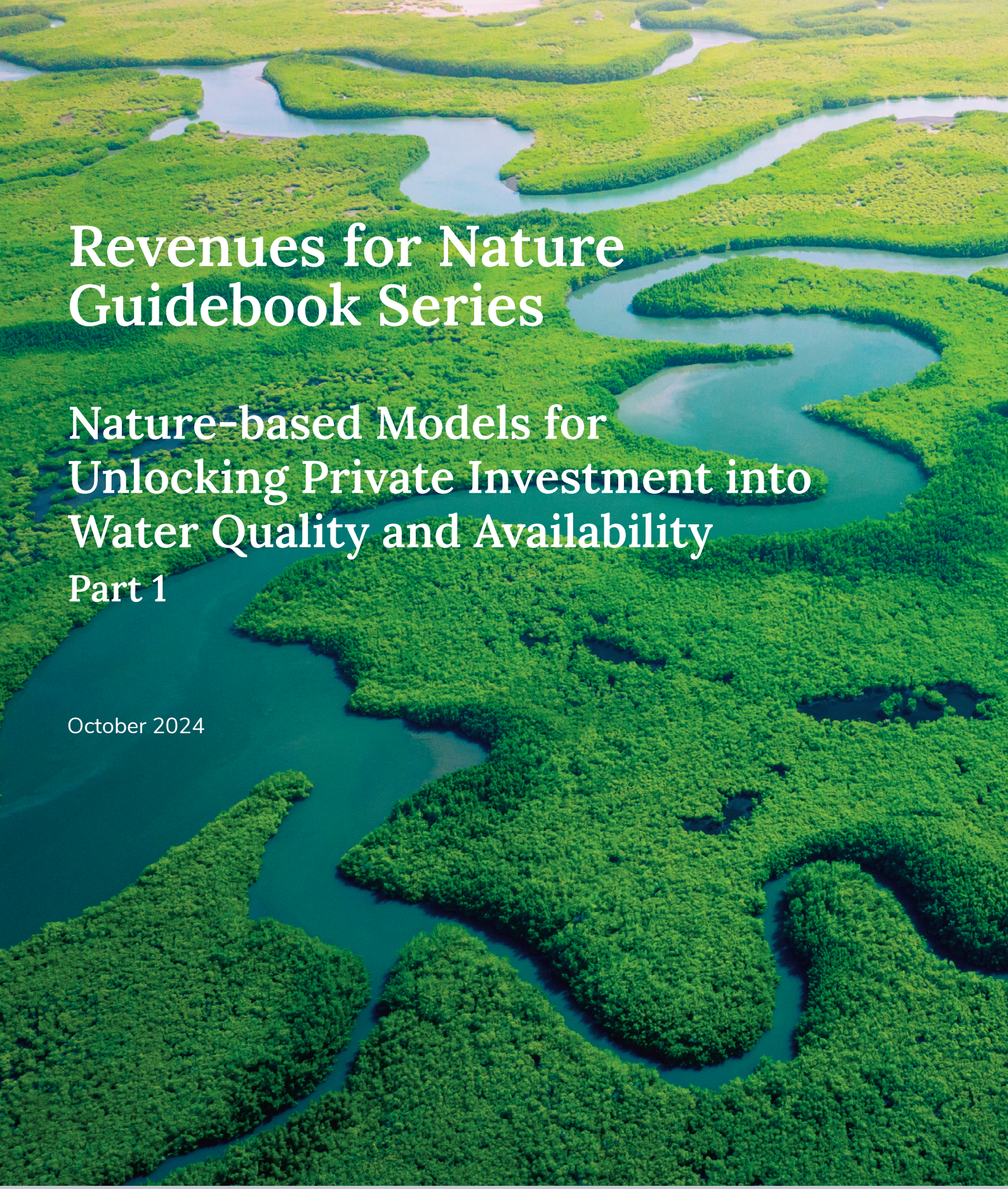


Revenues for Nature Guidebook Series

Nature-based Models for Unlocking Private Investment into Water Quality and Availability

Part 1

October 2024

UNDP

BIOFIN
The Biodiversity Finance Initiative

UN environment programme finance initiative

Green Finance Institute | HIVE

greenfinanceinstitute.com/gfihive/revenues-for-nature

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.

