taken to avoid creating impacts from the outset of project development, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.

Biodiversity hotspot: A biodiversity hotspot is a region with significant levels of biodiversity that is threatened with destruction. There are two main criteria for determining whether a region is a biodiversity hotspot: it must contain a minimum of 0.5% or 1,500 species of vascular plants as endemic species, and it must have lost at least 70% of its primary vegetation cover. To date, at least 35 sites globally have met these criteria, which together contain almost 60% of the world's amphibian, bird, mammal, reptile, and plant species.

Compensation fund: See "Financial compensation."

Compensation ratio: The ratio between the area of compensatory mitigation required by regulatory agencies and the area of original negative impact. Typically, regulators require that a greater area of land is protected, restored/enhanced, or created/reestablished than has been impacted. Compensation ratios can also be used to adjust for habitat quality (for example requiring a higher ratio if the mitigation area is protected than restored) and manage project implementation risks.

Compensatory mitigation: See "Offsets and compensation."

Credit: A defined unit of environmental goods or services that can be applied toward compliance with a permit, or held, traded, sold or retired. Credits may be measured in terms of mass, acreage, functional units, or other assessment methods. In biodiversity markets, a credit is a defined unit representing the accrual or attainment of ecological functions and/or services at a compensatory mitigation site or within a compensatory mitigation program.

Ecosystem services: The benefits nature provides to human society, such as reliable flows of clean water, timber products, pollination of crops, or cultural values associated with a specific place.

Environmental Impact Assessment: A formal process, including public consultation, in which all relevant environmental consequences of a project are identified and assessed before authorization is granted.

Financial compensation: A third-party mechanism that collects and administers fees from developers to make a contribution towards offsetting their impacts to biodiversity. The money may go directly towards compensating biodiversity loss or to more indirect biodiversity-related projects (i.e., funding protected area management or research). In the United States, also known as "In-lieu fee mitigation."

In-lieu fee mitigation: See "Financial compensation."

Landscape-level planning: Whether conducted to guide conservation, sustainable land use or development, landscape-level planning sets out to tackle issues that are not tractable at the very local scale by taking a multi-stakeholder perspective at a wider, landscape scale. It encompasses a diverse range of practices that seek to link grassroots and community-based actions at the site, farm, or forest levels to the broader landscape or ecosystem level, taking into consideration national and regional perspectives.

Like-for-like equivalency: Conservation (through a biodiversity offset) that closely resembles the species composition, habitat structure, and/or ecosystem function as that affected by the development project, in close proximity to the impact site and without temporal loss of biodiversity values. Also referred to as "in-kind."

Like-for-like or better equivalency: Conservation (through a biodiversity offset) that meets the standards of like-for-like equivalency, or results in species composition, habitat structure, and/or ecosystem function of higher conservation significance than that affected by the project.

Minimization: Measures taken to reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.

Mitigation: This terms refers to the overall process prescribed by the mitigation hierarchy of avoiding, minimizing, restoring/rehabilitating, and then offsetting or compensating for negative impacts to biodiversity.

Mitigation bank ("bank"): A site, or suite of sites, where resources (e.g., wetlands, streams, habitat, species) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for future impacts. In general, a mitigation bank sells compensatory mitigation credits to developers whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor. Also referred to as a "habitat bank" or "species bank."

Mitigation hierarchy: A process for managing negative impacts of a development project in order to achieve no net loss of biodiversity or net gain. The mitigation hierarchy consists of four sequential steps: avoid, minimize, restore/rehabilitate, and offset/compensate. Within the mitigation hierarchy framework, offsets and compensation are undertaken only as a last resort after all other reasonable measures have been taken first. Correct application of the mitigation hierarchy is widely considered a fundamental best practice for compensatory mitigation.

Natura 2000: A network of nature protection areas in the European Union. Natura 2000 sites include Special Areas of Conservation designated under the Habitats Directive and Special Protection Areas designated under the Birds Directive. Special Areas of Conservation are selected by the European Commission from a list of sites submitted by Member States. Special Protection Areas are established by Member States themselves.

Net gain: A target for a development project in which the losses associated with impacts on biodiversity, ecosystem function, or ecosystem services caused by the project are exceeded by measures taken to avoid and minimize the project's impacts, to undertake restoration, and finally to offset or compensate for the residual impacts.

No net loss: A target for a development project in which the impacts on biodiversity, ecosystem function, or ecosystem services caused by the project are balanced or outweighed by measures taken to avoid and minimize the project's impacts, to undertake restoration, and finally to offset or compensate for the residual impacts, so that no loss remains. Where the gain exceeds the loss, the term "net gain" may be used.

Offset: This term refers to a measurable conservation outcome that is designed to compensate for any residual adverse impacts to habitat, environmental functions, or ecosystem services that cannot be avoided, minimized, and/or rehabilitated or restored. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation, or averted risk. Averted risk refers to protecting areas where there is imminent or projected loss of biodiversity. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function, and people's use and cultural values associated with biodiversity. Offsets can be implemented either by the party directly responsible for adverse impacts or a subcontractor of that party (known as "permittee-responsible") or by a third party developing offset credits in advance of impacts (known as "mitigation banking").

Offsets and compensation: In this report, this phrase is used as an umbrella term for the three main mitigation types (permittee-responsible offsets, financial compensation, and mitigation banking) that may be used as the final step of the mitigation hierarchy to address residual negative impacts.

Permittee-responsible offset: "Do-it-yourself" offsetting conducted by the developer or a subcontractor (as opposed to a third party). Permittee-responsible offsets are typically conducted concurrently with the development project or projects resulting in negative residual impacts, unless advance offsets are used (see "Advance offsets"

definition). Also known in the United States as "permittee-responsible mitigation." Also known in Australia as "First party" offsets.

Program: The overarching system that facilitates transactions between buyers and sellers, linked by a common administrator and/or market infrastructure (such as an exchange mechanism, crediting protocol, or regulatory framework). A program can encompass many distinct projects.

Project: A site, or suite of sites, where restoration, enhancement, or other resource conservation actions are implemented.

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

Relaxed equivalency: Conservation (through a biodiversity offset) where offset actions do not result in similar or the same species composition, habitat structure, and/or ecosystem function as that affected by the project, or conservation where actions are a significant distance from the impact site or entail temporal loss. Sometimes referred to as "out-of-kind."

Reversibility: In the context of biodiversity offsets, this term refers to the idea that some negative impacts on biodiversity can be effectively addressed through restoration, while others result in irreversible damages. Accepted best practice in offsetting says that these irreversible impacts cannot be addressed through offsets.

Temporal loss: A deficit in biodiversity values that exists for a period of time after negative impacts from development and before an offset site is mature, e.g., reaches full ecosystem function or desired species composition/habitat structure. Temporal loss may be addressed through advance mitigation, discounting, or other risk mitigation approaches.

Introduction: Biodiversity Mitigation

Mainstreaming Biodiversity Conservation into Global Infrastructure and Development

Biodiversity, broadly understood as the variety of life on earth, is in the midst of a mass extinction event. Between 1972 and 2020, we will likely see the average population size of vertebrate species globally decline by two-thirds (WWF 2016). Entire species are going extinct at rates never seen before in human history (Chivian and Bernstein 2008, Thomas et al. 2004).

Previous mass extinctions have been caused by asteroids, major volcanic eruptions, and dramatic climate fluctuations, but this one is unique, because humans are primarily to blame. One of the most formidable threats to Earth's species is human-induced habitat loss, degradation, and fragmentation. As human populations have grown, so have our cities, suburbs, industrial areas, and agricultural lands, disrupting or displacing the natural ecosystems that were once there.

This habitat loss, degradation, and fragmentation was the price paid for the development that brought humans access to clean water and sanitation, electricity, modern highways, housing, consumer goods, and other improvements to global standards of living. Protected areas—the traditional conservation response—have grown steadily in global coverage since 1970, and now cover nearly 15% of the world's surface. But still only one in five key biodiversity areas globally completely fall within protected areas, and new protected areas cannot be established quickly enough to keep pace with ongoing global biodiversity loss (UNEP-WCMC and IUCN 2016).

Between 2015 and 2030, an estimated $90 trillion[1] will need to be spent on new infrastructure assets, in order for transportation networks, energy, utilities, and other essential systems to keep pace with projected demand. That is more than the value of the entire existing global infrastructure stock, and nearly double our current spending rate ($6 trillion a year is needed; at present, investment stands at about $3.3 trillion). Two-thirds of it is needed in developing countries (Mercer and IDB 2017).

The challenge now becomes how new infrastructure development can actually work to preserve our natural capital and meet human needs at the same time. This requires, among other things, that biodiversity be considered early in the planning and design stages of development projects, including the explicit consideration of alternative locations or approaches, and that steps are taken to **avoid**, **minimize**, **rehabilitate**, and **offset**[2] negative impacts every time that new development occurs— a process known as the **mitigation hierarchy** (Figure 1)—so that there is no net loss (NNL) of biodiversity in the end, and even a **net gain**.

Governments have set ambitious biodiversity conservation priorities in the Convention on Biological Diversity (CBD) Aichi Targets and United Nations Sustainable Development Goals. But clear, coordinated policy aligning infrastructure planning and development with biodiversity conservation goals will be a critical step in achieving these priorities. There is growing interest from private investors in infrastructure, as this asset class becomes more competitive compared to others and as public entities increasingly seek public-private partnership in infrastructure development (Preqin 2017). Private investors emphasize time and again that policy and regulatory uncertainty is the greatest barrier to investing in sustainable infrastructure projects (Mercer and IDB 2017). Investors have also indicated interest in "green investments" but to date have lacked a large-enough pipeline of attractive projects and a standardized approach for evaluating biodiversity risks and opportunities.

Multilateral development banks and governments can play a central role in meeting this need for biodiversity-friendly infrastructure projects and attract much-needed private investment. Clear policy, regulation, and project/lending standards that reference NNL and the mitigation hierarchy all can support a pipeline of infrastructure projects with positive outcomes for global biodiversity. Mainstreaming biodiversity protection goals into infrastructure planning

[1] All monetary values are reported in US dollars ($) unless otherwise noted.

[2] All terms in pink bold text are defined in the Glossary on page ix.

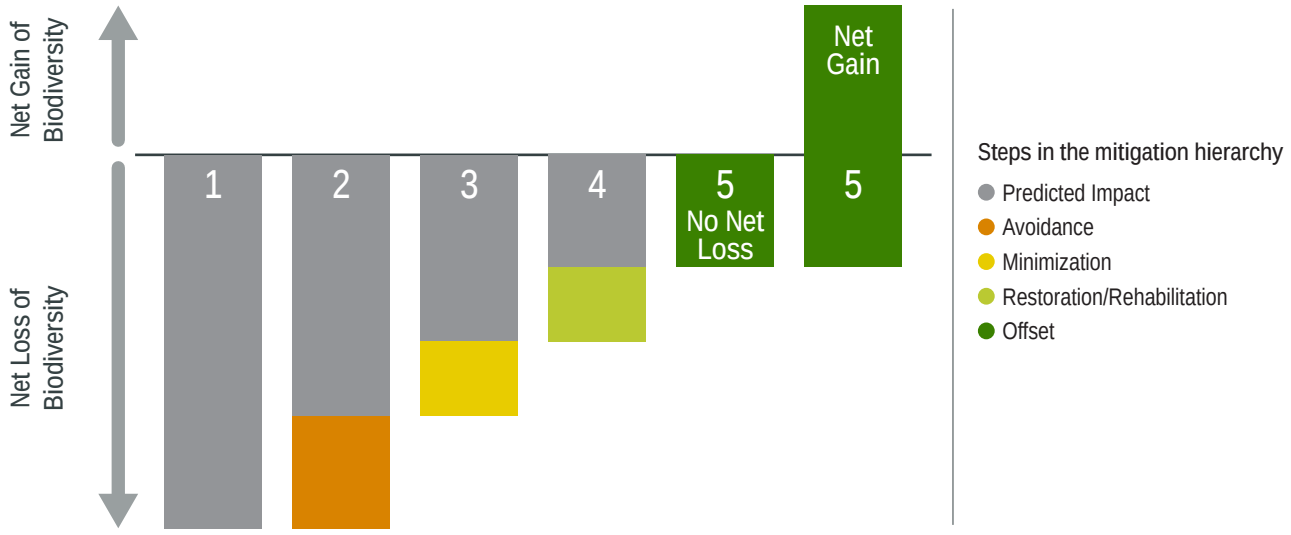
and economic decision making also moves countries closer to achieving or even exceeding the ambitious targets set out in the CBD Aichi Targets and the UN Sustainable Development Goals.

This report shows how smart **mitigation** policies can leverage new financial resources and momentum in pursuit of NNL of biodiversity. The policy approaches and mechanisms detailed in this report also suggest how a clear, well-designed, and predictable framework for achieving NNL can increase regulatory certainty, speed up the pace of planning and permitting, and improve ecological outcomes.

We focus on the final step of the mitigation hierarchy: **offsets and compensation** (also referred to in this report as "**compensatory mitigation**") (Figure 2). Although offsets and compensation should only be used as a last resort to address residual negative impacts of infrastructure and other development, they can be a powerful tool. In the United States, for example, where market mechanisms have been used since the 1980s in pursuit of NNL of wetlands, compensatory mitigation supports a $4 billion (B)-a-year industry, hundreds of thousands of jobs, and billions more in spin-off long-term economic benefits (BenDor et al. 2015).

Following the mitigation hierarchy is widely recognized as best practice in environmental management of development projects (Figure 1). When a development project, such as construction of a new highway, is being planned and is likely to have negative impacts for biodiversity, the mitigation hierarchy dictates the following process. First, potential negative impacts are assessed (Step 1) and then avoided to the greatest extent possible (Step 2). Next, impacts that cannot be avoided are minimized (Step 3), and biodiversity affected is restored or rehabilitated (Step 4) as much as possible. Finally, as a last resort any residual negative impacts are offset or compensated for (Step 5), either on-site or in another location. Best practice is for offsets to be designed to deliver gains in the amount and condition of species and habitats greater than the losses incurred by the development project, in order to achieve net gain.

Figure 1. The Mitigation Hierarchy Concept



In total, nearly a hundred offset and compensation policies were active in 33 countries around the world in 2016. Collectively, these programs have restored, recreated, and protected important habitats on more than 8.3M hectares—an area of land roughly the size of Austria. Nearly two-thirds of the costs of these conservation efforts has been paid by the private sector, primarily the energy, transportation, and mining/minerals sectors. Compensatory mitigation projects have also yielded financial benefits: private investors reported that 67% of capital committed to mitigation banks in 2009–2015 delivered on projected internal rates of return (IRR), while 20% exceeded expectations. Mitigation banking's IRR outperformed the broader category of habitat conservation investments tracked by Ecosystem Marketplace (Hamrick 2016).

Yet offset and compensation activity appears to track far more closely to regulatory stringency and enforcement than to impacts from infrastructure and development activity, highlighting the need to put strong mitigation policies in place and then implement them properly. This report illustrates some of the promise of mitigation instruments, but also their pitfalls.

These failures undermine public trust and confidence in these mechanisms, and rightly so. Still, the biodiversity crisis is too grave not to employ every tool available to us. We recognize that offsets and compensation are often a divisive issue. This report offers two connected lessons: that compensatory mitigation mechanisms can be a powerful force for biodiversity conservation planning and finance, and that this can only happen if mitigation policies are thoughtfully and rigorously designed and enforced. It is our hope that readers of this report take away both lessons.

Figure 2. Compensatory Mitigation Mechanisms Tracked in this Report

Key Findings

- An estimated $4.8B in mitigation bank credits and financial compensation was transacted in 2016, more than doubling in value since 2011, according to data collected by Forest Trends' Ecosystem Marketplace on transaction volumes and prices of mitigation programs globally (Madsen et al. 2011). Globally, Ecosystem Marketplace tracked 99 regulatory programs in 33 countries that used compensatory mitigation to achieve biodiversity conservation goals in 2016.
- **Mitigation banks** transacted an estimated $3.6B in 2016 in compliance markets, or more than seven out of every ten dollars transacted in mitigation markets globally. Banking is concentrated in just a few countries; the largest markets are in the United States, Australia, Germany, and Canada.
- The largest banking market in the world is by far the US Aquatic Resources Compensatory Mitigation program focused on wetland and stream offset credits, which transacted an estimated $3.3B in bank credits in 2016. By volume of credits transacted, wetland and stream banks in the United States have posted an average annual growth rate of 18% since 2010.
- **Compensation funds** accepted a reported $1.2B with 35% of programs reporting transactions, led by programs in India and the United States. But funds also reported that at least $7.1B in total compensation funds globally collected to date remained unspent as of 2016, suggesting that a tremendous amount of offsetting activity has yet to be implemented, even though negative impacts to biodiversity have already taken place.
- Virtually all capital committed to mitigation banks by private investors had expected IRR between 10 and 25% (Hamrick 2016). Mitigation banking investments had significantly higher projected yields than other habitat conservation investments tracked by Ecosystem Marketplace. Investors reported that 67% of capital committed in 2009–2015 delivered on projected IRR while 20% exceeded expectations. Mitigation banking's IRR outperformed the broader category of habitat conservation investments tracked by Ecosystem Marketplace.
- In the years since our last *State of Biodiversity Mitigation* report in 2011 (Madsen et al. 2011), regulators in the United States and Australia have made significant progress in terms of transparency–at least when it comes to third-party mitigation. Public registries tracking project data and transactions for mitigation banks and financial compensation funds are now available for most major compliance mitigation banking and financial compensation systems in these countries, significantly improving public access to information about biodiversity offsets and compensation.
- However, **permittee-responsible offsets**, which comprise the lion's share of mitigation activity, have not been part of this progress. Permittee-responsible offsets are still the only option for compensatory mitigation in many countries. In the 33 countries tracked in this report with active compliance offsets & compensation programs in 2016, more than one-third of programs did not accept third-party compensatory mitigation as a compliance option, but rather only permittee-responsible offsets. Permittee-responsible offsets by area of habitat restored, protected, or created each year comprised an estimated 97% of overall global compensatory mitigation activity in 2016. In other words, the $4.8B in transactions to third-party mitigation providers documented in this report is only a fraction of actual spending on compensatory mitigation. Yet permittee-responsible offsets typically operate with far less public transparency than banking or financial compensation, and often enjoy lower standards set by regulators in terms of public notice during project design or reporting later on implementation and long-term outcomes. This makes it extremely difficult to track the economic value, ecological success, or adherence to regulatory objectives for permittee-responsible offsets.
- The energy, transportation, and mining/minerals sectors were responsible for more than 97% of offsets and compensation measured by cumulative land area under management.

- On the supply side, in countries with active banking programs, compensatory mitigation is frequently supplied by the private sector. Elsewhere, most permittee-responsible offsets and compensation funds support public lands management. Forest and wetlands projects dominated the data as far as habitat types created/re-established, restored, or protected by biodiversity offsets and compensation projects, comprising 80% and 13% of global land area respectively.
- Ecosystem Marketplace also tracked a limited number of voluntary offsets projects active in 2016. In total, we identified 23 developing or implemented projects in 13 countries, with conservation activities planned or underway on 273,000 ha. Demand for voluntary offsets has historically come from the energy and mining/minerals sectors, with virtually all offset land area reported as of 2016 funded by the energy development/extraction industry.

Photo Credit: Filipe Frazao/Shutterstock

Biodiversity Offsets and Compensation: The Basics

As nations around the world struggle to reverse the trend of biodiversity loss and **ecosystem services** degradation, attention has turned to the major driver: infrastructure development. Many new infrastructure development projects now adhere to the concepts of NNL or net gain of biodiversity. NNL means that negative impacts on species, habitat quality, ecological function, and/or ecosystem services caused by the project are outweighed by measures taken to mitigate for those impacts. Net gain takes the concept a step further, where restoration and conservation (e.g., gain) exceeds the original damage the project caused (e.g., loss).

The mitigation hierarchy (Figure 1) is a set of steps for achieving NNL or net gain of biodiversity. When a development project, like construction of a new highway, is likely to have negative impacts on biodiversity, project designers and regulators can follow these steps to avoid, minimize, and rehabilitate negative impacts, and then offset or **compensate** for any remaining damage. Obviously, this is a complicated process that requires a lot of work—and that is precisely the point. Although development projects with net negative impacts to biodiversity might still be approved if there is overriding public interest, the idea is to divert development from places that are more biologically valuable, and encourage development in places where impacts are relatively low. Offsets should be used only as a last resort.

We use the term "offsets" in this report to refer to actions taken to compensate for quantified residual adverse impacts to species, habitat quality, ecological function, and/or ecosystem services that cannot be avoided, minimized, and/or rehabilitated. Offsets might take the form of restoration of degraded ecosystems, creation of new ecosystems or habitats, or protecting existing high-quality ecosystems at risk of degradation or loss (also known as an "averted risk" approach).

Since offsets can only work if they're implemented correctly and guided by well-designed frameworks, professionals working in the policy and practice of biodiversity offsetting came together beginning in 2004 to develop a framework for best practice. They formed The Business and Biodiversity Offsets Programme (BBOP), which is a collaborative network of over 80 organizations and individuals involved in offsetting including companies, financial institutions, government agencies and civil society organizations. BBOP has developed a set of principles for international best practice in biodiversity offsets, informed by the on-the-ground experiences of its business partners (Box 1). BBOP also released a Standard on Biodiversity Offsets in 2012 to guide companies and auditors for the Standard in designing and implementing offsets in accordance with these principles (Business and Biodiversity Offsets Programme 2012).

Box 1. The BBOP Principles

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

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

1. **Adherence to the mitigation hierarchy:** A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimization, and on-site rehabilitation measures have been taken according to the mitigation hierarchy.
2. **Limits to what can be offset:** There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.
3. **Landscape context:** A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes, taking into account available information on the full range of biological, social, and cultural values of biodiversity and supporting an ecosystem approach.
4. **No net loss:** A biodiversity offset should be designed and implemented to achieve *in situ* [e.g., on-site or locally], measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.
5. **Additional conservation outcomes:** A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.
6. **Stakeholder participation:** In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, and implementation and monitoring.
7. **Equity:** A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks, and rewards associated with a project and offset is in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognized rights of indigenous peoples and local communities.
8. **Long-term outcomes:** The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.
9. **Transparency:** The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
10. **Science and traditional knowledge:** The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

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

Offsetting Challenges and Best Practices

In order to develop effective offsetting frameworks, project developers and regulators face several challenges. They must choose metrics that accurately measure the state of biodiversity and ecological function (e.g. baseline conditions). Because offset activities like restoring habitats can take many years or decades, there is often a time lag between when the damage is inflicted and when these offset efforts take effect (known as "**temporal loss**").

Any particular piece of land is part of a broader ecosystem, with different areas within the system performing different functions. In order to effectively leverage offsets to create a healthy and productive ecosystem, offsetting schemes should take a **landscape-level planning** approach. Focusing on a larger scale helps ensure that the ecosystem's most critical biological, social, and cultural areas are being conserved. However, the larger the area projects consider, the more likely they are to infringe on other landowners' properties.

There is also the issue of **equivalency**: does the area being conserved or restored have the same level of ecological value as the area being damaged? Even if the area is determined to have equal value, there are simply some areas that are too rich in biodiversity or cultural value or ecological function to be developed. For instance, if an area is home to an endangered endemic species, or provides life-saving ecosystem services like flood protection to a major population center, it should never be slated for development. Where regulators draw the line between protecting irreplaceable lands and allowing for development is often contentious.

