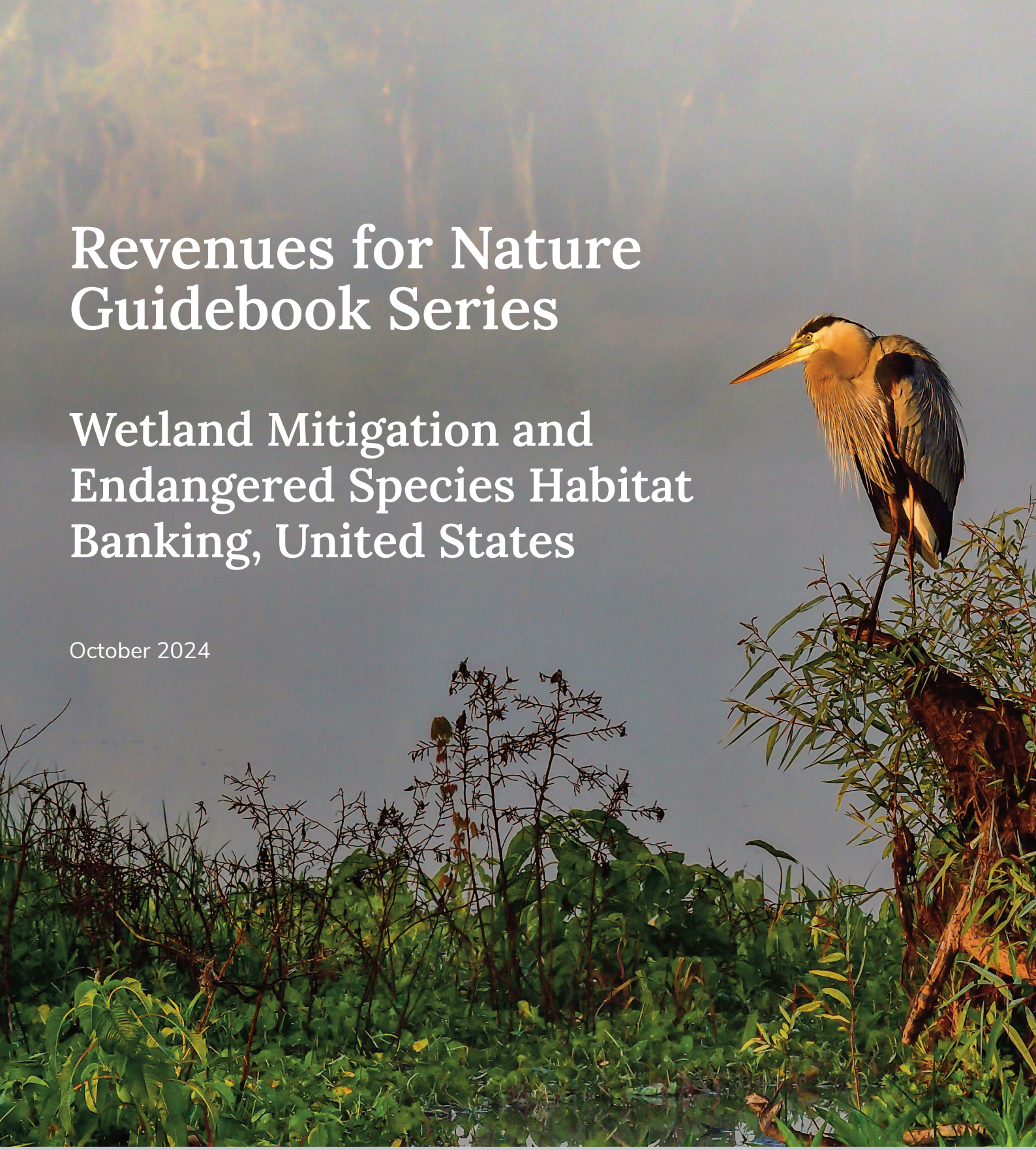
Revenues for Nature Guidebook Series

Wetland Mitigation and Endangered Species Habitat Banking, United States

October 2024



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Revenues for Nature Project

Revenues for Nature (R4N) is a global project led by the Green Finance Institute Hive, in partnership with UNDP Biodiversity Finance Initiative (BIOFIN) and UNEP Finance Initiative (UNEP FI).

R4N aims to contribute to the achievement of Target 19 of the Kunming-Montreal Global Biodiversity Framework (GBF) by supporting countries in identifying and implementing effective models for mobilising private sector finance into nature restoration and conservation.

The project's three pillars of work include:

1. **Knowledge Sharing,** with the publication of a series of detailed Gguidebooks capturing how to establish, replicate and scale high-integrity nature-based revenue models. The Guidebooks are complemented by a database of nature-based revenue models and markets that mobilise private sector finance into nature conservation and restoration.
2. **Multistakeholder Learning** via a Community of Practice which includes the private sector, governments, investors and funders, and project developers to support shared learning for the development of nature models and markets.
3. **Implementation** plans to support governments and relevant partners in rolling out impactful nature-based revenue models.

R4N is funded by the Gordon and Betty Moore Foundation.

Guidebook Series

The R4N Guidebook Series provides an in-depth analysis of models across the globe that unlock private sector capital into nature restoration or protection, including nature-based solutions (NbS). Each Guidebook offers detailed insights into the development of these models, the enabling conditions that allowed them to succeed, along with key lessons learned. The series examines the ecological, political, and socio-economic factors that support the replicability and scalability of these models in diverse regions, and explores how these models can generate revenue and improve biodiversity while leveraging some private sector financing.

The R4N Guidebook Series currently include:

- Biodiversity Net Gain, England – October 2024
- Wetland Mitigation and Endangered Species Habitat Banking, United States – October 2024
- Habitat Banks, Colombia – October 2024
- Nature-based Models for Unlocking Private Investment into Water Quality and Availability, Part 1– October 2024

The next publications of the R4N Guidebook Series will be released in the first half of 2025.

The Guidebook Series is aimed at policymakers, corporates and investors who are interested in scaling high-integrity models to mobilise private sector capital at scale into conservation and nature-positive outcomes.

About EPIC

Founded in 2017, the Environmental Policy Innovation Center (EPIC) is a US non-profit whose mission is to build solutions that accelerate the pace and scale of environmental progress. Working collaboratively at the intersection of government, industry, and the environmental movement, EPIC's programs include wide-ranging projects in restoration and mitigation, water infrastructure, agriculture, and technology. EPIC's growing staff of 37 includes policy experts, scientists, advocates, and technologists unsatisfied with the status quo in environmental stewardship—and dedicated to building policies and strategies to change it.

Views expressed here are EPIC's and do not reflect the policy or positions of our funders.

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Author biography

Becca Madsen is the Director of the Restoration Economy Center at EPIC. For over a decade, Becca Madsen has led multiple analyses of environmental markets at global and local scales. Her work has included two global "State of Biodiversity Markets" reports (2010, 2011), three analyses of the US wetland and stream mitigation program ("The Time It Takes for Restoration" quantitative and qualitative analyses from 2023 and a forthcoming 2024 update), and two analyses of California's species offsets program (2023, 2024). Becca also conducted local-scale feasibility analyses of mitigation banks while serving as an independent consultant from 2011 to 2012, and translated environmental markets concepts for corporate environmental managers in various reports for the Electric Power Research Institute.

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Contents

Executive Summary

Background and Objective

The US has offset markets for biodiversity[1] that usher in an average of USD 3.6bn annually in private investment and that have cumulatively protected an area equivalent to two US national parks (625,000 hectares). As other countries investigate regulatory and non-regulatory avenues for investment in biodiversity, there are lessons to glean from the US' 30-year experience in offsets for wetlands, streams, and species.

Through a review of the two major US biodiversity offset programs driven by two federal laws, the Clean Water Act (CWA) and the Endangered Species Act (ESA), this guidebook identifies and highlights the elements of the offset programs that work well and could be replicated in another context. These two biodiversity offset programs drive offsets for impacts to all freshwater and tidal wetlands as well as other aquatic habitats, and endangered species habitat for more than 1,500 protected species. It also identifies refinements to the US offset program and challenges that could be averted by new offset programs.

Opportunities for Replication

This guidebook could be used by any stakeholder interested in setting up or refining markets for biodiversity restoration and conservation. There are specific policies that are directly responsible for attracting billions in private capital including pension fund capital to US markets. National and sub-national governments could review lessons from US offsets programs as they consider adopting and implementing no net loss goals, and incentivizing private sector investment in habitat restoration and protection. While some U.S. programs are designed around 'no net loss' goals, they often require ratios of benefits that are 2x to 10x losses and thus can provide models for governments working to develop many different policy objectives. Offset programs can also be initiated in one administrative region and expand over time, as was the case with early implementation of species offsets in California.

[1] While there are other US offset programs that may benefit biodiversity, the US wetland & stream and species markets (together, USD 3.6bn/yr) dwarfs US sales of voluntary and compliance carbon credits from nature-based solutions (approximately USD 132m in 2022, US Department of Agriculture, 2023, p. 23), and US water quality trading volume (USD 10m/yr, Bennett and Carroll, 2014, p.9). Thus, the report guidebook focuses on the wetland & stream and species markets.

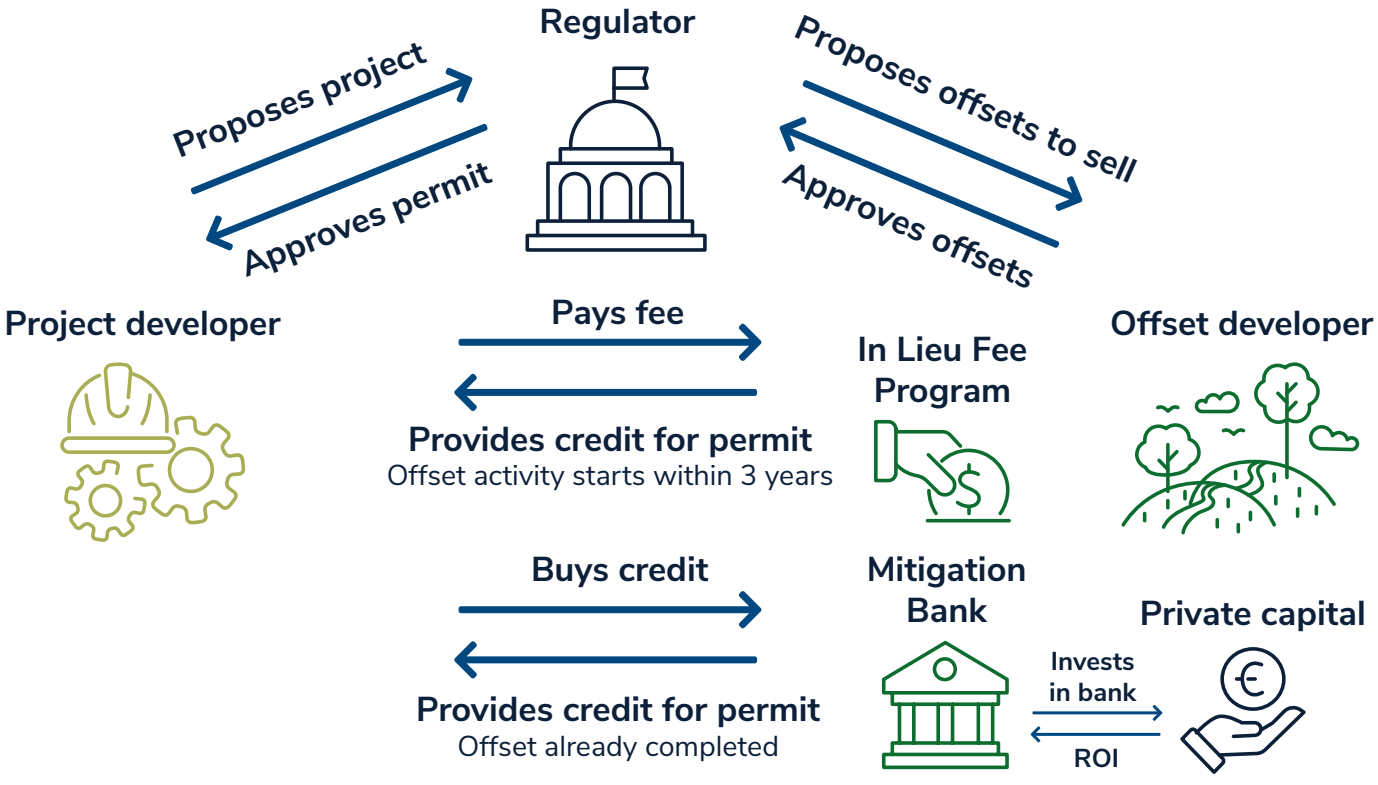
While numerous recommendations and lessons learned can be found in Section 8 as well as throughout this document, here we provide a brief overview of the programs and highlight key findings and tips for replication.

What are the Offset Programs?

The US has created offset programs rooted in regulation aiming for no net loss of wetlands & streams, and protected species (see Figure 1). Examples of protected species in the U.S. include wide-ranging ones like desert tortoise, Florida panther (Puma concolor coryi), California red-legged frog, and sage grouse and also hundreds of range-restricted species. After project developers (e.g., government agencies building roads, real estate developers) have avoided and minimized impacts on natural resources, they can offset unavoidable impacts by:

- Purchasing an offset from a 'mitigation bank,' which is one or more sites that have been restored and protected in advance of the purchase for the purpose of providing offsets, developed by for-profit restoration companies,
- Paying a fee to a compensation fund run by a government agency or non-profit organization (in US parlance, this is called an In Lieu Fee program [ILF]), or
- Developing their own offsets often on their own land or with a private company that is experienced with mitigation banking (above) (permittee responsible mitigation).

Figure 1: A General Model of How Offset Programs Work in the US



Source: EPIC, 2024. Not shown below is that a project developer can also create their own offset after the impact occurs.

Roughly 75% of the country's USD 3.6bn in annual offsets are supplied by mitigation banks, which are developed by private companies and backed by private investment including national and international pension funds. This niche ecological restoration industry is a major contributor to the US economy. In addition to the dollar volume of offset sales, BenDor et al. (2023) estimated that wetland and stream offsets alone create annual economic benefits of USD 2.3bn in supply chain, USD 3.8bn in spillover effects for the economy, and support over 53,000 jobs (which is comparable to employment levels in the US logging industry).

Early involvement in developing banks was dominated by small companies that primarily depended on personal savings, and friends and family investments to launch individual projects, often with no ability to pay salary until credit sales occurred. The market has transformed over intervening years as regulatory and cash flow risks, payment triggers and timing, and rates of return have become more favorable and predictable. Today the following are the major types of private companies involved in creating mitigation banks:

- **Real asset-backed private equity firms:** Such investment management companies acquire and hold land for timber, real estate, or mitigation banking purposes, and subcontract or directly carry out the work of restoring and managing ecological assets (examples: Lyme Timber, Weyerhaeuser, EIP, Westervelt Ecological Services, Earth Partners).

- **Privately-held companies:** These companies use equity investments, loans, lines of credit or other forms of borrowing from banks or other private entities to secure real estate and provide restoration before selling credits which pays back borrowed capital (examples: RES, Wildlands Inc., Davey Mitigation). Some firms in this category grew significantly through other areas of work and then created or acquired a mitigation business line.

- **Publicly-traded companies:** Mitigation banks are also created by publicly traded companies listed on the New York or other stock markets (ex: the construction materials company Vulcan Materials, NYSE: VMC; and a wholly-owned subsidiary of NextEra Energy Resources, NYSE: NEE).

- **Non-profit organizations:** There are more than one million non-profit companies in the US, a very few of which provide mitigation banks[2] as a minor service alongside other work they do (ex: The Conservation Fund). The major way a nonprofit differs is that profit cannot be shared back with owners of the company and is reinvested in the work or mission of the organization.

How Were US Offset Markets Developed?

The Clean Water Act and Endangered Species Act may be considered the foundations of offset markets in the US, but they would not have been possible were it not for other factors. The adoption of a no net loss policy, for example, came decades after these laws, and while also fundamental in the creation of these offset systems, was not enough. Additional necessary elements that contributed to success in the US market are:

- Mitigation hierarchy,
- Enforcement (e.g., consistently requiring offsets),
- Quantified impacts,
- A preference for projects that prove their success,
- Equivalent standards that require everyone to follow the same rules,
- Rigorous review and paperwork to prove success, and
- Substantial oversight to ensure the offset is delivering what it claims to deliver.

[2] Non-profit organizations are more frequently involved in in-lieu fee programs rather than mitigation banks.

Key Lessons Learned for Replication

Below is a synopsis of the **key opportunities for replicating and improving upon the US offsets system.** Additional detail is found in Section 8, as well as throughout the guidebook.

1. **A no net loss policy is not enough.** It cannot be overstated that the US offset market is one completely dependent on regulation and consistent and predictable implementation of regulation. The steps that the US took in developing their offsets programs could be replicated in another country, state or other administrative unit. These steps are:
   1) Adopt a no net loss or net benefit policy goal with the political will and leadership support to enforce it,
   2) Evaluate early implementation and course correct,
   3) Write and adopt enforceable regulation and implementation policy and guidance, and
   4) Maintain a predictable regulatory environment that attracts private investment.

2. **Adopt the transfer of legal liability from the project developer (permit applicant) to the offset developer.** Purchasing an offset is far more attractive if the permittee is not legally on the hook for any future failure of the offset. In other words, the purchase of the offset absolves the buyer of liability of the ecological success of the offset. The offset developer is the one that is scrutinized by regulators to ensure the ecological success of the offset. Transfer of liability should be included in any nascent market.

3. **Adopt a 'mitigation preference hierarchy' that favors offsets created and verified in advance of impacts.** The US adopted a mitigation preference hierarchy to prioritize offsets created in advance of impacts that have verified ecological performance, permanent site protection, and are larger/more ecologically valuable. The order of priority is: 1) offsets from banks that are created and verified in advance of impacts, 2) offsets from an in lieu fee program that can consolidate offsets into a larger area than could be accomplished by a one-off offset but are not initiated before the impact occurs, then 3) permittee responsible mitigation that occurs after the impact. The mitigation preference hierarchy both reduces ecological risk and stimulates investment in private sector banks.

4. **Protect offset sites for the long-term through legal instruments and long-term funding.** US mitigation banks and in lieu fee program sites are legally protected 'in perpetuity'[3] and include an endowment fund for long-term management. This ensures the continued ecological value of the offset and reduces risk of failure. Title or deed restrictions and business contracts are both highly enforceable in the US. This enforceability is crucial to the long-term success of banks and credits.

5. **Create a level playing field with equivalent standards for all offset developers.** US offset policies include 'equivalent standards' to ensure that any type of offset developed (by government, non-profit organizations, the private sector, or project developers themselves) will achieve equivalent ecological performance, additionality, and durability. All forms of offset are faced with the same paperwork and other requirements which translates to equivalent costs. Previously, private sector investment in developing offsets was undercut by permittee responsible mitigation that was cheap because it "got away with" less stringent requirements. The subsequent adoption of equivalent standards since 2008 has been a significant driver of demand for bank and in lieu fee offsets and should not be overlooked in policies that wish to replicate the best elements of the US offset system.

[3] Per the US Internal Revenue Service (2021 Conservation Easement Audit Technique Guide), "The restrictions on the property must be in perpetuity. Current and future owners of the easement and the underlying property must all be bound by the terms of the conservation easement deed."

6. **Avoid pitfalls of government-run offset development.** While new offset programs might view government agencies as potential developers of offsets, the US' experience suggests caution. Based on past challenges, it is strongly recommended to implement safeguards if government agencies are involved in offset development. First, the equivalent standards noted above must apply to government agencies. Second, when government agencies develop offsets, the prices of offsets should be based on the full cost accounting of developing those offsets, including the price of the land, staff time, and long-term site management. Finally, a prudent contingency should be that if a government offset program has not fulfilled their offset obligations in a timely manner (defined as three years in the US), the program should use the fees collected to either purchase offsets that have already been developed by a bank or open a competitive bid for external offset developers to fulfill offset obligations that have not been fulfilled. This last requirement is because a significant source of failure of government-run programs is that they simply fail to even spend the funding for offsets.

7. **Replicate and improve on offset verification, accountability, transparency, and evaluation.** The thorough review of individual bank and in lieu fee instruments by the regulators (US Army Corps of Engineers [USACE], and US Fish and Wildlife Service [USFWS], and Interagency Review Teams) shows a high level of verification that other offset programs could emulate. Some aspects could be improved upon, namely sufficient staffing of regulatory agencies and having leadership hold staff accountable. While US offset programs overall have succeeded in mobilizing private investment, it is difficult to assess ecological outcomes. This is because the agencies overseeing offset programs do not regularly or transparently report on whether their permitting and offsets systems are achieving no net loss goals. The US has a public platform that shows banks and in lieu fee programs and serves as an offset registry (RIBITS), but the platform does not include permittee responsible mitigation and very little impact information is publicly available. This is a major flaw in the US system that other offset programs should avoid. There should be routine publicly available evaluations of the required elements of credit programs, as well as broader evaluation of whether no net loss has been achieved. One example of a solution for both permit and offset project management and public transparency and evaluation is the state of Virginia's Permitting Evaluation and Enhancement Program (PEEP, discussed more in Section 8 below).

The two additional points below are also crucial for any government or state seeking to create offset models.

Recommendations for Inclusion of Indigenous Communities

Indigenous communities in the US, generally referred to as tribes,[4] have developed seven offset sites (six banks and one in lieu fee program) on tribal lands. However, these banks sometimes faced difficulty in approval because of wording and requirements of policies – these should be avoided by other offset programs. The US has recognized in recent species offset policy that its traditional form of offset site protection – which legally separates owners from some rights to their land – is inappropriate when viewed from the perspective of tribal sovereignty, and alternative site protection mechanisms are now allowed. Tribes should be treated as a government, upholding the government to-government relationship. In addition, ownership of bank and ILF credit sites are often transferred to a non-profit organization or government agency once credits are sold and ecological conditions are achieved and stable. Offset programs should consider Indigenous stewards as a valuable option for transfer of land, and long-term management of an offset site and beneficiaries of bank's permanent financial endowment.

[4] "Tribe" is used broadly in this guidebook in the US context, referring to the 574 federally recognized tribes and Alaska Native Corporations (ANC) in the US. Other terminology may be preferred outside the US including Inuit, Yup'ik, and Aleut Peoples; First Nations, First Peoples, or Aboriginal; and indígena comunidad (indigenous community).

Stacking Credits

In the US, no one has attempted stacking compliance credits since one failed attempt in 2009 and it remains a topic of philosophical discussion but no action. The U.S.'s 30-year experience shows that stacking credits often adds complexity without resulting in benefits or activity. This suggests that nascent markets forgo stacking, at least in earlier phases. However, if an offset program decides to take on credit stacking, it should be prepared to closely track credit sales and retirement.

The Counterfactual – What if the US Didn't Have Offsets Programs?

US offset systems, though flawed, offer a better solution than the pre-implementation alternatives: ignoring environmental impacts (common in many governments) or halting projects entirely (for a small minority of highly controversial cases). For example, the US National Environmental Policy Act requires disclosure of impacts to habitats without endangered species but still allows net loss or complete removal of those habitats. In the US, wetland and stream offset requirements developed on a region by region basis, and the evidence shows that state-level regulators in regions without supplies of offsets simply approved permits without achieving no net loss goals. In the US, political views often gravitate toward these extremes, but offsets remain the practical, albeit somewhat unpopular, middle ground.

Guidebook Overview

Using the US' 30+ year experience as a case study, the guidebook provides a deep dive into topics that biodiversity offsets stakeholders struggle with during an investigative phase or in early implementation (i.e., credit methodologies, assurances for long-term protection). Section 8 expands upon the lessons learned noted above for readers interested in opportunities to replicate and improve upon the US offset system.

Content Summary

1. **Overview of US Offsets and Compensation for Wetlands, Streams, and Endangered Species.** Brief review of the regulatory background of offsets and why they were implemented, the current scale of activity and area protected, differences between wetland and species offset programs, and the degree to which offset programs are meeting the regulatory goal.

2. **Demand Drivers and Buyer-Side Program Elements.** Additional detail on the main buyers, when/where/why/how credits are used, the concept of equivalent standards, service areas, and the absence of limitless demand for offsets.

3. **Supply and Seller-Side Program Elements.** Review of offset developers, differences in requirements between types of offset, government agency review and the making of an offset, an overview of the required elements in an offset proposal, public engagement, and siting within a landscape context.

4. **Credit Methodologies, Ecological Standards and Verification.** Review of crediting methodologies, metrics/quantification/ratios, stacking, ecological performance standards and verification for credit release.

5. **Financial Assurances, Offset Price, Risk and Profitability.** Review of financial assurances, ILF fees and bank prices, and seller-side perspective of risk and profitability.

6. **Investment Drivers.** The role of private finance in developing a supply of offsets, the role of government investment in offset creation, and broader government investment in offset program development and implementation.

7. **Program Administration Elements.** Review of administrative elements not included above such as tracking impacts, tracking offsets, monitoring and enforcement mechanisms, funding for administration and staffing, and areas for improvement in government offset development.

8. **Lessons Learned and Opportunities to Replicate and Improve upon the US Offset System.** Discussion on what makes the US an investable market now and what lessons have been gleaned from 30 years of implementation of offsets programs, including areas where the US could improve upon their existing system and challenges that could be averted with new offsets programs. Subject areas covered include: strong, predictable, stable, and enforced regulations; transfer of legal liability; a preference for offsets created in advance of impacts; equivalent standards; areas for improvement in government-run offset development; verification, accountability, and evaluation; tribal participation; and credit stacking.

Overview of US Offsets and Compensation for Wetlands, Streams, and Endangered Species

This section includes a brief review of the regulatory background of offsets and why they were implemented, the current scale of activity and area protected, differences between wetland and species offset programs, and the degree to which offset programs are meeting the regulatory goal.

Brief Review of the Regulatory Background & Why Offsets Were Implemented

The US lacks a singular law that holistically protects biodiversity. Instead, laws protecting aquatic resources (wetlands, streams) and individual (endangered) species are a surrogate for holistic biodiversity protection, and these laws have driven the development of offset systems in the US.

These two laws are the Clean Water Act (CWA) for wetlands and streams, and the Endangered Species Act (ESA) for individual species designated as threatened and endangered.[5] The CWA was passed in 1972 to restore and maintain the quality of the nation's waters, with Section 404 regulating impacts to wetlands and streams. The ESA was passed in 1973 to prevent the extinction of, and recover threatened and endangered species, with 'incidental' impacts to species regulated under Sections 7 and 10.

[5] While there are other US offset programs, the US wetland & stream and species markets (together, USD 3.6bn/yr) dwarfs US water quality trading volume (USD 10m/yr, Bennett and Carroll, 2014, p.9) and US sales of voluntary and compliance carbon credits from nature-based solutions (approximately USD 132m in 2022, US Department of Agriculture, 2023, p. 23). Thus, the guidebook focuses on the wetland & stream and species markets.