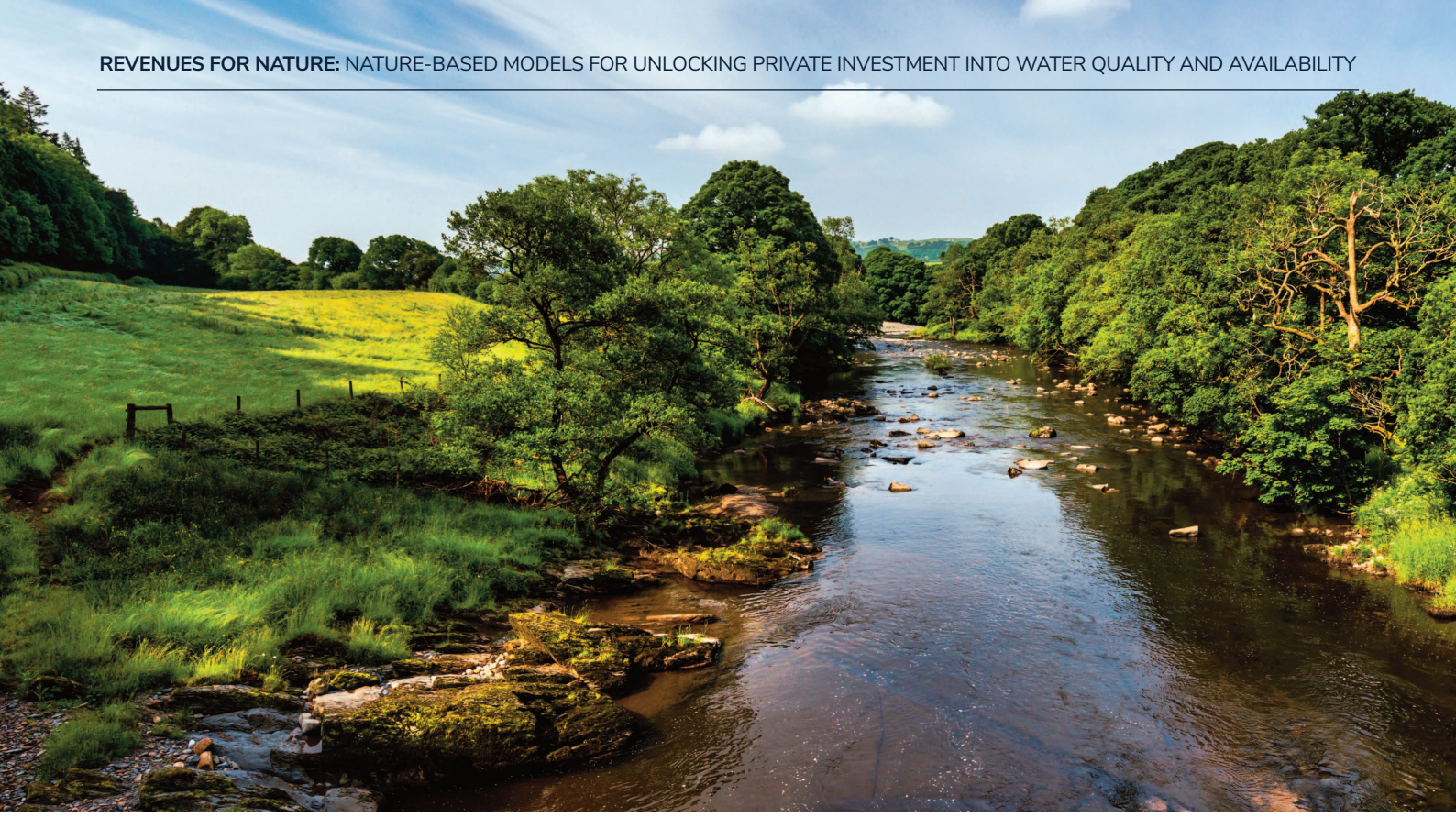
The Guidebook Series is aimed at policymakers, corporates and investors who are interested in scaling high-integrity models to mobilise private sector capital at scale into conservation and nature-positive outcomes.

About this Guidebook

This Guidebook Part 1 focuses on seven examples of models that leverage private sector finance for investment in freshwater quality and availability. It provides summaries of the models and their development, as well as key lessons learned and considerations for replicating and scaling these models. Part 2 will provide an in-depth analysis of one model and review a set of additional innovative models for private finance contributions to freshwater quality and availability. Part 2 will be published in 2025 and we invite interested stakeholders to reach out to the Revenues for Nature team for content suggestions at revenues4nature@gfi.green

The lead author for this guidebook is **A. Allan**, Green Finance Institute

Contents



Executive Summary

This Guidebook outlines seven innovative revenue models that address the critical challenges of water quality and availability through nature-based solutions (NbS). Water quality and quantity are inherently linked—poor water quality reduces available freshwater, while water scarcity exacerbates pollution. Both public and private sectors play pivotal roles in restoring freshwater ecosystems and securing long-term water supplies. The models range from voluntary corporate actions and market-driven approaches to those underpinned by governmental regulations.