In order to manage and overcome these difficulties, scientists and project developers have developed a series of strategies. Table 1 summarizes typical challenges and common design recommendations in the current literature on biodiversity offsetting.

Photo Credit: Jiri Foltyn/Shutterstock

Table 1. Putting Principles into Practice: Challenges and Design Recommendations in Biodiversity Offsetting

Problem	Description	Design Recommendations
Currency	Choosing metrics for measuring biodiversity	Use multiple or compound metrics Incorporate measure of ecological function as well as biodiversity
No Net Loss	Defining requirements for demonstrating no net loss of biodiversity	Measure no net loss against dynamic baseline,* incorporating trends State whether no net loss is at project or landscape level Consider discounting rate**
Equivalence	Demonstrating equivalence between biodiversity losses and gains	Require "like-for-like" offsetting except in the case of losses that have little or no conservation value, where "like-for-like or better" should be required
Longevity	Defining how long offset schemes should endure	Offsets should last at least as long as the impacts of development Offsets should be adaptively managed for change
Time lag	Deciding whether to allow a temporal gap between development and offset gains	Require offsets to be delivered through biodiversity banking/ **advance offset** mechanisms
Uncertainty	Managing for uncertainties throughout the offset process	Development of a framework for uncertainty in offsets is a research requirement
Thresholds	Defining threshold biodiversity values beyond which offsets are not acceptable	Define explicit thresholds for impacts that cannot be offset

Source: Adapted from Bull et al. 2013.

*Achieving true NNL requires a defined baseline. Best practice suggests that baselines should not be fixed, but rather dynamic in order to incorporate changes in ecosystems (such as from climate change or large-scale invasive species problems).

**Applying a discount rate for future gains against present losses arguably helps to ensure that losses and gains are equivalent, since full gains may not be realized for decades.

Biodiversity Market Mechanisms and Drivers

Offsets and compensation, when used appropriately, can generate new finance for conservation and create incentives to protect biodiversity. Market-based mechanisms are based on the idea that biodiversity loss is a negative externality of development projects, i.e., an impact to society that is not included in the price of the transaction. Mitigation requirements seek to internalize that cost by putting a price on negative impacts to biodiversity, and using that income to invest in habitat preservation, restoration, and creation.

In this report, we differentiate between **compliance-driven** and **voluntary** offsets and compensation. Offsets and compensation are typically compliance-driven: they are implemented to help participants meet regulatory requirements. Developers might also offset their biodiversity impacts voluntarily, driven by ethical or philanthropic motives, or to manage business reputational and brand concerns. Some voluntary activities are carried out in anticipation of forthcoming regulations, known as **pre-compliance** offsets or compensation. The vast majority of offsetting activities we tracked in 2016 were compliance-driven, and so this report focuses primarily on the compliance market.

In this report, we focus on three primary mechanisms for implementing biodiversity offsets: mitigation banking, financial compensation, and permittee-responsible offsets (Table 2). Mitigation banking and financial compensation are both examples of *third-party* compensatory mitigation, where money is exchanged for offsetting activities.

1. *Mitigation banks* are projects that develop offset **credits** for purchase by parties responsible for environmental damage. Credits are an example of **advance mitigation**, e.g., when mitigation actions occur *prior* to any negative impacts from development. Developers can also create their own mitigation banks to ensure a supply of credits for current and future projects. Mitigation banking is the most market-like of the three mechanisms, in the sense that a standard commodity (a bank credit) is bought and sold by multiple buyers and sellers, with price at least partially set by the forces of supply and demand.

2. *Financial Compensation* occurs when the party responsible for environmental damage makes a financial payment, usually to a government agency or designated environmental fund, which, in turn, funds and oversees biodiversity management and protection programs to compensate for the biodiversity loss. In the United States, this method is also called “In-lieu fee” mitigation. The compensation rate is typically fixed or calculated based on the developer’s impact.

3. *Permittee-responsible offsets* occur when the party responsible for negative biodiversity impacts carries out its own offsets or compensation, either directly or through a subcontractor. Offsets can either be on- or off-site, depending on the offsetter’s preference and regulatory requirements.

Each of these mechanisms has strengths and weaknesses. For a full list of the different features of offset and compensation mechanisms, see Table 2.

Table 2. Features of Permittee-Responsible Offsets, Financial Compensation, and Mitigation Banking Mechanisms

	Permittee-Responsible Offsets	Financial Compensation	Mitigation Banking
Driver	Compliance or voluntary	Compliance or voluntary	Compliance or voluntary
Policy Examples	Offsets under various **Environmental Impact Assessment** laws	Brazil's Industrial impact compensation	United States wetland mitigation banking
Implementation Complexity	Medium	Low	High
Required Program/Market Infrastructure	Low to medium	Low	High
Broad-Scale/Landscape Conservation Potential	Less likely	Dependent on design	More likely
Ecological Effectiveness	Dependent on design and enforcement	Dependent on design and enforcement	Dependent on design and enforcement
Who Carries Out Compensatory Mitigation?	The developer or third party offset provider	Government or non-governmental organization (NGO) managing financial compensation mechanism	Private sector banker, NGO, government, or developer
Transparency	Less likely	Moderately likely	More likely

Source: Adapted from Madsen et al. 2010.

Comparing Mitigation Approaches

From a management and regulatory perspective, permittee-responsible offsets and financial compensation projects are relatively simple (though potentially time- and resource-intensive depending on monitoring and enforcement). Banks, while more complex, also have the potential to streamline the offsetting process. By managing several projects simultaneously, banks can achieve economies of scale in design, implementation, and monitoring, reducing overall costs of compensatory mitigation. In the United States, banking has been demonstrated to reduce regulatory permitting times compared to financial compensation or permittee-responsible offsetting (Institute for Water Resources 2015).

In order to create a functional market, mitigation banking requires a high degree of regulatory and market certainty. With their reliance on advance mitigation, banks require significant upfront investment, especially if they are not permitted to release credits for sale before the bank is fully operational.[3] This shifts the implementation risk and (in some countries such as the United States) regulatory liability from the offset buyer to the project developer. Bank developers must be able to expect sufficient future demand, driven by predictable regulatory requirements for impact mitigation and bank approval (Burgin 2008, Gane 2010).

On the other hand, in permittee-responsible offset and financial compensation programs, offset activities are usually developed after size and ecological requirements for offsets have been established by regulators, meaning that relatively little market infrastructure is required, and there is a more direct match between supply and demand.

[3] See Box 12 for a discussion of scaling up private investment in mitigation banking.

The ecological success of any program depends on its design, implementation, and enforcement. That said, programs tend to be most effective when they take a broad, landscape-level design approach and minimize temporal loss. Permittee-responsible offsets are typically not designed at the landscape level, and the area being degraded may not be the optimal place to preserve or restore. Mitigation banking and large-scale advance offsets have the potential to both facilitate landscape-level preservation and reduce temporal loss. Bank developers delivering offset credits for multiple projects can operate over larger geographic areas, allowing bankers to select offset areas based on their ecological value instead of carrying out permittee-responsible offsets onsite at the development project location. Protection of larger contiguous areas has been found to deliver better ecological results than smaller, isolated projects (Pindilli and Casey 2015). And critically, because banks rely on advance mitigation, there is no lag time between the points in time when the environmental damage is done and when compensatory activities are initiated, thereby minimizing temporal loss.

Photo Credit: Meiqianbao/Shutterstock

Report Scope

This report's scope includes the three main forms of compensatory mitigation currently in use around the world:

1. Mitigation banking
2. Financial compensation (also referred to in this report as "**compensation funds**" or "In-lieu fee programs" in the case of the United States)
3. Permittee-responsible offsets

Government-mediated payments for biodiversity, payments for ecosystem services, and other market mechanisms such as certifications for biodiversity are not in this report's scope.

This report is organized into two main parts: Section 1 provides an overview of the status and geographic scope of compliance **programs** for biodiversity offsets and compensation as of 2016, while Section 2 offers an analysis of offsets and compensation activity in 2016 in terms of value, volume, and conservation activities carried out by compliance and voluntary offsets and compensation **projects**.

A program is the overarching system facilitating transactions between buyers and sellers, linked by a common administrator and/or market infrastructure. A program can encompass many distinct projects. Given the variety of program frameworks supporting biodiversity mitigation, our definition of programs included all of the following examples:

1. Legal requirements and policy context (national, state, or municipal) within which a biodiversity offset can be designed and implemented;
2. Specific programs administered by a project developer or agency; and
3. Supranational regulations such as the European Union's Habitats Directive (Council Directive 92/43/EEC) requiring compensatory measures that have been transposed at the national or subnational level into legislation and policy.

Projects are defined as the specific site, or suite of sites, where restoration, enhancement, or other resource conservation actions are implemented for the purposes of marketing the resulting ecosystem service assets or outcomes to buyers. We collect data on transactions and conservation activities primarily at the project level.

Methodology

Data was collected through three methods:

1. A survey collecting data on the size, scope, and characteristics of biodiversity offsets and compensation mechanisms in 2016 worldwide. The survey was disseminated online during April and May 2017 to program administrators, project developers, and other market actors;
2. Personal communications via semi-structured phone and email interviews;
3. Desk research investigating program reports, donor reports and databases, academic journal articles, project registries, and other primary and secondary sources.

While this study aims to offer an overview of worldwide biodiversity offsets and compensation activity, we do not believe that we have captured all activity. The inherent limitations of survey-based research, and the opacity of many compensatory mitigation programs, are constant obstacles. Some project developers are more willing to share data than others; some programs make more data publicly available than others.

We report actual transactions, except for the United States where we had sufficient data on volume and price to extrapolate estimated market value for 2016. See Appendix 1 for a detailed explanation of our methodology. All transactions are in non-adjusted 2016 US dollars.

We consider "transactions" to occur at the point that offset credits are contracted, or when third-party providers accept compensation or otherwise agree to deliver offsets immediately or in the future. For permittee-responsible offsets, we estimate value by collecting data about overall spending commitments and actual spending by offset proponents to date. Where actual spending information for 2016 was not available, we estimated annual spending by pro-rating overall spending commitments evenly across the time period of commitment.

In order to protect the confidentiality of our respondents, Ecosystem Marketplace's standard policy is to only publish a data point if three or more organizations within that category (for example, mitigation banks selling a particular type of credit within a specific state or region) provide data. Throughout this report, wherever a data point has not been published for reasons of confidentiality, we have noted so.

Analysis of transaction values and volumes, conservation activities, and other market dynamics in this report is based on data collected at the project level. In some cases, we have eliminated a single project from analysis: the Oyu Tolgoi project in Mongolia, which at 5M hectares had the effect of skewing results significantly. Wherever this project has been excluded from analysis, we have made this clear in figure/table notes. Otherwise, aggregate figures reflect all projects in our dataset.

Throughout the report we have tried to provide details on the sample sizes of data on which our analysis is based, to provide some sense of our confidence in findings. All findings can reasonably be considered a conservative or minimal estimate of actual activity. A list of programs and projects by country is provided in Appendix 2.

Because the aim of this report is to account for all transactions and spending on offsets and compensation, we do not apply any quality criteria screens for offsets included in calculations. However, we do follow up with survey respondents to confirm or clarify survey responses that were incomplete or raised a red flag. In a few cases where we were unable to confirm that transactions occurred, these responses were omitted.

Finally, where data is analyzed at the regional level, Mexico is included in the "Latin America and the Caribbean" group.

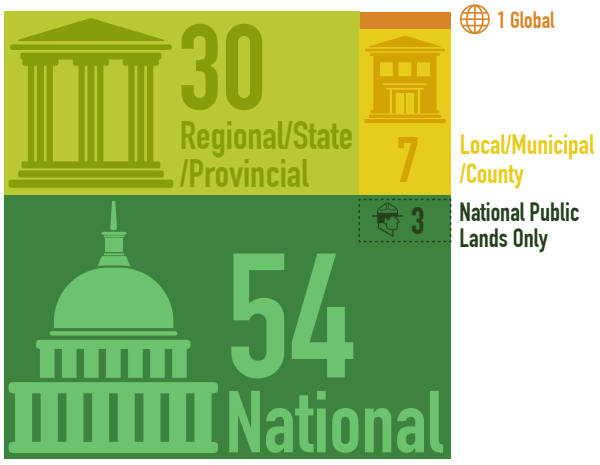
Section I. Compliance Frameworks for Biodiversity Offsets and Compensation Worldwide

Map 1. Compliance Offsets and Compensation: Countries with Active Programs, 2016

Globally, Ecosystem Marketplace tracked 99 regulatory programs that use compensatory mitigation to achieve biodiversity conservation goals (Map 1).[4]

More than half of these programs are national in scale (Figure 3). Approximately one-third are subnational, operating at the regional, state, or provincial level. Some programs operate on a local or community level.

Figure 3. Compliance Offsets and Compensation: Number of Active Programs by Jurisdictional Scale



Notes: Based on 95 active compliance programs for which jurisdictional scale could be determined.

[4] Excluding 63 subnational programs that implement a national policy or regulation on a state, regional, or provincial scale.

The success of compensatory mitigation programs depends not just on when offsets and compensation are used, but also on how they are designed and managed. Box 2 discusses some key design elements that policy-makers must consider when crafting the regulatory framework underpinning an offsets or compensation program. It is important to note the variety of different approaches to compensatory mitigation found around the world, from the highly regulated system in the United States, for example, to purely voluntary approaches. Some policies have explicit NNL or net gain goals, while others are tied to desired conservation outcomes or are less explicit.

In practice, policy design is far more nuanced than the simple framework set out in Box 2—and appropriate policy design in one country or context may not be right in another place. One direction for future research in the biodiversity offsets field is clearer guidance on good practice for policy design, such as a policy benchmark that decision-makers could use to evaluate whether their proposed framework meets minimum standards or to consider other design options. Some preliminary "lessons learned" on policy design are presented in Box 3. Boxes 4, 5, and 6 provide some illustrative examples of different policy and program design approaches.

Box 2. Design Elements of Active Compliance Offsets and Compensation Programs Around the World, 2016

Mitigation Triggers

Most programs focus on protecting certain sets of protected species or areas of special conservation concern. Nineteen of Europe's programs for example are triggered by damage to areas with **Natura 2000** designation, which is an EU-wide network of core breeding and resting sites for rare and threatened species.

Other programs focus on a particular ecosystem type, such as forests, wetlands, or coastlines. We found aquatic habitats (such as wetlands and streams) to be the most common ecosystem triggering compensatory mitigation requirements, with 11 distinct programs, followed by seven for forests, and four for native vegetation.

Some programs only apply to activities in certain sectors. Liberia's Mining Sector Offset Policy, for instance, applies only to companies in the mining sector. China's Forest Revegetation Fee applies to mining and construction projects such as highways, power plants, and warehouse construction, but exempts certain rural public benefit projects like schools, hospitals, and nursing homes.

37	22	16	4
Programs focusing on impacts to protected or designated priority species or habitats	Programs focusing on impacts to a specific ecosystem type	Programs focusing on impacts to biodiversity or environment in general	Programs focusing on impacts by a specific sector, such as mining or hydropower generation

Mitigation Types

Permittee-responsible offsets remain the most common form of compensatory mitigation (71 programs used permittee-responsible offsets in 2016), followed by financial compensation (45 programs) and mitigation banking (23). Many programs (38 out of 99) support multiple forms.

71	45	16	38
Permittee-responsible offsets	Financial compensation	Mitigation banking	Permittee-responsible offsets and/or financial compensation and/or mitigation banking

Box 2. Design Elements of Active Compliance Offsets and Compensation Programs Around the World, 2016 (continued)

Equivalency

One challenge is determining whether the ecological value of the area lost is equivalent to the area gained through offsetting. With that in mind, many programs require that an offset adhere to a certain equivalence standard. The most common types are "**like-for-like**" and "**like-for-like or better**." "Like-for-like" requires that the offset area where gains are delivered be similar to the area affected by the development project in terms of species composition, habitat structure and/or ecosystem function, and that it be in close proximity to the impact site. It also prohibits any temporal loss of biodiversity values. In the case of "like-for-like or better," (also known as "trading up") the offset must be of higher conservation value that that affected by the project.

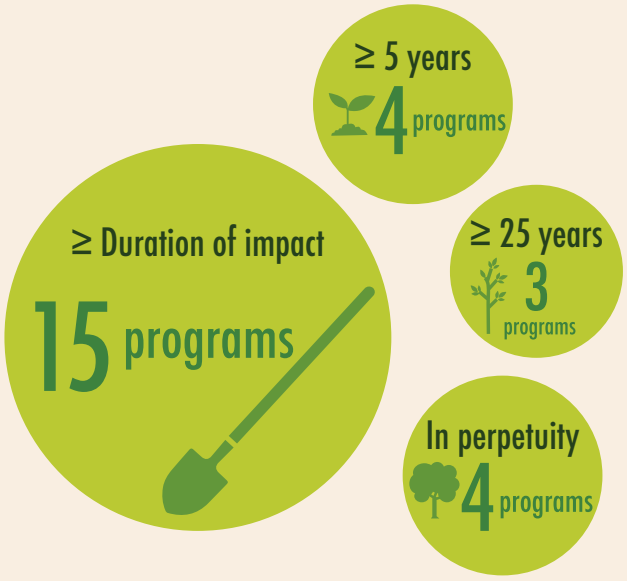
24	9	21
Programs requiring strict like-for-like offsets	Programs requiring "like-for-like or better" offsets	Programs with **relaxed equivalence** requirements or significant regulatory discretion

Note: Based on 54 programs for which information on equivalency requirements was available.

Duration

Another consideration is the duration of the offset. Most of the programs that have a stated duration requirement mandate that the offset be maintained either throughout the duration of the project (which could be as little as five years or as long as 50) though several, including the major US Aquatic Resources Compensatory Mitigation, US Conservation Banking, and India's Compensatory Afforestation programs, require protection in perpetuity. Most programs had no explicitly stated duration requirements, leaving that decision to the discretion of regulators or the project developers themselves. It is also important to note that while long-term/in-perpetuity protection may be a condition set by regulators, the duration of time during which the impacting party is responsible for active *management* may be shorter.

Figure 4. Compliance Offsets and Compensation: Number of Active Programs by Typical Duration of Protection



Box 3. Features of Successful NNL/Net Gain Systems, Drawing on Lessons Learned from Around the World

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

Source: ten Kate and Crowe 2014.

Box 4. Established Programs: The United States Aquatic Resources Compensatory Mitigation Program

Location	National; implemented at a regional level by eight Army Corps of Engineers Divisions across the United States
Start year	2008*
Regulators	United States Army Corps of Engineers (USACE), in coordination with US Environmental Protection Agency (USEPA), US Fish and Wildlife Service, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, and numerous state and local agencies managing natural resources
Policy target	Wetlands, streams, and other aquatic resources from activities authorized by Clean Water Act section 404 permits or other Department of the Army permits
Desired or required outcome	To restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material and to achieve No Net Loss of wetland acreage and function in the United States**
Offset options	Permittee-responsible offsets (on-site or off-site), financial compensation, or mitigation banking Since 2008, when USACE and USEPA jointly issued the Final Rule on Compensatory Mitigation for Losses of Aquatic Resources (the "Final Rule"),*** an explicit regulatory preference exists for offsets from mitigation banks (first preference) or compensation funds (known as "in-lieu fee" programs) (second preference) as opposed to permittee-responsible offsets (called "permittee-responsible mitigation" in the United States, and the least preferred). The new rule has resulted in a shift toward the use of mitigation bank credits, though full implementation across districts remains uneven.† The Final Rule also introduced a watershed focus and gave preference to larger, landscape-scale offsets created before the impact, rather than on-site permittee-responsible offsets after impacts had already occurred. Offsets generally must be sourced from projects within the same watershed as the impact, designated by US Geological Survey Hydrologic Unit Codes.
Methodology: Calculating loss/ gain	USACE Division staff have considerable discretion in interpreting and implementing Clean Water Act regulations and compensatory mitigation requirements. Additionally, there is tremendous variety in structure and function of aquatic resources in the United States. This means there is no single preferred methodology for calculating wetland or stream losses (debits) or gains (credits). Instead, a range of approaches exists for measuring impacts and determining credits, and the choice of methodology is frequently a point of contention in regulatory approvals. Credit determination methods often used include the Ratio Method, look-up tables using structured worksheets, and Rapid Assessment Methodology protocols.‡ Common considerations across all approaches include a comparison of values and functions of the mitigation site to the impacted site, assessments of the likelihood of mitigation success, and adjustments for any temporal loss.

* Start year of modern regulatory framework. Compensatory mitigation for wetlands has existed in various forms in the United States since the 1980s.

** Bush 1989.

*** Department of the Army, Corps of Engineers, Department of Defense and Environmental Protection Agency 2008.

† Institute of Water Resources 2015.

‡ For additional information on credit determination methodologies see for example Vanderbilt (2016).

Box 5. Established Programs: Offsets in Western Cape Province, South Africa

Location	Western Cape Province, South Africa
Start year	2007
Regulator	Western Cape Department of Environmental Affairs and Development Planning
Policy target	Threatened ecosystems and species, special habitats, valued ecosystem services, and important ecological and evolutionary process areas in a landscape context
Desired or required outcome	(1) The cumulative impact of the development authorization and associated Environmental Impact Assessment process does not cause any ecosystem to become more threatened than "endangered" or the conservation status of species and the presence of "special habitats" to decline. (2) Conservation efforts arising from the development application process and contributing to improved protection of the Western Cape's unique species and ecosystems are focused in areas identified as priorities for biodiversity conservation. (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 safeguarded.
Offset options	Permittee-responsible offsets (on-site or off-site) Although the focus of offsets is on formally securing habitat for conservation purposes, monetary compensation may be considered as an interim measure to secure habitat in some cases.
Methodology: Loss/gain calculations	The ecosystem threat status of the impacted habitat is used to assign an offset ratio designed to ensure that conservation targets for the affected ecosystem would be met. Offsets are calculated by multiplying the area (extent) lost by the offset ratio. A range of context-specific considerations are then used to adjust this basic offset area, including: the condition of the affected habitat; the significance of residual impacts on threatened species; the significance of residual impacts on special habitats; the significance of residual impacts on important ecological corridors or process areas; and the significance of residual impacts on biodiversity underpinning ecosystem services with socioeconomic value.

Source: Business and Biodiversity Offsets Programme 2009.