The primary goal of offset systems in the US is to achieve no net loss of the resources protected under these laws. If projects like roads, ports, or residential developments cannot completely avoid impacts to wetlands, streams, or endangered species habitat, the project developer must purchase or develop an offset as part of the permitting process. The offset systems also aim to improve ecological outcomes by developing standard requirements for all offset developers and encouraging the creation of larger areas of restoration and protection in advance of impacts. Finally, offset systems were developed as a solution for project developers to meet regulatory requirements and shift legal liability to offset developers.

While the CWA and ESA led to the ultimate development of these offset markets, neither of the laws started out with a 'no net loss' goal and other actions have had to take place to result in the markets seen today. A policy goal of no net loss, for example, was adopted in 1990 for CWA and only recently (May 2023) for ESA.[6] The essential foundation for offsets, therefore, did not develop in the US until decades after environmental laws were passed.

A goal of no net loss alone, however, was not enough to create robust biodiversity markets. Additional implementation rules and policy created specific mechanisms to compensate for impacts. For wetlands and streams, this was a 2008 rule on "Compensatory Mitigation for Losses of Aquatic Resources" (US Army Corps of Engineers [USACE], 2008 herein '2008 Rule'), and for species, there has been a chronology of adopting guidance in 2003, and then more formal policy in 2023 (US Fish and Wildlife Service [FWS], 2023). Additional detail on the 2008 Rule and species offset policies is covered in Section 2 of this guidebook.

Currently, both the CWA and ESA require adherence to the mitigation hierarchy, i.e. requiring avoidance, then minimization of impacts, and only then offsets or compensation. The mitigation hierarchy was adopted in 2008 for wetland and stream offsets and compensation, and in 1981 for species but with updated guidance in 2023 (US Army Corps of Engineers [USACE], 2008 herein '2008 Rule'; US Fish and Wildlife Service [FWS], 2023).

How do the US Offset Systems Operate?

To understand the practical implementation of these offset systems, it's crucial to examine the mechanics of how they operate in practice. The process typically unfolds as follows:

1. A permit applicant submits a project proposal that includes how they intend to avoid and minimize the impact of their project (ex. extending a road or other linear infrastructure, building a residential development, developing a solar farm).
2. The regulator reviews the proposal and may ask for adjustments to avoidance and minimization. The regulator for CWA wetland and stream permits is the US Army Corps of Engineers[7] (USACE) and the regulator for ESA species permits is the US Fish and Wildlife Service[8] (USFWS).
3. After discussions between the project developer and the regulator, there may be unavoidable impact remaining.

[6] Note that these are policy goals, and USACE has noted "There is no federal statute or regulation that requires 'no net loss'' of aquatic resources (USACE 2021, p.9)

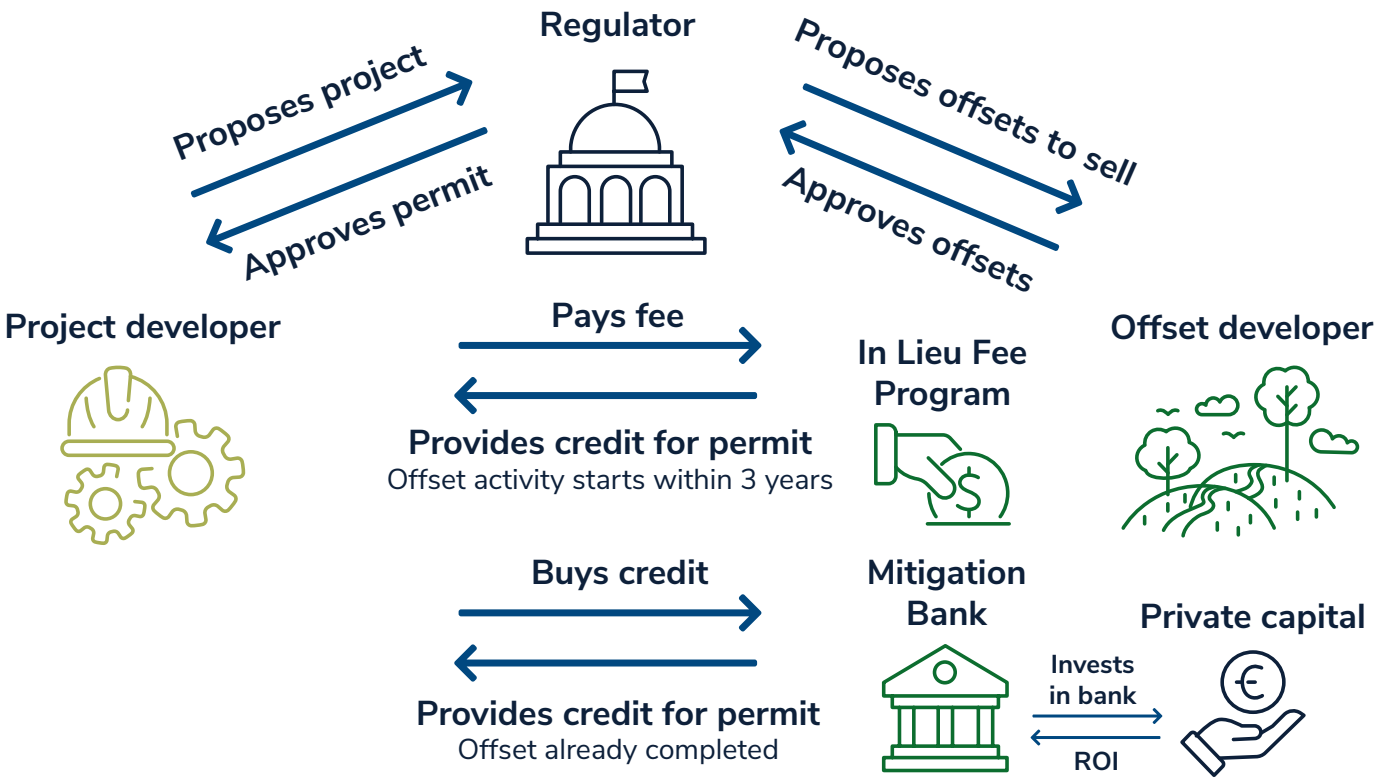
[7] USACE's role comes from its long history of regulating construction and structures in navigable waters under the Rivers and Harbors Act of 1899. Additionally, the US Environmental Protection Act plays a role in jointly issuing regulations (including the 2008 Rule). The EPA also can disagree with USACE and veto issuance of a permit (Gardner, 2011).

[8] The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) also regulates marine or anadromous fish offsets. For simplicity's sake in this guidebook, we only indicate USFWS as the regulator.

4. The permit applicant then offsets their impact either onsite or offsite through:
   a. Purchase of a credit from a mitigation bank[9] that completes the offset before the impact occurs,
   b. Payment into a compensation fund managed by a non-profit or government entity (in-lieu fee program or ILF[10]) that must complete the offset within three years, or
   c. A one-off biodiversity offset created by the permittee after the impact (permittee-responsible mitigation or PRM).

After the regulator approves of the offset method, the permit is approved and the project developer may begin construction (see Figure 2).

Figure 2: A General Model of How Offset Programs Work in the US



Source: EPIC, 2024. Not shown below is that a project developer can create their own offset after the impact occurs.

[9] Mitigation bank is the US term for a biobank, but US stakeholders understand that a mitigation bank also implies adhering to all of the requirements of the US offset system like financial assurances, protection in perpetuity, and a non-wasting endowment fund. See additional detail in "The Making of an Offset" in Section 3.

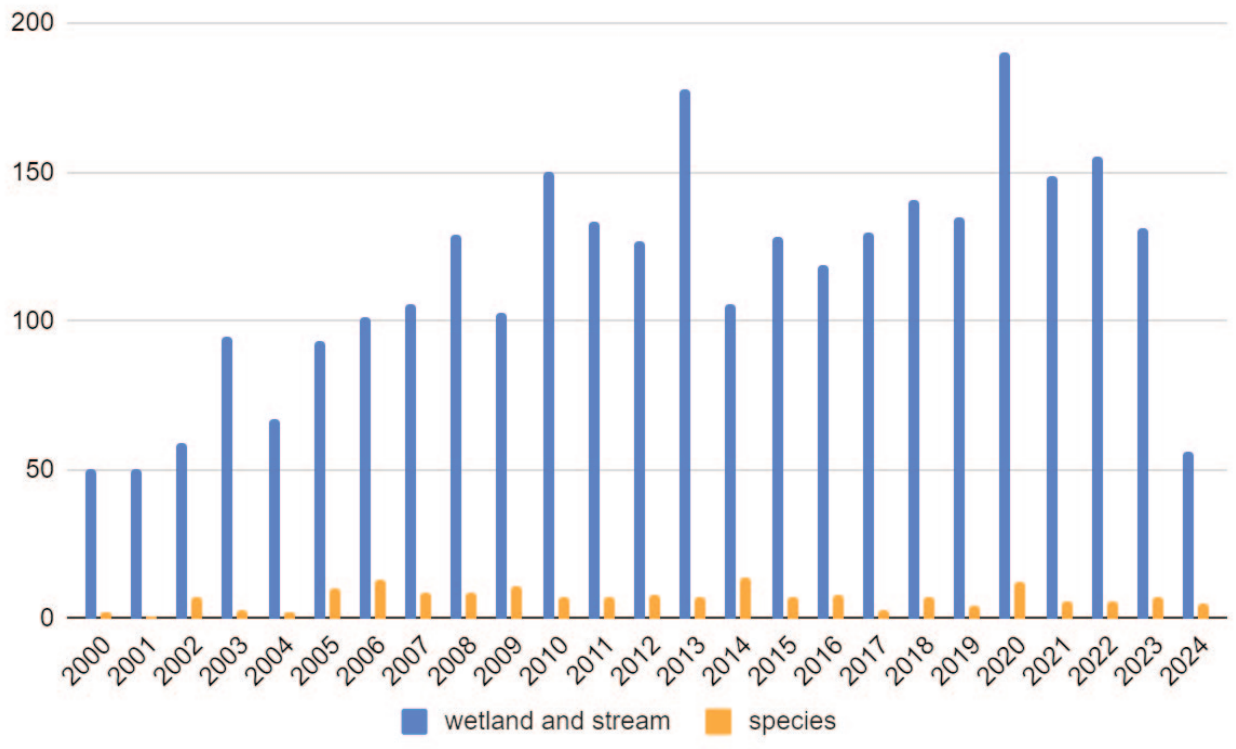
[10] An in-lieu fee program (ILF) is similar to a compensation fund in that a government agency or non-profit organization collects fees (in US parlance, sells 'advance credits'), and spends fees on restoring and protecting lands to offset impacts. An ILF, however, differs in two ways: 1) there is a three year deadline between when fees are collected and when a project must be initiated, and 2) if an ILF creates offsets beyond what was promised with the fees collected, the ILF may sell those credits in the same way a mitigation bank does. The advantage of an ILF over PRM is the ability to pool funds into a larger restoration site than would be possible with a one-off PRM offset.

The US also adopted a 'mitigation preference hierarchy' that prioritizes purchase of credits from a mitigation bank, then use of credits from an ILF (if no bank credits are available), and then PRM. This preference developed following a national review of wetland and stream offset implementation from the early 1990s to 2000. The study, conducted by the National Research Council, found that the previous preference for onsite offsets could lead to 'postage-stamp' offsets with poorer chances of ecological success at both the local and landscape scale (National Research Council, 2001). Mitigation banks and ILF project sites are legally protected 'in perpetuity'[11] and include an endowment fund for long-term management.

Scale of US Offset Programs

As of June 2024, there are 3,374 approved banks (3,180 wetland and stream, 194 species banks), and 107 ILF programs for wetlands and streams[12] (with 1,769 project sites under those IFLs).[13] Note that species banks are geographically concentrated in California, where ESA offsets were first tested by the Sacramento administrative region of the USFWS (Figure 4).

Figure 3: Number of Mitigation Banks Approved by Year



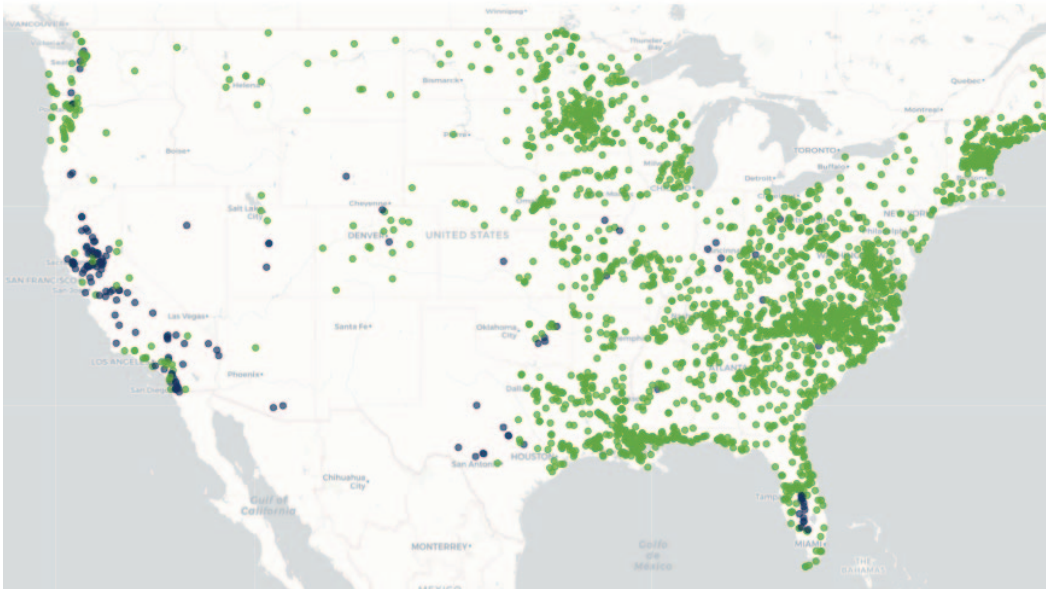
Note: Data from 2024 does not reflect a full year

[11] Per the US Internal Revenue Service (2021 Conservation Easement Audit Technique Guide), "The restrictions on the property must be in perpetuity. Current and future owners of the easement and the underlying property must all be bound by the terms of the conservation easement deed."

[12] ILFs are at this time almost entirely for wetland and stream offsets. As of August 2024, RIBITS shows only 3 approved ILFs for species - all in California and all for aquatic habitats.

[13] This information is based on data available on the RIBITS platform (Regulatory In lieu fee and Bank Information Tracking System)

Figure 4: Map of Banks and ILFs



Data source: RIBITS, accessed June 2024. Key: green = wetland or stream; blue = species

The total area protected under CWA offsets is 516,000 ha / 13,000 km (1,276,000 ac / 8,100 mi), and the area protected under species banks is 109,000 ha (270,000 ac). The amount of PRM for CWA offsets was difficult to obtain and involved using conservative estimates of amounts prior to 2010.[14] We were unable to obtain any information on PRM for ESA offsets.

Table 1: Summary Data of Area and Linear Length[15] Protected in US Offsets

Type	# of banks or sites	Hectares	Km	Acres	Miles
Bank – wetland and stream	3,180	342,000	3,400	846,000	2,100
PRM – wetland and stream	Unknown	150,000	8,800	370,000	5,500
ILF – wetland and stream	1,769 sites (in 107 programs)	24,000	800	60,000	500
Total - wetland and stream	4,949	516,000	13,000	1,276,000	8,100
Bank & ILF[16] – species	194	109,000	NA	270,000	NA
PRM – species	Unknown	Unknown	Unknown	Unknown	Unknown
Total – wetland, stream, species	**5,143**	**625,000**	**13,000**	**1,546,000**	**8,100**

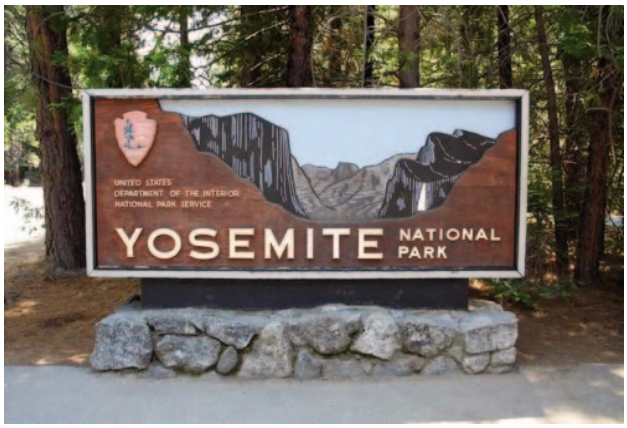
[14] For PRM area, acreage of PRM is reported in a 2015 USACE IWR report for the years 2010-2014, we used USACE ORM data for 2015-2023, and for the remaining years (pre-2000 - 2009, 2024) we used a low conservative estimate of 10,000 acres/year (lower than the calculated average of the data provided, 18,000 acres). PRM linear figures are reported in a 2015 USACE IWR report for the years 2010-2014, we used USACE ORM data for 2015-2017 (in 2018 USACE switched to tracking stream restoration as width and length as opposed to linear feet) and for per 2000 - 2009, we used a low conservative estimate of 1,500,000 lf (lower than the calculated average of 1,737,399).

[15] The US has recorded stream offsets as a linear length (see Km and Miles protected below).

[16] ILFs are at this time almost entirely for wetland and stream offsets. As of August 2024, RIBITS shows only 3 approved ILFs for species - all in California and all for aquatic habitats.

For scale, US offsets permanently protect an area larger than Yosemite National Park and Rocky Mountain National Parks combined, and the length of streams restored and protected – if stretched out – would stretch from the west coast of the US to Egypt (Figure 5).

Figure 5: Context of Scale of Offsets



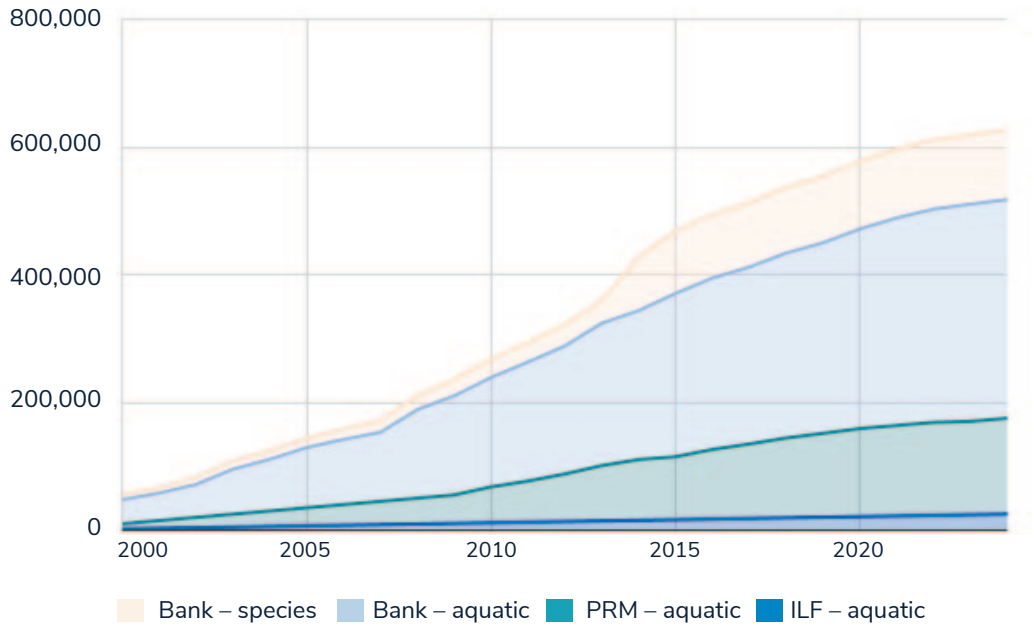
516,000 hectares (1,546,000 acres) is larger than Yosemite and Rocky Mountain National Park combined

13,000 kilometers (8,100 miles) of streams restored and protected

Data source: RIBITS, accessed June 2024. Photo credits: Yosemite sign, Rocky Mountain National Park sign, Google maps measure feature.

Figure 6 shows the cumulative area conserved in US offsets over time. It is worth noting that the private sector has created the majority of offsets in the US. Most of the PRM, about 75% of the aquatic banks, and the vast majority of species banks have been developed by private entities. Government and non-profit organizations are responsible for the ILF area, and about 25% of the bank area (a portion of banks are made by and for Departments of Transportation for their own needs).

Figure 6: Growth of Area (Hectares) Conserved in US Offsets Over Time



Note: Annual amount of PRM are low conservative estimates for the years 2000-2009, and annual amount of ILF area protected is an estimate (total amount protected is known, amount protected by year is unknown)[16]

The US has seen an increasing use of offsets created by mitigation banks over time. Offset prices range from USD 20,000 - USD 900,000 USD per unit[17] and the total market for wetlands & streams and species credits (combined) has been estimated between USD 1.6bn - USD 6.3bn, or a conservative average of USD 3.6bn annually (Ecosystem Marketplace, 2017).

Differences Between Wetland/Stream and Species Offset Programs

The market for species offsets is far smaller than wetlands & streams in terms of banks/ILFs (191 species banks and 3 ILFs vs. 3,180 wetland/stream banks and 107 ILF programs), area protected (109,000 ha for species vs. 516,000 ha wetland/stream) and dollar volume of offsets sold annually (USD 354m species vs. USD 3.3bn USD wetland, USD 274m USD stream).[18] This is generally due to the time lag in policy adoption - the 2008 Rule provided strong, predictable, and enforced offset regulations for wetlands and streams, while until 2023, only 'guidance' was available for species offsetting. Additionally, determining offset calculation methodologies for a relatively similar habitat type–wetlands–is far simpler than determining methodologies for each and every one of the 1,674 species currently protected under the ESA (FWS ECOS, June 2024). Indeed, there are currently only 89 types of species offsets; the vast majority of protected species do not have a credit methodology at this time (Miller, USFWS, presentation at the Environmental Markets Conference, 2024; RIBITS report generated August 2024[19]). More details on the US species offset program can be found in later sections.

[16] The total area conserved under ILFs is available in RIBITS (in the report "Acres/Linear Feet of Wetland & Stream Mitigation Methods"), but area conserved by ILFs by year is not. The ILF figures are derived by taking the total cumulative area reported by RIBITS divided by 25 years, and accumulating those acres over time. For PRM area, acreage of PRM is reported in a 2015 USACE IWR report for the years 2010-2014, and the remaining years (pre-2000 - 2009, 2015-2024) used an estimate of 20,000 acres/year (lower than the calculated average of the data provided, 25,200 acres).

[17] A majority of offsets are area based (e.g., acres), others are functionally based. See additional detail in Section 4.

[18] Based on data available on the RIBITS platform as of June 2024

[19] The report can be generated by the following navigation / filters: Credits->Credit tracking->Bank & ILF Program ledgers->Banks only; filter: Credit Type List.

Summary of Evidence of US Offset Program Success

As seen above, the US has a thriving environmental offset market for wetlands, streams, and species. Indeed, US offsets created by banks and ILFs accounted for 74% of the world's dollar volume of compensatory mitigation (USD 3.6bn of a global total of USD 4.8bn, Bennett et al., 2017). While US offsets have succeeded in mobilizing private investment, it is difficult to assess ecological outcomes. This is because the agencies overseeing the CWA and ESA offset programs (USACE and USFWS, respectively) do not regularly or transparently report on whether their permitting and offsets systems are achieving no net loss goals. Indicators of success can, however, be found in the minutiae of proposed policy and regulation, presentations at national conferences, and in sporadic agency reports and peer-reviewed literature.

Wetland and Stream Offset Evidence

Some examples of evidence of program success for CWA offsets:

- **Wetland and Stream Offset Regulations Catalyze Private Investment and Contribute to the Economy.** The ecological restoration industry (i.e., mitigation banks, ecological consulting firms, engineering firms, native plant nurseries, legal firms, etc.) is a major contributor to the US economy. BenDor et al. (2023) estimated that the CWA offset market alone creates annual economic benefits of USD 2.3bn in supply chain and USD 3.8bn in spillover effects for the economy, which is in addition to the USD 3.6bn in annual sales of offsets. The researchers also found that CWA offsets supported over 53,000 jobs, which is comparable to employment levels in the logging industry in the US (54,000 employees). Importantly, many of the jobs in the ecological restoration industry are located in rural and economically depressed areas, and they often provide wages that are higher than local averages (BenDor et al. 2015). This suggests that the ecological restoration industry is playing an important role in supporting economic development in underserved communities.
- **Wetland and Stream Offsets Achieve Ecological Performance Standards at a High Rate.** A 2012 study of 722 wetland and stream banks found that 98.3% of banks have met or are meeting their ecological performance standards as indicated by review and approval of credit releases by USACE and the 'Interagency Review Team'[20] (Denisoff and Urban 2012).
- **Wetland and Stream Offsets Catalyze Avoidance of Impacts.** The USACE has reported that over 90% of all wetland and stream impact permits received annually have avoided and minimized impacts to the point where offsets are not required (0.0012 - 0.2 ha).
- **Wetland and Stream Offsets Minimize Temporal Loss of Ecosystem Services.** There is also a trend of increasing use of offsets created in-advance of impacts – in other words, offsets created by mitigation banks. Offsets from banks went from 30% in 2010 to over 60% in 2023 (Matson, USACE, presentation at the Environmental Markets Conference, 2024). Because these offsets are created in advance of impacts, they reduce the loss of natural services like water filtration, flood reduction, and carbon sequestration between the time the impact occurred until the time the restoration succeeds (called 'temporal loss' of ecosystem services).
- **Wetland and Stream Offsets Speed Up Processing Times.** Hough and Harrington 2019 noted that "permit processing times are approximately 50% less when mitigation bank or ILF program credits [roughly 140 days] are used compared to using traditional off-site permittee-responsible mitigation [roughly 225 days]."

[20] Banks and ILFs are reviewed not just by the main regulatory agency, but an Interagency Review Team (IRT) composed of multiple federal and state agencies that have a substantive interest. This is described further below.

If the US Has a Policy Goal of No Net Loss of Wetlands, Why Are We Seeing Net Loss?

From the aforementioned evidence, the US wetland and stream offset system 1) is successfully directing project developers to avoid and minimize impacts, 2) is reducing the amount of temporal loss of ecosystem services, and 3) in terms of permitting should be achieving no net loss of aquatic resources that are legally protected. However, according to a FWS report on status and trends of wetlands in the lower 48 states (FWS 2024, herein Status and Trends report), the US had a net loss of 89,000 hectares (220,000 acres) from 2009-2019. The report does not look at permitted impacts but rather aerial photos over time to estimate wetland loss. The report identified the conversion of wetlands to upland agriculture as "the dominant driver of net wetland loss resulting in a total wetland reduction of 79K ha (194K ac)."