Governments, bound by international commitments like the Kunming-Montreal Global Biodiversity Framework (GBF), are essential in creating policy frameworks that protect water resources.[1] However, public funding alone is insufficient to meet growing water infrastructure demands, and there is an increasing need for additional private sector investment. Target 19 of the GBF illustrates the commitment of the international community to diversify and align financing sources for biodiversity, including private capital.

The private sector is increasingly aware of its interdependencies with water. Industries heavily dependent on freshwater are facing increasing financial risks from water shortages and pollution. These risks, compounded by climate change, are driving businesses to invest in NbS to enhance resilience, reduce operational costs, and meet increasing regulatory requirements and stakeholder demands.

In many contexts, NbS interventions for water provide a compelling business case, due to their cost-effectiveness, long term impact and adaptability compared to traditional grey infrastructure. NbS generally offer lower upfront costs, reduced long-term maintenance, and co-benefits such as enhanced biodiversity and improved relations with the communities in which they operate. By investing in NbS, businesses and private investors can mitigate water-related risks and improve the resilience of their operations/portfolio against climate and nature-related uncertainties, while contributing to global sustainability efforts.

[1] CBD (2023). Water and Biodiversity.

Summary of Case Studies within this Guidebook

Policy driven models

Policy-driven models play a crucial role in addressing water-related challenges by creating regulatory frameworks that incentivise or mandate investment into NbS. By integrating NbS into regulatory requirements, governments can drive large-scale investments in watershed conservation, pollution control, and other measures for improved water quality and availability. This guidebook highlights two case studies where policy interventions have been designed to mobilise additional resources and create frameworks for NbS investment.

England's Nutrient Neutrality policy addresses nutrient pollution from nitrogen and phosphorus, which threatens water quality and biodiversity. Excessive nutrients from agricultural runoff and wastewater treatment contribute to poor ecological conditions in rivers, causing eutrophication and harming aquatic ecosystems. Under the Conservation of Habitats and Species Regulations 2017, developers are required to demonstrate that new projects do not increase nutrient pollution in protected areas.[2] This regulation has slowed development in some regions but aims to balance environmental protection with sustainable growth. The policy offers a framework for compensatory offsetting by requiring projects to achieve "nutrient neutrality," mitigating their environmental impact and helping restore England's waterways. Capacity has been a key challenge for local authorities which administer the scheme. Supply of credits has presented an additional challenge, which government responded to by creating a national Nutrient Mitigation Scheme where nutrient mitigation projects would be publicly funded and supported by government.[3]

In Peru, water tariff reforms have significantly boosted investments in nature-based solutions for water management, with funding increasing 13-fold between 2014 and 2019.[4] Water utilities are now required to earmark one percent of revenue to invest in natural infrastructure. The reforms began in 2009 in Moyabamba, where the water utility added a 1 PEN (USD 0.33) tariff to fund watershed conservation.[5] Legislative changes, such as the 2013 Sanitation Services Law and the 2014 Compensation for Ecosystem Services Law, further enabled utilities to integrate NbS into their 5-year plans and pay upstream landowners for conservation efforts. As of 2024, over USD 50 million has been committed for NbS by 40 utilities, including a USD 25 million commitment from Lima's utility, SEDAPAL.[6] However, delays in project execution highlight the need for building capacity within utilities to manage NbS projects. This model demonstrates the importance of policy support, stakeholder engagement, and new tools for cost-benefit analysis to balance grey and green infrastructure investments.

Water Funds

Water funds are an innovative financial mechanism designed to attract, manage, and allocate resources for watershed conservation. Initially developed by The Nature Conservancy, these funds have been implemented across diverse geographies, providing a sustainable model for financing NbS. By pooling resources from various stakeholders, including public utilities, private companies, and local communities, water funds enable targeted investments in watershed conservation and restoration efforts. This guidebook highlights two case studies that illustrate the variety of funding sources and interventions that water funds support and how policy can support their development and scaling.

---

[2] The Conservation of Habitats and Species Regulations (England) 2017
[3] Natural England & Department of Environment, Food and Rural Affairs (2023). Natural England's nutrient mitigation scheme for developers
[4] Forest Trends (2022) Opening the Tap: State of finance for natural infrastructure for water security in Peru, 2021.
[5] Gammie et al (2021). Mobilizing funding for nature-based solutions: Peru's drinking water tariff.
[6] Interview with Mia Smith, Forest Trends. (2024).