Box 6. Emerging Programs: Uganda's Emerging Offsets Framework

Location	Uganda
Country context	Uganda is a small country that is rich in biodiversity. It spans multiple ecosystems, with mountainous rainforests in the south home to some of the world's last wild mountain gorillas, and savannah in the north, with populations of elephants, lions, leopards, and rhinos. Uganda is categorized by the United Nations as a least developed country and has one of the world's highest rates of population growth. Uganda also has an active and growing energy sector, with multiple known oil and gas deposits.
Current offsetting frameworks	Uganda does not currently have polices or laws in place setting a NNL/net gain objective achieved through use of the mitigation hierarchy. At present, all biodiversity offsets in the country are taking place either voluntarily or to fulfill lender requirements. The International Finance Corporation, which lends funding for many economic and social development projects, requires that any project, located in modified, natural, and critical habitats that could impact ecosystem services must follow the mitigation hierarchy to achieve no net loss or, preferably, net gain of biodiversity. For example, the Bujagali Hydroelectric Plant is a 250 MW dam located along the White Nile River, just north of the river's origin in the town of Jinja. Constructing the dam required flooding high-value agricultural land, as well as the Bujagali Falls, previously a local tourism destination. The 2007 indemnity agreement between the Government of Uganda and the World Bank International Development Association required "counterbalancing or making up for" the negative effects caused by Bujagali dam on the environment. As a result, Bujagali Energy Limited and lender representatives worked with federal and local government officials and other stakeholders to develop the Kalagala Offset Sustainable Management Plan. The plan aims to support sustainable management of the Mabira Ecosystem by integrating the area's plans for forests, environment, ecotourism and land use.

Box 6. Emerging Programs: Uganda's Emerging Offsets Framework (continued)

Emerging offset frameworks

Establishing a policy framework or amending existing policy toward this end would likely require creation of new rules and incentives to ensure NNL/net gain on private lands and careful consideration of Uganda's system of customary tenure, which could create uncertainty in application of the mitigation hierarchy. Several pieces of recently passed legislation and draft legislation explicitly call for mandatory application of the mitigation hierarchy to ensure that NNL/net gain objectives are included in new development projects.

The NGO-led Conservation, Impact Mitigation and Biodiversity Offsets in Africa project is working with governments, developers, and industry to expand and improve the application of the mitigation hierarchy in Uganda and three other African nations. The project is helping governments develop policy mechanisms that result in NNL or a net gain of biodiversity, along with the necessary institutional, legal, and financial mechanisms for offset implementation.

How an offsetting program would be structured and managed is currently undecided. One mechanism under consideration is a Conservation Trust Fund to collect and manage financial contributions to biodiversity offsetting, especially from the energy extractives sector. In the spring of 2017, the Wildlife Conservation Society and US Agency for International Development launched the Uganda Biodiversity Fund to help generate resources and channel them towards biodiversity conservation projects around the country. A feasibility study for this fund listed financial contributions from energy sector projects seeking to offset their biodiversity impacts as a potentially major source of long-term funding for conservation.

Sources: Nabanyumya, Khaukha, and Naluwairo 2017 (under development).

Ministry of Water and Environment n.d.

Wildlife Conservation Society and USAID Uganda 2014.

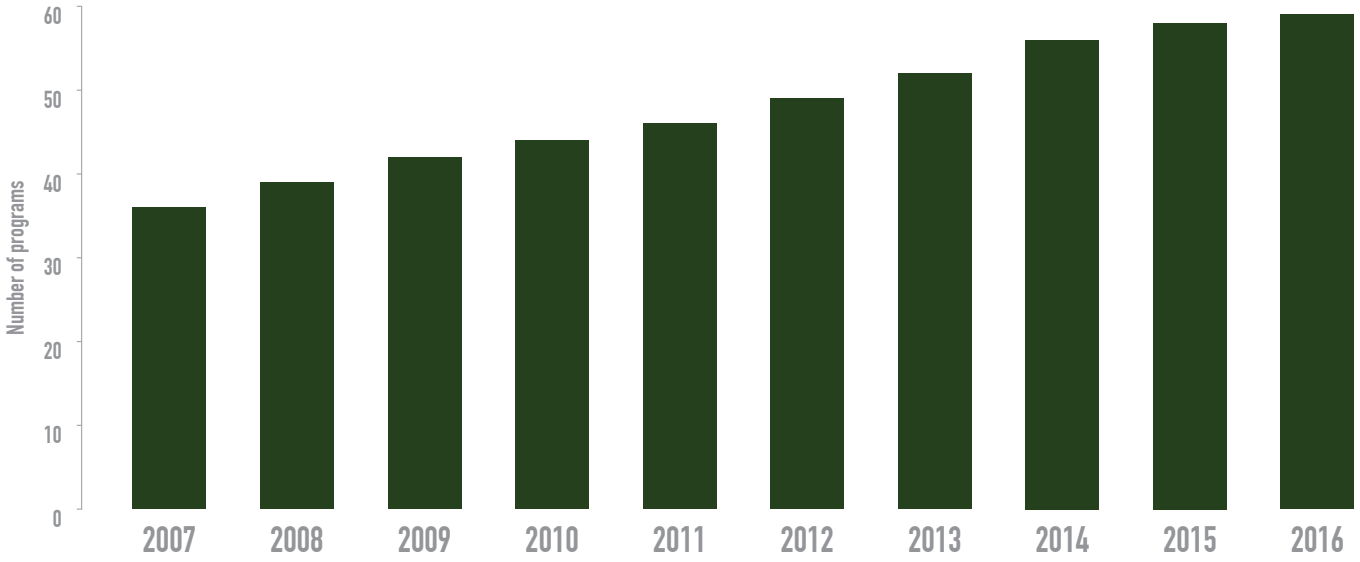
Program Activity in 2016

Only 36 out of 99 offsets and compensation programs (36%) posted actual activity in 2016 either through transactions to compensation funds or banks or new spending by permittee-responsible offset projects. Though each year seems to bring new policy or regulation around the world (Figure 5), it is unclear whether these policies are actually resulting in much compensatory mitigation (or whether they are effective in securing NNL/net gain objectives, for that matter).

This "gap" between policy and practice can be understood in a few ways. To begin with, biodiversity offsets and compensation often operate with woefully inadequate efforts at public transparency[5]—an issue discussed throughout this report. The gap might also, more optimistically, be a sign that the mitigation hierarchy is working: programs may be addressing impacts successfully through avoidance, minimization, and rehabilitation, and thus not need to use offsets very frequently. On the other hand, offsets may be needed to achieve NNL or net gain but are not being used.

Our data suggest in any event that there is scope for improvement in the rigor with which the entire mitigation hierarchy is applied in pursuit of biodiversity conservation targets, including the use of high-quality offsets. Relevant policy seems to be present in many places, but is often ambiguous and lacking in clear guidance and implementation mechanisms, rendering it effectively optional and difficult for developers to apply. Requirements are often not monitored and enforced. As a result, actual spending on projects to mitigate for residual impacts is likely insufficient, and a net loss of biodiversity is accumulating over time, posing a significant risk for the future. Additional research into how to address these and other barriers to effective implementation of mitigation policy would be a very useful contribution to the field.

Figure 5. Compliance Offsets and Compensation: Number of Active Programs by Mitigation Type, 2007–2016



Notes: Based on 60 programs for which start year was reported.

[5] With some notable exceptions—see Box 7 on page 25.

Section II. Findings

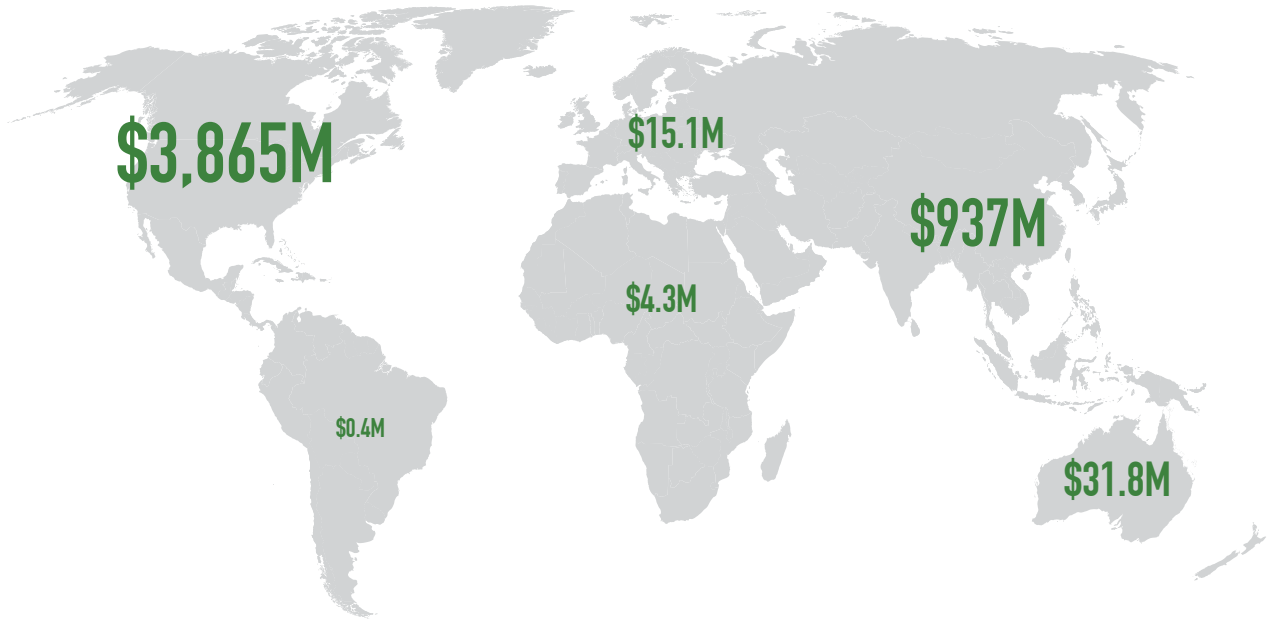
Compliance Offsets and Compensation: Activity in 2016

This section benchmarks the value, scale, and scope of biodiversity offsets and compensation projects globally in 2016. Market findings are broken out by mitigation type. We look first at third-party compensatory mitigation mechanisms—mitigation banking and financial compensation—followed by permittee-responsible offsets.

Third-party compensation mitigation providers transacted $4.8B in 2016

An estimated $4.8B was transacted in 2016 by mitigation banks and financial compensation funds.[6] Mitigation banks collected more than seven in ten dollars (74% of total value, or $3.6B) of total transactions in 2016.

Map 2. Compliance Offsets & Compensation: Value Transacted by Region, 2016



Notes: In this report, Mexico is included in the Latin America & Caribbean region.

Market value was led by compliance-driven buyers in the United States (Map 2). In India, the national Compensatory Afforestation Program collected an estimated $937 million (M) in compensation funds in 2016. Australia is home to a number of sophisticated state and local programs supporting banking and financial compensation operating at smaller scales ($31.8M in total in 2016).

In China, a large-scale Forest Revegetation Fee also collected compensation funds for forest impacts. That program transacted a reported $1.27B in 2011 (Finance Yearbook of China 2012) but is not included in this report since the way program revenues and expenditures are reported by the Chinese government has changed, and we were unable to confirm 2016 payment values.

[6] Transaction figures come from actual reported transaction data with the exception of the US Aquatic Resources Compensatory Mitigation and Conservation Banking programs, where market value has been estimated based on average prices and reported transaction volumes. Please see Appendix 1 for an explanation of our methodology.

Mitigation banking commanded an estimated $3.6B in 2016 market share, led by US market for wetland offsets

Mitigation banks transacted an estimated $3.6B in 2016 in compliance markets (Table 3). Banking is concentrated in just a few countries; the largest markets are in the United States, Australia, and Germany. Pilot banks in France also were active in 2016. Banks transacted credits representing a reported 6,491 ha in 2016.[7] These figures likely underestimate actual activity, since several major offsets and compensation programs that permit mitigation banking (namely in Germany and Canada) make relatively little data publicly available on banking activity in terms of land area (Box 7).

The largest banking market in the world is by far the US Aquatic Resources Compensatory Mitigation program focused on wetland and stream offset credits, which transacted an estimated $3.25B in bank credits in 2016. Credits transacted represent a reported 5,233 ha of wetland and 91,139 linear meters of stream.[8] By volume of credits transacted, wetland and stream mitigation banks have posted an average annual growth rate of 18% since 2010; the conservation banking market has grown an average of 10% per year during the same period (Figure 6).

Box 7. Transparency in Mitigation Banking and Financial Compensation Leaps in Some Markets, Lags in Others

In the years since our last State of Biodiversity Mitigation report in 2011, regulators in the United States and Australia have made tremendous progress in terms of transparency—at least when it comes to third-party mitigation. Public registries tracking project data and transactions for mitigation banks and financial compensation funds are now available for all major compliance mitigation banking and financial compensation systems in these countries, significantly improving public access to information about biodiversity offsets and compensation. However, permittee-responsible offsets, which still comprise the lion's share of mitigation activity, have not been part of this progress. As a result, it is much more difficult to evaluate the economic value, ecological success, or adherence to regulatory objectives for permittee-responsible offsets.

In other compliance markets, transparency also remains an issue. Germany and Canada both host active habitat compensation programs, but Ecosystem Marketplace staff encountered challenges collecting data on projects or transactions associated with these programs. Developing and maintaining publicly available data on compensatory mitigation requires significant resources and coordination—an especially heavy lift for relatively low-volume programs (such as Canada's Fish Habitat Compensation) or highly decentralized programs (such as compensation driven by Germany's Impact Mitigation Regulations). But transparency is worth the effort, in order to maintain high standards of mitigation and assuage public concerns that offsets and compensation could be used to "rubber-stamp" projects that should have not been approved in the first place.

[7] Biodiversity offset credits are not at all standardized, unlike other environmental markets such as carbon offset markets. Ecosystem Marketplace has recorded literally thousands of different credit types in its historical tracking data, representing a range of species and habitats. Crediting methodologies vary enormously both across and even within markets depending on ecological context and regulator discretion. In general where possible we report impact in terms of simple hectares or meters, an admittedly imperfect indicator that does not capture a site's specific species/habitat values, ecological function, or ecosystem services.

[8] Stream credits are measured by linear feet of stream, though the interventions accepted by regulators to generate credits can include both instream work (preservation, restoration/enhancement, or relocation of a stream channel) or preservation, restoration/enhancement, or creation of riparian buffer zones in the stream corridor.

Table 3. Compliance-Driven Mitigation Banking Programs by Country, Number, Volume (Credits and Land Area), and Value Transacted in 2016

Program Name	Country	Number of Active and Sold-Out Banks	Total Credits Transacted in 2016	Total Land Area Transacted in 2016	Value of Credits Transacted in 2016
Aquatic Resources Compensatory Mitigation	USA	1,300*	260,781 wetland credits 824,715 stream credits	5,233 ha of wetlands 91,139 linear meters of stream	$3,259.6M**
Conservation Banking	USA	148*	9,440 credits	1,258 ha	$354.2M**
New South Wales Biodiversity Banking and Offsets Scheme	Australia	60	1,044 ecosystem credits 287 species credits	n/a	$7.4M
Victoria Native Vegetation Offsets	Australia	n/a	41.1 General Biodiversity Equivalence Units 17.2 Specific Biodiversity Equivalence Units ***	n/a	$7.1M
National Habitat Banking Experiment	France	2	n/a†	n/a†	n/a†
TOTAL		1,981	1,096,267	6,491 ha 91,139 meters	$3,628.3M

Notes: This table presents transaction volume measured in both credits and hectares since there is considerable variation in the credit:hectare ratio across assessment methodologies and in their application. Not listed in this table due to insufficient data: Canada's Fish Habitat Compensation and Banking program and Germany's Impact Mitigation Regulations. Public reporting on German compensation pools at present does not usually link project activity to specific buyers/impacts; see Bull et al. (forthcoming). Ecosystem Marketplace was unable to verify specific transactions by year for German banking projects beyond a few examples, and thus determined that we had insufficient data on transaction volume and average prices in 2016 to estimate overall market size. Other studies have estimated the overall transaction value of offsets and compensation in Germany to be $1.2–3.6B (€1.1–3.4B), based on an extrapolation of estimated project costs and scale of demand for offsets (Institute for European Environmental Policy 2016). Also not listed in this table is New South Wales, Australia's native vegetation offsets framework for rural landowners driven by the 2003 Native Vegetation Act, which was repealed in 2016. The Native Vegetation Act has been replaced by provisions in the new Biodiversity Act 2016, but offsets are not yet active as of the time of this report's writing in Summer 2017. Finally, Queensland, Australia allows entities to develop advance offsets, but as these are not strictly banks they are not included in this table.

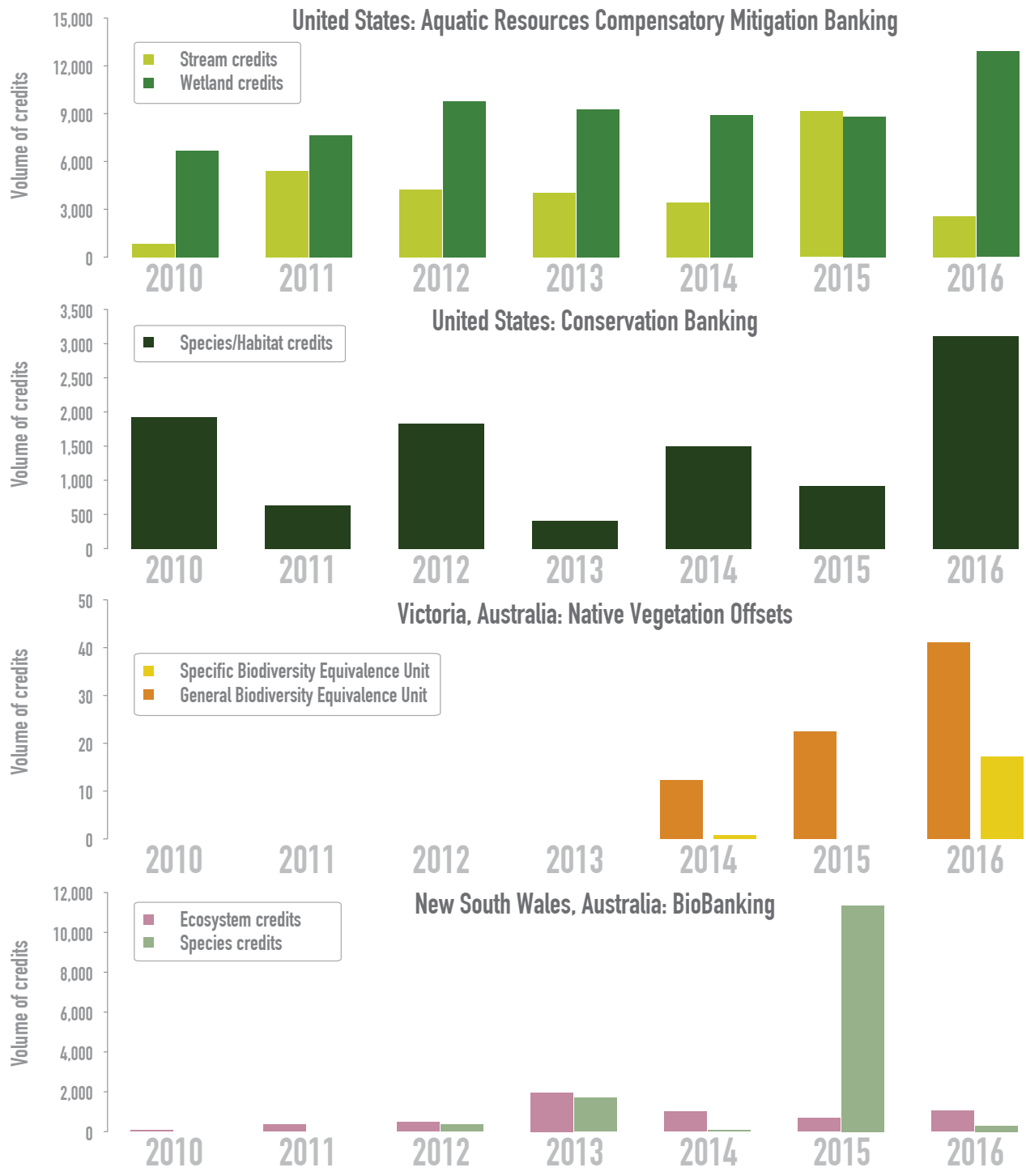
*Includes banks approved for "Group" credits that may be sold to buyers in either the Aquatic Resources Compensatory Mitigation Program (e.g., wetland credit buyers) or the Conservation Banking program (e.g., species credit buyers). Thus, a total of 30 projects were counted as belonging in two programs. These double-counted projects are included only once in "Total" project numbers.

**Estimated market value of wetland and stream credits transacted in 2016 is $1,312M-$5,207M; market value of species and group credits transacted in 2016 is estimated to be $154.2M-$681.6M. Figures shown in this table are the average value of these ranges. See Appendix 1 for a detailed explanation of our methodology.

***In 2014, Victoria introduced new crediting units, the General Biodiversity Equivalence Unit and Specific Biodiversity Equivalence Unit. However, credit units used prior to 2014 are also still transacted. In 2016, the Victoria Native Vegetation Offsets program also saw the sale of 52 habitat hectares, 81 "very large old trees," 127 "large old trees," and 1,453 "recruits."

†In order to protect the confidentiality of our respondents, Ecosystem Marketplace's standard policy is to only publish a data point if three or more organizations within that category provide data.

Figure 6. Major Mitigation Banking Markets in the United States and Australia: Credit Volume Transacted, 2010–2016



Notes: Both within and across markets, a "credit" can represent a very different unit of species or habitat value, ecological function, or ecosystem service(s). See footnote 29.

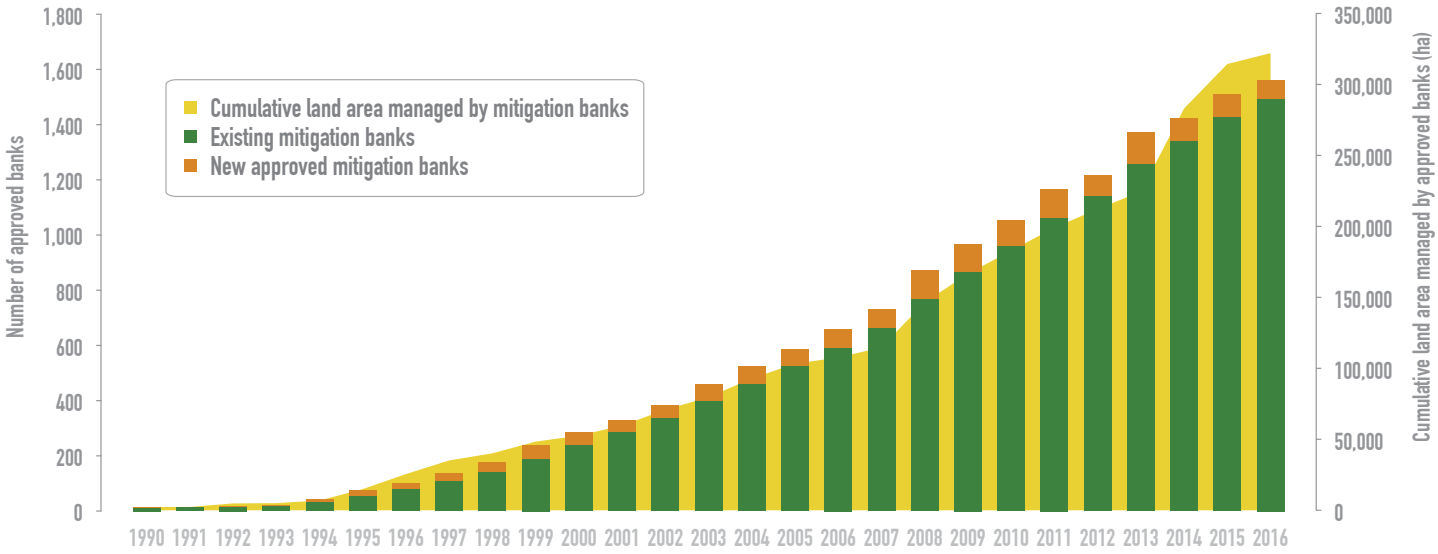
In 2014, Victoria Native Vegetation Offsets program administrators introduced new crediting units, the General Biodiversity Equivalence Unit and Specific Biodiversity Equivalence Unit. However, credit units used prior to 2014 are also still transacted. In 2016, the Victoria Native Vegetation Offsets program also saw the sale of 52 habitat hectares, 81 "very large old trees," 127 "large old trees," and 1,453 "recruits," not shown in this figure.