Not all wetlands are covered by the regulation. Not all impacts to wetlands require permits (and associated offsets). Established and ongoing agricultural and forestry activities are an example of activities that may be exempt (EPA 2024). Second, if an area does not fall under the legal definition of Waters of the United States, a CWA 404 permit is not required. For example, wetlands that were previously converted to agriculture are not protected under the CWA, so "further modifications to these areas are generally not subject to CWA requirements" (Robertson and Hough 2016). The legal definition of which wetlands and streams are protected by the CWA has changed many times over the last 50 years (see Box 1 below for recent developments). Additionally, for impacts to wetlands that do require permits, not all impacts require offsets. Impacts under a certain threshold that are permitted under 'nationwide permits' are not counted in no net loss equations by the USACE. However, these impacts - 2,220 hectares annually (5,480 acres) - account for less than a quarter of the net loss identified in the Status and Trends report. Coastal and tidal wetlands also disappear because of sea level rise, which is not regulated by this policy. Finally, there is the possibility that activities thought to have 'temporary' impacts may have more permanent impacts, but we have seen no research on the topic.

Too Much Reliance on Preservation as a Form of Offsetting. Wetland and stream offsets may be created through four methods under USACE regulations: restoration, establishment, enhancement, and preservation. Offsets from preservation have to meet certain regulatory conditions[21] and guidance indicates they "should generate fewer credits [offsets] than the same amount of restoration, establishment, or enhancement acreage or length" (EPA, 2022). Nevertheless, preservation accounts for about 18% of approved offsets (data source – RIBITS, 2024 "Approved Stream & Wetland Mitigation Methods" report).

Issues with the Wetland Offsets Themselves. There is also the potential that wetland offsets have failed and the land has converted to uplands. Rules for banks and ILFs provide some assurance against this risk, as offsets are not able to be sold until monitoring reports provide evidence and the regulator has concurred that the restoration project has met certain ecological milestones.

Finally net wetland loss may be the outcome of many other contributing factors including indirect mechanisms such as climate change and invasive species.

Overall in the US, we have ideas of explanatory factors for wetland loss, but we don't know the degree to which each of these factors contribute to the problem. Recommendations for safeguarding against these failures in the US system are included in Section 8 Lessons Learned.

[21] Preservation offsets have to: "Provide important functions for the watershed; Contribute substantially to the ecological sustainability of the watershed; Be determined appropriate and practicable by the Corps; Be under threat of destruction or adverse modification*; Be permanently protected; and To the extent appropriate and practicable, done in conjunction with restoration, establishment, and/or enhancement of aquatic resources." (EPA, 2022, paraphrasing more detailed conditions from USACE, 2008).

Box 1: Legal Developments that Underlie the Scope of Wetland and Stream Protections in the US

The strongest recommendation in this paper is a foundation of strong, predictable, stable, and enforced offset regulations. The US has experienced recent legal developments that affect offset programs.

A recent Supreme Court decision focused on what constitutes 'Waters of the United States' (WOTUS), which determines the extent of the Clean Water Act protections of wetlands, streams, rivers, and lakes across the US. Only impacts to WOTUS require a permit (and require offsets). If a wetland type like prairie potholes or ephemeral streams are not included in the definition of WOTUS, they are legally not considered wetlands or streams even though scientifically they are. For the past 45 years, the definition of WOTUS was a combination of agency interpretation of the CWA and the interpretation of a previous Supreme Court case also focused on WOTUS. In October of 2022, the Supreme Court heard the case Sackett vs EPA and in May of 2023 determined that the federal government was overstepping in its interpretation of WOTUS. The Court's new definition of WOTUS excludes wetlands that do not have a continuous surface water connection to navigable waters. This significantly narrowed the extent of wetlands protected in the US at the federal level[22], particularly in the arid Southwest US where there are numerous seasonal wetlands and streams (e.g., fed by snowmelt). This is an example of how even a fundamental law can change and have ripple effects in offset programs, and ultimately net loss of wetlands. However, 23 states have wetland laws that are stronger than federal protections. For these states, impacts could be minor. Other states are in the process of developing state laws that are more protective of wetlands and streams, which may shift private sector investments geographically. As far as private investment in offsets, one mitigation bank staff noted: "Our wetland mitigation services would likely gravitate more toward those states that would still require mitigation for impacts no longer considered jurisdictional under Sackett" (Matt Stahman, RES).

This example of recent developments highlights the risk of political and Court shifts in interpretation of law, but is not likely to upend US offset programs.

Species Offset Evidence

There is far less analyzable information on species impacts and offsets. The adoption of no net loss as a policy goal is only a recent addition to ESA offset (2023) and thus tracking and reporting on habitat loss and gain was not a requirement to adhere to the guidance (Gamarra and Toombs, 2017). To date, the only element of no net loss that is tracked nationally with any detail are species banks on the RIBITS platform, but there is no link showing the permit using the offset or area of impact.

Safeguarding offset tracking and evaluation is one of the recommendations in Section 8 below that applies both to the US species offset program and any potential new program in development.

[22] States can enact laws that are more protective than federal law, as 26 states have (ELI, 2024).

Demand Drivers and Buyer-Side Program Elements

This section includes additional detail on the main buyers, the regulations creating demand, when/where/why/how credits are used, the concept of equivalent standards, service areas, and the fallacy of limitless demand for offsets.

The Main Buyers

The buyers of US offsets are permit applicants proposing projects that may impact wetlands, streams, or species habitat. In their permits, project developers must detail avoidance activities, minimization activities, and how they plan to offset unavoidable impacts. Fundamentally, offsets are a means of complying with regulations. The most common buyers are government agencies building roads, bridges and ports (which account for more than a third of demand); and property/real estate development (another third of demand). The remaining most frequent buyers include energy distribution/generation, local government, energy development/extraction, in addition to multiple other sectors. (Bennett et al. 2017, Madsen et al. 2011).

We have found no evidence of US wetland or species offsets being purchased voluntarily, with one exception – offsets that are 'voluntary' but essentially pre-compliance offsets (Bennett et al., 2017). It cannot be overstated that US offset markets are completely dependent on regulation and consistent implementation of regulation; this is the reason why this guidebook puts a large emphasis on regulations creating demand.

Additional Detail on the Regulations Creating Demand

In the US, regulations are the driver for high quality wetland, stream, and species offsets. However, as previously mentioned environmental protection laws alone did not create the catalysts for wetland and stream offsets and species offsets in the US. As noted in Section 1, the CWA and ESA have been around since the early 1970s, but did not gain regulatory "teeth" until additional implementation elements were added.

Clean Water Act Demand Drivers for Wetland and Stream Offsets (The 2008 Rule)
For the CWA specifically, the adoption of the "no net loss" policy goal in 1990 was a crucial step. However, it was the 2008 Rule that provided the necessary implementation framework. The 2008 Rule has many requirements that have made private sector investment in offsets viable:

- The 2008 Rule adopted the **mitigation preference hierarchy** (use mitigation bank offsets first, then offsets from an ILF, then offsets created by the developer [permittee-responsible mitigation, or PRM]).
- **'Equivalent standards'** provided assurance to private developers that their ability to sell offsets would not be undercut by other actors being able to create cheaper offsets due to differing requirements (e.g., a lower standard of additionality, durability, or ecological performance). Additional detail is below.
- **Legal liability is transferred** from the permit applicant to the bank or ILF. This means that after purchasing an offset, a permit applicant is not responsible for the success of the offset, the bank or ILF is.

The other major demand driver of wetland and stream offsets is the actual **enforcement** of wetland impact regulations and requirements in the 2008 Rule by the regulator, the US Army Corps of Engineers (USACE). As Bennett et al. (2017) noted: "offset and compensation activity appears to track far more closely to regulatory stringency and enforcement than to impacts from infrastructure and development activity."

Timelines for approval of offsets from banks and ILFs were included in the 2008 Rule, and is a prudent element to ensure that offset development does not drag on so long as to be financially unfeasible. Research by Martin and Madsen (2023) has indicated, however, that USACE is exceeding their timelines. The average time 'on the regulator's desk' is 336 days on average as opposed to the required 225-day timeline stipulated in the 2008 Rule, and the total review timeline that includes the mitigation bank developer's time is on average three years (the longest timeline in the dataset of 500 records was over 12 years). Therefore, accountability mechanisms are also recommended (e.g., public transparency of review timelines, leadership oversight and prioritization). The senior leader of USACE echoed these accountability mechanisms in an agency memo released very recently ("Improving U.S. Army Corps of Engineers Timeline Compliance with the 2008 Compensatory Mitigation Rule," USACE, September 2024). Many other details of the 2008 Rule are highlighted in this and other relevant sections of the guidebook.

While the 2008 Rule applies to the entire US, there is variation in how it is interpreted because the USACE's 38 regional districts are provided discretion in how they interpret the 2008 Rule. Thus, we see regional variation that is partially explained by differences in ecosystems (e.g., different metrics or restoration techniques for different types of wetlands) but may also be explained by regional government agency interpretation, experimentation, &/or leadership preference.

Endangered Species Act Demand Drivers for Species Offsets

In terms of demand drivers for species offsets under the ESA, there has historically been a lack of solid policy or regulatory drivers for consistent application of offsets (Male and Li, 2021). Although the USFWS published guidance on 'conservation banks' in 2003, the development of species offsets lagged behind wetland offsets and was not due to a lack of impacts on species (USFWS 2003). Offset activity lagged for several reasons:

1. The FWS lacked any overarching national offset policy or regulation (until 2016),
2. The 2003 guidance lacked the force of policy or regulation, and
3. The 2003 guidance failed to include a stated mitigation preference hierarchy for offsets developed in advance of impacts.

All three of these factors created a level of risk unfavorable to private investment in early days of species offset implementation, at least nationally. However, there has been more use of species offsets in California. There, the state adopted a state level species offsets policy in 1995 and the USFWS first tested offsets for federally protected species in 1999 (see Figure 4 in Section 1 to see the dramatic concentration of species banks in the state). Finding success in streamlining these initial efforts, regulators in the Sacramento USFWS field office subsequently approved offsets for additional species in California (Mead 2008, chapter in Carroll et al. 2008). Adoption and comfort with the use of offsets appears to be a key determinant for the growth of species offsets in the US.

More recently, in 2016, USFWS adopted two mitigation policies at the agency-level and specific to the ESA that provided a new policy backbone for species offsets under the ESA. The Trump administration rescinded these in 2018, and mitigation policies were recently re-adopted with minor adjustments in 2023 (FWS Mitigation Policy, and Endangered Species Act Compensatory Mitigation Policy). The 2016/2023 policies adopted a goal of no net loss, equivalent standards, and transfer of legal liability, amongst other requirements. ESA mitigation policies did not stipulate required timelines for approval of offsets. These new policies provide more regulatory weight than the 2003 guidance, but they are not "regulations" and it is too early to tell if it will provide a strong demand driver for species offsets.

A more recent regulatory change may also prove helpful for demand for species offsets. In April of 2024, the USFWS amended Section 7 of the ESA, which applies to projects with a federal connection – projects that are funded, permitted, or carried out by any federal agency (USFWS 2024). Section 7 accounts for over half of ESA permitting. The recent ESA amendment made clear that offsets could be used under Section 7 and did not need to be onsite. This reverses guidance in a 1998 USFWS handbook that indicated it was "not appropriate to require mitigation for impacts of incidental take" (FWS, 1998). Even with the language above in place since 1998, in practice, offsets were informally used. The 2024 ESA regulatory amendment however means that for the first time, USFWS staff are empowered to require Section 7 permit applicants to purchase or develop offsets.

One other unique aspect of species offsets is that US species credit methodologies are species-specific because the ESA itself is focused on individual species (e.g., American burying beetle vs. "biodiversity"). This brings the challenge of creating a new methodology for each species, which can create a bottleneck in offset program activity overall. This contrasts with wetland offsets where credit methodologies are comparatively standard across regions, and regulations outside the US that focus on protecting holistic habitat categories or 'biodiversity' itself (e.g., one credit methodology), such as England's "Biodiversity Net Gain" policy.

When, Where, Why, and How Do Buyers Use Offsets?

At their core, US offsets represent to buyers regulatory compliance and transfer of legal liability for the ecological success of the offsets. This is because the offset developer has already completed all required tasks and had their credits approved by the regulator (and the interagency teams that provide input, as discussed in the next section). A buyer (aka, a permit applicant) can identify whether credits are available from banks or ILFs on the RIBITS registry of credits. If available, the buyer may reach out to the offset developer to purchase a credit to offset their impact after they have avoided and minimized their impact. RIBITS itself is not a marketplace as no sales occur directly on the platform. However, after a sale, the credit is debited from the offset provider's available supply of credits in RIBITS, and the credit is officially associated with the impact permit. The USACE records mitigation in their (internal) national permit database called ORM (which stands for the OMBIL Regulatory Module). This government registry of credits (RIBITS) and database of permits (ORM) ensures that a credit cannot be used twice. In other words, once a credit is used, it is retired.

Since credits created in-advance of impacts from banks and ILFs have already been approved by the regulator, the part of the permit process relating to identifying appropriate offsets is speedy. While there are delays in the review process for offset banks and ILFs, the transaction between buyer and seller is fast and cuts the project developer's permit processing time by close to 50% (Hough and Harrington 2019, USACE Institute for Water Resources 2015).

Equivalent Standards and Demand

Even if the face value of credits may be considered by the buyer as costly, developing their own offset incurs not only the costs of creating the offset, but also time delays and liability of meeting all requirements for the offset's success. Indeed, the 2008 Rule's emphasis on equivalent standards strongly influences demand for high-quality in-advance offsets. This is because if the permit applicant decides to create their own offset instead of purchasing a credit, they must reach the same (or mostly the same) high standards and ecological performance as banks and ILFs. The adoption of equivalent standards has been a significant driver of demand for bank and ILF offsets and should not be overlooked in policies that wish to replicate the best elements of the US offset system. If permit applicants, non-profits, or government agencies are held to a lesser standard for the offset they are required to develop, they will rise only to the lower level (and lower cost) of that standard, and higher quality offsets will not be able to compete, which further disincentivizes investment in supply and creates delays for permit applicants.

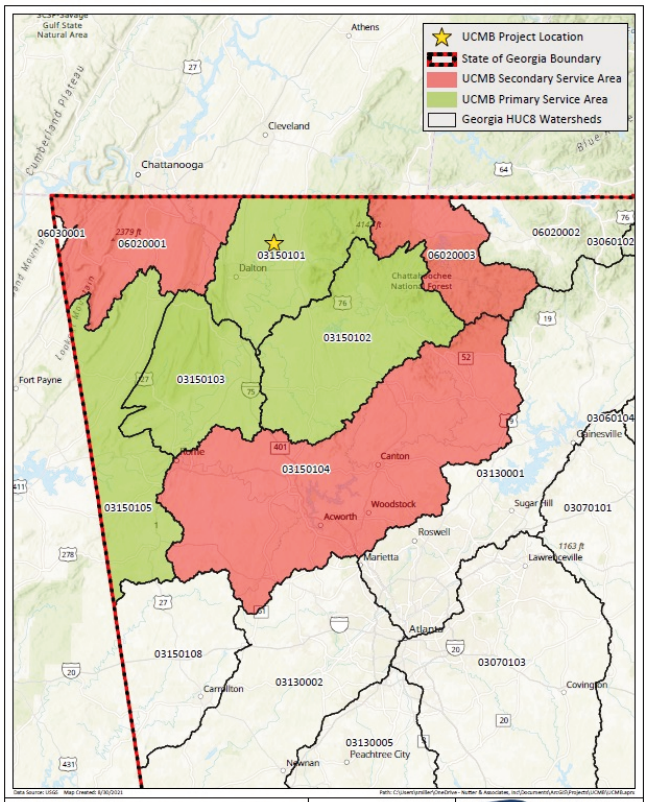
Service Area and Demand

Buyers must purchase an offset within the same 'service area' as their impact (in the same watershed / catchment for wetlands and streams, or the same species habitat for species, see Figure 7 for examples). While carbon credits offset emissions at a global scale, the reason for creating a service area is to ensure no net loss of resources at a local scale. If not for service areas, there could be 'hotspots' of loss of wetlands, streams, and species habitat where developers might create impact locally but purchase compensation from distant sites that may be ecologically unrelated, and less expensive, which undermines the core incentive structure of compensation.

The 2008 Rule states that "the service area must be appropriately sized to ensure that the aquatic resources provided will effectively compensate for adverse environmental impacts across the entire service area" (2008 Rule). Regulators have the discretion to determine what that appropriate size is, and may allow broader service areas or use of credits in an adjacent watershed (secondary service area) if none are available in the watershed of impact (see Figure 7, left side). This may occur more frequently in rural areas with low demand for credits. When a credit from a secondary service area is used the buyer may have to purchase more credits (e.g., double the amount of credits than would have been required). Both buyers and sellers (banks and ILFs) are motivated to get the largest service area possible approved by the regulator, as it creates a larger market area where offsets can be bought and sold. Buyers must also purchase like-for-like offsets, meaning an impact to a California tiger salamander must be offset with a California tiger salamander credit, or an impact to a riverine/lacustrine fringe wetland must be offset with a riverine/lacustrine fringe credit, etc. Note in the figure below that the wetland service area is arbitrarily cut by a political (e.g., state) &/or administrative (e.g., USACE District) boundary. Even if it has no ecological basis, service areas are occasionally set in this manner.

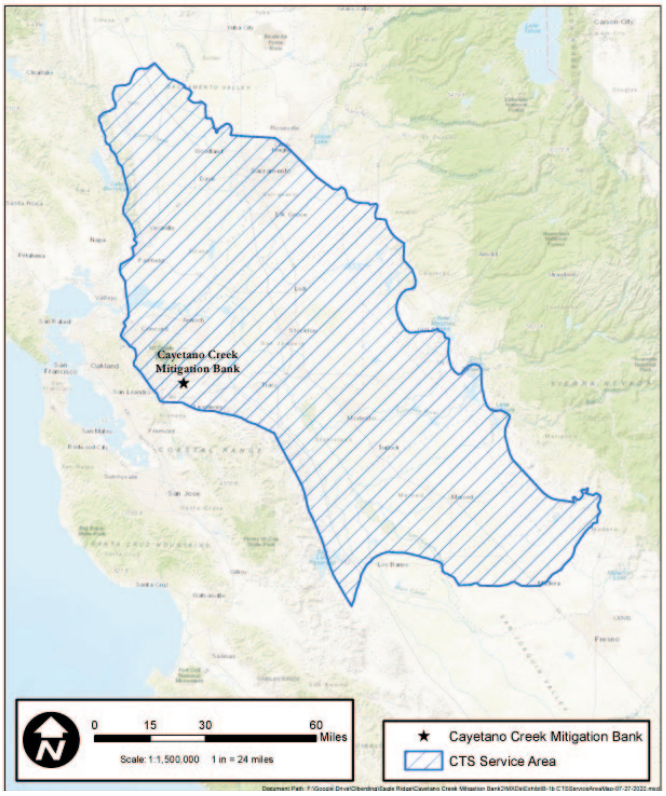
Figure 7: Examples of Service Areas

Example of CWA offset primary (green) and secondary (red) service areas for riverine/lacustrine fringe wetlands



Source: RIBITS, Upper Coosa Mitigation Bank, wetland service area, north of Atlanta, Georgia

Example of ESA offset service area for California Tiger Salamander



Source: RIBITS, Cayetano Creek Mitigation Bank, service area for California Tiger Salamander, east of San Francisco Bay

There Isn't Demand for Offsets Everywhere or for Every Species

A frequent misconception with US offsets is that a landowner or government agency can just create a mitigation bank anywhere and start selling credits. However, offsets – like real estate – are all about location (...and regulations, and enforcement of regulations, and all of the important elements noted above). **There must be demand within the service area, or there is no market.** If there are no known planned or predicted development impacts in the service area, no one is going to buy credits and there is no business case for a mitigation bank. In a similar vein, people may assume that land with great restoration and preservation potential for regulated species would be an ideal situation to create a species offset bank. Not necessarily. Local or regional USFWS staff may not be supportive of offsets, or feel that they do not have the authority to require offsets for permits. If there are no already-established crediting methodologies for a particular species, a new methodology must be developed (this is a downside born of the single-species focus of the ESA vs. a broader biodiversity credit as is seen in the UK or habitat-based credits like US 'wetland' credits). USFWS staff may not have experience, and/or time, and/or inclination to work with a species bank developer to create a brand new methodology for a single species. Regulatory agencies need sufficient staff, training, and leadership support to implement an offset program (Madsen and Martin, 2023).

Supply and Seller-Side Program Elements

This section includes a review of offset developers, differences in requirements between types of offset, government agency review and the making of an offset, an overview of the required elements in an offset proposal, public engagement, and siting within a landscape context.

Under both CWA and ESA, offsets are categorized by who creates the supply (aka the sellers): mitigation banks, in lieu fee programs (ILFs), or the permittees themselves (PRM). Each supply type has slightly different requirements under 'equivalent standards' (see Table 2) and this will determine how the offsets are developed.

The Sellers

Mitigation banks sell the most CWA and ESA credits, followed by credits developed by in lieu fee programs (see Table 1 and Figure 6). Only banks and ILFs sell credits. PRM are not credits that are sold, but are offsets developed and used for a particular project.

Mitigation Banks

Bankers enter the market when there is sufficient predicted demand within a service area. With exceptions, most banks are developed by private for-profit firms or public transportation agencies (departments of transportation, port authorities). The major types of for-profit companies involved in mitigation banks are limited liability companies, real asset-backed private equity firms, publicly-traded companies, and in rare cases non-profit organizations. Mitigation banks require a large initial investment to purchase the land, design and permit the project, and conduct the restoration work. BenDor et al. (2011) estimate the upfront capital outlay to be between 75% – 93% of total costs for a bank.

Additionally, mitigation banks do not realize returns until the bank has been approved by the regulator and has met administrative and ecological performance standards which takes an average of three years (see detail in Section 4 below). Mitigation bank development also requires a particular set of expertise, including experience with permitting, ecological restoration, and financing. Because of the capital outlay and specialized expertise, mitigation banking in the US has been dominated by private for-profit companies. The largest players in US mitigation banking own dozens of banks each (ex. RES, Ecosystem Investment Partners, Westervelt Ecological Services). There are also mitigation banking firms with smaller holdings and landowners that have developed banks with the support of consultants.[23]

Due to the scale of potential impacts, transportation agencies in essence create their own pool of demand for offsets (they are both buyer and seller). A 2016 report indicated that a quarter of approved banks were developed by state transportation agencies for their own use (USACE IWR 2016). Multiple publicly-traded companies in the timber and construction materials industries have also developed banks for both their own use as well as to sell on the open market (examples: the timberland investment management organization Lyme Timber, or by the real estate investment trust Weyerhaeuser, the construction materials company Vulcan Materials). It may also be the case that a bank is created when it is possible to add additional restoration to what would otherwise be a one-off PRM project.

In Lieu Fee Programs (ILF)

ILFs, whichare managed by a non-profit organization or government entity, are generally developed when the demand for offsets within a given service area does not meet the economies of scale for the private sector to invest. About half of all ILF programs in the US are developed by non-profit organizations. The non-profit organizations sponsoring the most active ILFs in the US in terms of credits sold are The Nature Conservancy (administering programs in Virginia, Maine, Ohio, and other states), Tennessee Wildlife Resources Foundation, and the Land Learning Foundation (RIBITS report access October 2024). The major way a nonprofit differs from the private sector entities noted above is that profit cannot be shared back with owners of the company and is instead reinvested in the work or mission of the organization. The remaining ILFs are created by government agencies, "including state departments of fish and game, natural resources, or environmental protection; local water management districts; and tribal and county governments" (Kihslinger et al., 2019). Government agencies sponsoring the most active ILFs are: the New Hampshire Department of Environmental Services, the Massachusetts Department of Fish and Game, and the Kentucky Department of Fish and Wildlife.

ILFs are not banks, but like banks they pool financial resources to consolidate offsets for multiple impacts into one greater area, and share most of the same requirements and review processes as banks. Unlike banks, the financial resources do not come from the private sector but from fees collected. Because private capital is not required in developing ILFs, most non-profit and government involvement in offsets is through ILFs.

Impacts can occur before an offset is completed in ILFs, and a specific site may not be secured nor workplan for restoration finalized prior to collecting fees. After approval of a legal document outlining the concept of the restoration plan, general geographic area, and many other details (see steps below), ILFs are allowed to sell 'advance credits'[24] (aka collect fees) up to a certain point that is negotiated on a case-by-base basis by the regulator that approves the ILF. The amount of fees that can be collected by an ILF

[23] Readers interested in reviewing the over 1,000 mitigation bank sponsor organizations may search the RIBITS report for contacts, choose 'sponsor organizations' and filter for mitigation bank sponsors.

[24] "Advance credits means any credits of an approved in-lieu fee program that are available for sale prior to being fulfilled in accordance with an approved mitigation project plan. Advance credit sales require an approved in-lieu fee program instrument that meets all applicable requirements including a specific allocation of advance credits, by service area where applicable. The instrument must also contain a schedule for [implementing the restoration that creates the offsets for the credits already sold]."

is commonly based on historical average permit needs in a watershed multiplied by three years (Environmental Law Institute, 2019). If ILFs fulfill the offset requirements of the fees collected and have additional approved offsets created from a site, they may sell them in the same way banks do.

Many ILF program instruments cover an entire state, which is the case in approximately 20 US states (RIBITS search for ILF program service areas, August 2024). Offsets (ILF project sites) must still be created in the watershed where the impact occurs. The legal instrument of the ILF merely allows the program to operate in a large area.

Permittee Responsible Mitigation (PRM)

PRM is created by the permittee or their consultant either on-site or off-site after the impact occurs. PRM are not credits that are sold, but are credits developed and used for a particular project. While it is fairly easy to identify the supply of bank and ILF offsets created in the US on RIBITS, details on PRM offset amounts and locations are unavailable without submitting a formal Freedom of Information Act request (FOIA) to USACE and waiting months to receive that data (up to 9 months in our experience). We have not attempted to obtain PRM records under ESA from the USFWS but would surmise it is even harder to obtain. Additional information such as restoration plans, monitoring reports, etc. are basically impossible for the public to obtain at scale for PRM (documentation for banks and ILFs are available on RIBITS, although there are data gaps). Lack of transparency of PRM is a severe issue with offset administration in the US as the public cannot verify that laws are followed, and regulators are not reporting this to the public (see Section 7, Box 2 for an example).

Over time, fewer permits are using PRM to offset impacts (see Figure 5 above). Previously, PRM was used in about half of all permits; it now accounts for less than 20%. This trend stems from both the equivalent standards and mitigation preference hierarchy requirements stipulated in the 2008 Rule.