In the United States, program regulators have encouraged or established an explicit regulatory preference for advance mitigation over other forms of offsets and compensation (Department of the Army, Corps of Engineers, Department of Defense, and Environmental Protection Agency 2008). That has helped engineer a shift in overall market share in favor of banking (Institute for Water Resources 2015). In 2016 the US Fish and Wildlife Service issued guidance establishing a similar preference for banks over other forms of compensatory mitigation for species and habitats (Department of Interior, Fish and Wildlife Service 2016).

In Australia, regulators at the national level have followed suit with policy encouraging advance offsets and banking (Commonwealth of Australia 2012). But at the state level (which is the jurisdictional level at which markets are administered in Australia) no such preference exists. Year-to-year volume has been volatile in New South Wales' BioBanking program. In Victoria's Native Vegetation Offsets market, most credit types saw overall declines in volume transacted between 2010 and 2016. In 2014, two new credit types were introduced: the General Biodiversity Equivalence Unit and the Specific Biodiversity Equivalence unit, both of which have seen initial growth in their first three years on the market.

Globally, the number of banks has grown considerably in the last two decades (Figure 7), though that growth has concentrated within just a few countries and compliance markets. Interest in third-party and advance mitigation in Europe, Colombia, and Brazil suggests that banks may see growth in geographic scope in the future as well (see the Outlook section on page 54). The number of regulator-approved mitigation banks rose from 53 in 2005 to more than 1,500 as of 2016. To date, banks have restored, protected, or created more than 324,000 ha of habitat worldwide.

Figure 7. Mitigation Banks Worldwide: Cumulative Number of Approved Mitigation Banks by Year and Cumulative Land Area Managed by Banks, 1995–2016



Notes: Based on 1,512 banks for which year of regulatory approval and project area was reported. Banks that were approved but later terminated or suspended by regulators are excluded.

Financial compensation funds collected $1.2B in 2016, but some are slow to spend it

While mitigation banking primarily operates in only a few countries (US, Australia, Canada, Germany, France) compensation funds are more widespread. They are found in 19 countries in all regions of the world. Compensation funds accepted a reported $1.2B in 2016 (Table 4), led by programs in India and the United States. Our figure almost certainly underestimates actual activity, since only 35% of programs reported payment data in 2016.

Table 4. Compensation Funds in 2016: Information about Active Programs

Region	Number of Active Programs	Fund Revenues Received in 2016	Fund Balance as of End of 2016	Cumulative Project Area Reported
Africa & Middle East	5	$4.1M	$4.1M	9k ha
Asia	2	$935.3M	$6,635.0M	708k ha
Europe	11	$8.7M	$155.3M	n/a
Latin America & Caribbean	6	$0.4M	$49.8M	762k ha
North America	70	$251.2M	$163.0M	48k ha
Oceania	9	$16.3M	$58.8M	3k ha
TOTAL	103	$1.2B	$7.1B	1.5M ha

Data on compensation fund expenditures (e.g., value *spent* on conservation projects in a given year rather than value *paid into* the fund by compensatory mitigation buyers that year) was very difficult to obtain. Less than one in ten projects (9.2%) provided information on their 2016 expenditures; total value reported was only $78M globally. This paucity of data makes it difficult to directly compare the annual ratio of revenues to expenditures, which in turn could suggest whether significant temporal loss is occurring (e.g., if there is a long lag time between negative impacts and mitigating activities).[9] But funds did report that at least $7.1B in total compensation funds collected to date remained unspent (with 42% of programs reporting on this data point), suggesting that a tremendous amount of offsetting activity has yet to be implemented, even though negative impacts to biodiversity have already taken place.

Some programs are obligated by law to minimize temporal loss by spending compensation funds within a fixed period of time. For instance, compensation funds can only be held for a maximum of three years in the United States and Italy. A new law in India in 2016 recognized that that country's Compensatory Afforestation Program (the largest compensation program in the world tracked in this report, and the biggest offender when it comes to failure to implement projects) was taking far too long to spend funds and instructed officials to create a statutory framework to speed up the pace of implementation of compensation projects (Ministry of Law and Justice 2016).

Mitigation banking and compensation funds: Transaction prices in 2016

Ecosystem Marketplace collected data on credit prices for mitigation bank and compensation fund transactions in major markets in the United States and Australia in 2015–2016 (Figures 8 and 9, Table 5).

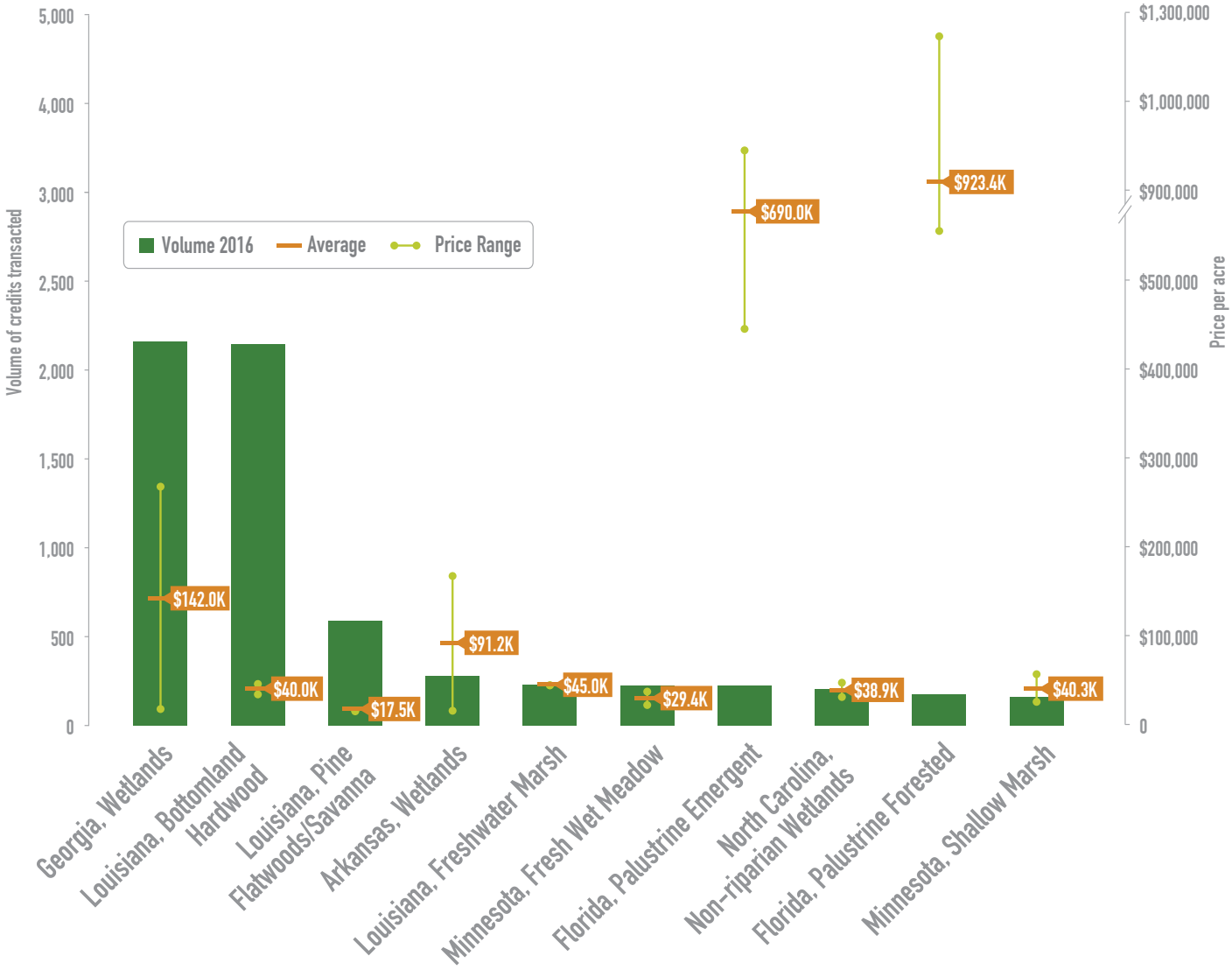
Direct comparison of prices across credit types is not meaningful, since crediting methodologies (even for the same species) focus on a broad range of biophysical indicators and use many different approaches. In 2016 alone, Ecosystem Marketplace tracked 3,372 different credit types sold in the United States and Australia.[10] But publishing price ranges for common credit types can help observers understand general trends in the market. For example, compensation funds in some cases provide compensatory mitigation at lower prices than banks. (Mitigation bankers report that this is because compensation funds are often required to meet lower standards of mitigation.) Price data can also provide a general indication of underlying project costs (Figure 10). Factors like

[9] Temporal loss refers to the deficit in biodiversity values that exists for a period of time after negative impacts from development and before an offset site is mature, e.g., reaches full ecosystem function or desired species composition/habitat structure. Temporal loss may be addressed through advance mitigation, discounting, or other risk mitigation approaches.

[10] Note that prices are provided per acre rather than per hectare for the United States for our US readers' convenience. Where prices were reported as credits rather than per-acre, we have normalized price to acres through a calculation of average credit:acre ratios at the state level. Please see a further explanation of our methodology in Appendix 1.

efficiency of permitting, local land prices, and the interventions undertaken (for example, habitat preservation versus restoration) can considerably affect the cost of compensatory mitigation.

Figure 8. Transacted Volume and Price per Credit for Top Wetland Credit Classifications in the United States, 2016



Notes: Not shown in this figure are credit classifications for which Ecosystem Marketplace had fewer than three price points for 2016 transactions. This includes Mississippi, Bottomland hardwood; Minnesota, Open Bog or Coniferous Bog; South Carolina, Freshwater Enhancement/Restoration; Louisiana, Coastal Prairie; South Carolina, Salt Marsh Enhancement/Restoration; Minnesota, Sedge Meadow; and Louisiana, Freshwater Marsh Tidal. Each of these credit classifications transacted volumes that placed it in the top fifteen in terms of demand in the United States in 2016.

Figure 9. Transacted Volume and Price per Credit for Top Species Credit Classifications in the United States, 2016

Notes: Not shown in this figure are credit classifications for which Ecosystem Marketplace had fewer than three price points for 2016 transactions. This includes Oklahoma, American Burying Beetle; and Texas, Black-capped vireo.

Volume data is not provided for California tiger salamander credits as these are typically sold in "group" credits (e.g., approved for multiple species/habitat types) and it is not possible to determine volume transacted specifically for conservation of this species.

Table 5. Compensatory Mitigation Programs in Australia: Credit Prices in 2016 for Frequently Transacted Credits

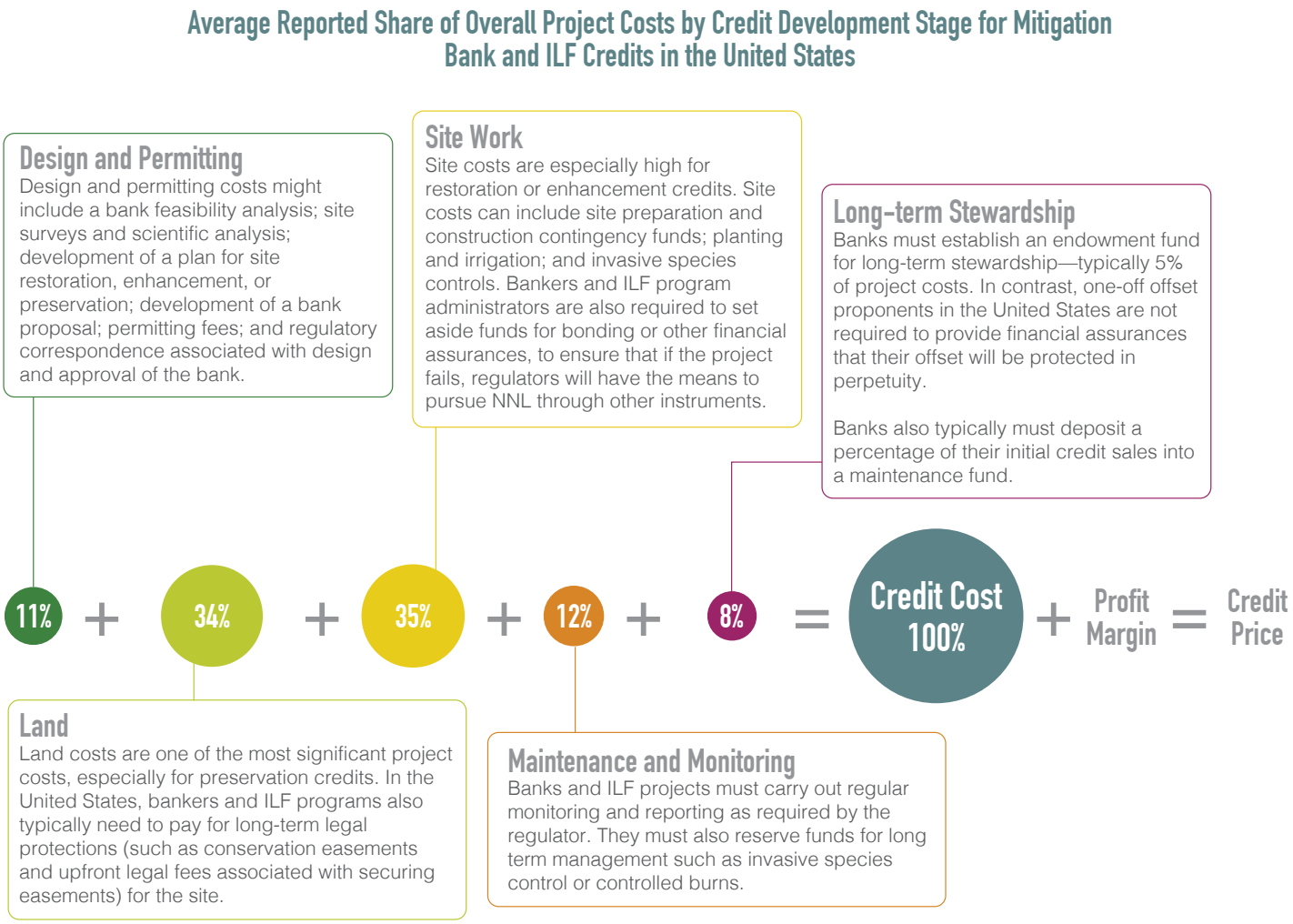
State-Level Programs					
New South Wales Biobanking					
Credit Classification	**Credit Unit**	**Mitigation Type**	**Average Price**	**Low Price**	**High Price**
White-footed Dunnart	Credit	Banking	$1,114	$1,114	$1,114
Darwinia biflora	Credit	Banking	$1	$1	$1
HN528/Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Credit	Banking	$9,293	$9,293	$9,293
HN556/Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Credit	Banking	$6,688	$5,714	$7,143
SR545/Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Credit	Banking	$5,357	$5,357	$5,357
Queensland Environmental Offsets					
Credit Classification	**Credit Unit**	**Mitigation Type**	**Average Price**	**Low Price**	**High Price**
Fish Passage - Waterway	Hectare	Financial compensation	$ 17,857	$17,857	$17,857
Freshwater wetlands	Hectare	Financial compensation	$10,395	$10,395	$10,395
Mangroves	Hectare	Financial compensation	$163,714	104,143	$210,000
Seagrass	Hectare	Financial compensation	$178,571	$178,571	$178,571
Thesium australe (toadflax)	Hectare	Financial compensation	$30,397	$30,397	$30,397
Victoria Native Vegetation Offsets					
Credit Classification	**Credit Unit**	**Mitigation Type**	**Average Price**	**Low Price**	**High Price**
Plains Grassland	Habitat hectare	Banking	$124,957	$94,213	$168,000
Swampy Riparian Woodland	Habitat hectare	Banking	$168,000	$168,000	$168,000
Plains Grassy Forest	Habitat hectare	Banking	$130,813	$130,813	$130,813

Table 5. Compensatory Mitigation Programs in Australia: Credit Prices in 2016 for Frequently Transacted Credits (continued)

Victoria Native Vegetation Offsets					
Credit Classification	Credit Unit	Mitigation Type	Average Price	Low Price	High Price
Coastal Saltmarsh	Habitat hectare	Banking	$280,000	$280,000	$280,000
Herb-Rich Foothill Forest	Habitat hectare	Banking	$70,525	$1,050	$140,000
Heavier Soils Plains Grassland	Habitat hectare	Banking	$196,000	$196,000	$196,000
Lowland Forest	Habitat hectare	Banking	$71,621	$1,050	$210,000
Low Rises Grassy Woodland	Habitat hectare	Banking	$26,217	$1,260	$77,000
Local/Municipal Programs					
Kingborough (Tasmania) Environmental Offsets					
Credit Classification	Credit Unit	Mitigation Type	Average Price	Low Price	High Price
Hectare	Hectare	Financial compensation	$16,800	$16,800	$16,800
High conservation value tree	Tree	Financial compensation	$350	$350	$350
Very high conservation value tree	Tree	Financial compensation	$700	$700	$700
Melbourne (Victoria) Strategic Assessment Habitat Compensation					
Credit Classification	Credit Unit	Mitigation Type	Average Price	Low Price	High Price
Golden Sun Moth	Hectare	Financial compensation	$11,080	$11,080	$11,080
Growling Grass Frog	Hectare	Financial compensation	$10,541	$10,541	$10,541
Matted Flax-lily	Hectare	Financial compensation	$15,674	$15,674	$15,674
Native Vegetation	Hectare	Financial compensation	$133,105	$133,105	$133,105
Scattered tree	Hectare	Financial compensation	$18,505	$18,505	$18,505
Southern Brown Bandicoot	Hectare	Financial compensation	$5,621	$5,621	$5,621
Spiny Rice-flower	Hectare	Financial compensation	$11,112	$11,112	$11,112

Notes: Prices shown for most-transacted credit types in 2016.

Figure 10. Unpacking Offset Credit Prices



Why do credits cost what they do? Ecosystem Marketplace asked mitigation bankers and compensation funds in the United States about the average costs associated with developing a habitat credit. Average shares of project costs by credit development are presented below. In practice, these costs can vary considerably: for example, a restoration project will likely have relatively higher site work costs than a preservation project. Regulatory permitting processes also have a strong influence on project costs, both in terms of direct costs (for instance, in California stage regulators levy a $100,000 application fee for proposed banks) and indirect costs (such as higher carrying costs faced by project developers if the permitting process takes many years).

For much of the world, permittee-responsible offsets are still the only game in town

As discussed in Section 1 of this report, permittee-responsible offsets are still the only option for compensatory mitigation in many countries. Permittee-responsible mitigation remains the "default" option while the third-party compensatory mitigation mechanisms discussed in this report's preceding pages, especially mitigation banking, are less common. In the 33 countries tracked in this report with active offsets and compensation programs in 2016, 25 (or 76%) had programs that accepted permittee-responsible offsets, compared to 19 countries where financial compensation was accepted and eight countries using mitigation banking.

We identified 1,855 compliance permittee-responsible offsets projects initiated in 2016 around the world and at least 16,940 to date (or 86% of all compensatory mitigation projects tracked to date). Projects initiated in 2016 covered 21,057 ha; reported cumulative land area as of 2016 exceeds 6.9M ha. Collectively permittee-responsible offset projects committed $293M in 2016 to habitat preservation, restoration, or creation to mitigate for negative residual impacts to biodiversity (Figure 11). Asia commands the largest share of permittee-responsible offset projects by land area, mainly due to a very large project, Oyu Tolgoi, in Mongolia. By project count, most permittee-responsible offsets initiated in 2016 were in the United States. Across all permittee-responsible offsets tracked, the average total spending commitment per project in 2016 was $9.1M. (See Box 8 for an example of a permittee-responsible offset project.)

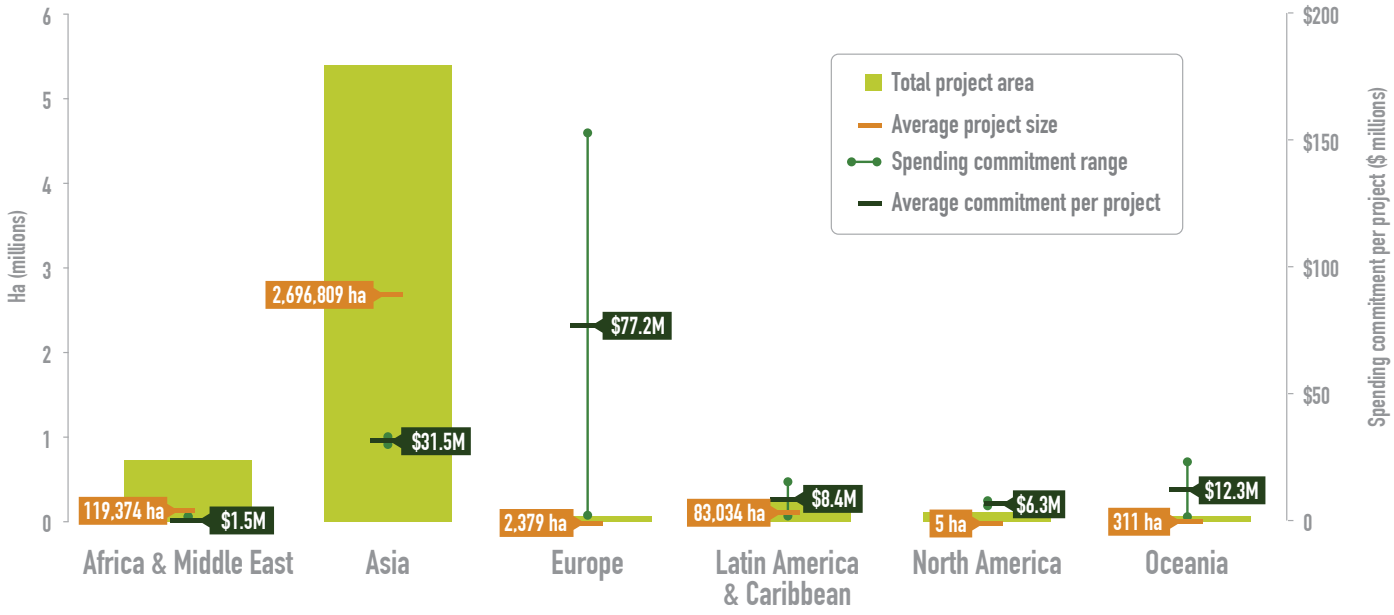
Photo Credit: Leungchopan/Shutterstock

Box 8. A Permittee-Responsible Offset Case Study: Kennecott Copper Mine

Location	Utah, United States
Regulatory driver	United States Clean Water Act permit
Mitigation goal	No Net Loss of wetland function
Equivalency	Like-for-like
Duration	Permanent protection
Description of impact requiring compensatory mitigation	427 hectares containing wetland areas impacted by expansion of the mine's tailings area
Offset approach	Rather than using the "vegetation, soils and hydrology" criteria typically applied in wetland restoration at the time, the company decided to focus on restoring habitat for shorebirds, and to find appropriate currency to determine replacement values. Achieving a shift in the current mindset from "using set parameters," to thinking about "ecological function," took considerable discussion. The Technical Advisory Group felt that a Habitat Evaluation Procedure would provide a sound basis for determining the requirement for replacement of habitat function and value to wildlife. Three different Habitat Evaluation Procedure models were used to determine the size of offset: the American Avocet model for nesting shorebirds; the Migratory Shorebirds model for shorebirds that used the wetland for feeding and roosting; and the Cinnamon Teal model for "dabbling ducks." A Mitigation Review Team, comprising representatives from State and Federal regulatory agencies (the Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service, USEPA, and USACE) as well as non-government organizations (The Nature Conservancy, National Audubon Society) was set up to help design the compensatory conservation. Although 427 ha of wetlands were impacted by the project and a similar area needed to be restored in order to compensate fully for that impact, Kennecott identified and purchased a 1,011 ha site suitable for wetlands mitigation, less than a kilometer from the project site. This wetland offset project is recognized as one of the largest and most successful mitigations in the United States. The proponent went beyond legal requirements to provide a large area of restored wetland habitat now internationally recognized as important for resident and migratory shorebirds (the Inland Sea Shorebird Reserve).

Source: Business and Biodiversity Offsets Programme 2009b.

Figure 11. Compliance Permittee-Responsible Mitigation Projects: Total Project Area, Average Project Size, and Spending Commitments per Project by Region, 2016



Notes: Based on 64 projects.

Project costs per hectare varied quite widely and on the whole tended to be lower than mitigation banks credits or compensation fund fees (Table 6). Part of the reason for this is that permittee-responsible offsets may face lower regulatory standards than mitigation banks or financial compensation. In the United States for instance parties undertaking permittee-responsible offsets for species/habitats are not required to provide financial assurances that a project area will be protected in perpetuity, but banks and compensation programs must do so (Pindilli and Casey 2015). In France banks also have stricter requirements than permittee-responsible offsets regarding long-term management and demonstration of additionality (Bennett et al. 2017).

Table 6. Costs per Hectare Reported by Active and Completed Permittee-Responsible Offsets Projects by Region: Low-High ranges and Median Values, 2016

	Low	High	Median
Africa & Middle East	$61.7	$1,554.2	$761.6
Asia	-	-	-
Europe	$9,117.0	$198,707.8	$53,285.9
Latin America & Caribbean	$240.0	$4,290.0	$2,265.0
North America	-	-	-
Oceania	$225.0	$178,571.4	$107,142.86
TOTAL	$61.7	$198,707.8	$25,487

Notes: In order to protect the confidentiality of our respondents, Ecosystem Marketplace's standard policy is to only publish a data point if three or more organizations within that category. Here, cost data for Asia and North America did not meet our threshold for publication.

Box 9. Permittee-Responsible Offsets: The "Dark Matter" of the Mitigation Universe

This reports primarily on market activity for third-party compensatory mitigation, e.g., mitigation banking and financial compensation. But the $4.8B spent on bank credits and compensation fees in 2016 is actually only a small share of overall compensatory mitigation activity. Permittee-responsible offsets by area of habitat restored, protected, or created each year comprised an estimated 97% of overall global compensatory mitigation activity in 2016. In other words, the $4.8B in transactions to third-party mitigation providers documented in this report is likely only a fraction of actual spending on compensatory mitigation.

Yet permittee-responsible offsets operate with far less public transparency than banking or financial compensation, and often enjoy lower standards set by regulators in terms of public notice during project design or reporting later on implementation and long-term outcomes. This makes it extremely difficult to track the economic value, ecological success, or adherence to regulatory objectives for permittee-responsible offsets. Our transaction data estimates are undoubtedly underestimates of actual spending activity. Although we know the number of projects and the area they comprise, information on spending commitments associated with project activities or estimates of projects costs per hectare was available for less than 1% of the permittee-responsible offsets projects identified in this report. Thus in this report we do not even attempt to estimate the annual value of permittee-responsible offsets spending.

In the United States, Australia, France, Germany, and South Africa, regulators or program administrators are working to establish and maintain public registries of offsets projects, which could potentially improve transparency, though these efforts are in early stages and typically include information about project approval but little subsequent documentation concerning implementation. For example, for the largest compensatory mitigation program in the world, the US Aquatic Resources Compensatory Mitigation Program, data on project design and transactions are readily available online through the Regulatory In-lieu fee and Bank Information Tracking System (RIBITS) database. But to obtain information from regulators about permittee-responsible offsets, it is necessary to file a Freedom of Information Act request and even then, data is only available on permits issued since 2012 where permittee-responsible offsets have been used to mitigate for negative residual impacts. Information on implementation such as mitigation plans, compliance inspection reports, monitoring reports, and stewardship plans—which can be found on RIBITS for banks and ILF project sites—is simply not available for permittee-responsible offsets.

Box 10. Historical Growth in Permittee-Responsible Offsets, Financial Compensation, and Mitigation Banking

The first compensatory mitigation projects date back to the 1970s, when Germany's Federal Nature Conservation Act in 1976 introduced its Impact Mitigation Regulations* which sought to ensure no net impact to nature and landscapes by avoiding environmental damages and mandating restoration and replacement compensation for residual unavoidable impacts.

Projects and programs that incorporate compensatory mitigation increased throughout the 1980's and 90's, especially in Europe and the United States. By 2000, 13 programs and 285 projects existed worldwide. The industry was growing, but still remained relatively small: in 2000, there were still only 109,798 ha worldwide managed under compensatory mitigation efforts, which is less than half the size of Hong Kong.

Since 2000 there has been a continual increase in the size and scope of the market. The last time Ecosystem Marketplace produced a report on the state of compensatory mitigation for biodiversity conservation was in 2011. Since then, the total annual market value has approximately doubled and the number of projects has increased dramatically (Table 7).

As of 2016, compliance-driven compensatory biodiversity mitigation had protected over a cumulative 3.25M hectares, an area greater than the size of Belgium.** Ecosystem Marketplace identified 2,734 active or fully implemented compliance projects in 28 countries and on all six populated continents.

*For a review of the program, see Chapter 3 in Darbi et al. 2009.

**With 82% of compliance projects reporting land area data.

Table 7. Comparing Biodiversity Offsets and Compensation Activity in 2011 and 2016

	2011	2016
Number of Active or Completed Projects Tracked	716	20,175
Estimated Global Value, Compliance and Voluntary Projects	$1.8–2.9B	$2.6–$7.3B
Total Land Area Reported, Compliance and Voluntary Projects	86,000 ha	8,347,123 ha

Source for 2011 data: Madsen et al. 2011.

Notes: Please see Appendix 1 for an explanation of our methodology for estimating 2016 transaction value.

Compliance Offsets and Compensation: Global Demand for Compensatory Mitigation

Figure 12. Demand in 2016: By the Numbers

SHARE LAND AREA TRANSACTED BY PROFIT STATUS, 2016

PRIVATE SECTOR: 54%

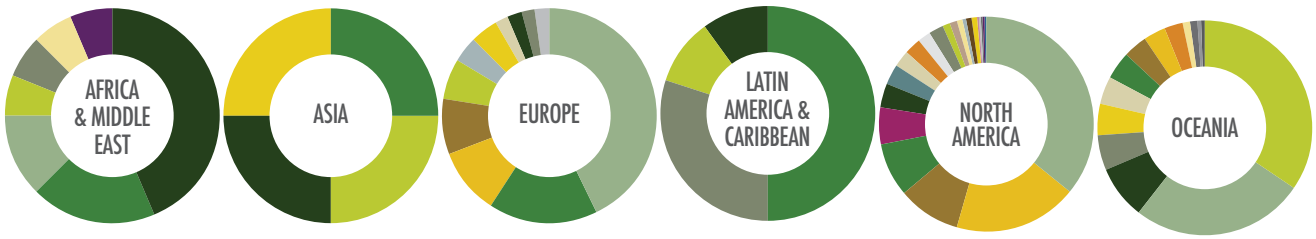
PUBLIC SECTOR: 46%

SHARE LAND VALUE TRANSACTED BY PROFIT STATUS, 2016

PRIVATE SECTOR: 63%

PUBLIC SECTOR: 37%

SHARE OF BUYERS BY REGION AND SECTOR, 2016



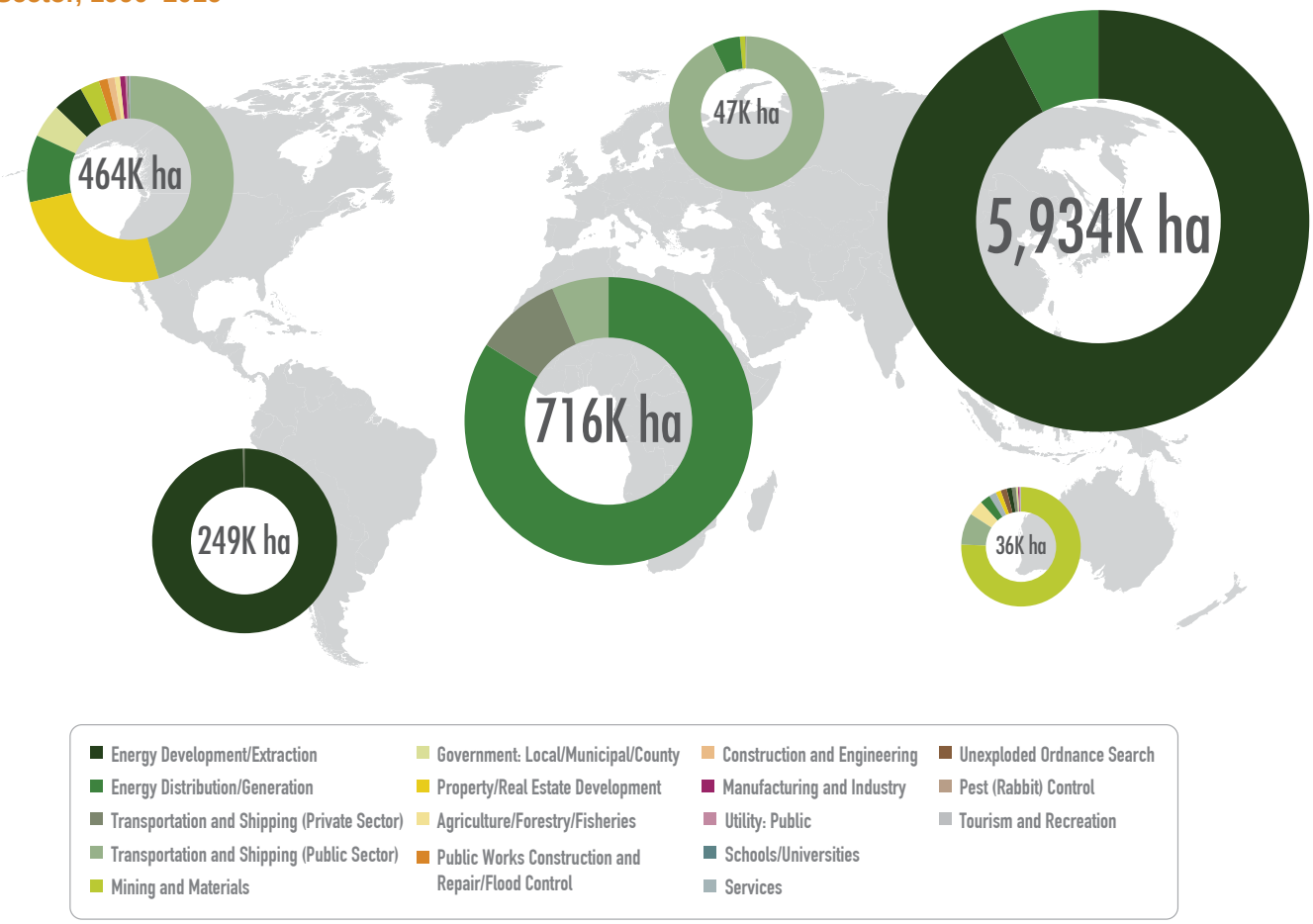
- Energy development/Extraction
- Energy distribution/Generation
- Transportation and shipping (private sector)
- Transportation and shipping (public sector)
- Mining and materials
- Property/Real estate development
- Agriculture/Forestry/Fisheries
- Manufacturing and industry
- Utility: Public
- Construction and engineering
- Services
- Communications
- Construction and engineering
- Consumer goods
- Finance and insurance
- Flood control/dam/bank stabilization/other structural projects
- Government: National
- Government: State/Regional/ Provincial
- Government: Local/Municipal/County
- Non-profit organization
- Pest (rabbit) control
- Schools/Universities
- Unexploded ordnance search
- Tourism and recreation
- Ecological restoration projects

TOP FIVE BUYER SECTORS BY LAND AREA TRANSACTED, 2016

	Transportation and Shipping (Public Sector)	Property/Real Estate Development (Commercial and Residential)	Energy Distribution and Generation	Energy Development and Extraction	Mining and Materials
Total Land Area Transacted in 2016	11,310 ha	5,997 ha	2,071 ha	723 ha	632 ha
Median Transaction Size in 2016	0.2 ha	0.4 ha	0.2 ha	0.2 ha	9.9 ha
Average Transaction Size in 2016	65 ha	7 ha	6,298 ha	98,111 ha	489 ha

Infrastructure projects drive global growth

Map 3. Compliance Offsets and Compensation: Cumulative Land Area Conserved by Region and Buyer Sector, 1990–2016



Notes: Based on 6.5M ha for which buyer sector was reported. Cumulative land area includes all habitat restored, protected, or created as of 2016. Since not all land is preserved in perpetuity, this number may overestimate actual land area under management as of 2016.

Historically, the energy, transportation, and mining/minerals sectors have been responsible for more than 97% of offsets and compensation measured by total land area under management (Map 3). Yet, offset and compensation activity appears to track far more closely to regulatory stringency and enforcement than to impacts from infrastructure and development activity.

Compliance Markets: Compensatory Mitigation Supply

Offsets and compensation conserved 8.3M ha globally, led by permittee-responsible offsets

The scale of project land area supported by biodiversity offsets and compensation varied tremendously by region. With over 6M hectares reported as of 2016, Asia had the greatest amount of land area under compensatory management projects, mainly due to one mega-project, Oyu Tolgoi, in Mongolia. Oceania and Europe had the least. Median project size ranged from 1,269 ha in Africa and the Middle East to just 0.7 ha in North America, with other regions falling somewhere in the middle (Table 8).

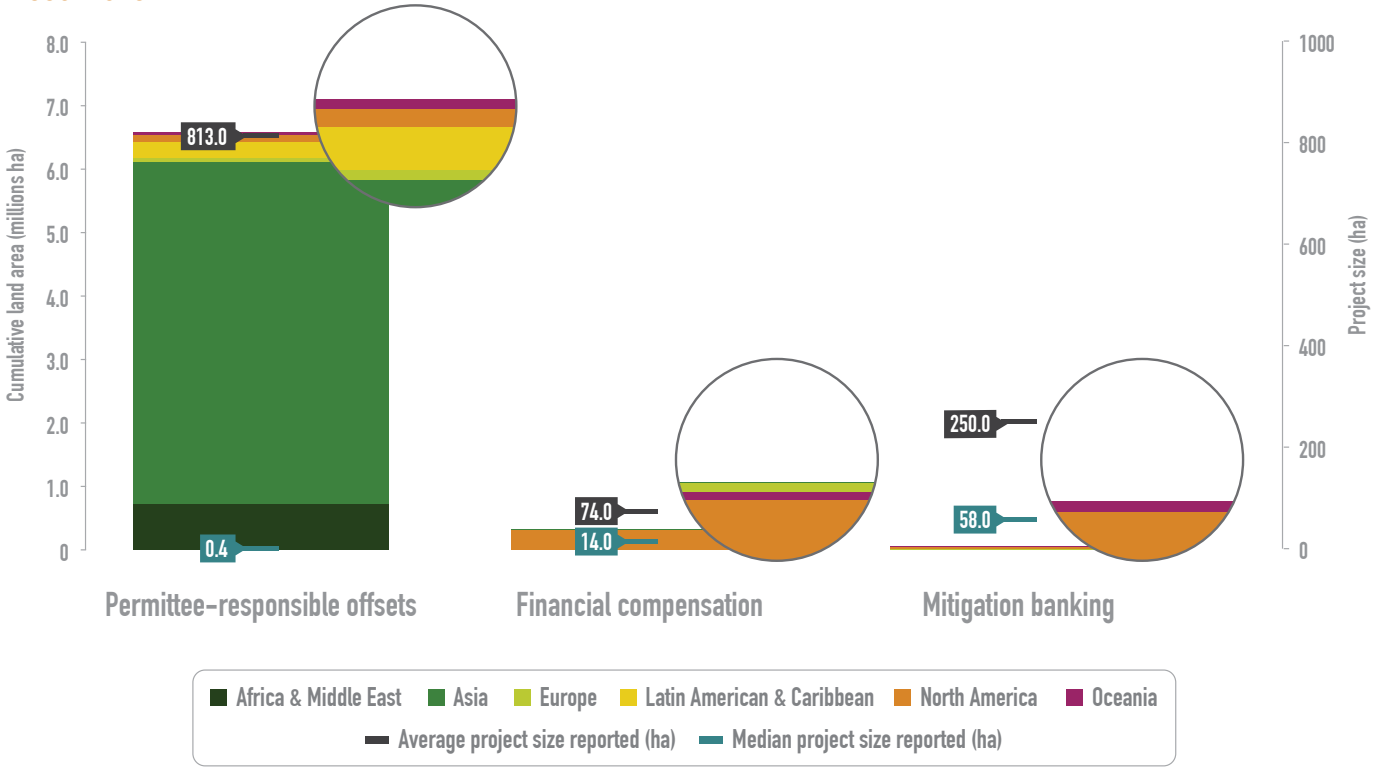
Table 8. Global Supply of Compliance Biodiversity Offsets and Compensation

Region	Number of projects in 2016	Share of approved projects by mitigation type	Cumulative land area in 2016	Median project size
Africa and Middle East	8 approved 7 pending approval	14 permittee-responsible offsets	719,151 ha	1,269 ha
Asia	3 approved 4 pending approval	7 permittee-responsible offsets	6,101,510 ha	419 ha
Europe	507 approved 6 pending approval	36 permittee-responsible offsets 5 compensation projects 474 banks	104,363 ha	32 ha
Latin America and Caribbean	3 approved 8 pending approval	10 permittee-responsible offsets 1 compensation project	939,811 ha	351 ha
North America	4,036 approved 680 pending approval	1,844 permittee-responsible offsets 1,086 compensation projects 1,998 mitigation banks	520,131 ha	0.7 ha
Oceania	437 approved	234 permittee-responsible offsets 117 compensation projects 62 mitigation banks	68,977 ha	12 ha
TOTAL	3,155 approved 705 pending approval	306 permittee-responsible offsets 1,209 compensation projects 2,534 mitigation banks	8,347,123 ha	32 ha

Notes: Suspended or withdrawn (e.g., inactive but not completed) projects were excluded from this table. Projects with no status reported were excluded (accounting for two projects located in Africa and the Middle East). Mitigation type was unavailable for one project in Africa, six projects in North America, and 31 projects in Oceania.

In terms of dominant mitigation type within regions, permittee-responsible offsets make up the majority of compensatory mitigation project area to date in Africa and the Middle East, Europe, North America, and Oceania, while financial compensation is the main mitigation type in Asia and Latin America (Figure 13).[11] Our tracking found a limited number of very large permittee-responsible offset projects, pushing up overall regional land area totals and average project size calculations (Table 9). But at the level of the individual project, third-party compensatory mitigation projects actually tended to be much larger: reported median global project size for permittee-responsible offsets was just 0.4 ha in 2016, compared to 14 ha for financial compensation projects and 58 ha for mitigation banks.

Figure 13. Compliance Offsets and Compensation: Cumulative Land Area by Mitigation Type and Region, 1990–2016



Notes: Data on permittee-responsible offsets land area for wetland and stream compensatory mitigation in the United States could not be obtained for the years prior to 2012. Thus "cumulative" figures only reflect the 2012–2016 period for this subset of the data. Includes the Oyu Tolgoi project, a permittee-responsible offset located in Mongolia.

Table 9. Minimum, Maximum, Average, and Median Project Size of Compliance Projects by Mitigation Type

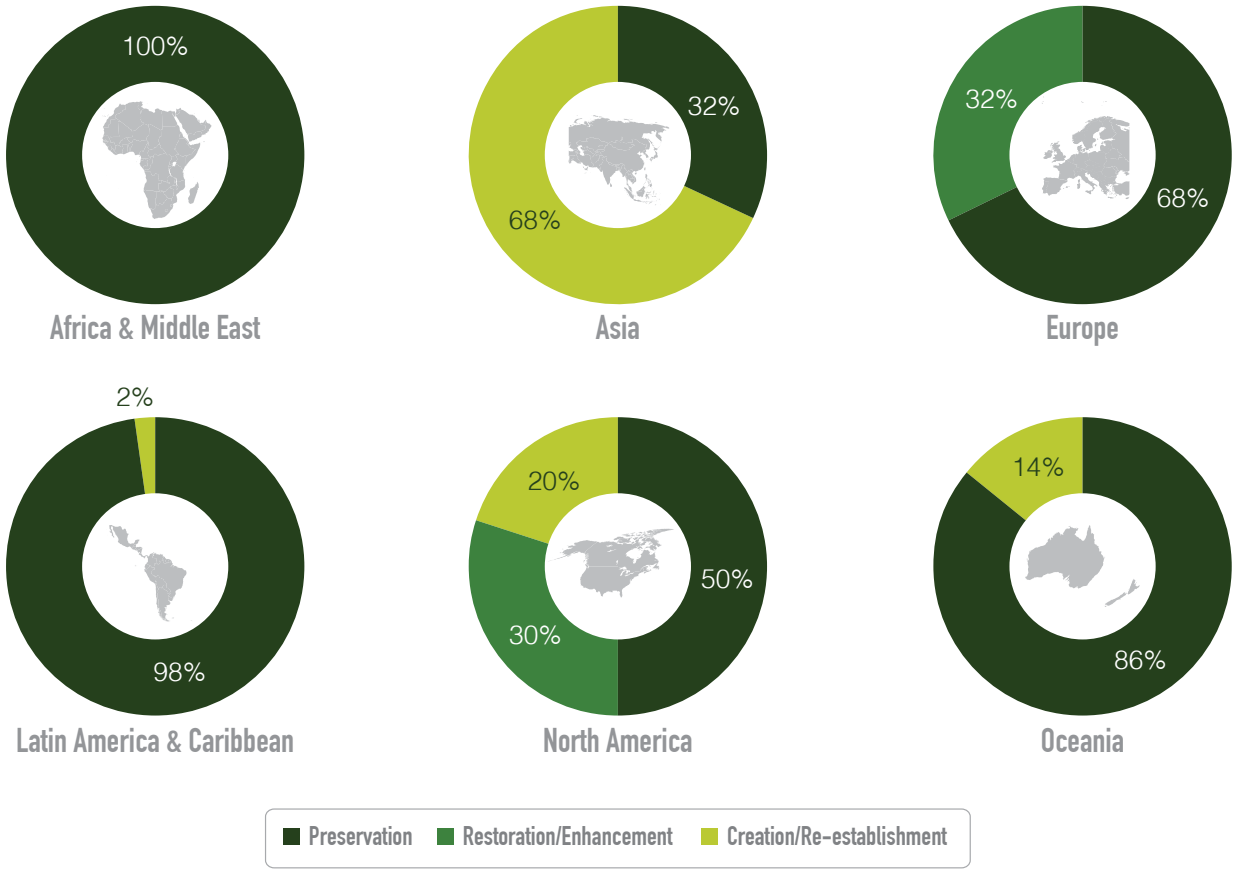
	Minimum project size reported	Maximum project size reported	Median project size reported
Permittee-responsible offsets	0.001 ha	5,000,000 ha	0.4 ha
Financial compensation	0.004 ha	8,411 ha	14 ha
Mitigation banking	0.02 ha	45,000 ha	58 ha

[11] In the United States, following establishment of regulatory preference for mitigation banking and financial compensation over one-off offsets, the balance is slowly shifting each year further toward third-party compensatory mitigation being the dominant source of supply (Institute for Water Resources 2015).