Equivalent Standards and Supply

Before diving into the specifics of how offsets are created and approved, a review of the requirements based on credit type should be noted. As mentioned previously, both CWA and ESA offsets require, to the extent practicable, equivalent standards. The table on the following page lists the elements that are the same or differ depending on the offset developer category. The major differences are in when the offset occurs (before or after the impact), the level of rigor of review (higher for banks and ILFs), likelihood of site visits to ensure compliance (required for banks and ILFs, historically not completed for PRM, see NRC 2001), and transparency / documentation of the offset (information is on RIBITS for banks and ILFs, information is unavailable for PRM). Additionally, information like monitoring reports posted on RIBITS creates transparency and assurance that banks and ILFs are meeting requirements. There is no public transparency of PRM, and no public reporting that PRM requirements have been met.

Table 2: Similarities and Differences in Requirements under 'Equivalent Standards'
Note this table applies to both CWA and ESA offsets unless otherwise noted, and this table generalizes requirements–exceptions occur.

	Mitigation Bank	Permittee Responsible Mitigation	In Lieu Fee Program
When offset is implemented	Before impact	After impact. Both CWA and ESA recommend PRM be in-advance of impact when possible	Restoration must start a maximum of 3 years after impact / funds are collected
Allows some credits to be sold before restoration is complete	Yes, generally a portion of credits (15%) can be sold after the land is protected and the regulator approves all elements of the bank's plan (the instrument)	NA	Yes, 'advance credits' can be sold, the amount is usually equal to the historical average permit needs * 3 years (ELI, 2019)
Durability / funding for long-term management	Financial assurances prior to the completion of restoration, permanent site protection and non-wasting endowment for long-term management	Permanent protection and "long-term financing mechanism"	Same as bank
Legal responsibility for ecological success	Transferred to banker	Stays with permittee	Transferred to ILF program administrator
Elements in an approved restoration plan	See elements in Table 3 below. Bank and ILF are equivalent.	2008 Rule notes requirements should be "commensurate with the scale and scope of the impacts"	See elements in Table 3 below. Bank and ILF are equivalent
Level of review for approval Note: All have opportunity for public comment	Extensive review by regulatory agency and an Interagency Review Team (3+ years)	Review by regulatory agency, but not by an IRT (6-8 months)	Same as bank
Monitoring of ecological success by offset developer & regulator	Minimum 5 years (generally more, 7-10 years of offset developer monitoring/ reporting, annual regulator site visits	2008 Rule specifies a 5-yr minimum, for species, monitoring required but minimum period not stipulated. Decreased likelihood of regulator site visits with PRM.	Same as bank
Transparency / documentation of the offset	Instrument, monitoring reports, and credit transactions posted on RIBITS	Information not available	Same as bank

Government Review of Offset Projects

Both CWA and ESA offsets are approved by regulators after a review period that ranges from months to 12 years, with an average of three years for banks and ILFs and 6-8 months for PRM (Martin and Madsen 2023, IWR 2015). Banks and ILFs are reviewed not just by the main regulatory agency, but an Interagency Review Team (IRT) comprised of multiple federal and state agencies that have a substantive interest in the bank or ILF and "have authorities and/or mandates directly affecting, or affected by, the establishment, operation, or use [of the bank or ILF]" (2008 Rule). The IRT reviews and comments on three main stages of planning/documentation: an early prospectus of the project, a draft mitigation bank or ILF instrument, and a final instrument. 'Instrument' is the term used in the US to describe the "legal document for the establishment, operation, and use [of banks and ILFs]" (2008 Rule). Instruments follow a general template of about 20 pages followed by dozens or hundreds of pages of Appendices (a search of the five most recently approved CWA banks found that these documents ranged between 117 - 419 pages). Elements in bold are discussed in greater detail in the guidebook (below unless otherwise noted).

Table 3: Elements in Bank and ILF Instruments

Common elements of bank and ILF instruments

- Overview of the objective of the bank/ILF
- Description of the site and criteria for selection (including consideration of regional plans)
- Responsibilities of parties: bank/ILF developer (including assumption of legal responsibility of offsets), IRT, final land ownership & legal responsibility for site protection, long-term steward
- Service area (discussed in Demand section)
- Site protection mechanism
- Restoration plan including the site's baseline condition and restoration work plan
- Crediting methodology and determination of credits (discussed in Credit Methodologies section)
- Ecological performance standards and credit release schedule (discussed in Credit Methodologies section)
- Procedures for debiting, tracking credit sales, reporting to the regulator (discussed in Program Administration section)
- Monitoring, reporting, maintenance
- Long-term management of the site, including identification of a long-term steward and creation of a fund for long-term management[1] (discussed in Financial Assurances section)
- Adaptive management, contingencies for non-compliance, natural disasters, etc.How the instrument can be changed (major and minor modifications)
- Financial assurances (discussed in Financial Assurances section)
- How the bank/ILF will be closed

Elements specific to ILF instruments

- Allocation of advance credits
- Initial identification of ILF project sites, and how future ILF project sites are selected and approved
- Pricing of credits and changes over time (discussed in Financial Assurances, Offset Price section)
- Administrative fee
- Financial accounts, how funds are invested, how funds will be authorized/transferred to cover the cost of ILF site restoration work

Common appendices (all)

- Maps/surveys of the site, wetland boundaries, soils, hydrological studies, documentation related to permitting/compliance with other agencies (e.g., survey of protected species, historic and cultural surveys, a certification of the maintenance of water quality)
- Detailed work plans, species planting lists, invasive species control plans
- Budgets that relate to the level of construction/ implementation of financial assurances
- Detailed monitoring and long term management plans
- Description of mechanism used to ensure conservation in perpetuity & legal documentation, detail & legal documentation of financial assurances of long term management
- Legal documentation of title to the land and transfer of the land to the long-term steward

[26] After meeting all ecological performance standards, the bank/ILF land and long-term funding is transferred to a non-profit organization or public natural resource agency

Identifying the Optimal Offset Site within a Landscape Context

Both CWA and ESA offsetting policies are steeped with consideration of landscape-level conservation planning. Both policies define terms ('watershed approach', 'landscape scale approach') and encourage consideration of the landscape context in bank and ILF proposals. USACE and USFWS prefer that offsets are sited in areas identified in existing landscape-scale plans (e.g., state wildlife action plans, watershed plans), but policies do not require it (Robertson and Hough 2016). Researchers found that 50% of the species banks they reviewed did not explicitly mention landscape plans or priorities in documentation (Carreras and Toombs 2017).

Public Engagement

While banks, ILFs, and PRM are required to provide public notice and solicit input from interested stakeholders, this is not a step that elicits much input from the public. Very few people know where to go to find information on proposed projects requiring an ESA or USFWS permit. Two large mitigation banking firms noted that they rarely received public notice, but when they did it was often from a competitor (personal communication, anonymous mitigation bank staff, September 2024). Beyond public notice and comment periods, two proxies for public engagement are: engagement during state and local conservation or watershed planning (plans are supposed to be considered by banks and ILFs in siting decisions), and public agencies representing the public interest in bank and ILF reviews. A more transparent permitting process for CWA and ESA could lead to increased public engagement. For example, making all impact permit information available to view, along with proposals to create offsets. Additionally, the public could have the ability to sign up for alerts on public notices based on geography, amount of impact, or project type (e.g., construction of a new pipeline).

Credit Methodologies, Ecological Standards and Verification

This section includes a review of crediting methodologies, metrics/quantification/ratios, stacking, ecological performance standards and verification for credit release.

Crediting Methodologies of US Offsets

US offset programs require some form of quantification of impact and offset. A 'credit' is a unit of measure that represents the ecological uplift at a site from restoration, enhancement, creation, preservation, active management (e.g., prescribed burns), and other activities that provide benefit to the natural resource (the latter two activities are only noted in ESA mitigation policies). For wetlands and streams, the 2008 Rule gives a preference for restoration because "the likelihood of success is greater… and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation."

A weakness of US policies is that many regions came up with their own methods to credit wetland or stream benefits and impacts and the same is true for individual species. There are dozens of methodologies to determine the quantified unit of impact from a development project and amount of credits created by an offset project in the US (USGS 2022). For wetlands and streams, methodologies are focused on broad natural resource categories (e.g., freshwater wetlands, or sometimes a more specific sub-category like ephemeral wetlands). Despite the common habitat type, there are 40 different wetland and stream credit methodologies in the US developed by USACE Districts, at times with input from other federal or state agencies. This variety of methodologies to some extent is due to ecological variety.

For example, the USACE Charleston District has separate wetland and stream methodologies, and the USACE Galveston District has different methods for "herbaceous riverine," "lacustrine fringe," and "riverine," and "tidal fringe" aquatic resources. Beyond the ecological explanation of differences, the variety of methodologies is also a noticeable outgrowth of the divested power to interpret the 2008 Rule at the USACE District level. Granted, many CWA credit methodologies are similar; researchers pointed out that eight USACE Districts used some variation of the USACE Charleston District methodology (EPA 2010, ELI 2016). The variety to some extent erodes economies of scale with mitigation banking firms practicing across multiple regions that must become experts in every methodology, but also can be seen to allow for experimentation and innovation.

While a wetland credit methodology would apply to all wetlands within a USACE District, for ESA offsets each species requires its own credit methodology. The reason US species credit methodologies are species-specific is because the Endangered Species Act itself is focused on individual species. The single-species focus of the ESA contrasts with regulations outside the US focusing on protecting holistic habitat categories or 'biodiversity' itself, such as England's "Biodiversity Net Gain" policy. The exact number of species credit methodologies is unknown, but researchers from the US Geological Survey (USGS) collected 33 methodologies in 2022 (USGS 2022). As there are 56 different species that have credits listed on RIBITS (not including grouped credits[25]), we suspect that there are additional methodologies &/or that a methodology may apply to more than one species. It is worth noting that the vast majority of protected species (1,674 species) do not have a credit methodology at this time. Creating a new methodology is a time-consuming process and the onus (/cost) may largely be put on the offset developer. New offset programs could consider allocating budget to developing methodologies, particularly for species or habitats with the greatest number of permits.

Of the dozens of CWA and ESA credit methodologies, there are similarities in parameters assessed and methods of calculation. The general types of methodologies are listed below, and detailed examples are included for reference in the Appendix (Table 6 and Figures 11-12 for species credit methodologies and Figures 13-18 for wetland and stream credit methodologies).

- **Ratio methods** provide a minimum of 1 credit for every 1 area unit restored / require a minimum of 1 credit for every 1 hectare impacted. The ratios may vary based on whether the activity is restoration, enhancement, or preservation (e.g., granting 1 credit for 2 acres of restoration vs. granting 1 credit for 15 acres preserved); and resource type (e.g., granting more credits for shrub-scrub wetlands than for submerged aquatic vegetation). Example of ratio methods: USACE New England District, Golden cheeked warbler credit.

- **Credit / debit tables** incorporate ratios plus either qualitative scoring of administrative or resource factors; or a quantitative / quasi-quantitative assessment of resource function & condition. Factors have multipliers that are summed and multiplied by area or length to result in credits generated. Common factors are: resource type, level of monitoring rigor, mechanism of site protection, priority area / category, and net benefit assessment (e.g., a scoring based on categorical descriptions of restoration actions or functional assessments). Example of credit / debit table methods: USACE Charleston District (credit / debit table plus functional assessment of net improvement factor), Vernal pool preservation bank crediting.

[25] In California in particular, species credits are often categorized as a single credit (e.g., California tiger salamander) as well as a grouped credit where multiple species are on the same unit of land (e.g., a "CTS / SJKF / SWHA / BUOW" credit that includes California tiger salamander, San Joaquin kit fox, Swainson's hawk, and Burrowing owl).

- **Quantitative methods** incorporate simple to rigorous field assessments of the condition of simple indicators of existing condition or quality, or measure more complex features or indicators of ecological processes. The assessment would be for both the project site (existing condition) and either a reference site (as proxy for post-restoration), or modeled post-restoration assessment. For example, a credit could be calculated as UPLIFT % score * ACREAGE based on multiple factors measured or assessed of existing conditions and post-restoration conditions. The Texas Rapid Assessment Method (TXRAM) method helpfully incorporates field measurements that are already required for a wetland determination.[26] Example of conditional assessment methods: TXRAM, FWS' Indiana field office guidelines for non-REA staging/swarming mitigation.

- **Resource equivalency analysis (REA) and habitat equivalency analysis (HEA)** are methods that were created for US laws requiring compensation for damages from man-made catastrophes like oil spills. REA and HEA have been used in species crediting in some instances (e.g., salmonid species, raptor species, and most recently endangered bats). REA/HEA "provides a unit of measure and a framework for comparing losses and gains" and are represented in units of resource services focused on a species (e.g., bat years), or a suite of ecosystem services provided by a habitat (USFWS, 2014, Desvouges et al., 2018). Example of an HEA method: salmonid species HEA methodology.

We have found no research on whether one credit methodology creates better outcomes from a biodiversity perspective. From an investor perspective, predictability is key to understanding whether a restoration project can create a financial return as well as ecological benefits (e.g., the project may be profitable if it yields 100 credits, but not if it yields 50 credits). If a government is considering methodologies, they should test whether the credit methodology is objective enough that multiple users would come to the same number of calculated credits. If a methodology depends too much on subjective interpretation or opinion, an investor may be hesitant to propose projects if their credit quantification estimates are wildly different from the regulator's estimate.

Stacking – You Can't Sell Twice

In terms of compliance offsets (offsets used to fulfill regulatory obligations), under US law and policy, it is not permitted to sell a wetland or stream credit and later sell a species credit off the same land (or vice versa), it is not permitted to sell carbon off a wetland or stream credit used for compliance under CWA 404(d) per the 2008 Rule, and it not permitted to sell carbon off a species credit[27] used for compliance under the ESA per the 2023 ESA Mitigation Policy. Compliance credit stacking was only tried once in 2009 - selling a water quality (nutrient reduction) credit off an established wetland bank - and it was harshly criticized. No project developer has attempted stacking compliance credits since and it remains a topic of philosophical discussion but no action.

What project developers can do in the US is develop multiple types of credit and either: sell one and retire the other, or sell a bundled credit (as mentioned, this only happens in California). In reality, this only happens in California. Per 2023 ESA mitigation policies, a single unit of a mitigation site could "provide compensation for two or more spatially overlapping ecosystem functions or services that are grouped together into a single credit type and used as a single commodity to compensate for a single permitted action." Species credits in California may be categorized as a single credit (e.g., California tiger salamander) as well as a grouped credit where multiple species are on the same unit of land (e.g., a "CTS / SJKF / SWHA / BUOW" credit that includes California tiger salamander, San Joaquin kit fox, Swainson's

[26] A wetland determination (also known as a jurisdictional determination) is a field survey defining the border of wetlands and streams that fall within the protection of the CWA. This is a required step in obtaining any CWA permit, including getting a permit to develop a bank or ILF.

[27] "The loss of species habitat at the impact site included all functions and services associated with that habitat, including carbon sequestration, so selling that same unit of compensatory mitigation again for carbon sequestration results in no carbon offset for the loss of carbon sequestration at the second impact location" (2023 ESA Mitigation Policy).

hawk, and Burrowing owl). But, the 2023 ESA policy [hits home] "the project developer cannot unstack the stacked credits to provide mitigation for more than one permitted impact action even if all resources included in the stacked credit are not needed for that action."

Ecological Performance Standards and Verification for Credit Release

Both CWA and ESA banks are required to meet administrative and ecological performance standards before regulators (in consultation with the IRT) allow credits to be sold. This verification of meeting standards before offsets can be sold is called credit release in the US. Bank and ILF instruments will specify a schedule of credit releases in multiple stages: initial, interim, and final credit release. Initial release may be tied to administrative/preservation goals like having a conservation easement in place and instrument approved by the regulator. Interim credit releases may be tied to completion of construction, and for stream credits 'bankfull events'[28] to ensure that stream geomorphology performance standards are met after a flood event. For restoration projects, the regulator may release credits after reviewing required monitoring reports &/or a site visit. Preservation credits may be released sooner - potentially as soon as site protection and long-term funding mechanisms are in place - because preservation credits are not contingent on meeting ecological milestones that restoration would be required to track and prove. See examples of bank credit release schedules and performance indicators below.

Note that ILF credit releases are somewhat different from banks because of an ILF's ability to sell advance credits. As we noted above, the amount of advance credits granted to an ILF is commonly based on historical average permit offset needs in a watershed multiplied by three years. Advance credits have similar administrative standards to a bank's initial credit release: credits are granted when "the project site or mitigation plans are approved, the site is secured (protected), financial assurances have been established, and any other requirements established by the district have been met" (EPA 2022). Advance credits are "paid back" when the commitment to provide the offset is completed (/ the site has met performance standards).

[28] Per USACE (2013), the definition of bankfull is "The water level, or stage, at which a stream, river or lake is at the top of its banks and any further rise would result in water moving into the flood plain. It may be identified by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."

Table 4: Examples of Credit Release Schedules and Ecological Performance Standards
Key: w = wetland, str = stream, s= species. Performance measures are simplified for ease of understanding.

Bank or ILF	Initial release	1st interim release	# of additional releases	Final release	Final release
Butler Creek, 2022 (wl, str)	30% (str) 15% (wl) Approved instrument, conservation easement in place, short term financial assurances in place	10% (str) Construction per stream design 20% (wl) Planting / construction stage (including dam breach). Both: long-term management account funded, as-built monitoring report provided.	5 (str) 4 (wl)	20% (str) after 2nd bankfull event 20% (wl) Both: after TXRAM assessment - multiple indicators including: "250+ stems / acre of desirable tree species [surviving] for 5+ yrs"; index of biotic integrity = or > baseline	Aligned with TXRAM methodology
Blue Heron Slough, 2014 (s)	15% Approved instrument, conservation easement in place	15% Portion of restoration complete, 'as-built' monitoring report review, indications of newly created hydrologic connections	2	10% Yr 5 performance standards met (3): 60% survival of riparian woody plantings and evidence of natural recruitment of native wetland/riparian species; 50% of intertidal zone is native salt or brackish marsh vegetation; amount of large woody debris is = or > 50% of baseline	Also requires invasive species no > baseline. Factors evaluated not completely aligned with credit methodology.
Bandera Conservation Bank, 2011 (sp)	No staged credits. 100% credit release conditional on approved instrument, conservation easement in place and accepted by qualified easement holder, long-term management fund in place.				Credits are all preservation at simple 1:1 ratio.

A 2012 study reviewed 722 approved wetland and stream banks and found that 98.3% of banks have met or are meeting their performance standards as indicated by credit release review and approval by USACE and the IRT (Denisoff and Urban 2012).

Financial Assurances, Offset Price, Risk and Profitability

This section includes a review of financial assurances, ILF fees and bank prices, and seller-side perspective of risk and profitability.

Financial Assurances for Long Term Management and During Restoration Work

US offsets consider financial assurances in two categories: 1) funding for long-term management, maintenance, and monitoring; and 2) financial assurances while restoration activities are taking place. Both the 2008 Rule and USFWS mitigation policies require long-term management funding, but only the 2008 Rule specifies shorter-term financial assurances while the USFWS mitigation policy mentions this only briefly in relation to the principle of durability.[29]

The 2008 Rule requires that bank and ILF instruments describe "provisions necessary for long-term financing… [including] provisions to address inflationary adjustments and other contingencies, as appropriate." Mechanisms noted in the 2008 Rule include: "non-wasting endowments, trusts, contractual arrangements with future responsible parties, and other appropriate financial instruments." USFWS mitigation policies only reference an endowment. A 2022 guide for interagency reviews provides additional detail on appropriate methods for considering long-term stewardship costs, contingency rates (generally between 10% – 30%), administration costs, and consideration of inflation (EPA 2022). The amount of funding required is calculated as "the annual cost of management divided by the expected earnings from investment of those long-term management funds, adjusted for inflation" (Ibid). The instrument also must describe the means for funding the long-term management fund. From a review of 11 mitigation bank instruments, the amount of long-term management funds ranged from USD 50,000 USD - USD 1,200,000 USD, and were funded as a lump-sum payment, or as a percent or set amount of each credit sold until the endowment is fully funded (ex: 3% of each sale, USD 5,000 of each sale). For additional information, see the USACE's helpful 2016 resource on "Implementing Financial Assurance for Mitigation Project Success" (USACE IWR, 2016).

[29] The FWS mitigation policy generally mentions "Proponents [i.e., offset developers]] provide assurances of durability, including financial assurances, to support the development, maintenance, and long-term effectiveness of the mitigation measures" (FWS mitigation policy, 2023).

The 2008 Rule provided guidance on shorter-term financial assurances which ensures that the restoration work plan is implemented. This is a hedge against risk of failure of achieving ecological performance standards, and is particularly salient when the initial credit release is solely based on meeting administrative performance standards (see Table 4 above for examples). In a review of 10 mitigation bank instruments, we found escrow funds, performance bonds, maintenance bonds, and a letter of credit with amounts ranging from 30% to 100% of restoration costs. Some instruments include an exhibit of all estimated expenses as the basis for the short-term assurances, others have this information redacted.[30] The 2008 Rule states that short term financial assurances are phased out "once the compensatory mitigation project has been determined by the district engineer to be successful in accordance with its performance standards."

Establishing ILF Fees and the Need for Full Cost Accounting

Both the 2008 Rule and ESA mitigation policy make a statement that credit pricing is up to the bank or ILF, but that's not entirely the case with ILFs because ILF fees are reviewed and approved by USACE and in consultation with the IRT during the instrument review process. In response to concerns that ILFs underpriced credits &/or failed on delivering mitigation, the 2008 Rule includes a section that requires ILFs to base their prices on 'full cost accounting.' Full cost accounting requires that a credit price reflect all of the time, expenses, and land costs of the full lifecycle of creating, stewarding, and providing a long-term endowment for the offsets created. Full cost accounting is an important concept in a fee-based offsetting program, because there is a possibility for a government entity or non-profit to unintentionally subsidize development. Examples of practices that should not be replicated in offset programs:

- ILF fees were set without consideration of a real estate boom, and thus the fees are too low to purchase land. The result is the ILF fails to meet mitigation obligations.
- A taxpayer-funded government employee is using their staff time on an offset project "for free" and does not include that cost in the credit price.
- Taxpayer-funded lands already protected for conservation purposes are "donated" for free for an offset project and the cost is not included in the credit price.
- A non-profit may co-mingle grant funds and use what otherwise would have gone to conservation to subsidize an offset.

Additionally, these practices price out private investment because they are artificially low. Section 7 discusses issues with government development of offsets in further detail.

Unlike banks, ILFs publish the fees they charge. Nascent offset programs may be curious on methods for pricing offsets. The table below shows examples including: a flat rate for a given resource type (wetland, stream, or more specific category) for a given watershed; a base rate plus multipliers (and sometimes discounts for bulk purchases); calculators; or complex formulas (Table 5).

[30] "Most ILF programs and/or Districts consider their [budget] content to be proprietary or confidential information, not subject to release under the Freedom of Information Act" (EPA 2022a)

Table 5: Examples of ILF Fees

NC ILF Fees Statewide (non-premium areas, USD per acre)			NC ILF Fees Premium Areas (excerpt, USD per acre)		
Statewide Standard	Stream	USD 739	Catawba 03050102 and 03050103	Freshwater Wetlands (Riparian & Non-Riparian)	USD 126,110
Statewide Standard	Freshwater Wetlands (Riparian & Non-Riparian)	USD 76,838	French Broad 06010105	Freshwater Wetlands (Riparian & Non-Riparian)	USD 114,714
Statewide Standard	Coastal Wetlands	USD 757,898	Neuse 03020201	Freshwater Wetlands (Riparian & Non-Riparian)	USD 117,715
ME ILF Fee Base Rate Per Watershed (excerpt)			ME ILF Resource Multiplier (excerpt)		

Table 1 Resource Compensation Rates 1/1/2024 to 12/31/2025		
County	**Natural Resource Enhancement & Restoration Cost/ Sq. Ft.**	**Avg. Assessed Land Value/ Sq. ft.***
Androscoggin	$5.05	$0.23
Aroostook	$4.69	$0.02
Cumberland	$5.05	$0.96
Franklin	$4.69	$0.07
Hancock	$4.69	$0.26

1. A resource multiplier of 2 shall be used for:

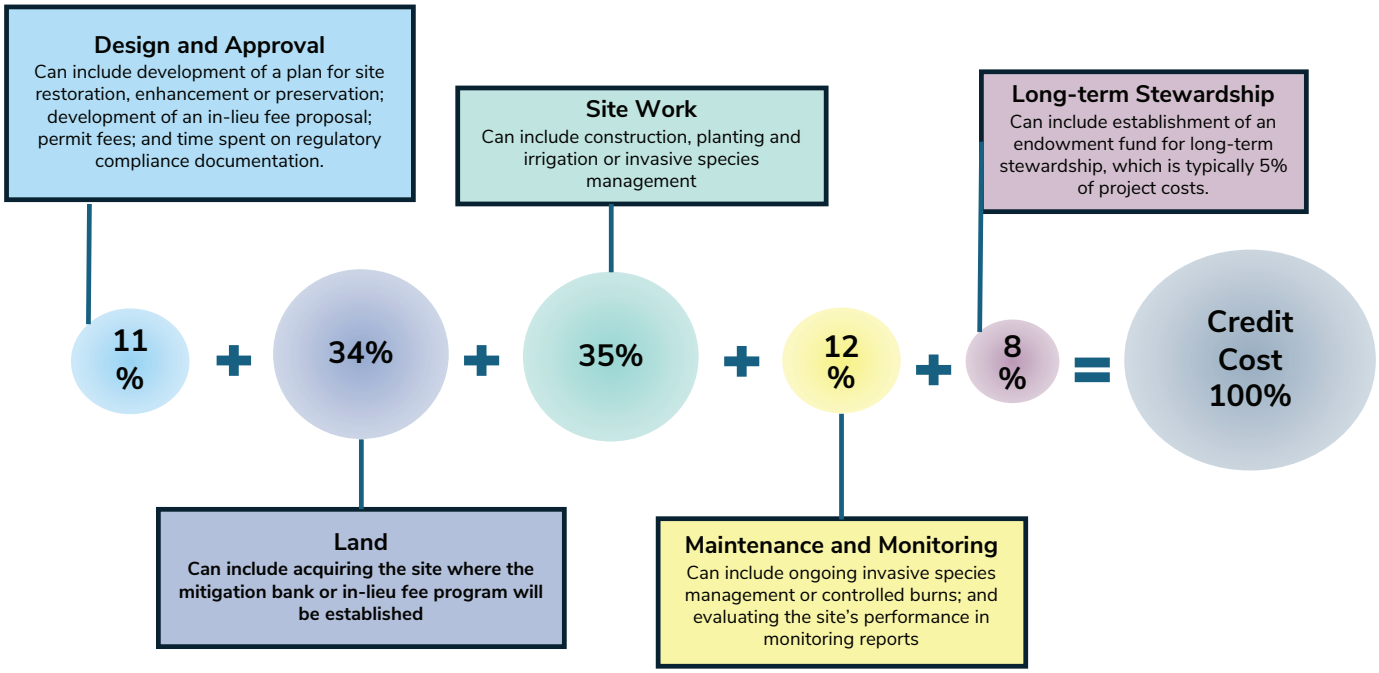
   a. Direct impacts to wetland areas containing at least 20,000 square feet of aquatic vegetation, emergent marsh vegetation or open water, except for artificial ponds or impoundments and areas of wetland routinely altered by anthropogenic activities such as road ditches etc;
   b. Direct impacts to peatlands dominated by shrubs, sedges and sphagnum moss;
   c. Direct impacts to coastal wetlands;
   d. Direct impacts to freshwater wetland areas contained within an inland wading bird & waterfowl habitat (IWWH);
   e. Direct & indirect impacts to a shorebird habitat and associated buffers;
   f. Direct impacts to great ponds; and
   g. Direct impacts to freshwater wetland areas contained within a significant vernal pool habitat.