Habitat preservation main target of global spending

As of 2016, most land under management funded through offsets and compensation was preserving existing high-quality habitat (Figure 14). Projects also chose to restore or enhance habitat, to re-establish severely degraded or lost habitat types, or to create new habitats, but at lower rates.

Figure 14. Compliance Offsets and Compensation: Share of Cumulative Land Area by Management Approach within Regions, 2016



Notes: Excludes Oyu Tolgoi, a restoration project in Mongolia. Based on 1.6M ha for which management approach was reported.

There is a debate as to whether preservation can truly contribute to No Net Loss goals. If loss of a hectare of habitat in one place is offset with protection of already-existing habitat somewhere else, then on the whole, habitat has been lost, unless **compensation ratios** are used. More crucially, the case for protection-based offsets rests on an argument about additionality or "averted loss"—e.g., an offset results in protection of an area under threat of degradation—that requires an assumption about the baseline level of biodiversity risk. Since generally the baseline reflects ongoing declines in biodiversity, "averted loss" offsets can arguably "lock in" biodiversity loss.[12]

On the other hand, in many areas insufficient resources exist to manage protected areas critically important to biodiversity conservation; arguably then the best use of offsets and compensation funds is to first ensure that areas that are presently of high conservation value but under risk of degradation are being managed properly well into the future. In some ecosystem types, restoration has not been shown to consistently lead to the return of lost or degraded ecosystem values or functions. In South Africa for example, many ecosystems are considered to be

[12] See Maron et al. (2015) for a discussion of this issue.

non-restorable, and offset funds would be better spent on averting loss of threatened habitats.[13] Similarly, in cases where habitat for imperiled species is the focus of compensatory mitigation, preservation of existing high-quality habitat may be a better bet than restoration or creation/re-establishment projects.

Still, with proper implementation and enforcement, restoration or enhancement is often understood to be more likely than habitat creation or re-establishment to result in high quality replacement habitat. In many programs including in the US Aquatic Resources Compensatory Mitigation program regulatory protocols grant more credits to restoration projects than to habitat creation or re-establishment. (US regulators also show a preference for restoration over preservation in setting compensation ratios required for mitigation, with an eye to achieving No Net Loss.)

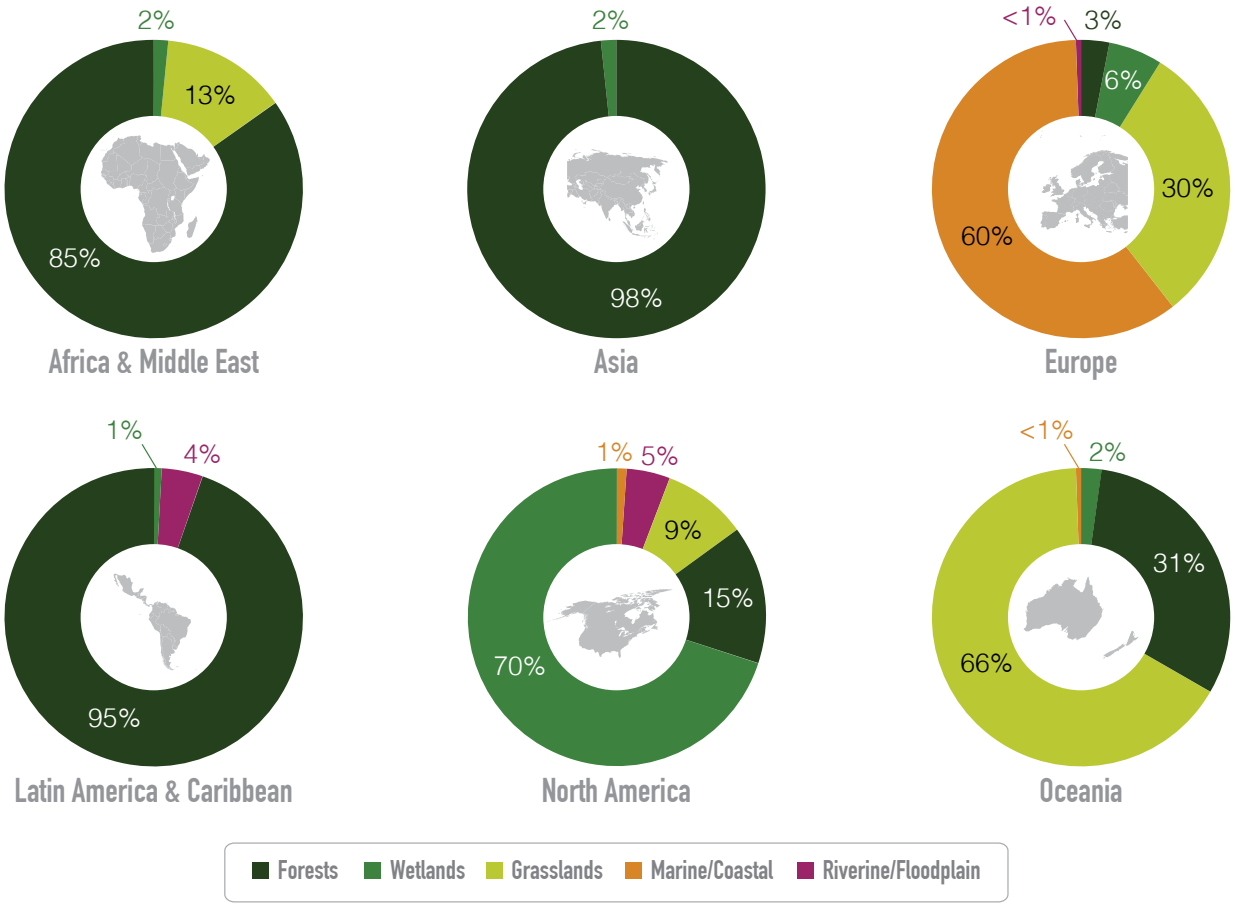
Photo Credit: Aaltair/Shutterstock

[13] The need for economic development is also an explicitly recognized factor in opting for averted loss over restoration in existing provincial policy frameworks for offsetting (Jenner and Balmforth 2015).

Projects focus on forest and grassland habitats

Figure 15. Compliance Offsets and Compensation: Share of Cumulative Land Area by Habitat Type within Regions, 2016

Forest and wetlands projects dominated the data as far as management intervention of choice for biodiversity offsets and compensation, comprising 80% and 13% of global land area respectively (Figure 15).[14] Forest preservation, restoration/enhancement, and creation/re-establishment was the most common activity by cumulative land area in Latin America, Asia, and Africa & the Middle East as of 2016. North America was more evenly split. Its largest program, the Aquatic Resources Compensatory Mitigation program, focuses on wetlands and streams.



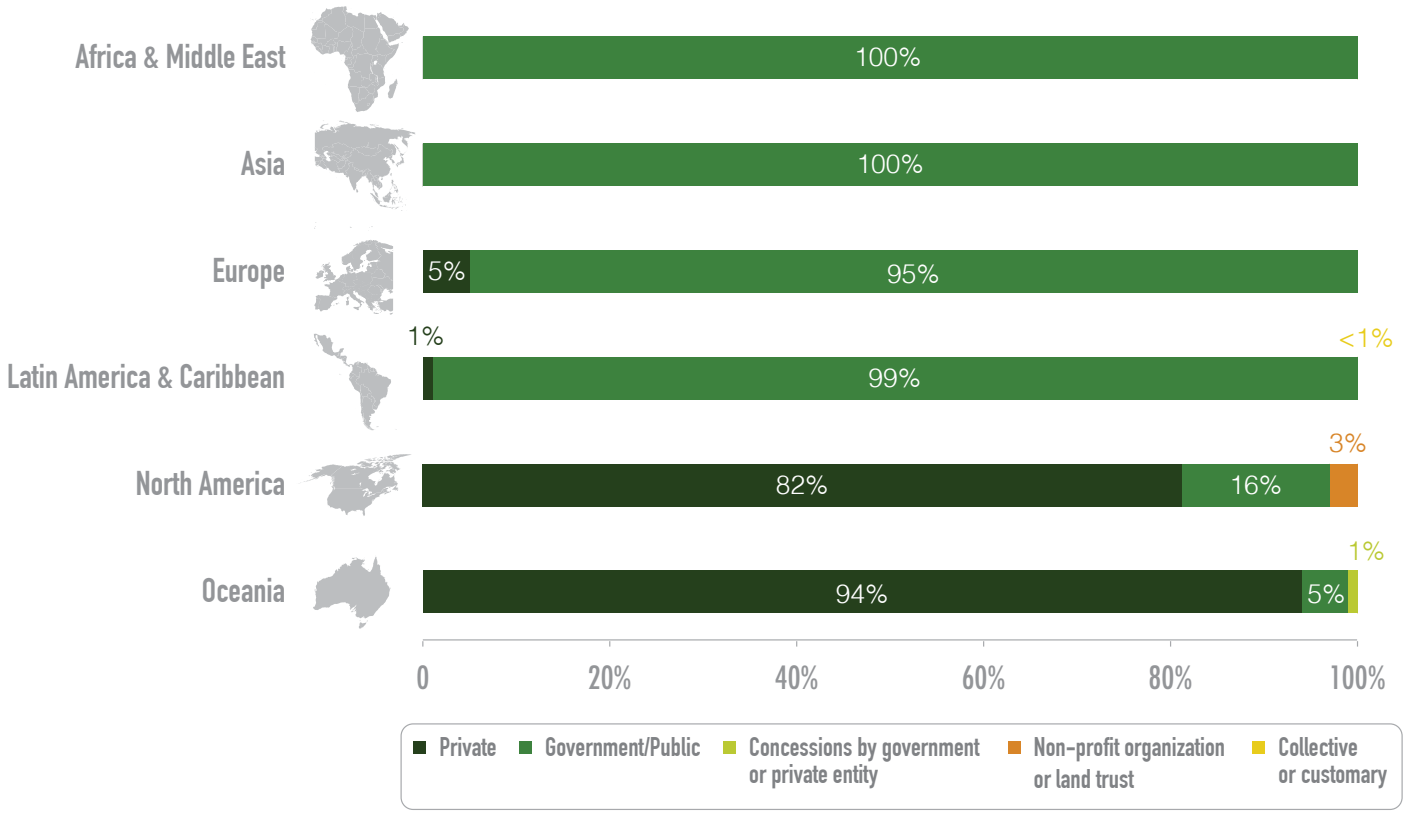
Notes: Excludes Oyu Tolgoi, a grasslands-dominated project in Mongolia. Based on 1.76M ha for which habitat type was reported.

[14] One very large grasslands restoration project, Oyu Tolgoi in Mongolia, has been excluded from analysis in this chapter since it skewed the data significantly. Please see the Methodology section for more information.

Private lands largest supply of offsets and compensation in US and Australia, while other countries favor public lands conservation

Figure 16. Compliance Offsets and Compensation: Share of Cumulative Land Area by Land Ownership within Region, 2016

In the United States, Canada, and Australia, and to a lesser extent in Europe (i.e., in the countries where banking is more active) offsets and compensation projects more often are developed on private lands by private entrepreneurs. Elsewhere, most permittee-responsible offsets and compensation funds support public lands management (Figure 16).



Notes: Totals may not add up to 100% due to rounding.

More than 90% of the total land area conserved as of 2016 is designated as domestic protected areas or priority areas for conservation. Another 7.5% is domestic critically endangered, endangered, vulnerable, or threatened species habitat. In Europe, offsets and compensation activities focused on Natura 2000 sites, which are a network of nature protection areas in the European Union designated under the Habitats and Birds Directives. Even mitigation banking, which in the United States and Australia overwhelming takes place on private lands, is more a public matter in Europe: In Germany, home of the largest share of mitigation banking activity, an estimated 80% of banks (known in Germany as “compensation pools”) are managed by local governments.

Voluntary Offsets

In addition to activity in compliance markets described above, Ecosystem Marketplace also tracked voluntary offsets projects active in 2016. In total, we identified only 23 implemented or developing projects in 13 countries, with conservation activities underway or planned on 273,000 ha (Table 10).

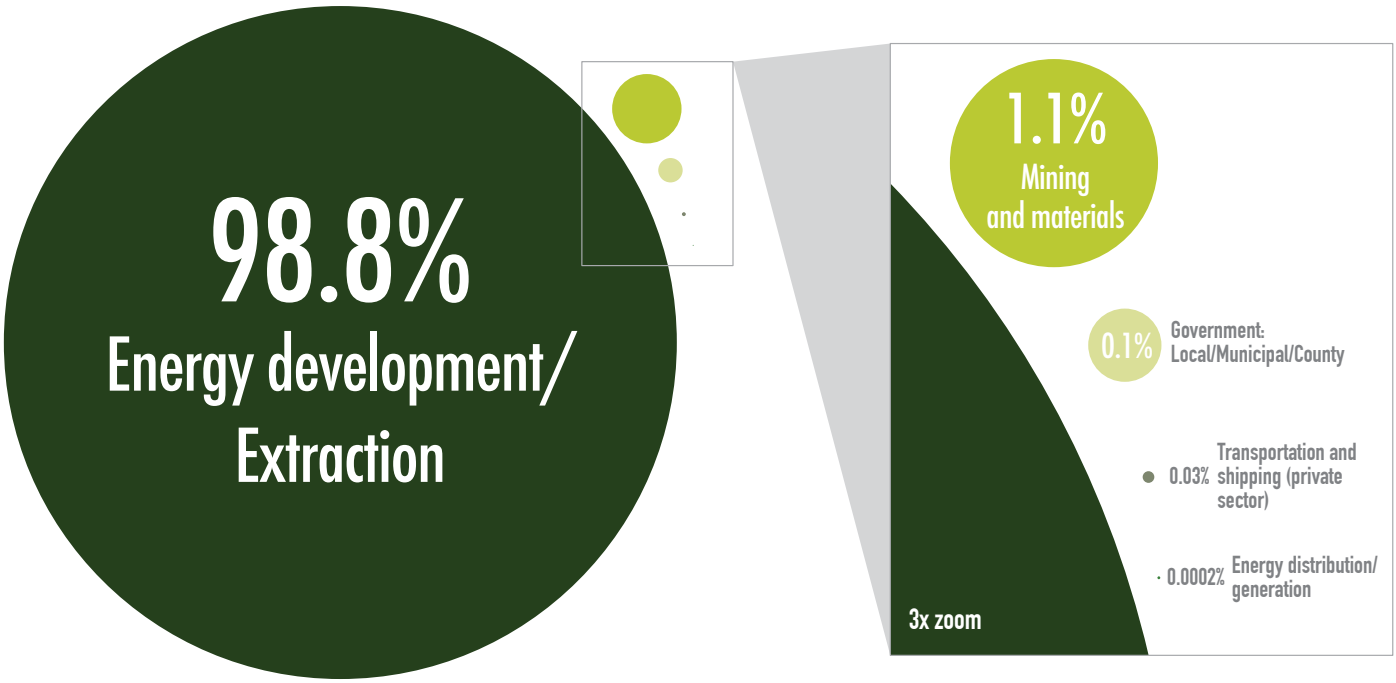
Table 10. Voluntary Offsets Projects: Number Implemented and In Development and Total Land Area in 2016 by Region

	Implemented	In development	Land Area
Africa & Middle East	2		n/a
Asia	1		n/a
Europe	9	3	2,591 ha
Latin America & Caribbean	2	1	22 ha
North America	2	3	236,069 ha
TOTAL	16	7	272,999 ha

Notes: In order to protect the confidentiality of our respondents, Ecosystem Marketplace only reports a data point if three or more organizations provide data. As only two organizations provided data on projects in Africa & the Middle East and one in Asia, we are unable to provide that information here. However, global total hectares in this table do include those data points.

Demand for voluntary offsets has historically come from the energy and mining/minerals sectors, with virtually all offset land area reported as of 2016 funded by the energy development/extraction industry (Figure 17).

Figure 17. Voluntary Offsets and Compensation: Share of Cumulative Land Area by Buyer Sector, 2016



Notes: Based on 244,094 ha for which buyer sector was reported.

Many "voluntary" projects are actually in reality pre-compliance projects, wherein buyers fund offsets in an effort to manage regulatory uncertainty about future biodiversity mitigation requirements, or establish advance offsets in anticipation of future mitigation needs under existing compliance programs. In the United States for instance,

several programs have emerged to develop habitat credits for species that are candidates for listing under the Endangered Species Act. By purchasing these credits, buyers may be able to secure assurances that their actions will count toward future regulatory obligations, or even achieve sufficient conservation progress to ensure that candidate species are not ultimately listed as threatened or endangered.[15] In the United Kingdom, the government supported a biodiversity offsets pilot project from 2012–2014 on a voluntary basis with an eye to testing out its efficacy as an option for developers seeking mitigation to satisfy national planning framework requirements. These pre-compliance projects will either ultimately migrate into the compliance category, or close shop, depending on their results and regulators' actions.

Truly *voluntary* biodiversity offsets are relatively rare, in large part because offsetting according to best practice is such a time- and resource-intensive process (Box 11). Developers are unlikely to undertake offsetting without some sort of regulatory driver.

Box 11. A Voluntary Offset Case Study: Ambatovy Mine in Madagascar

Ambatovy is a large-scale nickel and cobalt mining enterprise located in Madagascar, an island country known for its high numbers of endemic species. The operations consist of an approximately 1,300 ha mine site, a 218 km slurry pipeline, and a 320 ha industrial complex. Ambatovy's mission is to be a leader in the sustainable production of high-quality nickel and cobalt. The company's biodiversity management strategy is based on application of the mitigation hierarchy and aims to deliver no net loss, preferably a net gain, of biodiversity. The business benefit is essentially linked to risk management and aims to sustain "a good citizen project" status in a host country recognized to constitute a **biodiversity hotspot** but suffering from chronic poverty.

After taking steps to avoid, minimize, and restore damage, Ambatovy developed a landscape-scale, multi-faceted offset program to compensate for residual biodiversity losses. These residual losses are expected to amount to just under 1,467 ha, including azonal, transitional, and zonal forests. Offset sites were identified based on criteria like the comparable (like-for-like) nature of their biodiversity (priority species and affected forest types) and the potential for achieving significant additional biodiversity "gains" through long-term protection measures. Based on a review process involving desk research and intensive field surveys, five sites were selected: two patches of azonal forest (306 ha), and a larger patch (3,338 ha) of mostly zonal forest within the mining concession; 5,715 ha of azonal and zonal forest to the north of the mine site; 3,876 ha surrounding wetlands south-east of the mine; and 7,269 ha of mostly zonal forest and connecting the mine's conservation areas with nearby Mantadia National Park. Four scenarios were established to project the potential for averted losses. Depending on the projected baseline deforestation rate and success of these interventions, the project's net gain is expected to be between 340 and 4,294 ha by 2040.

Source: Business and Biodiversity Offsets Programme 2014.

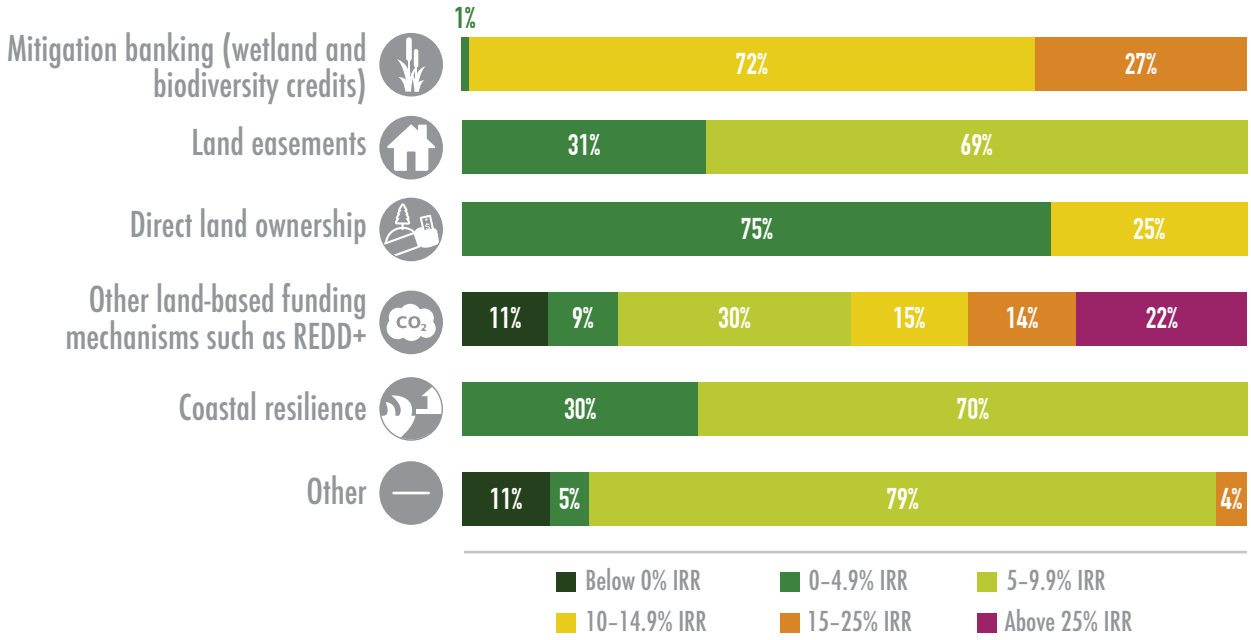
[15] Regulatory assurances are buyers' primary motive, but they are not guaranteed. In at least one case–a gopher tortoise habitat crediting program in the Southeastern United States–efforts to build a viable pre-compliance market foundered largely due to a lack of support from regulators (Pindilli and Casey 2015).

Private Investment in Mitigation Banking

Eighty-three percent of mitigation banks met or outperformed investor expectations in 2009–2015

According to data collected for Ecosystem Marketplace's *State of Private Investment in Conservation* report, virtually all capital committed by private investors in mitigation banking had expected IRR between 10 and 25% (Hamrick 2016) (Figure 18). Mitigation banking investments had significantly higher projected yields than other habitat conservation investments tracked by Ecosystem Marketplace, which is likely a reflection of the high risks associated with banking.

Figure 18. Projected Internal Rate of Return for Mitigation Banking and Other Habitat Conservation Commitments



Notes: Based on responses by 35 organizations reporting on $503,719,750 in investments in habitat conservation.
Source: Hamrick 2016.

In terms of actual performance, investors reported that two-thirds of capital committed to mitigation banks in 2009–2015 delivered on projected IRR, while 20% exceeded expectations. Mitigation banking outperformed the broader category of habitat conservation investments tracked by Ecosystem Marketplace (Table 11).

Table 11. Performance of Mitigation Banking Investments and Overall Habitat Conservation Investments Relative to Expectations: Share of Total Capital Committed, 2009–2015

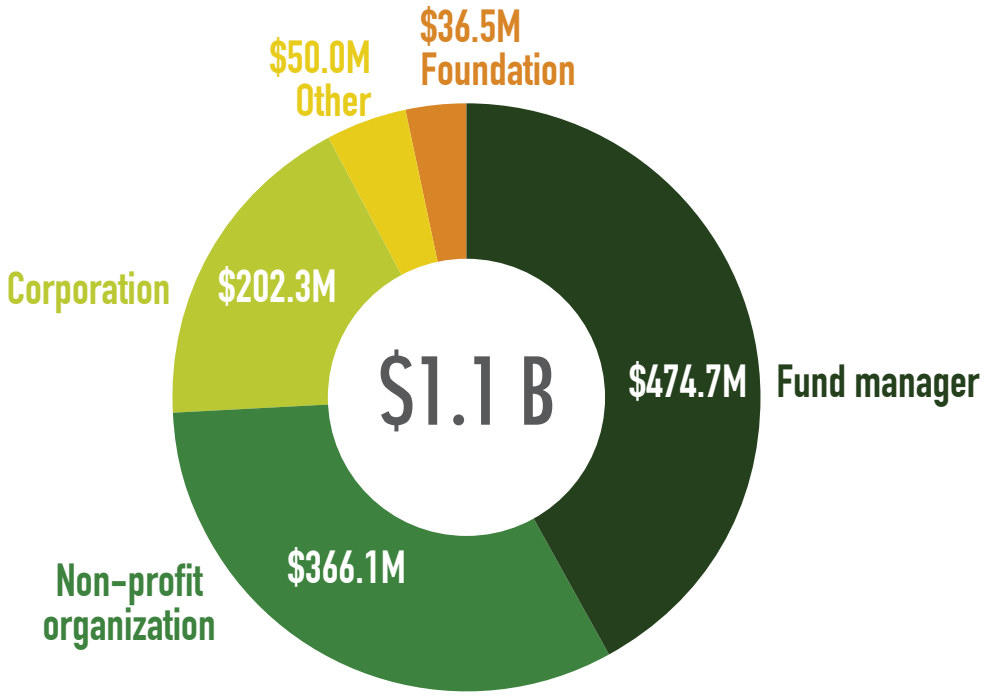
	Below expectations (underperformed)	Met expectations (performed as expected)	Exceeded expectations (outperformed)	Too early to tell
Mitigation Banking Investments	13%	67%	20%	-
Habitat Conservation Investments Overall	17%	64%	5%	14%

Notes: This table was developed based on the source dataset [unpublished] for Hamrick 2016. These results are as reported by investors in the Ecosystem Marketplace survey. EM did not collect or verify actual returns.

$1B in capital ready to deploy in 2016–2018 for habitat conservation, with banking potentially poised for a large slice of the pie

Private investors reported $1.1B in already-raised but uninvested capital ready to be deployed for habitat conservation in the 2016–2018 period (Figure 19). A sizeable share of this could conceivably flow to mitigation banking, given the sector's IRR and historical share of capital investments (banks received 28% of total private investments in habitat conservation for the 2009–2015 period—or $314M out of a total of $1.1B). However, barriers to increased private investment in mitigation banking persist (detailed in Box 12).

Figure 19. Already-Raised Capital that Respondents Intend to Deploy in 2016–2018 for Habitat Conservation by Investor Type



Source: Based on Hamrick 2016.

Box 12. Scaling Up Private Finance for Mitigation Banking

The level of private investment in mitigation banking has steadily grown over the 2004–2015 period, thanks to competitive returns relative to other conservation investments (see Figure 20), robust IRR, and a clear demand driver. But capital values remain very low relative to overall financial markets activity or even the social impact investment space.

For the broader field of conservation investments, investors say issues like lack of a management track record, inadequate information on returns and investment products, and a dearth of big-enough deals all contribute to low levels of conservation investment to date (Hamrick 2016).

In the United States, the mitigation banking sector performs well on some of these counts: the sector has a far stronger business management track record than other conservation investment vehicles; a robust regulatory driver (Section 404 of the Clean Water Act) and regulators that have explicitly established a preference for banking over other forms of compensatory mitigation for wetlands and streams; and well-developed impact metrics.

But there are also some specific barriers for mitigation banks in attracting new private investment. The higher yields expected by investors for mitigation banking investments reflect the fact that banking is a relatively high-risk venture. The main source of risk to return on capital in banking is credit sales: will a bank be able to sell its credits at the expected price, and within the expected timeframe?

A number of factors can negatively impact credit sales, and thus a bank's overall return on capital. These include:

Delays in permitting and the credit release schedule

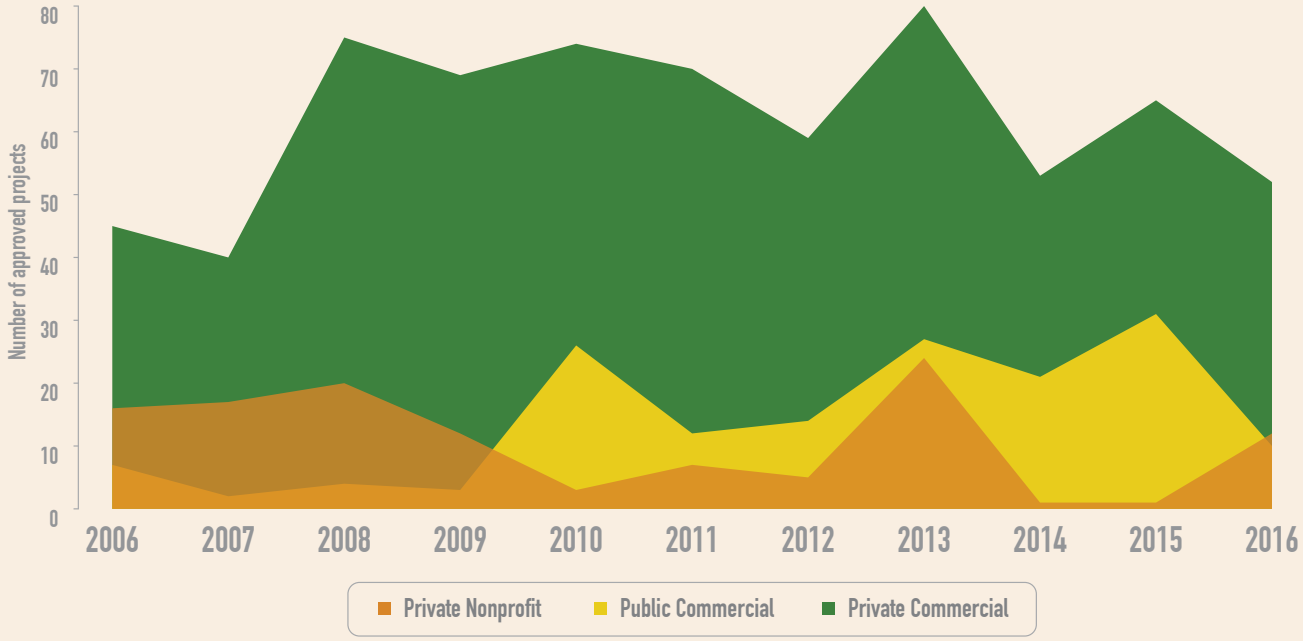
If regulatory approval of a mitigation bank takes longer than is predicted under standard regulatory permitting timeframes, a bank developer's legal and planning costs grow while revenues from credit sales are delayed. (For example, many USACE Districts have recently attempted to set out a predictable timeline for permitting, though project developers say these are not always adhered to.) Mitigation bank credits are usually "released" for sale by regulators slowly over a five- to ten-year period in order to manage for implementation risk. But a slower-than-expected release of credits can limit mitigation banks' ability to respond to market demand and dramatically affect a bank developer's bottom line. Mitigation bankers also report to Ecosystem Marketplace that credit release schedules create an uneven playing field, since permittee-responsible offsets are effectively granted all of their offset credits immediately, but costs are spread out over the duration of the offset project. For banks, it is precisely the opposite: most of their costs are upfront, but it may be a decade before they can sell all of their credits.

Competition from public sector-sponsored mitigation projects

Since mitigation credits offered by public agencies typically are generated on government-owned land and do not have a profit motive (public actors can only charge for mitigation credits an amount equal to the costs of mitigation plus an administrative fee), these projects often can offer compensatory mitigation at a lower price than private mitigation banks. Costs are also often lower for these projects since government-sponsored ILFs are not required to post financial assurance or to fund an escrow for long-term maintenance (Final Rule 2008). Perhaps as a consequence, even though mitigation banking officially is the preferred mitigation option by regulators (Final Rule 2008), the number of new approved government-sponsored mitigation projects in the United States has actually grown at a faster average annual rate since 2006 than private mitigation banks (21% average annual growth in new projects for public sector-sponsored commercial projects compared to 16% for private sector-sponsored projects), though private sector-backed projects still outnumber public compensatory mitigation providers in absolute terms (Figure 20).

Box 12. Scaling Up Private Finance for Mitigation Banking (continued)

Figure 20. Compliance Offsets and Compensation: Number of New Approved Mitigation Banks and In-Lieu Fee Sites in the United States by Profit Status, 2006–2016



Notes: Two other common profit status structures (single-client, which may be either public or private but this could not be determined from USACE data, and public/private mitigation projects) are not shown in this figure.

Uneven implementation of regulatory preference for mitigation banking

Although the Final Rule established a "preference" for mitigation banking over financial compensation and permittee-responsible offsetting, this is not legally binding, and project developers say it is not always practiced. Uneven implementation of the Final Rule has been called "by far the biggest risk" for private sector mitigation banks (Hook and Shadle 2013).

Mitigation bankers report that sometimes regulators will ask permittees seeking to use permittee-responsible offsets to simply demonstrate that their proposed mitigation plan is comparable to existing bank mitigation credits in the area–thus treating banks more like a benchmark than a preference, and not generating any actual increased demand for bank credits. Bank developers also told Ecosystem Marketplace that regulators may try to minimize administrative and enforcement costs by encouraging permittees with small impacts to buy bank credits, since these have relatively higher costs. As a result, bankers say, regulatory staff sometimes "save" bank credits for small projects and allow large projects to use permittee-responsible mitigation, with the effect of delaying returns on investment for mitigation banks.

Section III. Outlook

Demand Drivers to Watch: Policy and Enabling Conditions for Offsets and Compensation

Turning from the historical performance documented in this report to future outlook and opportunities, Ecosystem Marketplace has identified some key demand drivers to watch in the biodiversity offsets and compensation world.

All around the world, new policies and regulations using the mitigation hierarchy in pursuit of NNL/net gain continue to emerge, though in some cases there seems to be a troubling lack of follow-through in terms of enforcement. This undercuts the potential of offsets and compensation mechanisms to contribute to NNL/net gain and increases public distrust of these tools. As discussed earlier in this report, there is a pressing need to better monitor and enforce mitigation requirements, and better understand barriers to growth, in order to effectively implement mitigation policy (Box 13). But there are bright spots, too—particularly in work being done to improve transparency around compensatory mitigation and to mainstream biodiversity into developing-country infrastructure and economic development planning.

Africa and the Middle East

- In March 2017, **South Africa's** Department of Environmental Affairs released for public comment a draft national Biodiversity Offsets Policy (South Africa Department of Environmental Affairs 2017). The policy tries to improve predictability and consistency in the use of offsets in environmental authorizations. Since Western Cape, KwaZulu-Natal, Gauteng, and Northern Cape provinces have all delayed finalizing their own guidance and policies in the absence of a national policy, release of draft text for comments—which has been put off repeatedly since a national policy was first drafted in 2012—promises to be a step in the right direction.
- Meanwhile, the **South African** National Biodiversity Institute (SANBI) is developing an online registry of offset projects in the country in order to improve transparency around offsets authorization and implementation. At present, information about offsets required under environmental authorizations is extremely difficult to access in South Africa (Susie Brownlie, pers. comm. May 24 2017). SANBI's offsets registry, along with recent advances in public transparency making environmental authorizations and associated environmental management programs more readily publicly available, should provide better access to information about when and how offsets are used, and how well they are being implemented (Costas 2017).
- In 2015, the World Bank Group published a roadmap for a sector-wide offsets program for **Liberia's** mining sector (Johnson 2015). The proposed framework would replace the current ad hoc system with a standard methodology for determining offsets design. It would also establish a process for transferring responsibility for offsets planning, design, and long-term management to government agencies who could better pursue biodiversity conservation goals in a coordinated manner. But to date, the Ebola crisis has delayed progress on implementing these recommendations.
- The World Bank group published a similar roadmap in 2016 for **Mozambique** (Bechtel and Nazerali 2016). Here, a proposed national offsets program could build on existing efforts by the Ministry of Environment to set a standard of NNL for the mining and oil and gas sectors. Ministry decrees already require that major projects result in NNL of biodiversity, and the Ministry has begun integrating offsets into existing EIA regulations. The roadmap recommends using offset funds to put the extremely underfunded national protected area network back on its feet and expand the network to add new high-biodiversity value areas. An existing not-for-profit conservation trust fund, Foundation for the Conservation of Biodiversity (BIOFUND), was proposed as a possible financial mechanism for implementation.

Asia

- **India's** Compensatory Afforestation Program collects nearly a billion dollars every year in compensation funds but has made little progress on using that money for forest projects. As a result, a new CAF act in 2016 attempted to put the wheels in motion for mobilizing compensation funds faster through the

establishment of national- and state-level funds that will be responsible for implementation of afforestation projects (Ministry of Law and Justice 2016). An expert committee also recently recommended increasing compensation fees, which range from $6,800–$16,100/ha (INR 4.38–10.43 lakh), to $8,700–$85,800 (INR 5.65–55.55 lakh) depending on forest quality (Divya Narain, pers comm. May 3 2017).

Europe

- In 2011, the EU Biodiversity Strategy called on the **European Commission** to develop a NNL initiative for Europe's ecosystems and ecosystem services (European Commission n.d.), a request that was repeated that year by the Environment Council of Ministers (Council of the European Union 2011) and in 2012 by the European Parliament (European Parliament 2012). In 2014, the Commission opened a public consultation to gather views on scope, instruments, and application of a NNL policy (European Commission n.d.). A majority of respondents were in favor of offsetting, but many expressed concerns about whether offsets in practice could be correctly implemented to achieve no net loss. Nevertheless, an impact assessment study of No Net Loss policy options published in 2016 suggested that in order to achieve NNL in Europe in the long term some form of mandatory offsetting measures would be necessary (IEEP 2016).
- At the same time, existing NNL policies and regulation, including frameworks for offsets and compensation, are too often characterized by a lack of transparency in Europe. One recent study reviewed data available in the public domain on offsets implementation in **France**, **Germany**, **the Netherlands**, and **Sweden** (Bull et al. forthcoming). Its authors found that lack of transparency precluded a thorough assessment of how offset projects or broader NNL policies were being implemented. This report's authors encountered similar difficulties in collecting data for this report: whether due to a lack of capacity or political will, regulators and other public agencies in Europe responsible for overseeing offsetting and compensation have made very little information available to the general public about how these mechanisms actually are working on the ground.
- In 2014, the **European Commission** kicked off a three-year pilot of its Natural Capital Financing Facility (NCFF) funded by the European Investment Bank. In its first phase, NCFF has a budget of up to $141M (€125M) for loans and investments that will support projects taking ecosystem-based approaches to natural resources and climate adaptation challenges. It aims to focus on "bankable" initiatives that can either generate revenue or deliver cost savings, an approach that may prick up the ears of private capital seeking investment-grade conservation projects. In 2017, the NCFF inked its first loan agreement with Rewilding Europe Capital, an enterprise financing facility based in the Netherlands. Rewilding Europe Capital says it will use NCFF funds to invest in initiatives that make a "business case" for conservation and ecological restoration at 20–30 Natura 2000 sites across Europe (European Commission 2017).
- Habitat banking was responsible for the largest share of new projects (22) and land area (46,826 ha) in the pipeline in 2015, compared to other mitigation types. Yet pilot efforts in **France**, **Spain**, **the Netherlands**, and **the United Kingdom** have met with mixed success, with bank developers citing a lack of regulatory drivers and clear guidance behind weak demand. In France and Spain, forthcoming regulations and guidance seek to streamline permitting processes and ensure that offsetting requirements are equivalent for banks and permittee-responsible offsets. Meanwhile in **Germany**, where banking is well-established but an estimated 80% of banks are publicly managed, there are new signals that private sector actors are interested in developing more banks (Bavarian State Office for the Environment 2015).
- New legislation in **France** will seek to address persistent inequalities in regulatory standards for different mitigation types. At present, habitat banks in France face stricter requirements in terms of demonstrating additionality and providing for long-term management of offset sites; bank developers say that these requirements have increased costs and hurt business. A forthcoming decree on the bank accreditation process is expected to address these issues.
- As the Brexit proceeds in the coming years, some environmental protections may be discarded along with EU membership. **United Kingdom** government sources in 2017 suggested off-the-record that the EU Habitats Directive would be repealed in Britain as part of a broader effort under Prime Minister Theresa

May's government to trim regulation (Financial Times 2017). In that event, a major driver of offsets in the United Kingdom would cease to exist.

Latin America and the Caribbean

- **Brazil's** new Forest Code and implementation of a rural environmental registry (CAR), which allows landowners to use offsets to meet environmental reserve quotas, by some estimates could create the largest environmental offset market in the world. A recent study estimated that gross market value could exceed $9B and the market could transact certificates representing more than 4M ha of forests, with the largest volume of trades taking place in Mato Grosso and São Paulo States (Soares-Filho et al. 2016). But implementation has been slow, thanks to Brazilian politics. Since regulations or guidance have not yet been promulgated to implement the trading mechanism, the market for environmental reserve quotas remains essentially voluntary and very small (iBVRio 2016). As of summer 2017, the Environmental Ministry was at work on a draft policy for regulating quota creation and trading, but launch of an operational system was not expected until at least 2018 and probably later.
- In **Peru**, where the Ministry of Environment announced a resolution on NNL and biodiversity compensation in 2014 at the 20th Conference of the Parties (COP20) under the United Nations Framework Convention on Climate Change (UNFCCC), progress has also slowed en route to a workable national offsets system. Pilots to test offset metrics in coordination with a number of environmental NGOs (including Forest Trends, The Nature Conservancy, the Peruvian Society for Environmental Law, the Wildlife Conservation Society [WCS], and the Conservation Strategy Fund) appear to have stalled.
- Meanwhile in **Colombia**, the outlook is brighter. Following a report summarizing emerging environmental markets in the country including biodiversity offsets and compensation (Fondo Acción, Fundepúblico, and WCS 2016) and steady advocacy from NGOs including Fundepúblico, WCS, and FondoAcción, the Colombian government in June 2017 updated its Manual on Compensation, expanding the scope of permitting that would trigger offset requirements and establishing regulations for habitat banking (Ministro de Ambiente y Desarrollo Sostenible 2017). Fundepúblico and WCS are also collaborating on Colombia's first pilot mitigation bank.

North America

- As this report went to press in fall 2017, the mitigation industry and conservationists in the **United States** were still waiting to understand the full "Trump effect" on offsets and compensation. However, the outlook is not good. A March 2017 executive order repealed an earlier Obama Presidential Memorandum that ordered federal agencies to adopt a clear and consistent approach to mitigation in pursuit of NNL and encourage private investment in natural resources restoration (President Barack Obama 2016). That order was followed by Secretary of Interior Ryan Zinke announcing a "reexamination" of mitigation policies and practices across his Department (Varner and Fanning 2017). More recently, Zinke has pronounced compensatory mitigation "un-American" (Zimmerman 2017). One particularly large chicken that could be on the chopping block is the US Fish and Wildlife Service's 2016 Compensatory Mitigation Policy for species and habitat banking and compensation.
- Of course, the largest potential impact of regulatory rollback would come from a trimmed-down definition of "waters of the United States" under the Clean Water Act. This is a possible outcome of a rulemaking process underway as this report was being written, following a February 2017 Executive Order from President Trump moving to rescind and replace an earlier rule on the same topic. That rule, issued under the Obama administration, had clarified, and arguably expanded, waterbodies over which the federal government had jurisdiction. Limiting the definition of "waters of the United States" would have the effect of reducing demand for wetland and stream credits under Section 404 of the Clean Water Act. A proposed new regulation was released for public comment in July 2017 (Department of the Army, Corps of Engineers, Department of Defense, and Environmental Protection Agency 2017). Any new rule is expected to meet legal challenges by conservation groups.
- Still, some project developers reported to Ecosystem Marketplace causes for optimism: although ground gained during the Obama administration may be lost, rollback of proven programs like the Aquatic

Resources Compensatory Mitigation program is highly unlikely. Moreover, President Trump's support of a major new national infrastructure investment initiative could create a lot of demand for compensatory mitigation. One oft-cited caveat noted by project developers is the need for regulatory predictability, including a reduction in the number of crediting methodologies used by regulators, which bankers in particular felt muddled the market.

- The **United States** also continues to experiment with applying the banking model to new conservation challenges. In multiple regions, new "Habitat Exchanges" have sprung up to protect species that are candidates for listing under the Endangered Species Act, such as the Monarch Butterfly. Habitat Exchanges differ from traditional conservation banking in that they have developed a universally applied Habitat Quantification Tool to determine credits for all new projects, rather than regulators' determining credits on a case-by-case basis. Supporters of the model say this will streamline the crediting process, increasing the mechanism's appeal to landowners. Another new model in the United States is agricultural wetland mitigation banking, where the regulatory driver is the need for landowners to maintain wetland conservation compliance requirements associated with receipt of Farm Bill subsidies. In 2016, the U.S. Department of Agriculture Natural Resources Conservation Service provided more than $7M in funding to support the development of new agricultural wetland mitigation banks in ten states in the Midwest and Northern Great Plains.