OR ILF Fee Calculator (excerpt, link downloads spreadsheet)

Enter the DSL Application Number:		*Enter the DSL-assigned application number, if known (APP0000000)*	Current Calc
Area to be mitigated (acres)	1	*Insert the acreage of the wetland loss that must be mitigated. Enter to the nearest 0.01-acre for impacts greater than 0.01 of an acre or to the nearest 0.001-acre for impacts les than 0.01 of an acre.*	1
Tax lot acreage (impact site)	10	*Insert the total acreage of the tax lot where impact is located*	10
Real market land value of tax lot	$ 20,000.00	*Insert the real market land value for the tax lot; do not include the value of structures or improvements. Refer to the most recent property tax statement from the county assessor* or from a recent land appraisal. The proportional cost of the area to be mitigated is used in the payment calculation.*	$ 20,000.00
Zoning Adjustment Factor	1	*Insert the correct adjustment from table 1 based on the zoning of the tax lot being impacted*	$ 1.00
Restoration cost (per acre)	$39,524	*Insert the restoration cost from table 2 for the basin where the impact is located*	$ 39,524.00
PAYMENT REQUIRED:	$ 205,517.62	Payment = (RMV + R + LT + A)*mm or calculated to not exceed maximum cost per acre. See information below.	$ 205,517.62
			$ 205,517.62
			$ 300,000.00

Table 2: Restoration Cost by Basin	
Basin (6 digit hydrologic unit code)*	**Wetlands (per**
Black Rock Desert (160402)	$27,996
Deschutes River Basin (170703)	$39,832
John Day River Basin (170702)	$27,996
Klamath River Basin (180102)	$35,899
Lower Columbia (170800)	$28,796
Lower Snake (170601)	$30,754
Middle Columbia River Basin (170701)	$39,524
Middle Snake-Boise (170501)	$27,996
Middle Snake-Powder (170502)	$27,996
Northern Oregon Coastal (171002)	$24,670
Oregon Closed Basins (171200)	$27,996
Southern Oregon Coastal (171003)	$20,979
Upper Sacramento (180200)	$27,996
Willamette River Basin (170900)	$24,886

Figure 8: An illustrative example of the five types of costs that determine Mitigation Bank and In-Lieu fee program credit prices (Bennett et al., 2017)



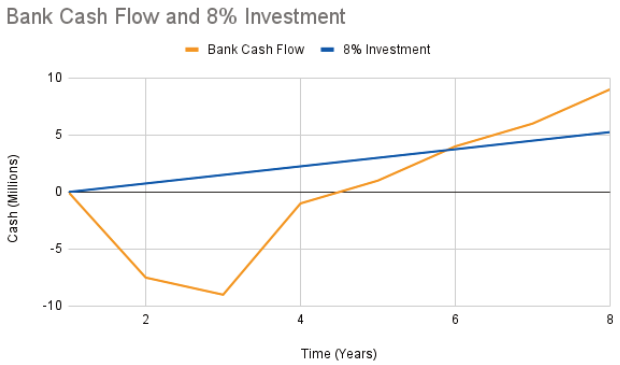
Note: In the study by the environmental nonprofit Forest Trends, tha authors collected detailed project cost data from administrators of 12 mitigation bank and in-lieu fee programs in the United States to develop this figure

Seller-Side Perspective of Risk and Profitability

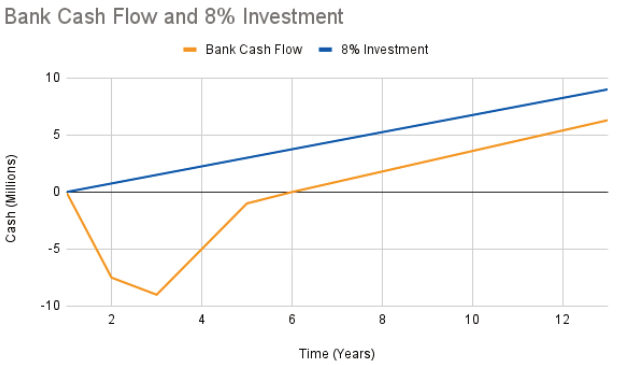
The discussion on the factors to consider in full cost accounting noted above apply to banks as well as ILFs. Cost of capital and risk are additional factors unique to banking. ILFs collect fees, private banks must find a source of funds and pay their lenders or investors back plus interest. Banks also have to cover the cost of risks related to permitting, including the delays that banks experience in the approval process, the possibility that a bank will not be approved at all, the risk that credits will take longer than expected to sell, or that credit releases will be delayed, or that regulations will change that will kill demand for credits, and many other risks. The average timeframe for the approval of CWA banks is 3 years, but the full range is from 78 days - 12 years (Madsen and Martin 2023). The average time of credit releases is three months after the request is received (it is supposed to take 45 days, per the 2008 Rule). For additional detail on risk in mitigation banking see: "The Business of Banking" (Denisoff 2021), an excellent training module that details business considerations; and "Navigating Wetland Mitigation Markets: A Study of Risks Facing Entrepreneurs and Regulators" (Hook and Shadle, 2013), which provides a detailed review of risks. Figure 9 shows an excerpt from Denisoff (2021) explaining how a longer timeline to sell credits (right side) may make investment in a bank unprofitable.

Figure 9: Cash Flow vs. Standard Investment

Scenario: credits sell out in 5 yrs



Scenario: credits sell out in 10 yrs



Source: Denisoff (2021)

Bank Credit Prices

Banks are not required to disclose the price of their credits. Ecosystem Marketplace has collected credit prices anonymously from US banks on two occasions (2010, 2017), and found a range of wetland prices between USD 17.5k – USD 923.4k per unit[31], and species prices between USD 2.4k – USD 137.5k per unit (Ecosystem Marketplace, 2017, p.44-45). A private firm has created a business out of collecting bank credit prices published publicly in public agency receipts from payment for offsets and news articles (EASI 2024). Published ILF credit prices can also be a proxy for bank credit prices (see Table 5).

Bankers consider a credit price ceiling as what a PRM project would cost, as this is a permittee's alternative to purchasing a credit. That said, a bank could charge over and above the cost to develop PRM because of the time and convenience factor of a permittee satisfying their regulatory requirements immediately upon purchase of a credit.

[31] A majority of offsets are area based, others are functionally based. See additional detail in Section 4.

Investment Drivers

This section includes a discussion of the role of private finance in developing a supply of offsets, the role of government investment in offset creation, and broader government investment in offset program development and implementation.

Role of Private Finance

Private finance plays two essential roles in US programs that have been critical for their success, expansion, and longevity. First, businesses take on the risky activity of anticipating and building credit supply where demand remains uncertain or unknown. For example, regional housing construction trends may change, or an anticipated, major transportation or energy infrastructure project may be delayed by years or canceled. Private investment has typically been behind entrepreneurial efforts to build supply where it might be needed in the future. Public agencies are typically unwilling to build offset supplies without more certainty that demand is certain and by that time it is too late. Second, what is probably the single most important feature of US stream and wetland credits (and to a lesser extent species credits) is that the majority of projects must demonstrate they have met ecological and physical success criteria before credits can be sold. This policy requirement is directly connected to the ecological success of the programs, but it likely could not exist but for private capital.

An average of 150 wetland & stream and species mitigation banks are approved every year in the US. Those banks may require 6 months to 2 years of real estate and other preparatory work before owners submit applications for bank approval and an average of 3 years before banks are approved and are allowed to sell credits. If banks have customers lined up in advance, they may be able to earn 10-20 percent of expected revenue upon bank approval, but the remainder of credits cannot be sold for up to five or even ten years after approval. Thus, all US mitigation banks[32] require significant upfront private capital to fund the development of credits from the beginning of the proposal through approval, through funding of a non-wasting endowment, and finally to credit releases.

[32] ILFs have advance credits to sell to cover expenses.

The per hectare costs of creating a bank and funding its long-term stewardship endowment range from USD 42,000 – USD 993,000, with an average of USD 518,000 (Bennett et al. 2017, ELI 2002, NRC 2001).[33] BenDor et al. (2011) have estimated that banks require between 75% - 93% of the total costs for upfront capital. With an average of 14,000 hectares in mitigation banks approved each year[34] and using the most conservative estimate of per hectare costs,[35] upfront capital requirements for all mitigation banks in the US is a minimum of USD 440m per year. As we noted in Section 1, about 75% of banks are created by private sector mitigation firms, which implies private investment of at least USD 330m per year.

Multiple international and national investors have significantly funded the US firms that develop credit projects. Institutional investors are known for being relatively conservative in their risk tolerance and rather sophisticated in their selection of placements, and the fact that so many have invested speaks well to the predictability of demand and potential for growth that these companies represent. A large number of companies and projects also depend upon smaller investments, personal investments, and bank loans to build supplies of credits in advance of sale. The following are examples of investors with a minimum of 50m, but often much more, invested in US companies that develop credit projects:

- **International pension funds.** Three Danish pension funds (Sampension, AP Pension, and Lærnernes Pension) have pledged USD 162m to Ecosystem Investment Partners latest fund (2024). Caisse de dépôt et placement du Québec (CDPQ), a Canadian public retirement and insurance fund invested in Westervelt Ecological Services in 2021 and 2023.
- **US state pension funds.** The Minnesota State Board of Investment (pension fund) (2023), Washington State Investment Board (WSIB; 2019), and New Mexico Educational Retirement Board have invested hundreds of millions in these companies.
- **Other private investments.** Toronto-based Onex Partners V fund and global investment firm KKR have invested more than USD 0.5 billion in one company that provides credits (2016; 2022). Publicly-traded climate investor, Hannon Armstrong, has also backed credit projects.

The other effect that private finance has had in benefiting the development of credit projects in the US is that the scrutiny of projects and project portfolios by investors has likely led to more rigorous due diligence in picking good projects and in requiring companies to have thoughtful strategies for regulatory approval, credit release, and other verification hurdles that could impede projects from being approved. It is hard to get information about how often this is part of due diligence around investments, but there is anecdotal evidence that this happens and has benefits to credit supply and credit quality.

Role of Government in Project Finance

With regards to government investment, government agencies - most typically departments of transportation and port authorities - use government funding to create mitigation banks to meet their own current and projected future demand. From the calculations above, this translates to a minimum of USD 150m of annual government investment in the production of offsets. Government agencies also administer in lieu fee programs that create offsets, but these do not use government funds as a source of capital, but rather collect fees from project developers seeking permits.

However, there are also specific, additional roles that government can play in making credit markets successful and attractive to private investment.

[33] The figures here are an average of the three sources, adjusted for inflation.
[34] Calculated as the average acreage of banks approved over the last 5 years, based on RIBITS data.
[35] Applying the high end per acre cost to all banks would result in an unreasonable high end range, so we applied the low end range of per acre costs (17,000) and the average per acre cost as the high end (210,000).

Offtake agreements. As with renewable energy finance, transportation, port, military and other government agencies frequently sign agreements that commit them to purchase some or all credits from banks in the future at an agreed upon price, before credits have been approved or in advance of infrastructure projects formally requiring credits. These agreements have helped secure adequate supplies of credits to meet public needs and also significantly reduce risks to capital that has to be deployed to produce those credits.

Creating credit supply in low demand areas. In areas with insufficient demand for private investment in banks, agencies sometimes take on the role of an ILF program administrator. The best example is the state of North Carolina Department of Mitigation Services, which collects fees in watersheds with no available supply and creates a bidding system for contractors to fulfill that need / create the offset.

I**ncreasing consistency and predictability of the market.** There are a number of ways that agencies have lowered risk to investment by making programs work more consistently across regions. For example, by creating templates and credit methodologies (particularly for species or habitats with the greatest number of permits).

Avoiding stranded assets. Agencies have sometimes made decisions that have undermined demand for credit supplies, but can also make choices that ensure that changes in programs do not penalize earlier efforts to create credits. For example, funding consistent and repeated evaluation of offset programs, and if adjustments are needed in the program, 'grandfathering' offsets already created that can be sold without change.

Seeding a new program or market. Agencies can pilot test the implementation of offsets in an administrative region as the USFWS Sacramento regional office did, or develop an offsets program at the state level, as California did for species regulated at the state level.

Program Administration

This section includes a review of administrative elements not included above such as tracking impacts, tracking offsets, and monitoring and enforcement mechanisms.

Regulators of offsets in the US have multiple tools and mechanisms for administration of offset programs, including systems of tracking impacts and offsets, evaluation (at a minimal level), and enforcement mechanisms.

Tracking Impacts – USACE's ORM Database and USFWS' ECOS Database

For CWA offsets, on the impact side, USACE has a national permit database called ORM (which stands for the OMBIL Regulatory Module, and OMBIL stands for Operations and Maintenance Business Information Link). Staff create unique records for permits and track the location and amount of authorized impact, whether it is temporary or permanent, what type of aquatic resource was impacted, whether offsets were required, and more (see Appendix, Box 4 for additional detail).

For ESA Offsets, the USFWS' main threatened and endangered species information platform, ECOS, does provide links to permitting documentation for over 5,000 Section 7 and Section 10 permitting & planning documents as of July 2024.

Tracking of Offsets – the RIBITS Platform

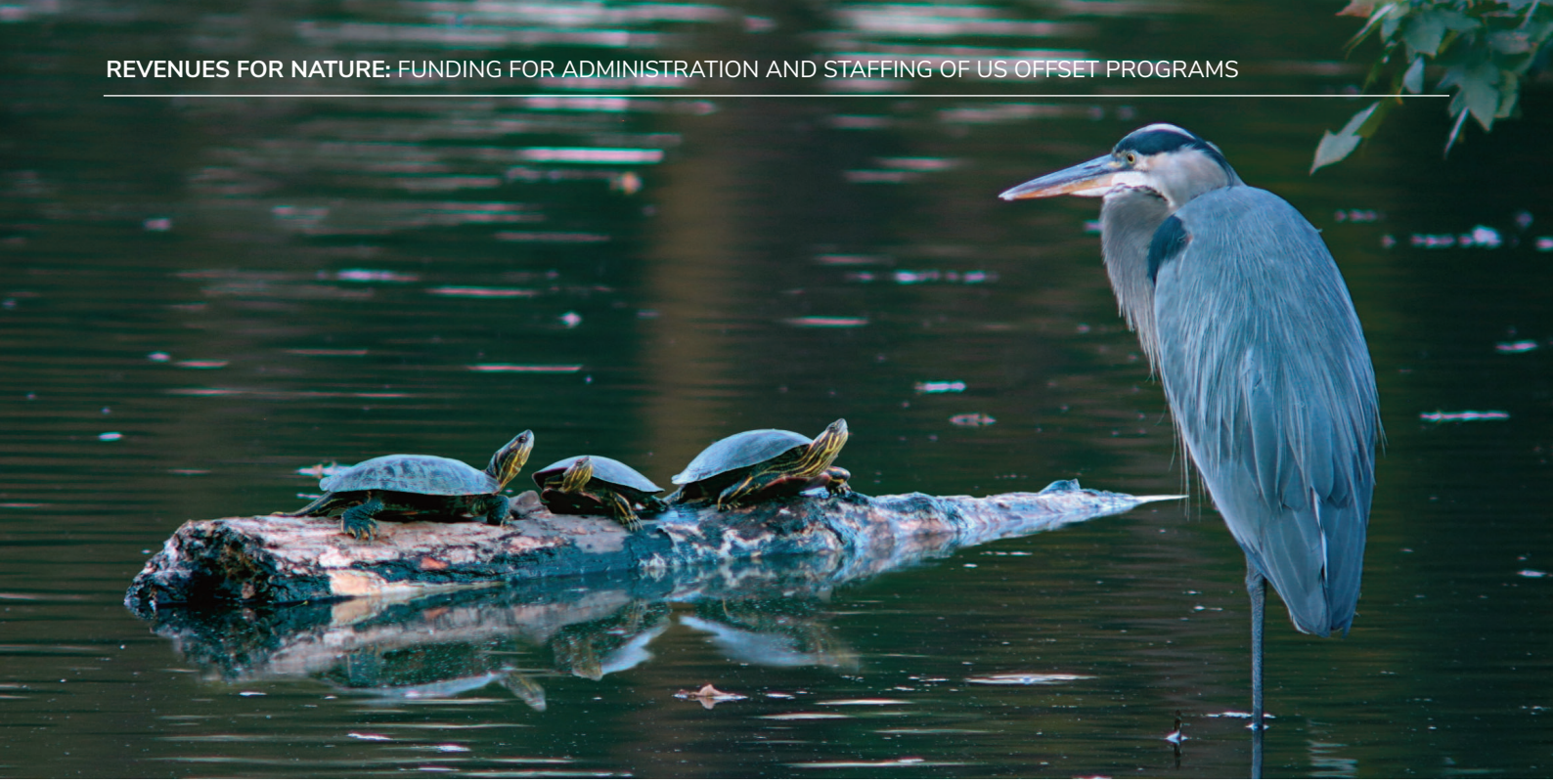
The online database called Regulatory In-Lieu Fee and Banking Information Tracking System (RIBITS) was adopted by USACE Districts and some USFWS regions in the late 2000s and provides accountability and transparency of bank and ILF offsets.

RIBITS provides a publicly-available platform (ie., registry) on the location of banks and ILFs, documentation (including instruments and monitoring reports), and credits available for sale and credits sold. The link between RIBITS and USACE's ORM database occurs when a wetland or stream credit is sold, it is associated with the unique ID of the impact permit. For species credits, there is no data tie between RIBITS and the USFWS' ECOS internal database.

The site is key for both buyers needing credits, and sellers considering their 'competition' when determining new bank or ILF projects. The site also provides opportunities to download and analyze data, and includes an API (application programming interface, which provides a way to 'tap into' data). APIs are important because they provide a way for external users to tailor data to their needs.

Monitoring and Enforcement

There is rigorous monitoring, reporting, and review of individual banks and ILF programs by USACE, USFWS, and interagency review teams (IRTs). Bank and ILF instruments include stipulations about the type and frequency of monitoring, and credit releases are tied to meeting ecological milestones. Regulators review monitoring reports and annual reports that provide updates on long-term management funding, credit ledgers, and financial assurances. Regulators also conduct site visits to ensure compliance. Regulators have the following mechanisms for dealing with non-compliance: delaying release of credits, developing a corrective action plan, decreasing the amount of available credits, suspending credit sales, directing an ILF to purchase mitigation credits (if the program has not initiated restoration within 3 years of an advance credit sale), suspending operations, mobilizing financial assurances, and terminating the bank or ILF (Richardson 2021, Oversight and Compliance training module).



Lessons Learned and Opportunities to Replicate and Improve upon the US Offset System

The US has proven itself to be investable market because of:

- Strong, predictable, stable, and enforced offset regulations
- The ability to transfer legal liability
- A preference for offsets created in advance of impacts
- Equivalent standards between private, public and non-profit offset developers
- Verification by regulatory agencies to ensure offsets are meeting all requirement
- Government accountability and capacity to implement its own policies

Below we review these and other key features for replication and improvement in detail. We also review opportunities for tribal participation in offset programs, and other lessons that have been noted in the guidebook, synthesized here for reference.

Replicating Strong, Predictable, Stable, and Enforced Offset Regulations

The US has learned that simply enacting a Clean Water Act was not enough to catalyze a market. There are many key elements to catalyze a market noted in this section, but adopting a no net loss policy goal with enough leadership support and political will to enforce were key policy steps. After early experimentation with wetland and stream offsets, a major evaluation of early offsets by the National Research Council (2001, approximately a decade after no net loss goal adoption) provided over two dozen recommendations for a course correction in the offset program. Many of the recommendations were adopted in the 2008 Rule for wetlands & streams (and were mirrored in species offsets policies later). The entire NRC report is an excellent study on lessons learned from a country struggling with early implementation of offsets, and is a superb snapshot of how a policy framework can be analyzed and ultimately refined for far better outcomes. Highlights of the NRC recommendations include: requiring better compliance from PRM, adopting a watershed-based approach to offsets, creating a preference for offsets developed in advance of impacts, and requiring legal and financial assurances for long-term durability of the offset.

While there were many intermediate policy and guidance steps for offsets between the early 1990s and the early 2000s, the evolution of a new industry group, the Ecological Restoration Business Association (formerly known as the National Mitigation Banking Association, established in 1998) added pressure to formalize regulations. Following the development of this industry group, in 2004, Congress inserted language in a defense funding bill in 2004 that required regulatory agencies to develop the 2008 Rule.[36] In contrast to this 2008 Rule, ESA offsets for species only had guidance on 'conservation banks' in 2003 until a formal policy was issued in 2023. In the US, guidance does not have the same level of force as policy or regulation and has resulted in far fewer offsets developed in advance of impacts. During the Obama administration, a Presidential Memorandum along with a Department of Interior Secretarial Order (3330), provided the push to draft and then adopt USFWS and ESA mitigation policies in 2016. The Trump administration rescinded these in 2018, and mitigation policies were recently re-adopted with minor adjustments in 2023 (FWS Mitigation Policy, and Endangered Species Act Compensatory Mitigation Policy). One of the adjustments was to adopt a no net loss goal instead of a net benefit goal, the latter of which had been the subject of push-back from entities seeing this as a government overreach.

It cannot be overstated that the US offset market is one completely dependent on regulation and consistent implementation of regulation. The steps that could be replicated in another country, state or other administrative unit to create a strong offset program are: 1) adopt a no net loss / net benefit policy goal with the political will / leadership support to enforce it, 2) evaluate early implementation and course correct, 3) write and adopt enforceable regulation and implementation policy and guidance, and 4) maintain a predictable regulatory environment that attracts private investment.

Replicating Transfer of Legal Liability

Purchasing an offset created in advance of an impact is far more attractive if the permittee is not legally on the hook for any future failure of the offset. In other words, the purchase of the offset absolves the buyer of liability of the ecological success of the offset. The offset developer is the one that is scrutinized by regulators to ensure the ecological success of the offset. This transfer of liability should be included in any nascent market. Example text from the 2008 Rule:

> *"The responsibility for providing the required compensatory mitigation is transferred from the permittee to the third-party mitigation sponsor after the permittee takes the necessary steps to secure those credits and the district engineer has received the appropriate documentation in accordance with §332.3(l) [§290.93(l)]." (2008 Rule)*

Replicating a Preference for Offsets Created in Advance of Impacts

While the concept of a mitigation hierarchy (avoid, minimize, mitigate, offset) is well established amongst offset experts, the US uniquely adopted a mitigation preference hierarchy to prioritize offsets created in advance of impacts. This came from lessons learned with PRM in the days of early offset implementation. The 2001 NRC report identified multiple instances of offsets required by permittees that were not completed, lacked inspections to ensure compliance, and were disconnected from conserved lands or landscape priorities.

The mitigation preference hierarchy both reduces ecological risk (e.g., offsets are not available to be sold until performance standards are met), and stimulates investment in private sector banks. While government and non-profit organizations can and do create offsets in advance of impacts, the private sector has created the majority (roughly 75% of offsets). A nascent offset program should include

[36] "Section 314 of the National Defense Authorization Act (NDAA) for Fiscal Year 2004 (section 314) requires the Secretary of the Army, acting through the Chief of Engineers, to issue regulations "establishing performance standards and criteria for the use... of on-site, off-site, and in-lieu fee mitigation and mitigation banking as compensation for lost wetlands functions in permits issued by the Secretary of the Army under such section'" (preamble to the 2008 Rule).

language indicating a preference for offsets that are created in advance of impacts, have verified ecological performance, permanent site protection, and are larger/more ecologically valuable with more rigorous scientific and technical analysis.

For more specific language about the mitigation preference hierarchy in the 2008 Rule and species mitigation policies, see Appendix, Table 7. Interestingly, both the 2008 Rule and species mitigation policies include the logic behind the preference hierarchy, describing the characteristics of banks or ILFs that are preferable over PRM but noting that these characteristics could be achieved by any form of mitigation.

Replicating Equivalent Standards Creates a Level Playing Field

The equivalent standards principle in the 2008 Rule and species mitigation policies provide assurance to the public, the regulator, private sector offset developers, and investors that any type of offset developed will achieve equivalent ecological performance, additionality, and durability. All forms of offset are faced with the same requirements which translates to equivalent costs. Therefore, private sector investment in developing offsets should not be undercut by a PRM offset that was cheap because it "got away with" less stringent requirements. The adoption of equivalent standards has been a significant driver of demand for bank and ILF offsets and should not be overlooked in policies that wish to replicate the best elements of the US offset system.

Areas for Improvement in Government-Run Offset Development

Section 7 discussed challenges of government-run offset development. While new offset programs might view government agencies as potential developers of offsets, the US' experience suggests caution. Based on past challenges, it is strongly recommended to implement safeguards if government agencies are involved in offset development. First, the equivalent standards noted above should apply to government agencies (with public reporting or transparency to assure this is happening). Second, when government agencies develop offsets, the prices of offsets should be based on the full cost accounting of developing those offsets, including the price of the land and staff time. US ILF programs often include a prudent contingency that nearby bank credits could be purchased to fulfill offset obligations if the program has not started restoration in a timely manner (defined as 3 years in the US). Another option would be for the program to open a competitive bid for external offset developers to use the funds collected to fulfill offset obligations that the ILF has not fulfilled. Other safeguards for ensuring that government-run ILFs uphold offset principles can be found in Doyle et al. (2019, p.24-28).

Replicating and Improving on Verification, Accountability, and Evaluation

The thorough review of individual bank and ILF instruments by USACE, USFWS, and Interagency Review Teams shows a high level of verification that other offset programs could emulate. Some aspects of the US's Interagency Review Team could be improved upon, namely holding IRT members accountable to review deadlines, and creating an understanding that while team member input will be considered, the USACE has final decision making authority. The US has done a good job of establishing review timelines for stream and wetland offsets (but unfortunately not for species offsets). However, the review process is plagued by delays, and simply having a deadline written in regulation is not enough. Deadlines + sufficient staffing + leadership holding staff accountable are elements that the US and other offset programs should adopt for efficient review of offset proposals. It shouldn't be easier to approve a permit for a parking lot than for a wetland restoration project. The senior leader of USACE echoed these accountability mechanisms in an agency memo released very recently ("Improving U.S. Army Corps of Engineers Timeline Compliance with the 2008 Compensatory Mitigation Rule," USACE, September 2024). For additional recommendations on addressing bottlenecks in the review process, see the 50+ recommendations in Madsen and Martin (2023, p.22-29).