Oceania

- Beginning in 2015, the **Australian** national government pursued a "one-stop shop" approach to environmental assessments, including those that require offsets and compensation, which devolves approval authority for federal environmental protections to the state level. This tactic is expected to reduce time and costs required for approvals and eliminate multiple levels of authorizations (Australian Government Department of the Environment and Energy 2017). But concerns were also raised that the approach eliminates national oversight of environmental regulation enforcement and opens up potential for state governments to place political or economic motives ahead of biodiversity conservation (Hawdon et al. 2015). As this report went to press, the policy is still on the books but its implementation seems to be a low priority for the national government. However, the national government is at present drafting bilateral policies with states that would effectively accredit state-level offsets policies in order to minimize duplicative approval processes.
- Recent policy reforms at the state level *do* suggest varying levels of stringency across Australia when it comes to environmental assessment and use of offsets. In New South Wales, conservationists say offsets are being misused to approve inappropriate projects, particularly within the mining sector, and that environmental concerns are being dismissed in stakeholder consultations.[16] A 2017 review of a highway offset project in New South Wales found that the project had failed to achieve ecological goals four years in–and in fact, since regulations do not require ecological effectiveness but merely offset implementation, this was not considered a failed project (The Conversation 2017). In 2016, the New South Wales legislature passed the *Biodiversity Conservation Act* and *Local Land Services Amendment Act*, repealing the existing *Native Vegetation* and *Threatened Species* Acts. The *Biodiversity Conservation Act* consolidated imperiled species and habitat management, offsetting, and biodiversity impact assessment under a single policy, while the *Local Land Services Amendment Act* set out new criteria for determining when rural land-clearing requires regulatory approval. The *Biodiversity Conservation Act* also established a new system for evaluating impacts and setting offset requirements, and created a Biodiversity Conservation Fund for payments in lieu of purchasing offset credits (replacing the old Nature Conservation Trust fund). Critics of the acts, which both came into force in 2017, have expressed a number of concerns: that financial compensation is ineffective at securing NNL, that the *Biodiversity Conservation Act* relaxes "like-for-like" equivalency requirements and places too much emphasis on offsets rather than avoiding impacts, and that the *Local Land Services Amendment Act* loosens environmental standards on multiple fronts (Walmsley 2016).

[16] See for example ABC News, 2016; Slezak 2016a; Slezak 2016b.

- Meanwhile in Victoria, recent proposed reforms aim to *strengthen* the application of the mitigation hierarchy following 2013 legislation that eliminated the "avoid" requirement (Button and Elliott 2016). The proposed reforms also cover an expanded scope of biodiversity values to be considered in impact analysis (scattered trees and ecological plant communities), and enhanced monitoring and reporting of offset sites.

Global Demand Drivers

- In 2012, the World Bank Group's International Finance Corporation (IFC) launched its Performance Standard 6 (PS6). PS6 requires IFC borrowers to take steps to conserve biodiversity and achieve NNL of biodiversity—and net gain in Critical Habitat—through application of the mitigation hierarchy. As of 2017, PS6 has been a small but significant driver of offsets demand: Ecosystem Marketplace has tracked nine active projects carrying out offset activities to meet lending requirements on nearly 6.4M ha in **Cameroon**, **Colombia**, **Lao People's Democratic Republic**, **Madagascar**, **Mexico**, **Mongolia**, **Panama**, **Senegal**, and **Uganda**. Another 12 projects are in development. Even more importantly, the majority of PS6 disclosures where biodiversity impacts are reported do not include offsets at all, suggesting that IFC clients are instead fully addressing impacts through avoidance, minimization, and restoration.
- Private sector NNL/Net Positive Impact (NPI) commitments are on the rise. A 2014 study found that at least 32 major companies had made these commitments. Since voluntary commitments can co-occur with national/subnational regulation or lender requirements related to mitigation (such as IFC PS6), it is difficult to determine to what extent company NNL/NPI commitments have driven additional funds towards offsetting. However, as increasing numbers of companies work to reduce the negative impacts of their supply chains on ecosystems and biodiversity, private commitments have the potential to mobilize money and attention from board rooms, corporate offices, and investors toward the issue of biodiversity mitigation.

Box 13. A Roadmap for Governments Planning for a Net Gain of Biodiversity

Governments often start with a relatively simple system that contains the essential elements of a NNL/net gain system, and then follow a "roadmap" to develop the system over a period of years. A roadmap is a plan with key, five- to ten-year milestones to enable a sequential and orderly implementation of an effective NNL/net gain program.

Content of roadmap

The main elements of a system for Net Gain/NNL are law and policy; governance and planning; supporting measures (guidelines, information, standards, agreements, plans and finance); and capacity building and partnerships, including pilot projects. Internationally, policies on this topic typically comprise a number of elements:

- **The policy commitment**, including the nature of the commitment (e.g., an aspirational goal) and more detail on how, programmatically, government will put this into practice, often with reference to a set of principles;
- **Legal basis:** Law and regulations giving effect to the policy (when needed);
- **Guidelines** on how to apply the policy, including process and content; and
- **Institutional framework:** Governance arrangements, mechanisms, and institutions established to put the policy into effect.

Steps in the roadmap

The following steps in a roadmap can help governments plan and move towards Net Gain:

- **Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and options and gap analysis:** Explore the risks and opportunities of planning for NNL/net gain, identify options for the scope and governance of the system, undertake a comparative review of the advantages, disadvantages, and needs (including data and capacity requirements) for each option. Define any policy, regulatory, and capacity gaps that would need to be filled for each option to work in practice (including coordination with other policies). Involve stakeholders throughout. Select the preferred option.
- **Building blocks:** Working with scientists, NGOs, communities, and companies, collate the required data, maps, and plans and design and introduce the policy framework (policy, guidelines, and any necessary regulatory changes). Build the information systems, train the people responsible for running the system in government and supporting it in civil society. Ensure coordination between government departments. Line up potential supply of offsets ready for the launch of the system. Start any pilot projects.
- **Launch the NNL/net gain system:** From this point, developers must comply with any requirements and governance mechanisms and guidelines. Government administers the system and monitors and evaluates individual projects and their cumulative progress in achieving the overall policy goals, building and adapting the system over time.
- **Evolution:** Most governments take a phased approach to introducing a national system, building capacity and data, introducing new approaches to implementation and governance (e.g., market-based instruments and provision of biodiversity offsets by third parties), broadening scope (e.g., from terrestrial to marine), and deploying adaptive management based on monitoring and evaluation against policy goals.

New Projects in the Pipeline

Project developers reported a total of 724 new projects that were pending regulatory approval to operate in compliance markets as of the end of 2016 (Figure 21). Most were in North America, where 351 ILF project sites and 321 new banks were in the pipeline. Another 22 banks were awaiting regulatory approval in Europe. In Africa and the Middle East, Asia, and Latin America, most new projects are in design as permittee-responsible offset projects, although efforts are underway to pilot a bank in Colombia, and Brazil's forthcoming environmental reserve quota trading system could conceivably include advance mitigation elements.

Figure 21. Compliance Offsets and Compensation: Project Area of Projects in Development by Region, 2016

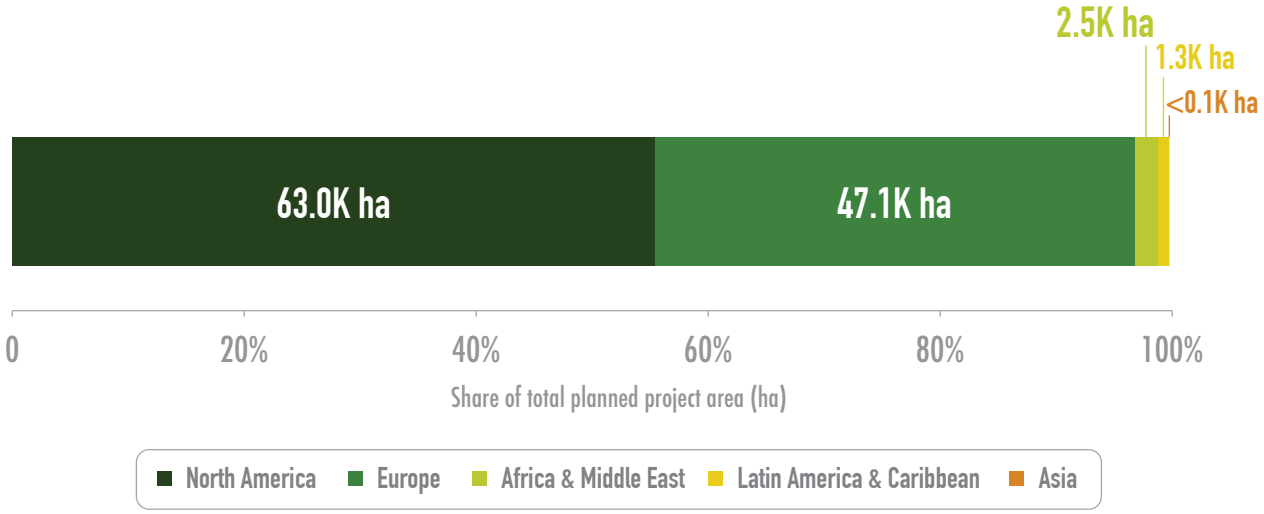


Photo Credit: Gopause/Shutterstock

Conclusion

As this report's introduction noted, we are living in the midst of both a global infrastructure boom and a biodiversity mass extinction event. In approximately the next decade and a half, we can expect to spend $90 trillion on new and updated power grids, roads, telecommunications, water systems, and other infrastructure. That amount is equal to the value of the world's entire existing stock of infrastructure in 2015.

This development is necessary to keep pace with growing populations, our current infrastructure's depreciation, and the moral imperative to provide a basic modern standard of living for all people on this planet. But infrastructure development also means inevitable impacts to the other living creatures who share the planet with us. As discussed elsewhere in this report, we cannot create new protected areas fast enough to keep up with biodiversity loss. Nor can protected areas help all of the species and habitats located outside of their boundaries.

Mainstreaming biodiversity conservation into infrastructure planning and development through the mitigation hierarchy is one way to ensure that new growth is matched by new conservation efforts. This report discusses how governments can promote the application of the mitigation hierarchy in infrastructure development planning within major infrastructure sectors, through regulatory frameworks and guidance, and the creation of enabling conditions for market-based instruments that include the private sector in conservation efforts. On the voluntary side, mitigation can be supported by establishing NNL requirements as a condition of project finance and encouraging corporate NNL commitments.

This report, which focuses on the final step of the mitigation hierarchy, offsets and compensation, demonstrates that significant conservation outcomes in pursuit of NNL or net gain are possible with compensatory mitigation—and that it's possible to get the private sector to pay for it, setting the stage for a "restoration economy" generating billions in direct revenues and (as other studies have shown) billions more in indirect economic benefits (BenDor et al. 2015).

At the same time, this report also illustrates that too often, the mitigation hierarchy is being implemented improperly or without adequate public oversight. Our findings that offsets programs often operate with little transparency (page 39), billions of dollars in compensation funds are sitting unspent (page 29), and that regulations designed to ensure NNL are not always being enforced (page 53) are extremely concerning, and provide fuel to criticisms that offsets enable inappropriate development projects or are a "license to trash." (Monbiot 2015). Offsets can only serve biodiversity conservation goals when they are used as a last resort, implemented correctly, and subject to public notice and evaluation.

Throughout this report, we have included discussions of accepted best practice for offset policy and project design (pages 7 and 9) and a "roadmap" for governments seeking to achieve net gain of biodiversity (page 61). We hope this report will serve as a useful benchmark to monitor future growth and activity, and that it suggests offsetting's promise as well as its practical challenges. Biodiversity loss is too serious a challenge not to employ all tools available to us that can help reverse ongoing declines—the challenge in the coming years will be to perfect these tools and their users.

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Appendix 1: Estimation of Market Value for Banking and In-Lieu Fee Programs in the United States

Market value for the Aquatic Resources Compensatory Mitigation and Conservation Banking programs in the United States was estimated using the following methodology:

1. Price data associated with specific credit sales occurring in 2015 and 2016 was collected through interviews with or materials provided by habitat bankers, credit retailers/brokers, and In-Lieu Fee program managers; data on In-Lieu Fee program price ranges provided by the US Army Corps of Engineers; and secondary sources such as news articles, public agency meeting minutes, and annual reports or public datasets of major buyers such as state-level departments of transportation.

2. For wetland and stream credits, prices were normalized to price per credit (prices may be reported as either per-credit or per-acre/per-linear foot). Average credits:acre and credits:linear foot ratios were calculated at a state level for common credit classifications based on initiation credits calculated between 2014–2016 for banks or ILF programs. Initiation credit data was obtained from the US Army Corps of Engineers, Regulatory In-Lieu and Banking Information Tracking System (RIBITS). Ratios more than one standard deviation from the mean were discarded to eliminate outliers.

3. Market value was estimated at a state level as a low-high range. Market value was calculated as follows for wetland and stream credits in turn:

$$\text{Estimated value of bank transactions for states} = \frac{(\text{Lowest price reported} \times \text{volume of transactions in 2016}) + (\text{highest price reported in 2016} \times \text{volume of transactions in 2016})}{2}$$

$$\text{Estimated value of ILF transactions for states} = \frac{(\text{Lowest price reported} \times \text{volume of transactions in 2016}) + (\text{highest price reported in 2016} \times \text{volume of transactions in 2016})}{2}$$

   For species credits, market value for specific credit types transacted in 2016 was calculated for each credit type in turn and then summed.

   Data on volume transacted was obtained from RIBITS. For wetland credits, tidal credits were excluded to avoid skewing analysis since they are typically much more expensive than other wetland credit types, but we did not have sufficient data to estimate their overall market value in 2016 as a distinct group. Where bank prices were unavailable for a particular state and credit type, the corresponding ILF price was used as a proxy. Since ILF prices are often lower than bank prices, resulting market value estimates may in some areas underestimate actual value. For a number of states, we were able to obtain actual financial reports for all ILFs in that state. Where this was the case, we used reported transaction data rather than the estimates described above.

4. Low-end and high-end ranges for banks and ILFs were summed at the state level for wetland, stream, and conservation credits.

5. Low-end and high-end ranges for states were summed at the national level, and average value calculated.

This approach yielded a low-end estimate of $1,605,264,244 and a high-end estimate of $6,352,221,018 transacted in 2016 in US Aquatic Resources Compensatory Mitigation and Conservation Banking markets (Table A1).

This is a fairly wide range; we suspect that actual value is likely at the higher end of the range for several reasons. Our approach of using ILF prices as a proxy for bank prices may result in underestimates of market value for states where ILF prices are lower on average than bank prices. Moreover, we did not have sufficient price data in five states to calculate the value of stream credit transactions in 2016. This missing data represents 18% of overall stream credit transaction volume in 2016 in the US. Finally, for five species/habitat/group credit types representing 2% of transaction volume in 2016, we did not have sufficient price data to calculate market value.

Table A1. Value Ranges (Low and High) and Average Value Calculated for US Wetland, Stream, and Species/Habitat Markets

	Low-end Estimate	High-end Estimate	Average of Low-High Range
Aquatic Resources Compensatory Mitigation: Wetland credits	$1,341,896,433	$5,230,303,026	$3,286,099,729
Aquatic Resources Compensatory Mitigation: Stream credits	$109,153,901	$440,308,399	$274,731,150
Conservation Banking: Species/habitat and group credits	$154,213,910	$681,609,593	$354,208,059
TOTAL	$1,605,264,244	$6,352,221,018	$3,915,038,938

Notes: Total average is value is the sum of average value for each credit category. The average of total low-end and high-end estimates is slightly higher: $3,978,742,631.

Appendix 2: List of Programs Tracked in this Report

Supranational				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
EU Environmental Impact Assessment	European Union	Dependent on country-level implementation	Dependent on country-level implementation	Dependent on country-level implementation
EU Environmental Liability Directive Compensation	European Union			
EU Habitats Directive Compensation	European Union			

National				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
Environmental Impact Assessment Law and Environmental Compensation Fund	Argentina	Yes	Yes	
Environmental Offsets Policy	Australia	Yes	Yes	Yes
Compensation and replacement measures	Austria			
Habitats Directive compensation	Austria	Yes		
Belgium: Principle of compensation	Belgium	Yes	Yes	
Consolidation of Conservation Area Offsets	Brazil			
Environmental Reserve Quota market	Brazil	Yes		
Industrial Impact Compensation	Brazil		Yes	
Fisheries Protection Policy and Environmental Damages Fund	Canada	Yes		Rare
Species at Risk Act Offsets	Canada	Yes		
EIA law and Guidelines for Biodiversity Compensation	Chile	Yes		
Native Forest Law	Chile	-	-	-
Forest Revegetation Fee	China		Yes	
National Offsets Policy for Terrestrial Ecosystems	Colombia	Yes		Yes
Environmental Impact Assessment Law	Costa Rica	-	-	-
Environmental Liability Directive compensation	Denmark	Yes		
Habitats Directive compensation	Denmark	Yes		
National compensation requirements	Denmark	Yes		
Environmental Protection Fund	Egypt		Yes	
Environment Code compensation	France	Yes		
Environmental Liability Directive compensation	France	Yes		
France national offsets policy	France	Yes		Yes
Habitats Directive compensation	France	Yes		

National				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
National Experimentation of habitat banking	France			Yes
Eco Accounts	Germany	Yes		Yes
Eingriffsregelung compensation	Germany	Yes	Yes	Yes
Environmental Liability Directive compensation	Germany	Yes		
Habitats Directive compensation	Germany	Yes		
National regulations on compensation	Iceland	Yes		
Compensatory Afforestation	India		Yes	
Forest compensation	Italy	Yes		
Habitats Directive compensation	Italy	Yes		
Act on the Conservation and Use of Biodiversity	Korea		Quasi	
Malagasy Environmental Charter and Mining Code	Madagascar	Yes		
Compensation for land-use change in forested areas	Mexico		Yes	
General Law of Ecological Equilibrium and Protection of the Environment	Mexico		Yes	
Program for Environmental Restoration and Compensation	Mexico		Yes	Yes
Fauna and Flora compensation	Netherlands	Yes	Yes	
Habitats Directive compensation	Netherlands	Yes		
National Nature Network compensation	Netherlands	Yes	Yes	Yes
Compensation for impacts to biodiversity	Norway	Yes	Yes	
Habitats Directive compensation	Poland	Yes		
Habitats Directive compensation	Slovenia	Yes		
National Environmental Management Act Biodiversity Offsets	South Africa	Yes	Yes	
National offsets guidelines for wetlands	South Africa	Yes	Yes	
Habitats Directive compensation	Spain	Yes		
National natural resources compensation regulations	Spain	Yes		
Environmental Code compensation	Sweden	Yes		
Fisheries Fee	Sweden	Yes	Yes	
Habitats Directive compensation	Sweden	Yes		
National compensation requirements	Switzerland	Yes	Yes	Pilot
Habitats Directive compensation	United Kingdom	Yes		

National				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
National compensation requirements	United Kingdom	Yes		
National Planning Policy Framework	United Kingdom	Yes		Yes
Aquatic Resources Compensatory Mitigation	USA	Yes	Yes	Yes
Conservation Banking	USA	Yes		Yes
Habitat Credit Trading systems	USA	Yes		Yes

National, Public Lands Only				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
Conservation Allowances	Canada	Yes	Yes	
Blm Mitigation Policy	USA	Yes	Yes	Yes
Recovery Credit System	USA	Yes	Yes	Yes

State/Provincial/Regional				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
Australian Capital Territory Offsets	Australia	Yes		
New South Wales Biodiversity Banking and Offsets Scheme	Australia	Yes	Yes	Yes
Queensland Environmental Offsets	Australia	Yes	Yes	
Victoria Native Vegetation Offsets	Australia	Yes	Yes	Yes
South Australia Native Vegetation Offsets	Australia	Yes	Yes	Yes
New South Wales Offsets Policy for Major Projects	Australia	Yes	Proposed	
Tasmania Vegetation Clearance Offsets	Australia	Yes		
Western Australia Environmental Offsets Policy	Australia	Yes	Yes	Yes
State-level regulations requiring compensation	Austria	Yes	Yes	
Wallonia Principle of Compensation	Belgium	-	-	-
Mechanism for Biodiversity Compensation in the State of Rio de Janeiro	Brazil		Yes	
Alberta Wetland Offset Program	Canada	Yes	Yes	
British Columbia Environmental Mitigation Policy	Canada	Yes	Yes	
New Brunswick Wetlands Conservation Policy	Canada	Yes	Yes	
Nova Scotia Wetland Policy	Canada	Yes		
Ontario Endangered Species Act	Canada	Yes		
Prince Edward Island Wetland Conservation Policy	Canada		Yes	
Quebec Wetlands Program	Canada	Yes		

State/Provincial/Regional				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
Lombardy Green Fund	Italy		Yes	
Provincial-scale biodiversity compensation	Netherlands		Yes	
Bay of Plenty Regional Coastal Environment Plan	New Zealand	Yes	Yes	
KwaZulu-Natal Provincial Offsets Guidelines	South Africa	Yes	Yes	Yes
Western Cape Provincial Guideline on Biodiversity Offsets	South Africa	Yes	Yes	
Regional compensation regulations: Andalucía	Spain	Yes		
Regional compensation regulations: Balearic Islands	Spain	Yes		
Regional compensation regulations: Extremadura	Spain	Yes		
Regional compensation regulations: Navarra	Spain	Yes		
California Eelgrass Mitigation Policy	USA	Yes	Yes	Yes
Maryland Forest Conservation Plan	USA	Yes	Yes	Yes
North Carolina Buffer Mitigation Program	USA		Yes	Yes
Willamette Ecosystem Marketplace	USA	Yes	Yes	Yes

Local/Municipal/County				
Name	Country	Permittee-responsible offsets	Financial compensation	Mitigation banking
Kingborough Biodiversity Offsets and Enviromental Fund	Australia	Yes	Yes	
Melbourne Strategic Assessment Habitat Compensation	Australia		Yes	
Offsets required by local planning authorities in Tasmania	Australia	Yes	Yes	
Town of Oakville Natural Heritage System planning framework	Canada	Yes	Yes	
Aachen guideline for the estimation of the effects on soil	Germany	Yes	Yes	

Our Supporter

Good Energies Foundation (http://www.goodenergies.org) supports sustainable systems that can prevent poverty and disruption caused by climate change in the Global South. Good Energies Foundation was established in 2007 and founded as an integral part of Good Energies Inc., a private equity company specialised in investing in the renewable energy and energy-efficiency industries. Good Energies Foundation's historical mission is the alleviation of future poverty in the Global South by mitigating climate change. Good Energies Foundation initially leveraged its know-how in solar photo-voltaic to provide access to clean energy, especially in the area of rural electrification. At a later stage, climate-change related solutions were added to the portfolio, including sustainable reforestation models. As temperatures rise, we believe that innovative solutions are urgently needed to prevent the future displacement and impoverishment of the world's most vulnerable populations.

Our Sponsors

WRA, Inc. is a leader in wetland mitigation and species conservation banking in California and Colorado, and across the United States. The firm works extensively with mitigation bankers and investors, to help them set and achieve their financial goals. Some of the largest developers retain them to help them make sense of and fulfill their mitigation obligations. WRA's banking team includes experts in finance, real estate, biology, permitting, landscape architecture, GIS, and marketing. They offer a full suite of services—from due diligence and feasibility studies to implementation and management—to meet the needs of their diverse client base. Visit www.wra-ca.com for more information about WRA.

Conservation Investment Management (CIM) is a private equity and financial advisory company focused on real assets that have a positive environmental and social impact. Our clients are some of the most sophisticated individual and institutional investors who are passionate about conservation and are looking for investment opportunities aligned with both their values and their return expectations. We invest in assets such as mitigation and conservation banks, terrestrial carbon projects, sustainably managed ranches and farms and eco-tourism ventures. We also work with foundations to design and implement innovative conservation strategies that incorporate grants, program related investments and market rate investments. CIM's team offers a range of technical and financial skill set from mergers and acquisitions to wildlife management and wetland ecology. For more information, see http://conservationinvestment.com/.

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