While the US is doing a good job of making bank and ILF information transparent on its RIBITS platform, information like instruments, monitoring reports, and other items are not available for 100% of banks and ILFs. The US and other countries should put in place routine reporting and accountability of proper documentation of offsets. See Section 7 Box 2 for an example of hidden problems that go undetected in an offset program when information is not provided transparently, &/or regular evaluation is lacking. The US and other countries should also ensure public transparency for all forms of offsets (including PRM, which the US has not done and is a major flaw for tracking no net loss of resources), and public transparency of where impacts are occurring and to what extent. It is heartening that a great deal of impact/permit information is captured by USACE in their internal ORM database (see additional detail in Section 7), but the lack of transparency / transparent evaluation or reporting dampens the optimism. There should be routine publicly available evaluations of the required elements of offset programs, as well as broader evaluation of whether no net loss has been achieved. For example, as we noted in the introductory section, offsets from preservation are supposed to be used only in rare circumstances, but accounts for about 18% of approved offsets from banks and ILFS. This and other information mentioned should be routinely evaluated to ensure that the implementation of an offset program is doing the best it can to meet regulatory goals.

Adopting e-permitting that provides a public interface is another opportunity to provide public transparency and accountability. The state of Virginia has adopted technology that takes great strides in improving transparency, accountability, and evaluation. Permitting Enhancement and Evaluation Platform, or PEEP is "... a publicly-accessible online platform where anyone can search and find details about a permit and where it is in the approval process." The platform provides public transparency of where permits are (with links to additional information) but it also incorporates smart project management functionality. PEEP automatically creates Gantt charts and target deadlines for parts of the approval process. The user can see whose desk the application is on (e.g., the state regulator, a federal agency, or the project developer) and it is easy for staff to enter a timestamp to track the timeline of the approval process. There are automatic reminders when a deadline is approaching, and performance reports are automatically generated to find out where the system is working well or failing. Finally, interested stakeholders can download permit data. The system was created with a budget of roughly USD 100k and was completed in about one year (Rolband, personal communication, 2023). Overall, PEEP is an elegant solution for project management and public transparency of permitting and offset data and is recommended for offset programs. For additional recommendations on general e-permitting systems, see Madsen et al. (2024).

Lessons about Tribal Participation in US Offsets Programs

This discussion is adapted from Black Bird et al., 2022 *and* Black Bird and Male, 2022a.

The development of biodiversity offsets or similar instruments in indigenous and local communities' lands has long been an issue of controversy and poorly developed policy, generally to the detriment of those communities and peoples. Indigenous communities in the US, generally referred to as tribes,[37] have developed mitigation banks on their own lands, and have thus played a role in the US offset market system. To the best of our knowledge, there are currently seven tribal compensatory mitigation projects; six mitigation banks and one in-lieu fee program:

- MS Band of Choctaw Indians
- Lummi Nation Habitat and Wetland Mitigation Bank
- Oneida Wetland Mitigation Bank
- Charles Etok Edwardsen Mitigation Bank (Ukpeagvik Inupiat Corporation)

[37] "Tribe" is used broadly in this guidebook in the US context, referring to the 574 federally recognized tribes and Alaska Native Corporations (ANC) in the US. Other terminology may be preferred outside the US including Inuit, Yup'ik, and Aleut Peoples; First Nations, First Peoples, or Aboriginal; and indígena comunidad (indigenous community).

- Ghost Dike Advance Mitigation Bank (Shoalwater Bay Indian Tribe)
- Villines Mitigation Bank (Cow Creek Bank of Umpqua Tribe of Indians)
- Quil Ceda Village InLieu Fee Program (Tulalip Indian Tribe)

However, these banks developed despite challenges related to policy definitions and requirements. The US has no guidance pertaining specifically to tribes and CWA or ESA offsets. Additionally, US offset policies include language that creates challenges for tribal participation and have treated tribes in a way that is inappropriate for tribal sovereignty (though this has been improved in the 2023 ESA offset policies). For example, US policies address private and public entities without defining what a private and public entity is. This distinction matters to a tribe because tribes are not private entities, nor are they a public entity. Tribes should be treated as a government, upholding the government-to-government relationship. The 2023 USFWS policy addressed this issue by separately noting tribal lands and tribes rather than lumping tribes into public entities, private entities, or leaving them out. Both the USFWS mitigation policy and the 2008 Rule include language about conducting government-to-government consultation if a proposed offset project may affect a tribe's interests (resources, rights, or lands). The 2023 USFWS mitigation policies also mention coordination and collaboration with tribes during early planning and effects assessment.

The most common method for permanent site protection in US offset programs is protecting the land under a conservation easement (a legal document restricting the use of the land), and transferring the land title to a non-profit organization or government agency. Requiring a tribe to use this conventional method – giving away land – is inappropriate when viewed from the perspective of tribal sovereignty. Tribes' deeply rooted historical mistrust of government attempts to control and take away tribal lands plays a role here. Conservation easements also open the door to enforcement of activities occurring on tribal lands, by non-tribal parties. Granting conservation easement enforcement rights could be seen as akin to diminishing tribal sovereignty. Site protection mechanisms should address tribal concerns of trust, perpetuity and protecting tribal sovereignty, as well as implementing cultural considerations, promoting tribal authority, and reserving tribal treaty rights on the offset site. Alternative site protection mechanisms are more appropriate, as reflected by the recently adopted language in the 2023 ESA offset policies:

> *"6.2.5. Compensatory Mitigation on Tribal Lands. Tribal lands are generally eligible as compensatory mitigation sites if they meet the standards and other requirements set forth in this policy. The Service recognizes that Tribes are sovereign nations and will consider them as government entities when we consider the eligibility of Tribal lands for compensatory mitigation. Ensuring durability, particularly site protection, is usually a sensitive issue for a Tribal nation because a conservation easement entrusts the land to another entity (Terzi 2012). Alternative site protection mechanisms are allowable for Tribal lands including, but not limited to, intergovernmental agreements, Tribal integrated natural resource management plans, memorandums of agreements, or other long term contracts that ensure Tribal sovereignty and governmental status is upheld."*

Tribes have a role to play in offset programs, whether as a consulted party, a developer responsible for offsetting unavoidable adverse impacts, an offset project sponsor, or as a long-term manager or steward of the site. The 2023 ESA mitigation includes the following language to support this opportunity:

> *"6.2.4. Transfer of Private Mitigation Lands to Public Agencies. Mitigation providers may transfer private mitigation lands to public agencies with a conservation mission or Tribes if allowed by applicable laws, regulations, and policies."*

A restored mitigation site, even with an existing conservation easement, may be favorable to a tribe because tribes have a real interest in restoring the ownership and health of their ancestral lands. We are unaware of any public or private bank or ILF that has transferred offset lands or long-term stewardship to tribes, but tribes should be considered a valuable option for transfer of land, and long-term management of an offset site and its permanent financial endowment.

Greater detail on recommendations for considerations of tribes in offset policies may be found in "Promoting Tribal Roles in Providing Compensatory Mitigation Offsets" (Black Bird and Male, 2022a).

Lessons about Credit Stacking

In terms of compliance offsets (offsets used to fulfill regulatory obligations), under US law and policy, it is not permitted to sell a wetland or stream credit and later sell a species credit off the same land (or vice versa), it is not permitted to sell carbon off a wetland or stream credit used for compliance under CWA, and it not permitted to sell carbon off a species credit[38] used for compliance under the ESA.

In the US, no one has attempted stacking compliance credits since one failed attempt in 2009 and it remains a topic of philosophical discussion but no action. The U.S.'s 30-year experience shows that stacking credits often adds complexity without resulting in benefits or activity. This suggests that nascent markets forgo stacking, at least in earlier phases. However, if an offset program decides to take on credit stacking, it should be prepared to closely track credit sales and retirement. If an offset program is going to take this approach, it should be prepared to closely track credit sales. For additional detail on stacking, see Section 4.

In conclusion, the US offset system offers valuable lessons for nascent programs worldwide. Key elements for success include strong and enforced regulations, transfer of legal liability, preference for advance offsets, equivalent standards across developers, robust verification processes, and transparent accountability measures. While the system has its strengths, there are also areas for improvement, particularly in government-run offset development and tribal participation. By carefully considering these lessons and adapting them to local contexts, new offset programs can build upon the US experience to create more effective and equitable systems that truly achieve no net loss of ecological resources.

[38] "The loss of species habitat at the impact site included all functions and services associated with that habitat, including carbon sequestration, so selling that same unit of compensatory mitigation again for carbon sequestration results in no carbon offset for the loss of carbon sequestration at the second impact location" (2023 ESA Mitigation Policy).

Appendix - Additional Information

Box 3: What Gets Counted in the Evaluation of No Net Loss of Aquatic Resources by the USACE

The Numerous, Minimally-Adverse Wetland and Stream Impacts Permitted under Nationwide PermitsThe majority of the roughly 50,000 annual wetland and stream permits in the US utilize one of 56 nationwide permits, which cover categories of activities,[39] for projects that meet certain conditions and are expected to have "no more than minimal adverse environmental effects" (EPA 2024, USACE 2021, Matson 2024). The thresholds for impacts that do not need offsets are between 0.04 - 0.2 hectares (0.1 - 0.5 acres) for wetland impacts and less than 0.012 hectare (0.03 acre) for streams.[40] The bottom-line is that an estimated around 2,22000 hectares of loss are permitted annually and this is accounted for separately and isn't considered in the no net loss equation for CWA permits. USACE ORM Data and Program Evaluation of No Net Loss of Aquatic ResourcesIn terms of evaluating no net loss of aquatic resources, the USACE is very specific about what type of impact they technically considered a loss:

- Only losses of aquatic resources that are determined to be "Waters of the US" in its current legal definition (see more discussion on changes to the extent of WOTUS in Section 1, Box 1)
- Only losses that permanently change an aquatic resource to dry land count for individual permits are counted on the loss side of the equation
  - Temporary impacts do not count.
  - Documentation that was provided during the delivery of data from a FOIA request indicated that "When calculating impacts used in our overall no net loss reports, we only include certain impact activity types - discharge of dredged material, discharge of fill material, and the fill associated with excavation activities." The USACE's manual for its ORM database indicates that the following impact types do not permanently change an aquatic resource to dry land and are not counted as wetland loss: "conversion of water type, dredging, ecological restoration, removal, structures, transport of dredged material, or other work (e.g., aquaculture, directional boring, aerial crossing)."
- Only permanent losses from individual (more complex) permits that account for 6% of all aquatic resource impact permits are considered in the loss equation. Impacts from nationwide permits are recorded but are only evaluated to determine if a project is meeting the threshold of the nationwide permit - between 0.04 - 0.2 hectares (0.1 - 0.5 acres) for wetland impacts and less than 0.012 hectare (0.03 acre) for streams.[41] Annual impacts from nationwide permits are estimated at "approximately 5,482 acres [2,197 hectares] per year" (USACE 2021). USACE described this as a conservative estimate as some of the impacts are categorized as temporary, and even the impacts categorized as permanent "may not convert waters and wetlands to uplands or built structures" (USACE 2021). Regardless, USACE does not 'count' these impacts in its calculation of no net loss, it only counts the impacts from the other ~6% of permits, 'standard individual permits.' USACE defends this decision by pointing out that the policy goal of no net loss lacks the legal weight that federal statute or regulation has in the US.[42]Gains are tracked as the offset associated with an individual permit with permanent loss.

[39] There are 56 nationwide permits. Examples of what these permits cover: residential developments, agricultural activities, land-based renewable energy generation facilities, electric utility line and telecommunications activities, oil or natural gas pipeline activities.

[40] Notes on offset thresholds: These thresholds are included in "nationwide permits" that cover similar activities anticipated to have minimal adverse effects. Thresholds have changed over time, and stream thresholds were not adopted nationally until 2021. Regardless of these thresholds, regional regulators have the discretion to require offsets for these nationwide permits even if the impacts are below the thresholds.

[41] Notes on offset thresholds: These thresholds are included in "nationwide permits" that cover similar activities anticipated to have minimal adverse effects. Thresholds have changed over time, and stream thresholds were not adopted nationally until 2021. Regardless of these thresholds, regional regulators have the discretion to require offsets for these nationwide permits even if the impacts are below the thresholds.

[42] "There is no federal statute or regulation that requires 'no net loss'' of aquatic resources. The 'no overall net loss' goal for wetlands articulated in the 1990 U.S. EPA-Army Memorandum of Agreement for mitigation for Clean Water Act section 404 permits states that the section 404 permit program will contribute to that national goal. The 1990 Memorandum of Agreement only applies to standard individual permits, not to general permits." (USACE 2021a, p.9)

Table 6: Species Credit Methodology Examples

Note: The following are examples of ESA credit methodologies, categorized by the general type of methodology.

Category of Methodology	Example
Ratio	"One GCW [Golden Cheeked Warbler] Credit will be created for each acre of suitable GCW habitat within the Easement Property, which will initially be based on the acres of suitable GCW habitat delineated in the Endangered Species Habitat Assessment" (Bandera Conservation Bank, Texas, 2011).
Credit / debit table	Determination of Available Credits and Service Areas for ESA Vernal Pool Preservation Banks (1996, found within Dove Ridge Conservation Bank credit evaluation documentation), see Figure 12 below. Note that we found two other vernal pool crediting systems, one a simple 2:1 ratio[45] (1996) and a quantitative functional assessment[46] that includes assessment of baseline and reference area conditions (2020).
Quantitative example – simple	FWS' Indiana Field Office Guidelines for Non-REA Staging/Swarming Mitigation (2018). Credits based on distances from an Indiana bat hibernaculum. For example, within a 0-1 mile ring, each 20 acres mitigation yields 1 percent of each covered bat species female population. The Bat Conservation Bank of Indiana calculated credits as such: "2,263 Indiana bat staging / swarming credits generated from this site: [(114.1 acre site / 20 acres / 100) * (39,697 female bats)" with the number of bats based on estimates of female bats using the site. The Indiana bat also has an REA methodology (see Figure 12 a-c below).
Habitat equivalency analysis	Salmonid species HEA methodology that determines a baseline and post-restoration habitat value to create a DSAY unit (discounted service acre-years). "The use of HEA requires several input parameters including the size of an affected area and nearshore habitat service values" the latter of which requires the use of an additional tool that considers physical and biological features of salmon habitat (National Oceanic and Atmospheric Administration, 2024).

[43] Programmatic Formal Endangered Species Act Consultation on Issuance of 404 Permits for Projects with Relatively Small Effects on Listed Vernal Pool Crustaceans Within the Jurisdiction of the Sacramento Field Office, California, 1996.

[44] California Rapid Assessment Methodology for Vernal Pool Systems (2020), referenced in Antonio Mountain Ranch Mitigation Bank documentation, 2018 (the bank used an earlier version of the methodology).

Figure 12: Vernal Pool Crediting Methodology

Note: The following is a specific example of a credit / debit table methodology for a species offset. Source: Dove Ridge Conservation Bank credit evaluation documentation, p.11-18

VERNAL POOL PRESERVATION BANK
CREDIT DETERMINATION METHOD

CRITERIA CATEGORY	VALUE	POINTS
1) Preserve Size	0 → 1000+ acres	0 → 2+
2) Vernal Pool Type*	add up to 2.00 points for rare types	0 → 2
3) Number of Federal/state listed, proposed listed, and candidate vernal pool species considered rare or endangered under CEQA	add up to 1.00 point for each species	0 → *n*
4) Rare Species of Particular Concern (see Table 3)*	add up to 1.00 point for each species	0 → *n*
5) Condition of the Site*	4 subcategories	0 → 2
6) Defensibility of the Site*	3 subcategories	0 → 2
	Total Points =	_____

Bank Value = Total Points ÷ 6 (number of categories above).
Total Bank Credits = Bank Value × number of acres of vernal pools on the bank site.

Figure 11: Example of REA Crediting Methodology for Indiana Bat

Note: The following is an example of a complex quantitative methodology - or more specifically, a type of Resource Equivalency Analysis (REA) method for a species offset. The figure below shows an overview of the methodology. Source: FWS, 2014. To see a worked example, see model inputs and outputs in the Protected Bat Species Habitat Mitigation Plan for the Crescent Wind Project, Hillsdale County, Michigan, May 2022, p.49-52 (link opens pdf).

Figure 1. A schematic of the Indiana bat REA Model.

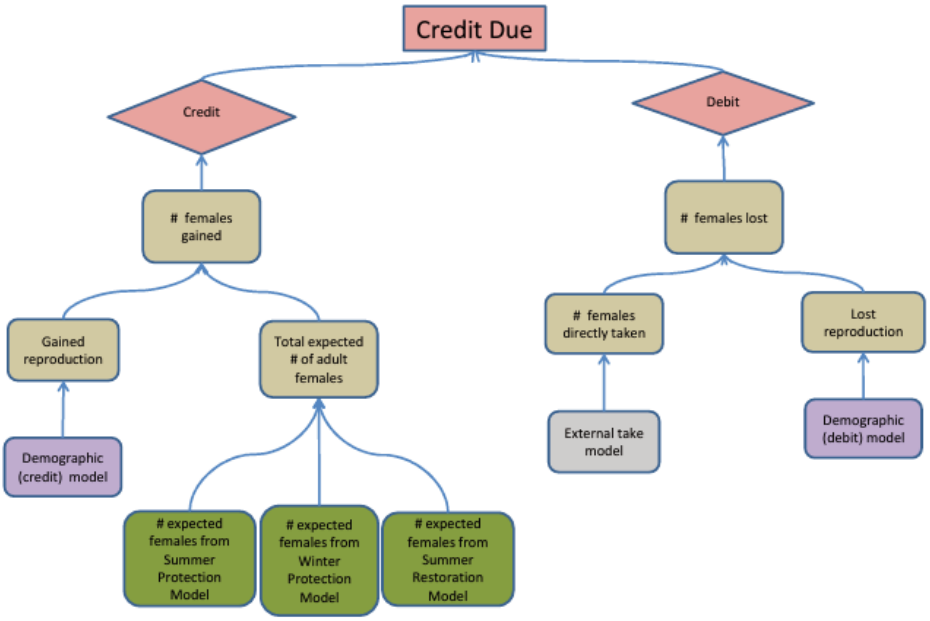


Figure 13: Example of Ratio Crediting Methodology for Stream Restoration (USACE New England)

Note: The following is a specific example of a ratio method for stream crediting. Source: USACE, 2020 (p.49-50)

TABLE C5 – RECOMMENDED COMPENSATORY MITIGATION MULTIPLIERS FOR STREAM CREDIT GENERATION

Starting Stream Condition / Form of Mitigation[21] (all shown as credits/lf)	Severely Degraded	Poor	Fair	Good	Excellent
Preservation - Additional credit may be granted if entire meander width, which is wider than 100' from the stream, is protected.	No credit[22]				Preservation of 100' unaltered[23]
One Side		No credit[21]	No credit[21]	0.1[22]	0.2
Both Sides				0.2[22]	0.4
Installation of fish ladder (length of stream made accessible to migratory species)					N/A
1st 3 miles		0.01			
> 3 -10 miles[24]		0.005			
Rehabilitation of the stream, riparian area, and/or floodplain[25], resulting in improvement of channel condition (e.g., poor to good):					
1 step			0.5		
2 steps			1.0		
3 steps			2.0		
Removal of dam or other barrier					
a. Footprint	2.0 (use linear feet[29] for stream or square feet for wetland credits)				
b. Former impoundment[26]	. . . . . .2.0				
c. Below dam improvement to channel condition					
1 step	. . . . . .0.25				
2 steps	. . . . . .1.0				
3 steps [27].	. . . . . .2.0				
d. Up to 3 miles above former impoundment[28]	. . . . . .0.02				
e. >3 to 10 miles[23] above former impoundment[5]	. . . . . .0.01				

[21] Mitigation types can be additive if more than one type of mitigation is being done to a length of stream.
[22] Unless associated with enhancement to bring stream to higher functional conditions, in which case 0.25 for one side and 0.5 for both sides.
[23] No forestry, agriculture, or other modifications to the buffer. In order to qualify for preservation credit the riparian area quantity score must ≥7 on both banks, and the riparian area quality must score ≥6 on both banks using Stream Visual Assessment Protocol 2.0.
[24] If evidence is provided that the benefits reach a greater extent that what is currently being calculated, then credits may be calculated on a case by case scenario.
[25] This might involve daylighting a channel, reconnecting a stream to its floodplain, reestablishment of a riparian buffer, reestablishment of a natural channel, installation of coarse woody debris, exclusion of livestock, upgrading a culvert to meet the New England District Best Management Practices for Stream Crossings, stormwater improvements, etc.

Figure 16: USACE Charleston District Stream Crediting Methodology

Note: The following is a specific example of a credit / debit table methodology for a stream credit that also includes a functional assessment of its 'net improvement' factor. Source: USACE Charleston District, 2010

A 2010 EPA report noted that eight Districts based their stream methodologies on the Charleston District credit table highlighted here. This methodology also happened to be the first stream crediting methodology developed in the US in 2002 (updated in 2010). The figure below shows the factors used in the Charleston District methodology for stream restoration and Figure 15 below shows how this was worked out for an approved bank. The Charleston District's 2010 "Guidelines for Preparing a Compensatory Mitigation Plan" describes how the scores for each factor are determined.

RESTORATION MITIGATION FACTORS FOR LINEAR SYSTEMS				
FACTORS	**OPTIONS**			
Stream Type[1]	Non-RPWs 0.05	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)	All Other Streams 0.2	
Priority Category	Tertiary 0.05	Secondary 0.2	Primary 0.3	
Net Improvement[2]	Refer to Net Improvement in Section 2.0. (Definitions), pg. 4 to calculate NI value			
Credit Schedule	Not Applicable 0	After .02	Concurrent .05	Before 0.1
Location	Case by Case 0	Drainage Basin .02	Adjacent HUC .05	8-Digit HUC 0.1
Riparian Buffer	Calculate Value from the Riparian Buffer Factor in Section 2.0 (Definitions)			

[1] Stream type does not include man-made linear features

[2] Net Improvement Values are for in-stream work only. For riparian buffer enhancement of preservation choose **Not Applicable** under Net Improvement and calculate buffer values under Riparian Buffer

Explanation of scoring in the figure above. In this case, streams larger than second order tributaries receive the highest score for the stream type factor while non-navigable ephemeral streams receive the lowest score. The highest score in the 'priority' category goes to locations identified as priorities by federal or state agencies (e.g., 'Wild and Scenic River' designation, or presence of a FWS endangered species). The 'net improvement' factor is more complicated and based on an assessment of both the restoration project site and a reference stream. The assessment includes 10 sub-factors like epifaunal substrate or available cover, bank stability, and vegetative protection (Figure 15 and 16 below). For one example of the sub-factors considered in the 'net improvement' assessment, the highest score for 'channel sinuosity' is if "The bends in the stream increase the stream length 3-4X longer than if it was in a straight line" (USACE Charleston District, 2010).

Other factors make more sense from the perspective of PRM. For example, for the 'credit schedule' factor, a bank will always score the highest score (0.1) because the offset is completed before the permitted impact occurs, but PRM may not start until after the impact. Likewise for the 'location' factor, the score will be 0 for banks because the location of the impact is unknown as it is associated with future permitted impacts.

Figure 15: Example of Determining Net Improvement of Streams in Crediting Methodology for Stream Restoration

Note: This is the second part of the Charleston stream credit method - a functional assessment of the "net improvement' factor. Textual documentation is below, followed by an excerpt of an assessment data sheet. Source: USACE Charleston District, 2010 (p.53, 71).

Net Improvement is an evaluation of the net level of functional lift to an aquatic resource resulting from a proposed mitigation action. This factor is evaluated based on anticipated functional improvement with values of 0.5 for minimal functional improvement, 1.0 for moderate functional improvement, 2.0 for significant functional improvement, and 3.0 for maximum functional improvement.

Steps to determine the appropriate value for Net Improvement:

1. **Refer to functional assessment sheets in Appendix D.**
2. **Complete the appropriate form (low-gradient or high-gradient streams) for the proposed restoration reach.**
3. **Complete the appropriate form (low-gradient or high-gradient streams) for the reference reach.**
4. **Determine your final score by inserting the scores from 2 and 3 (above) into the formula below:**

   Reference Reach Score (#3) – Proposed Restoration Reach Score (#2) = Final Score

5. **Determine Net Improvement Value using Final Score from # 4 (above) and the chart below.**
6. **Record value on Restoration Mitigation Factors worksheet under Net Improvement.**

If the final score is:	The value is:	And the net improvement is:
11 to 15	3.0	Maximum Improvement
7 to 10	2.0	Significant Improvement
4 to 6	1.0	Moderate Improvement
1 to 3	0.5	Minimal Improvement

LOW GRADIENT STREAM ASSESSMENT DATA SHEET				
Stream Name	Basin/Watershed:		USGS Quad:	
Latitude:	Longitude:		County:	
Date:	Time:		Investigator:	
Stream width:	Stream Depth:		Length of Stream Reach:	
Has it rained within the past 48 hours?		Adjacent land use? (Industrial, agriculture, etc):		
Habitat	**Condition Category**			
Parameter	Fully Functional	Partially Impaired	Impaired	Very Impaired
1.Epifaunal Substrate or Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e.logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat lack of habitat is obvious; substrate unstable or lacking.
SCORE	2.0	1.5	1.0	0.5
2.Pool Substrate Characterization	Mix of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mix of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan, clay, or bedrock; no root mat or vegetation.
SCORE	2.0	1.5	1.0	0.5
3.Pool variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.

Figure 17: Worked Example of Stream Restoration Crediting

Note: The figure below shows how a real mitigation bank stream restoration project was assessed using the Charleston methodology (credit / debit table plus functional assessment of net improvement). The columns indicate different reaches of the streams. The bottom three rows sum the scores of the mitigation factors and multiply this by linear feet to determine credits. Source: Approved mitigation instrument for Arrowhead Farms Mitigation Bank, 2015, in USACE Charleston District.

FACTORS	Elisha's Creek (upper)	Stream 2M (upper)	Stream 3-2	Stream 3-3	Stream 3C	Stream 5 (Middle)	Stream 5 (Lower)	Stream 5B	Frenchman Creek (Stream 6A)
Stream Type	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Priority Category	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Net Improvement	2	3	2	2	2	3	2	3	3
Credit Schedule	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Location	0	0	0	0	0	0	0	0	0
Riparian Buffer Side A	0.19	0.33	0.22	0.2	0.22	0.27	0	0.3	0.27
Riparian Buffer Side B	0.19	0.19	0.22	0.22	0.16	0.28	0.23	0.3	0.27
Sum of Mitigation Factors	2.98	4.32	3.24	3.22	3.18	4.35	3.03	4.4	4.34
Linear Feet of Proposed Restoration	2515	854	1322	860	661	888	986	1975	1613
M x LL	7494.7	3689.28	4283.28	2769.2	2101.98	3862.8	2987.58	8690	7000.42

Figure 18a - b: Example of a Quantitative Conditional Assessment Crediting Methodology for Wetland and Stream Restoration (TXRAM, used in USACE Ft. Worth District)

Note: The following is a specific example of a functional assessment methodology for wetlands and streams.The following are excerpts from the TXRAM 2.0 Wetlands and Streams Modules, focusing on one particular metric - non-native / invasive species infestation (highlighted). For a worked example, see the final assessed credits in Butler Creek Mitigation Bank, RIBITS, 2022.

a. TXRAM Metrics Related to Ecosystem Processes

Ecosystem Process	*Metrics*
Physical	Aquatic Context
	Buffer
	Water Source
	Hydroperiod
	Hydrologic Flow
	Sedimentation
	Topographic Complexity
Chemical	Organic Matter
	Soil Modification
	Herbaceous Cover
Biological	Edge Complexity
	Physical Habitat Richness
	Plant Strata
	Species Richness
	Non-native/Invasive Infestation
	Interspersion
	Strata Overlap
	Vegetation Alterations

b. TXRAM Non-Native / Invasive Infestation Metric Calculation

"2.3.5.3.4 Non-native/Invasive Infestation Metric Scoring Narratives

- The non-native/invasive infestation metric is scored using the narratives below.
- Wetlands with less than 1% average total relative percent cover of non-native/invasive species score a "4" for this metric.
- Wetlands with 1–10% average total relative percent cover of non-native/invasive species score a "3" for this metric.
- Wetlands with 11–25% average total relative percent cover of non-native/invasive species score a "2" for this metric.
- Wetlands with 26–100% average total relative percent cover of non-native/invasive species score a "1" for this metric."

Box 4: Wetland and Stream Impact Data Captured in the USACE's Internal Database

Per ORM Standard Operating Procedures, version 1.5, April 2021, obtained through personal communication, the data fields captured by USACE staff relating to no net loss are:

- The type of permit
- Authorized amount of dredge, fill or removal
- The latitude/longitude of the project
- Whether the impact was temporary or permanent
- The Cowardin classification of the wetland or stream for both impact and offset
- The current legal definition of Waters of the United States (see Section 1, Box 1) for additional discussion)
- Whether offsets are required and if so unit and amount of offset
- Whether offset was from PRM, bank or ILF (and name of bank or ILF)
- The latitude/longitude of the offset
- Legal protection and financial assurance of offset
- Compliance inspection (this includes site visits, but also receipt of monitoring reports)
- Whether authorized mitigation is complete
- When the permit was approved

Box 5: ORM Transparency

Only a limited amount of permits (6% of all permits) and a limited amount of information about those permits is easily available to the public through an online USACE permit finder (screenshot below). Note that the Figure 1 does not include information about offsets required, location of PRM, etc. In fact, there is no place that complete PRM information is publicly available and this is a major flaw in terms of accountability and transparency. The permit finder includes federally complete 'individual permits' - which are more complex permits and account for only 6% of total permits (the remainder are 'general permits' which are issued for projects deemed to have minimal adverse impacts, see Appendix, Box 3 for more detail). To access full permit information (including PRM) requires a Freedom of Information Act request, which can take up to a year and multiple reminders to receive data.

Screenshot of USACE Public Permit Finder

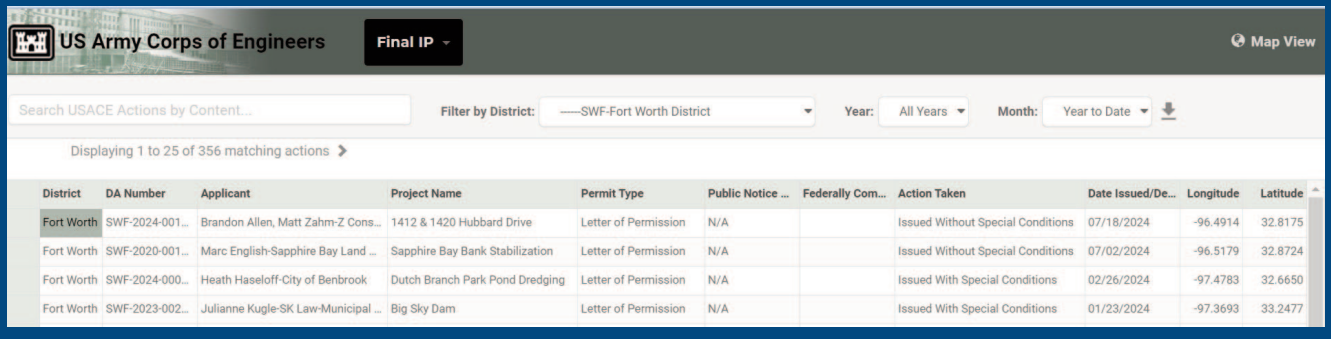


Table 7: Specific Language about the Mitigation Preference Hierarchy
Source: USACE 2008 Rule (first), USFWS species mitigation policies (second)

2008 Rule: "Since an approved instrument (including an approved mitigation plan and appropriate real estate and financial assurances) for a mitigation bank is required to be in place before its credits can begin to be used to compensate for authorized impacts, use of a mitigation bank can help reduce risk and uncertainty, as well as temporal loss of resource functions and services. Mitigation bank credits are not released for debiting until specific milestones associated with the mitigation bank site's protection and development are achieved, thus use of mitigation bank credits can also help reduce risk that mitigation will not be fully successful. Mitigation banks typically involve larger, more ecologically valuable parcels, and more rigorous scientific and technical analysis, planning and implementation than permittee-responsible mitigation. Also, development of a mitigation bank requires site identification in advance, project-specific planning, and significant investment of financial resources that is often not practicable for many in-lieu fee programs. For these reasons, the district engineer should give preference to the use of mitigation bank credits when these considerations are applicable. However, these same considerations may also be used to override this preference, where appropriate, as, for example, where an in-lieu fee program has released credits available from a specific approved in- lieu fee project, or a permittee- responsible project will restore an outstanding resource based on rigorous scientific and technical analysis...

Where permitted impacts are not located in the service area of an approved mitigation bank, or the approved mitigation bank does not have the appropriate number and resource type of credits available to offset those impacts, in-lieu fee mitigation, if available, is generally preferable to permittee-responsible mitigation. In-lieu fee projects typically involve larger, more ecologically valuable parcels, and more rigorous scientific and technical analysis, planning and implementation than permittee-responsible mitigation. They also devote significant resources to identifying and addressing high-priority resource needs on a watershed scale, as reflected in their compensation planning framework. For these reasons, the district engineer should give preference to in-lieu fee program credits over permittee-responsible mitigation, where these considerations are applicable."

FWS mitigation policy, 2023:
"6.7.1. Preferences for Compensatory Mitigation
Unless action-specific circumstances warrant otherwise, the Service should observe the following preferences in providing compensatory mitigation recommendations: Advance compensatory mitigation. When compensatory mitigation is necessary, the Service prefers compensatory mitigation measures that are implemented in advance of project impacts. Compensatory mitigation in relation to landscape strategies and plans. The preferred location for compensatory mitigation measures recommended or required by the Service is within the boundaries of an existing strategically planned, interconnected conservation network that serves the conservation objectives for the affected resources in the relevant landscape context. Compensatory mitigation measures should enhance habitat connectivity or contiguity, or strategically improve targeted ecological functions important to the affected resources (e.g., enhance the resilience of fish and wildlife populations challenged by the widespread stressors of climate change). Where existing conservation networks or landscape conservation plans are not available for the affected resources, Service personnel should develop mitigation recommendations based on the best available scientific information and professional judgment that would maximize the effectiveness of the mitigation measures for the affected resources, consistent with this policy's guidance on Integrating Mitigation Planning with Conservation Planning (section 6.1).

"ESA mitigation policy, 2023:

6.1.3. Preference for Consolidated Compensatory Mitigation The Service generally prefers mitigation mechanisms that consolidate compensatory mitigation on the landscape, such as conservation banks and in-lieu fee programs, to small, disjunct compensatory mitigation sites spread across the landscape. Consolidated mitigation sites generally have several advantages over multiple, small, isolated mitigation sites. These advantages include:

- avoidance of a piecemeal approach to conservation efforts that often results in small, non-sustainable parcels of habitat scattered throughout the landscape;
- greater contribution to a landscape-level strategy for conservation of high-value resources;
- cost-effective compensatory mitigation options for small projects, allowing for effective offsetting of the cumulative adverse effects that result from numerous, similar, small actions;
- increased public-private partnerships that plan in advance, and a landscape-scale approach to mitigation to provide communities with opportunities to conserve highly valued natural resources while still allowing for community development and growth;
- greater capacity for bringing together financial resources and scientific expertise not practicable for small conservation actions;
- economies of scale that provide greater efficiencies in resources for design and implementation of compensatory mitigation sites, and a decreased unit cost for mitigation;
- improved administrative compliance and ecological performance through the use of third-party oversight;
- greater regulatory and financial predictability for project [developers], greatly reducing the uncertainty for their projects; and
- expedited regulatory compliance processes, particularly for small projects, saving all parties time and money

Glossary

Adaptation, adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.[45]

Afforestation is the establishment of the forest through planting and/or deliberate seeding on land that, until then, was under a different land use, it implies a transformation of land use from non-forest to forest.[46]

Ambient environment, non-resource environmental factors that modify the availability of resources or the ability of organisms to acquire them.[47]

Assets, a present economic resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity.[48]

Beyond value chain mitigation, mitigation action or investments that fall outside a company's value chain, including activities that avoid or reduce Greenhouse Gas (GHG) emissions, or remove and store GHGs from the atmosphere.[49]

Biobanking (habitat/species), measurable conservation outcome resulting from an exchange system (or market) where offset credits can be accumulated and sold to developers to compensate for their species or habitat impacts. Credits are tradable units of exchange defined by the ecological value associated with intentional changes or management of a natural habitat. Biobanking includes habitat banking and species banking and is usually focused on endangered habitats and species. Biobanking shares certain features with tradable permit schemes whereby an objective of no net loss of biodiversity is established and provides developers with flexibility to determine either to invest in their own compensation or offset or to purchase a credit that has been developed by others (environmental banks).[50]

[45] TNFD Glossary, V2.0 June 2024, adapted from Fourth National Climate Assessment Glossary
[46] TNFD Glossary, V2.0 June 2024, from FAO, On Definitions of Forest and Forest Change (2020)
[47] Global Ecosystem Topology (IUCN), Glossary of selected terms
[48] TNFD Glossary, V2.0 June 2024, from International Financial Reporting Standard, Conceptual Framework: Elements of Financial Statements – Definitions and Recognition (2015)
[49] TNFD Glossary, V2.0 June 2024, from SBTi Beyond value chain mitigation
[50] UNDP BIOFIN, Catalogue of Finance Solutions

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 and ecosystem function and people's use and cultural values associated with biodiversity.[51]

Biological diversity / Biodiversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.[52]

Biomass, material of biological origin, excluding material embedded in geological formations and material transformed to fossilised material. Biomass includes organic material (both living and dead), such as trees, crops, grasses, tree litter, algae, animals, manure and waste of biological origin.[53]

Biome, global-scale zones, generally defined by the type of plant life that they support in response to average rainfall and temperature patterns e.g. tundra, coral reefs, or savannas.[54]

Biotope is as a well-defined geographical area, characterised by specific ecological conditions (soil, climate, etc.), which physically supports the organisms that live there (biocoenosis).[55]

Capital flow and financing, access to capital markets, improved financing terms or financial products connected to the management of nature-related dependencies, impacts, risks, and opportunities.[56]

Catchment management agency is a national or regional government agency that has the authority to make decisions on the allocation of water. This includes catchment management authorities, water resource management agencies, and catchment municipality councils.[57]

Certification programme provides procured volumes of a product with an official document attesting to a status or level of achievement against a certain standard.[58]

Conservation, an action taken to promote the persistence of ecosystems and biodiversity.[59]

Conservation easements, a voluntary and legally-binding agreement, similar to a deed restriction, that permanently limits a property's uses in order to protect conservation values and achieve conservation goals.[60]

[51] TNFD Glossary, V2.0 June 2024, from Business and Biodiversity Offsets Programme (2012) Glossary, 2nd Updated Edition, CDP (2022) Forests Reporting Guidance, European Commission (2023) Directive 2022/2464 (CSRD)
[52] The Convention on Biological Diversity, Article 2. Use of Terms,
[53] TNFD Glossary, V2.0 June 2024, from ISO ISO 14021:2016 (2016)
[54] TNFD Glossary, V2.0 June 2024, from Keith A. et al. (2020) IUCN Global Ecosystem Typology 2.0 (2020)
[55] TNFD Glossary, V2.0 June 2024, from European Environment Agency, EEA Glossary
[56] TNFD Glossary, V2.0 June 2024
[57] TNFD Glossary, V2.0 June 2024, adapted from Meissner, R., Stuart-Hill, S., Nakhooda, Z., The Establishment of Catchment Management Agencies in South Africa (2017)
[58] TNFD Glossary, V2.0 June 2024, adapted from CDP (2022) Forests Reporting Guidance
[59] TNFD Glossary, V2.0 June 2024, adapted from Levin, S. A. ed., The Princeton Guide to Ecology Princeton (2009)
[60] TNFD Glossary, V2.0 June 2024, from IPBES (2018)

Conversion is a change of a natural ecosystem to another land use or profound change in a natural ecosystem's species composition, structure, or function. Deforestation is one form of conversion (conversion of natural forests). Conversion includes severe degradation or the introduction of management practices that result in substantial and sustained change in the ecosystem's former species composition, structure, or function. Change to natural ecosystems that meets this definition is considered to be conversion regardless of whether or not it is legal.[61]

Critical habitat is any area of the planet with high biodiversity conservation significance, based on the existence of habitat of significant importance to critically endangered or endangered species, restricted range or endemic species, globally significant concentrations of migratory and/or congregatory species, highly threatened and/or unique ecosystems and key evolutionary processes.[62]

Debt-for-nature swaps, through debt restructuring agreements, governments are able to write off a proportion of their foreign held debt. The savings accrued will be channelled into domestic conservation initiatives and climate adaptation programmes. This often entails the establishment of a Conservation Trust Fund to channel the funds. Debt-for-nature swaps can target both official and commercial lending, with the former being the most common scheme.[63]

Deforestation is the loss of natural forest as a result of: (i) conversion to agriculture or other non-forest land use; (ii) conversion to a tree plantation; or (iii) severe and sustained degradation.[64]

Degradation are changes within a natural ecosystem that significantly and negatively affect its species composition, structure, and/or function and reduce the ecosystem's capacity to supply products, support biodiversity, and/or deliver ecosystem services. Degradation may be considered conversion if it: is large-scale and progressive or enduring; alters ecosystem composition, structure, and function to the extent that regeneration to a previous state is unlikely; or leads to a change in land use (e.g., to agriculture or other use that is not a natural forest or other natural ecosystem).[65]

Dependencies (on nature) are aspects of environmental assets and ecosystem services that a person or an organisation relies on to function. A company's business model, for example, may be dependent on the ecosystem services of water flow, water quality regulation and the regulation of hazards like fires and floods; provision of suitable habitat for pollinators, who in turn provide a service directly to economies; and carbon sequestration.[66]

Double materiality has two dimensions, namely: impact materiality and financial materiality.[67]

Downstream are all activities that are linked to the sale of products and services produced by the company. This includes the use and re-use of the product and its end of life, including recovery, recycling, and final disposal.[68]

Drivers of nature change, all external factors that affect nature, anthropogenic assets, nature's contributions to people and good quality of life. They include institutions and governance systems and other indirect and direct drivers (both natural and anthropogenic).[69]

[61] TNFD Glossary, V2.0 June 2024, from Accountability Framework initiative, Terms and Definitions (2020)
[62] TNFD Glossary, V2.0 June 2024, from International Finance Corporation, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012)
[63] UNDP BIOFIN, Catalogue of Finance Solutions
[64] Shortened from TNFD Glossary, V2.0 June 2024, from Accountability Framework initiative (Afi), Terms and Definitions (2024)
[65] TNFD Glossary, V2.0 June 2024, from Accountability Framework initiative, Terms and Definitions (2020)
[66] TNFD Glossary, V2.0 June 2024, adapted from Science Based Targets Network, SBTN Glossary of Terms (2023)
[67] TNFD Glossary, V2.0 June 2024, from European Commission, Directive 2022/2464 (CSRD) (2023)
[68] TNFD Glossary, V2.0 June 2024, adapted from Science Based Targets Network, SBTN Glossary of Terms (2023)

Ecological corridor, a clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity. The following terms are often used similarly: 'linkages,' 'safe passages', 'ecological connectivity areas', 'ecological connectivity zones', and 'permeability areas'.[70]

Ecological / habitat connectivity, the degree to which the landscape facilitates the movement of organisms (animals, plant reproductive structures, pollen, pollinators, spores, etc.) and other environmentally important resources, such as nutrients and moisture, between similar habitats. Connectivity is hampered by fragmentation.[71]

Ecological network (for conservation), a system of natural and semi-natural landscape elements designed and managed to maintain or restore ecological functions, conserve biodiversity, and facilitate sustainable natural resource use. It links core habitats, such as protected areas or other effective area-based conservation measures (OECMs), with ecological connectivity areas (e.g. ecological corridors) to enhance connectivity and genetic exchange, thus increasing the chances of survival of threatened species.[72]

Ecosystem means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.[73]

Ecosystem assets, a form of environmental assets that relate to diverse ecosystems. These are contiguous spaces of a specific ecosystem type characterised by a distinct set of biotic and abiotic components and their interactions.[74]

Ecosystem condition, the quality of an ecosystem measured by its abiotic and biotic characteristics. Condition is assessed by an ecosystem's composition, structure, and function which, in turn, underpins the ecological integrity of the ecosystem, and supports its capacity to supply ecosystem services on an ongoing basis.[75]

Ecosystem connectivity, the degree to which the landscape facilitates the movement of organisms (animals, plant reproductive structures, pollen, pollinators, spores, etc.) and other environmentally important resources, such as nutrients and moisture, between similar habitats. Connectivity is hampered by fragmentation.[76]
Ecosystem extent, area coverage of a particular ecosystem, usually measured in terms of spatial area.[77]

Ecosystem function, the flow of energy and materials through the biotic and abiotic components of an ecosystem. This includes many processes such as biomass production, trophic transfer through plants and animals, nutrient cycling, water dynamics and heat transfer.[78]

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[69] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[70] TNFD Glossary, V2.0 June 2024 from Hilty, J., et al., Guidelines for Conserving Connectivity through Ecological Networks and Corridors, IUCN (2020)
[71] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[72] TNFD Glossary, V2.0 June 2024 adapted from Bennett, G. and K.J. Mulongoy (2006).
[73] The Convention on Biological Diversity, Article 2. Use of Terms
[74] TNFD Glossary, V2.0 June 2024 from Adapted from UN et al., System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA) (2021)
[75] TNFD Glossary, V2.0 June 2024 adapted from UN et al., System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA) (2021)
[76] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[77] TNFD Glossary, V2.0 June 2024 from United Nations et al. System of Environmental-Economic Accounting – Ecosystem Accounting (2021)
[78] TNFD Glossary, V2.0 June 2024 from Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Global Assessment Report on Biodiversity and Ecosystem Services (2019)

Ecosystem Functional Group, a group of related ecosystems within a biome that share common ecological drivers, which in turn promote similar biotic traits that characterise the group. Derived from the top-down by subdivision of biomes.[79]

Ecosystem health is used to describe the condition of an ecosystem, by analogy with human health. Note that there is no universally accepted benchmark for a healthy ecosystem. Rather, the apparent health status of an ecosystem can vary, depending upon which metrics are employed to assess it and which societal aspirations are driving the assessment.[80]

Ecological integrity is defined as the system's capacity to maintain structure and ecosystem functions using processes and elements characteristic for its ecoregion.[81]

Ecosystem services are functions of an ecosystem that directly or indirectly benefit human wellbeing. Specifically, ecosystem services include both portions of the natural capital itself, such as timber or fish, that are harvested from ecosystems as well as the flows of services, such as watershed protection or climate regulation, that can be derived from and rely on stocks of natural capital.[82]

Endangered species are species considered to be facing a very high risk of extinction in the wild.[83]

Environmental assets are the naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.[84]

Ex-situ conservation means the conservation of components of biological diversity outside their natural habitats.[85]

Extinction risk (species), threat status of a species and how activities/pressures may affect the threat status. The indicator may also measure change in the available habitat for a species as a proxy for impact on local or global extinction risk.[86]

Final ecosystem services, when an ecological end-product transitions to being either an economic benefit or something that can be directly used or appreciated by people.[87]

Forest, land spanning more than 0.5 hectares with trees higher than five meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. Forest includes natural forests and tree plantations. For the purpose of implementing zero deforestation supply chain commitments, the focus is on preventing the conversion of natural forests.[88]

[79] The IUCN Global Ecosystem Typology
[80] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[81] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3, from Dorren et al. (2004)
[82] UNDP BIOFIN, The Little Book of Investing in Nature, from Daly and Farley, 2004; Voldoire and Royer (2004)
[83] TNFD Glossary, V2.0 June 2024 adapted from International Union for Conservation of Nature, IUCN Red List Categories and Criteria: Version 3.1 (2012)
[84] TNFD Glossary, V2.0 June 2024 from United Nations et al., System of Environmental-Economic Accounting – Ecosystem Accounting (2021)
[85] The Convention on Biological Diversity, Article 2. Use of Terms
[86] TNFD Glossary, V2.0 June 2024 from European Commission, Annex 1 to the Commission Delegated Regulation, supplementing Directive 2013/34/EU (2023)
[87] TNFD Glossary, V2.0 June 2024 from Finisdore, J. et al. (2020) The 18 Benefits of Using Ecosystem Services Classification Systems, Climate Disclosure Standards Board, Framework Application Guidance for Biodiversity-related Disclosures (2021)
[88] TNFD Glossary, V2.0 June 2024 from FAO Forest Resources Assessment - Terms and Definitions, Accountability Framework Initiative Terms and Definitions (2020)

Forest degradation entails a reduction or loss of the biological or economic productivity and complexity of forest ecosystems resulting in the long-term reduction of the overall supply of benefits from forest, which includes wood, biodiversity and other products or services, provided that the canopy cover stays above 10%.[89]

Forest ownership, generally refers to the legal right to freely and exclusively use, control, transfer, or otherwise benefit from a forest. Ownership can be acquired through transfers such as sales, donations, and inheritance.[90]

Freshwater, all permanent and temporary freshwater bodies as well as saline water bodies that are not directly connected to the oceans.[91]

Grassland can be broadly defined as areas dominated by grasses and other similar plant families, where there is a limited amount of trees or shrubs.[92]

Habitat means the place or type of site where an organism or population naturally occurs.[93]

Habitat fragmentation is a general term describing the set of processes by which habitat loss results in the division of continuous habitats into a greater number of smaller patches of lesser total and isolated from each other by a matrix of dissimilar habitats. Habitat fragmentation, which leads to a barrier effect, may occur through natural processes (e.g. forest and grassland fires, flooding) and through human activities (e.g. forestry, agriculture, urbanisation).[94]

Habitat loss is the reduction in the amount of space where a particular species, or group of species can survive and reproduce.[95]

Hinterlands are a city's surrounding areas which receive high demand for resources and services from the city. The hinterland in a way is not limited by geographic proximity to the city, given the trend to procure services from an increasingly broad area. With the growth of cities and the parallel globalisations, the hinterlands are becoming international and global.[96]

Indigenous Peoples are inheritors and practitioners of unique cultures and ways of relating to people and the environment, and have retained social, cultural, economic, and political characteristics that are distinct from those of the dominant societies in which they live. The UN Declaration on the Rights of Indigenous Peoples does not include a definition of Indigenous Peoples and self-identification as Indigenous is considered a fundamental criterion.[97]

[89] TNFD Glossary, V2.0 June 2024 from FAO and UNEP, The State of the World's Forests (2020)
[90] TNFD Glossary, V2.0 June 2024 from FAO, Forest Resources Assessment - Terms and Definitions (2020)
[91] TNFD Glossary, V2.0 June 2024 from The United States Geological Survey, Water Science Glossary of Terms, WHO (2017) Guidelines for Drinking-Water Quality (2018)
[92] TNFD Glossary, V2.0 June 2024 from Bardgett, R.D. et al., Combatting Global Grassland Degradation. Nature Reviews Earth & Environment 2: 720–735 (2021)
[93] The Convention on Biological Diversity, Article 2. Use of Terms
[94] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[95] TNFD Glossary, V2.0 June 2024 from UC Berkeley, Understanding Global Change
[96] TNFD Glossary, V2.0 June 2024 from Lee, S. E. et al., Advancing City Sustainability via Its Systems of Flows: The Urban Metabolism of Birmingham and Its Hinterland. Sustainability 8, 220 (2016)
[97] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3 from United Nations Department of Environmental and Social Affairs

Indigenous Peoples and Local Communities Conserved Territories and Areas (ICCAs), natural and/or modified ecosystems containing significant biodiversity values and ecological services, voluntarily conserved by (sedentary and mobile) Indigenous and local communities, through customary laws or other effective means.[98]

Indigenous rights, Indigenous Peoples' human rights are protected by a multitude of instruments, declarations, jurisprudence, and authoritative interpretations developed by international and regional human rights mechanisms. Those rights are most clearly articulated through The UN Declaration on the Rights of Indigenous Peoples (UNDRIP) which expresses and reflects legal commitments under the Charter of the United Nations, as well as treaties, judicial decisions, principles, and customary international law.[99]

Indigenous (=native) species, a species or lower tax on living within its natural range (past or present) including the area which it can reach and occupy using its natural dispersal systems.[100]

In-situ conditions are conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.[101]

In-situ conservation means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.[102]

Key Biodiversity Area, a site contributing significantly to the global persistence of biodiversity.[103]

Land includes all dry land, its vegetation cover, nearby atmosphere, and substrate (soils, rocks) to the rooting depth of plants, and associated animals and microbes.[104]

Landfilling refers to the final depositing of solid waste at, below or above ground level at engineered disposal sites.[105]

Land use change is the transformation from one land use category (e.g., cropland, grassland, forest/woodland, urban/industrial, wetland/tundra) to another category (e.g., transformation from natural forest to cropland).[106]

[98] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3 from World Parks Congress (2003)
[99] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3 from Expert Mechanism on the Rights of Indigenous Peoples (2017)
[100] TNFD Glossary, V2.0 June 2024 from International Council for the Exploration of the Sea, Glossary of Terms (2022)
[101] The Convention on Biological Diversity, Article 2. Use of Terms
[102] Ibid.
[103] TNFD Glossary, V2.0 June 2024 from International Union for Conservation of Nature, A Global Standard for the Identification of Key Biodiversity Areas: Version 1.0 (2016)
[104] TNFD Glossary, V2.0 June 2024 from IUCN, Global Ecosystem Typology (2023)
[105] TNFD Glossary, V2.0 June 2024 from GRI (2022) GRI Standards Glossary from UN, Glossary of Environment Statistics, Studies in Methods, Series F, No. 67 (1997)
[106] TNFD Glossary, V2.0 June 2024 from SBTi (2023) Forest, land and agriculture science- based target-setting guidance and IPCC, Annex I: Glossary (2019)

Local Communities is a term used based on the characteristic listed by the Convention on Biological Diversity and its article 8 (j) which refer to: 'Local communities embodying traditional lifestyles relevant for the conservation and sustainable of biological diversity'. Local Communities living in rural and urban areas of various ecosystems may exhibit some of the following characteristics:

- Self-identification as a local community;
- Lifestyles linked to traditions associated with natural cycles (symbiotic relationships or dependence), the use of and dependence on biological resources and linked to the sustainable use of nature and biodiversity;
- The community occupies a definable territory traditionally occupied and/or used, permanently or periodically. These territories are important for the maintenance of social, cultural, and economic aspects of the community;
- Traditions (often referring to common history, culture, language, rituals, symbols and customs) and are dynamic and may evolve;
- Technology/knowledge/innovations/practices associated with the sustainable use and conservation of biological resources;
- Social cohesion and willingness to be represented as a local community;
- Traditional knowledge transmitted from generation to generation including in oral form;
- A set of social rules (e.g., that regulate land conflicts/sharing of benefits) and organisational-specific community/traditional/customary laws and institutions;
- Expression of customary and/or collective rights;
- Self-regulation by their customs and traditional forms of organization and institutions;
- Performance and maintenance of economic activities traditionally, including for subsistence, sustainable development and/or survival;
- Biological (including genetic) and cultural heritage (bio-cultural heritage);
- Spiritual and cultural values of biodiversity and territories;
- Culture, including traditional cultural expressions captured through local languages, highlighting common interest and values;
- Sometimes marginalised from modern geopolitical systems and structures;
- Biodiversity often incorporated into traditional place names;
- Foods and food preparation systems and traditional medicines are closely connected to biodiversity/environment;
- May have had little or no prior contact with other sectors of society resulting in distinctness or may choose to remain distinct;
- Practice of traditional occupations and livelihoods;
- May live in extended family, clan or tribal structures;
- Belief and value systems, including spirituality, are often linked to biodiversity;
- Shared common property over land and natural resources;
- Traditional right holders to natural resources;
- Vulnerability to outsiders and little concept of intellectual property rights.[107]

Mandatory market credit schemes enable businesses, governments, non-profit organisations, universities, municipalities, and individuals to offset their impacts on biodiversity. In a compliance market, trading and demand is created by a regulatory mandate.[108]

[107] Shortened from TNFD Glossary, V2.0 June 2024 from Report of the Expert Group Meeting of Local Community Representatives within the Context of Article 8(j) and Related Provisions of the Convention on Biological Diversity 1 Territory is interpreted as lands and waters

[108] TNFD Glossary, V2.0 June 2024 adapted from Carbon Offset Research and Education Program Carbon Offset Guide

Mitigation hierarchy (and conservation hierarchy) is the sequence of actions to anticipate and avoid, and where avoidance is not possible, minimise, and, when impacts occur, restore, and where significant residual impacts remain, offset for biodiversity-related risks and impacts on affected communities and the environment. The conservation hierarchy goes beyond mitigating impacts, to encompass any activities affecting nature. This means that conservation actions to address historical, systemic, and non-attributable biodiversity loss can be accounted for in the same framework as actions to mitigate specific impacts.[109]

Natural Capital refers to "the stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people." [110]

Naturally regenerating forest, forest predominantly composed of trees established through natural regeneration.[111]

Nature, the natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment.[112]

Nature-based revenue model, mechanism which can attract commercial investments - i.e. investments linked to commercial terms, such as market-rate returns, and/or commercially acceptable tenor - to enable actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (defined as nature-based solutions).[113]

Nature-based solutions, actions to protect, conserve, restore, sustainably use, and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems that address societal, economic, and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits.[114]

Nature positive is a global societal goal defined as 'halt and reverse nature loss by 2030 on a 2020 baseline, and achieve full recovery by 2050'. Nature positive is a global and societal goal. Individual entities, geographies and countries can and must demonstrate their sufficient contribution to a global nature-positive outcome. In operationalising nature positive, tackling drivers and the negative and positive impacts is central. Companies and financial institutions can contribute to the Nature Positive goal by taking these high-level actions: Assess their material impacts, dependencies, risks and opportunities; shift their business strategy and models; commit to science-based targets for nature; report their nature-related issues to investors and other stakeholders; transform by avoiding and reducing negative impacts, restoring, and regenerating nature; collaborate across land, seascapes and river basins; and advocate to governments for policy ambition.[115]

[109] TNFD Glossary, V2.0 June 2024 adapted from Cross Sector Biodiversity Initiative (2015) and Science Based Targets Network, Step 4. Act (2023)
[110] UNDP BIOFIN, The Little Book of Investing in Nature, from the Natural Capital Coalition
[111] TNFD Glossary, V2.0 June 2024 from FAO, Forest Resources Assessment - Terms and Definitions (2020)
[112] TNFD Glossary, V2.0 June 2024 adapted from Díaz, S et al., The IPBES Conceptual Framework – Connecting Nature and People (2015)
[113] From WWF and South Pole, Common Success Factors for Bankable Nature-based Solutions, (2022)
[114] TNFD Glossary, V2.0 June 2024 adapted from IUCN, The IUCN Global Standard for Nature-based Solutions (2020)
[115] TNFD Glossary, V2.0 June 2024 from Nature Positive Initiative (2023)

Nature-related physical risks are risks resulting from the degradation of nature (such as changes in ecosystem equilibria, including soil quality and species composition) and consequential loss of ecosystem services that economic activity depends upon. These risks can be chronic (e.g. a gradual decline of species diversity of pollinators resulting in reduced crop yields, or water scarcity) or acute (e.g. natural disasters or forest spills). Nature-related physical risks arise as a result of changes in the biotic (living) and abiotic (non-living) conditions that support healthy, functioning ecosystems. These risks are usually location-specific.[116]

Net gain is the point at which project-related impacts on biodiversity and ecosystem services are outweighed by measures taken according to the mitigation hierarchy, so that a net gain results. May also be referred to as net positive impact.[117]

No net loss is defined as the point at which project-related impacts are balanced by measures taken through application of the mitigation hierarchy, so that no loss remains.[118]

Nutrient trading, measurable conservation outcome resulting from a trading system (or market) where nutrient reduction credits are established and traded. These credits can have a monetary value that may be paid to the seller for utilising management practices that reduce nitrogen, phosphorous, or sediment. In general, water quality trading utilizes a market-based approach that allows one source of water pollution to maintain its regulatory obligations by using pollution reductions created by another source. Trades can take place between point sources (e.g. wastewater treatment plants), between point and nonpoint sources (e.g. a wastewater treatment plant and a farming operation) or between nonpoint sources (such as agriculture and urban stormwater sites or systems). Systems can be voluntary or compliance.[119]

Ocean, all connected saline ocean waters characterised by waves, tides, and currents.[120]

Payment for ecosystem services (PES) is a type of market-based instrument that is increasingly used to finance nature conservation. Payment of ecosystem services programmes allow for the translation of the ecosystem services that ecosystems provide for free into financial incentives for their conservation, targeted at the local actors who own or manage the natural resources.[121]

Peat is a deposit of partially decayed organic matter in the upper soil horizons.[122]

Pesticide, any substance intended for preventing, destroying, attracting, repelling, or controlling any pest including unwanted species of plants or animals during the production, storage, transport, distribution and processing of food, agricultural commodities, or animal feeds or which may be administered to animals for the control of ectoparasites. The term includes substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport. The term normally excludes fertilisers, plant and animal nutrients, food additives, and animal drugs.[123]

Plantation forest is defined as planted forest that is intensively managed and meets all the following criteria at planting and stand maturity: one or two species, even age class and regular spacing.[124]

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[116] TNFD Glossary, V2.0 June 2024
[117] TNFD Glossary, V2.0 June 2024 from Cross-Sector Biodiversity Initiative (2015) A Cross-sector Guide for Implementing the Mitigation Hierarchy
[118] Ibid
[119] UNDP BIOFIN, Catalogue of Finance Solutions
[120] TNFD Glossary, V2.0 June 2024
[121] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Policy Instrument, Retrieved 11 September 2024
[122] Global Ecosystem Topology (IUCN), Glossary of selected terms
[123] TNFD Glossary, V2.0 June 2024 from FAO & WHO, Codex Alimentarius Commission Procedural Manual (2019)

Primary forest is a naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities, and the ecological processes are not significantly disturbed.
Explanatory notes:

1. Includes both pristine and managed forests that meet the definition.
2. Includes forests where Indigenous Peoples engage in traditional forest stewardship activities that meet the definition.
3. Includes forests with visible signs of abiotic damages (such as storm, snow, drought, and fire) and biotic damages (such as insects, pests, and diseases).
4. Excludes forests where hunting, poaching, trapping or gathering have caused significant native species loss or disturbance to ecological processes.
5. Examples of key characteristics of primary forests:

- They show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes;
- The area is large enough to maintain its natural ecological processes;
- There has been no known significant human intervention, or the last significant human intervention was long enough ago to have re-established natural species composition and processes.[125]

"Prior and informed consent" or "free, prior and informed consent" or "approval and involvement" free implies that indigenous peoples and local communities are not pressured, intimidated, manipulated or unduly influenced and that their consent is given, without coercion. Prior implies seeking consent or approval sufficiently in advance of any authorisation to access traditional knowledge respecting the customary decision-making processes in accordance with national legislation and time requirements of Indigenous peoples and local communities. Informed implies that information is provided that covers relevant aspects, such as: the intended purpose of the access; its duration and scope; a preliminary assessment of the likely economic, social, cultural and environmental impacts, including potential risks; personnel likely to be involved in the execution of the access; procedures the access may entail and benefit-sharing arrangements. Consent or approval is the agreement of the Indigenous peoples and local communities who are holders of traditional knowledge or the competent authorities of those Indigenous peoples and local communities, as appropriate, to grant access to their traditional knowledge to a potential user and includes the right not to grant consent or approval. Involvement refers to the full and effective participation of Indigenous peoples and local communities, in decision- making processes related to access to their traditional knowledge. Consultation and full and effective participation of Indigenous peoples and local communities are crucial components of a consent or approval process.[126]

Protected area, a clearly defined geographical space, recognised, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.[127]

Realm, one of five major components of the biosphere that differ fundamentally in ecosystem organisation and function: terrestrial, freshwater, marine, subterranean, atmospheric and combinations of these (transitional realms). Because variation in nature is continuous, we also include transitional realms, where the realms meet and have their own unique organisation and function.[128]

Reforestation is the conversion to forest of land that has previously contained forests but that has been converted to some other use.[129]

[124] TNFD Glossary, V2.0 June 2024 from FAO, Forest Resources Assessment – Terms and Definitions (2020)
[125] Ibid.
[126] TNFD Glossary, V2.0 June 2024 from Convention on Biological Diversity, Glossary of Relevant Terms (2018)
[127] TNFD Glossary, V2.0 June 2024 from IUCN, Guidelines for Applying Protected Area Management Categories (2018)
[128] The IUCN Global Ecosystem Typology
[129] TNFD Glossary, V2.0 June 2024 adapted from the IPCC, Annex I: Glossary (2019)

Regenerative agriculture, there is no scientific consensus definition of regenerative agriculture; rather there are process (use of cover crops, reduced tillage, etc.), principle and outcome-based definitions (improved soil health, etc.). The most cited outcomes as part of a definition of regenerative agriculture in scientific literature include improved soil health, increased carbon sequestration and increase in biodiversity.[130]

Rehabilitation refers to restoration activities that move a site towards a natural state baseline in a limited number of components (i.e. soil, water, and/or biodiversity), including natural regeneration, conservation agriculture, and emergent ecosystems.[131]

Resilience is defined as having the capacity to live and develop with change and uncertainty. It provides capacities for turning risks into opportunities. This includes: (1) adaptive capacities to absorb shocks and turbulence and avoid unpleasant tipping points, thresholds, and regime shifts; (2) capacities to prepare for, learn from, and navigate uncertainty and surprise; (3) capacities for keeping options alive and creating space for innovation; and (4) capacities for systemic transformation in the face of crises and unsustainable development pathways and traps.[132]

Resources, five fundamental resources in the environment that are essential to sustaining all life: water, nutrients, oxygen, carbon, and energy.[133]

Restoration is any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state. Active restoration includes a range of human interventions aimed at influencing and accelerating natural successional processes to recover biodiversity ecosystem service provision. Passive restoration includes reliance primarily on natural process of ecological succession to restore degraded ecosystems, but may include measures to protect a site from processes that currently prevent natural recovery (e.g. protection of degraded forests from overgrazing by livestock or unintentional human-induced fire).[134]

Restoration status is characterised by three phases described as the following:

- In preparation: [resources], funds committed, area [designated] for restoration, activities have not yet begun, and impacts of restoration may not yet be measurable.
- In progress: ongoing restoration activities and depending on the time that the activities have been ongoing, impacts may start to be measurable.
- Post-completion monitoring: restoration activities completed and efforts in place to monitor the restoration results.[135]

Rewetted, all deliberate actions that aim to bring the water table of a drained peatland (i.e. the position relative to the surface) back to that of the original, peat-forming peatland. When this goal has been reached, the peatland is 'rewetted.'[136]

[130] Shortened from TNFD Glossary, V2.0 June 2024 from Newton et al., What is Regenerative Agriculture? A Review of Scholar and Practitioner Definitions Based on Processes and Outcomes, Front Sust. (2020)
[131] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[132] TNFD Glossary, V2.0 June 2024 from Folke, C. et al. (2016) Social-Ecological Resilience and Biosphere-Based Sustainability Science, Ecology and Society; Rockström, J.et al. Krishnan, L. Warszawski, and D. Nel., Shaping a Resilient Future in Response to COVID-19, Nature Sustainability (2023)
[133] Global Ecosystem Topology (IUCN), Glossary of selected terms
[134] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[135] TNFD Glossary, V2.0 June 2024from CBD, Guidance on using the indicators of the monitoring framework of the Kunming-Montreal Global Biodiversity Framework (2024)
[136] TNFD Glossary, V2.0 June 2024 from Ramsar Convention, Global Guidelines for Peatland Rewetting and Restoration (2021)

Rewilding aims to restore ecosystems and reverse biodiversity declines by allowing wildlife and natural processes to reclaim areas no longer under human management. Well-applied rewilding can restore ecosystems at a landscape scale, help mitigate climate change, and provide socio-economic opportunities for communities. Evidence-based rewilding principles will guide practitioners to rewild safely, help assess the effectiveness of projects, and incorporate rewilding into global conservation targets.[137]

Semi-natural forest is a forest of native species, established through planting, seeding, or assisted natural regeneration. Explanatory notes:

1. Includes areas under intensive management where native species are used and deliberate efforts are made to increase/optimise the proportion of desirable species, leading to changes in the structure and composition of the forest.
2. Naturally regenerated trees from species other than those planted or seeded may be present.
3. May include areas with naturally regenerated trees of introduced species.
4. Includes areas under intensive management where deliberate efforts, such as thinning or fertilising, are made to improve or optimise desirable functions of the forest. These efforts may lead to changes in the structure and composition of the forest.[138]

Soil degradation, a change in soil health status, resulting in a diminishing capacity of the ecosystem to provide goods and services for its beneficiaries. The main types of soil degradation are defined by four categories: 1) soil erosion, 2) soil fertility reduction, 3) soil fertility reduction, 4) soil salinisation, 5) waterlogging.[139]

Soil fertility is defined as the ability of a soil to sustain plant growth by providing essential plant nutrients and favourable chemical, physical and biological characteristics as a habitat for plant growth.[140]

Soil carbon stocks express a balance between organic inputs and their stepwise decomposition by soil biota. The stock (tC ha−1) can be estimated as the sum over annual inputs (tC ha−1 year−1) multiplied with mean residence time (year) similar to tree cover transition.[141]

Soil salinisation is an increase in the salt content of the soil, often as a result of irrigation practices. Excess salt uptake hinders crop growth by obstructing the ability to uptake water, causing loss of soil fertility and desertification.[142]

Species are a fundamental category for the classification and description of organisms, defined in various ways but typically on the basis of reproductive capacity; i.e. the members of a species can reproduce with each other to produce fertile offspring but cannot do so with individuals outside the species.[143]

Species extinction risk, threat status of a species and how activities/pressures may affect the threat status. The indicator may also measure change in the available habitat for a species as a proxy for impact on local or global extinction risk.[144]

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137 TNFD Glossary, V2.0 June 2024 from IUCN Issue Brief: The Benefits and Risks of Rewilding (2021)
138 TNFD Glossary, V2.0 June 2024 from FAO, Global Forest Resources Assessment Update (2005)
139 TNFD Glossary, V2.0 June 2024 from FAO, Guidance on Core Indicators for Agrifood Systems: Measuring the Private Sector's Contribution to the Sustainable Development Goals (2021)
140 TNFD Glossary, V2.0 June 2024 from FAO, Global Soils Partnership
141 TNFD Glossary, V2.0 June 2024 from Van Noordwijk M , Climate Change: Agricultural Mitigation, Encyclopedia of Agriculture and Food Systems (2014)
142 TNFD Glossary, V2.0 June 2024 from Kumar and Droby, Microbial Management of Plant Stresses (2021)
143 TNFD Glossary, V2.0 June 2024 from Levin, S. A. ed., The Princeton Guide to Ecology (2009)
144 TNFD Glossary, V2.0 June 2024 from European Commission Directive 2022/2464 (CSRD)

Stressed watersheds are watersheds, where the demand for water exceeds the available amount during a certain period, or when poor quality restricts its use. Water stress freshwater resources to deteriorate in quantity (aquifer over-exploitation, dry rivers, etc.) and quality (eutrophication, organic matter pollution, saline intrusion, etc.).[145]

Structural connectivity for species, a measure of habitat permeability based on the physical features and arrangements of habitat patches, disturbances, and other land, freshwater or seascape elements presumed to be important for organisms to move through their environment. Structural connectivity is used in efforts to restore or estimate functional connectivity where measures of it are lacking.[146]

Supply chain, the linear sequence of processes, actors, and locations involved in the production, distribution, and sale of a commodity from start to finish.[147]

Sustainable forest management, a dynamic and evolving concept, intended to maintain and enhance the economic, social, and environmental value of all types of forests for the benefit of present and future generations, considering the following seven thematic elements as a reference framework:

1. extent of forest resources;
2. forest biodiversity;
3. forest health and vitality;
4. productive functions of forest resources;
5. protective functions of forest resources;
6. socio-economic functions of forests; and
7. legal, policy and institutional framework.[148]

Sustainable use means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.[149]

Third party certification standards, a third party with no stake in the business has determined that the final product complies with specific standards for safety, quality, or performance.[150]

Threatened ecosystem is an ecosystem assessed as facing a high risk of collapse in the medium-term. [151]

Threatened species, species assessed as facing a high risk of extinction in the wild in the medium-term. This includes flora and fauna listed in the International Union for Conservation of Nature (IUCN) Red List.[152]

Threshold (ecological), the point at which a relatively small change in external conditions causes a rapid change in an ecosystem. When an ecological threshold has been passed, the ecosystem may no longer be able to return to its state by means of its inherent resilience.[153]

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[145] TNFD Glossary, V2.0 June 2024 adapted from European Environment Agency, Environment in the European Union at the Turn of the Century (1999)

[146] TNFD Glossary, V2.0 June 2024 from Hilty, J. et al. (2019) Corridor Ecology: Linking Landscapes for Biodiversity Conservation and Climate Adaptation. 2nd ed. Washington, DC: Island Press; as cited in Hilty. J. et al., Guidelines for Conserving Connectivity through Ecological Networks and Corridors. Best Practice Protected Area Guidelines Series No. 30 (2020)

[147] TNFD Glossary, V2.0 June 2024 from Task Force on Climate-related Financial Disclosures, Guidance on Scenario Analysis for Non-Financial Companies (2020)

[148] TNFD Glossary, V2.0 June 2024 from FAO, Sustainable Forest Management

[149] The Convention on Biological Diversity, Article 2. Use of Terms

[150] TNFD Glossary, V2.0 June 2024 from FAO, Environmental and Social Standards, Certification and Labelling for Cash Crops (2003)

[151] TNFD Glossary, V2.0 June 2024 from IUCN, Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria (2017)

[152] TNFD Glossary, V2.0 June 2024 from IUCN Red List categories and criteria (2012)

[153] TNFD Glossary, V2.0 June 2024 from IPBES Glossary

Total surface area owned or leased, a clearly defined geographical space which an entity has the power to govern financially and operationally so as to obtain benefits from its activities.[154]

Traditional knowledge is the knowledge, innovations, and practices of Indigenous and Local Communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity.[155]

Tree cover loss, conversion of a tree-dominated land use type to a non-tree-dominated land use type. Note that deforestation is included in this, but that not all tree cover loss is deforestation, as it could also include tree cover loss within commercial forest plantations.[156]

Upstream, all activities associated with suppliers, such as production or cultivation, sourcing of commodities or goods, and the transportation of commodities to manufacturing facilities.[157]

Valuation, the process of estimating the relative importance, worth, or usefulness of natural capital to people (or to a business), in a particular context. Valuation may involve qualitative, quantitative, or monetary approaches, or a combination of these.[158]

Value at Risk is a measure of a potential loss in a portfolio, which estimates how much a set of investments might lose at a maximum, with a given probability (e.g. 99.5%, 99.9%), in a set time period. It requires estimation of the probability distribution for the changes in the value of the portfolio.[159]

Value chain, the full range of interactions, resources and relationships related to a reporting entity's business model and the external environment in which it operates. A value chain encompasses the interactions, resources and relationships an entity uses and depends on to create its products or services from conception to delivery, consumption and end-of-life, including interactions, resources and relationships in the entity's operations, such as human resources; those along its supply, marketing and distribution channels, such as materials and service sourcing, and product and service sale and delivery; and the financing, geographical, geopolitical and regulatory environments in which the entity operates.[160]

Voluntary credit markets enable businesses, governments, non-profit organizations, universities, municipalities, and individuals to offset their impacts on biodiversity outside a regulatory regime. Trading and demand in the voluntary market are created only by voluntary buyers (corporations, institutions, and individuals).[161]

Water catchment (also known as a watershed or basin) is an area of land where all water flows and is directed into a single stream or river. Natural boundaries of water catchments can vary in scale and can be very small for a single stream or river, or very broad for a large river such as the Amazon or Congo Rivers. Land and freshwater use in a watershed can affect the entire length of river depending on the intensity of the use and impact.[162]

154 TNFD Glossary, V2.0 June 2024
155 TNFD Glossary, V2.0 June 2024 from Convention on Biological Diversity, Glossary of Relevant Terms (2018)
156 TNFD Glossary, V2.0 June 2024
157 TNFD Glossary, V2.0 June 2024 from Science Based Targets Network, SBTN Glossary of Terms (2023)
158 TNFD Glossary, V2.0 June 2024 from Capitals Coalition, Natural Capital Protocol (2016)
159 TNFD Glossary, V2.0 June 2024 from Task Force on Climate- Related Financial Disclosures, Forward-Looking Financial Sector Metrics (2020)
160 TNFD Glossary, V2.0 June 2024 from International Financial Reporting Standard, S1 General Requirements for Disclosure of Sustainability-related Financial Information (2023)
161 TNFD Glossary, V2.0 June 2024 adapted from Carbon Offset Research and Education Program Carbon Offset Guide
162 TNFD Glossary, V2.0 June 2024 adapted from Freshwater Information Platform

Water quality, the biological, chemical, and physical properties of water, often assessed against a usage standard, such as whether its quality can support freshwater biodiversity, be used for drinking water for people, or irrigation. Note that standards and definitions of water quality vary across use cases.[163]

Water scarcity refers to the volumetric abundance, or lack thereof, of freshwater resources. Scarcity is human driven; it is a function of the volume of human water consumption relative to the volume of water resources in a given area. As such, an arid region with very little water, but no human water consumption would not be considered scarce, but rather arid. Water scarcity is a physical, objective reality that can be measured consistently across regions and over time. Water scarcity reflects the physical abundance of freshwater rather than whether that water is suitable for use. For instance, a region may have abundant water resources (and thus not be considered water scarce), but have such severe pollution that those supplies are unfit for human or ecological uses.[164]

Water sources include water withdrawn from surface water, groundwater, seawater, produced water and third-party water.[165]

Water stress (areas of) is formally defined as the ability, or lack thereof, to meet human and ecological demands for water. Water stressed (region): defined in three levels: 25%, below which no water scarcity exists; 60%, indicating approaching scarcity; 75%, above which strong water scarcity is identified. Anything above the 60% figure, approaching scarcity, is considered 'water stressed.[166]

Wetland banking, measurable conservation outcome resulting from a trading system (or market) where offset credits are tradable units of exchange defined by the ecological value associated with verifiable changes and management of a natural wetland habitat. A mitigation bank is a wetland, stream, or other aquatic resource area that has been restored and preserved for the purpose of providing compensation for expected adverse impacts to similar ecosystems nearby. The value of a bank is defined in compensatory mitigation credits that can be traded or sold. Most systems are designed for no net loss of wetlands even following residual development impacts.[167]

Wild species refers to populations of any native species that have not been domesticated through multigenerational selection for particular traits, and which can survive independently of human intervention that may occur in any environment. This does not imply a complete absence of human management and recognises various intermediate states between wild and domesticated.[168]

[163] TNFD Glossary, V2.0 June 2024 from UNEP, Water Quality Index for Biodiversity Technical Development Document (2008)
[164] TNFD Glossary, V2.0 June 2024 from The CEO Water Mandate (2014) Corporate Water Disclosure Guidelines, European Commission, Annex 2 to the Commission Delegated Regulation, supplementing Directive 2013/34/EU as amended by Directive 2022/2464 (CSRD), as regards sustainability reporting standards (2023)
[165] TNFD Glossary, V2.0 June 2024 from GRI, GRI 303: Water and Effluents (2018)
[166] TNFD Glossary, V2.0 June 2024 adapted from UN Water (2021) Summary Progress Update 2021: SDG 6 — water and sanitation for all and WWF, Contextual Water Targets: A Practical Guide to Setting Contextual Corporate- and Site-level Water Targets (2021)
[167] UNDP BIOFIN, Catalogue of Finance Solutions
[168] TNFD Glossary, V2.0 June 2024 from IPBES Sustainable Use of Wild Species Assessment, Chapter 1 (2022)

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