Quito, Ecuador's Water Fund, Fondo de Protección del Agua (FONAG), was the world's first water fund, established in 2000 through a 1% environmental surcharge on water bills by the city's water utility, EPMAPS. The fund's revenue is used to protect and restore the páramo ecosystems, which supply water to Quito's 2.7 million residents. FONAG invests in a range of NbS such as reforestation, sustainable agriculture, erosion control, and community education to enhance water security. The fund supports over 28,000 hectares of watershed conservation efforts, benefiting more than 3,500 farming families and balancing ecosystem restoration with local economic needs.[7] Over time, FONAG's funding has increased, reaching 2% of water tariffs, providing a long-term financial source to safeguard Quito's water supply. The project has demonstrated how public money can be effectively used to crowd in private capital into nature-based water conservation activities and that effective monitoring and community engagement are key to the success and replicability of the scheme.

The Upper Tana-Nairobi Water Fund was Africa's first water fund, created to manage the Upper Tana River watershed, which provides drinking water to Nairobi, powers half of Kenya's hydropower, and supports over 300,000 smallholder farmers.[8] Initiated by The Nature Conservancy in 2014, the Fund brought together stakeholders from government, private sector, and NGOs to invest in conservation measures aimed at reducing erosion, improving water yields, and increasing agricultural productivity. By introducing sustainable farming practices and restoring degraded lands, the fund achieved a 50% reduction in sediment concentration and generated significant economic returns, with an estimated USD 21.5 million in benefits from a USD 10 million investment over 30 years.[9] The Fund has since become a model for similar water conservation projects across Africa, demonstrating the effectiveness of nature-based solutions and the versatility of this model for water management and economic development in different contexts.

Private-sector led models

The private sector contribution to the development and management of nature-based revenue models for water is growing. These models often leverage corporate resources, supply chain management, and partnerships to fund and implement NbS. This guidebook highlights two case studies demonstrating how private-sector-led initiatives can drive investment into NbS for water quality and availability in diverse geographical and economic contexts.

The Kumamoto PES Scheme in Japan successfully addressed groundwater depletion by paying farmers to flood unused rice fields, enhancing groundwater recharge. Initiated in 2001 by Sony Semiconductor and a local NGO, the scheme compensated farmers for their participation, providing a sustainable income for an aging farming community while replenishing groundwater reserves. By 2009, the Technology Centre had replenished 9.8 million tons of groundwater, and the program expanded to include 38 companies by 2017.[10] The initiative, grounded in scientific understanding of local hydrology, proved highly cost-effective, costing just one-tenth of what increased water pumping would have required, offering a scalable and replicable solution to water scarcity in industrialised regions.

[7] Latin America Water Funds Partnership (2018). Fonda para la protección del agua.
[8] UTNWFT (2021). Upper Tana-Nairobi Water Fund Strategic plan 2022 – 2026.
[9] TNC (2015). Upper Tana-Nairobi Water Fund Business Case. Version 2. The Nature Conservancy: Nairobi, Kenya
[10] Okiria, Zaki, Noda (2021). A Review of Payment for Ecosystem Services (PES) in Agricultural Water: Are PES from the Operation of Agricultural Water Control Structures Ubiquitous? Sustainability, 13, 12624.

The Reef Credit Scheme is a voluntary market initiative designed to incentivise landholders to improve water quality in the Great Barrier Reef catchment in Australia. The scheme is administered by Eco-Markets Australia, an independent environmental organisation and was designed by GreenCollar, an environmental market investor and project developer, in partnership with natural resource management organisations, Terrain NRM and NQ Dry Tropics. The scheme employs a set of scientifically approved methodologies to quantify reductions in pollutants like nitrogen and sediment entering the Great Barrier Reef catchment. These methodologies go through independent scientific review and public consultation before being approved for use through the scheme. Eco-Markets Australia also allows for additional methodologies to be submitted for review, ensuring that the scheme is adaptable to a variety of pollutants and environmental contexts.

Landscape Enterprise Networks (LENs) is a collaborative initiative initially launched by Nestlé and 3keel, with support from Diageo, PepsiCo, and other regional partners, aimed at promoting sustainable agriculture and improving environmental performance across supply chains in Europe. LENs connect businesses with common needs for nature-based solutions to aggregated groups of farmers who can deliver those solutions. The mechanism facilitates transactions that fund regenerative practices such as tree planting and wetland creation. Through multi-stakeholder partnerships, LENs align with regional sustainable agricultural policies and shapes ecosystem service markets. Operating in regions across England, Hungary, Poland, and Italy—with plans to expand to Scotland in 2025—LENs enable shared investment in environmental solutions. Growing by 80% annually, LENs reached EUR 15 million in transactions in 2024, engaging 350 farmers and implementing sustainable practices on 45,000 hectares. This model demonstrates how engagement between supply chain partners and aggregation of demand and supply of environmental outcomes can generate landscape scale impacts.

Key Findings & Lessons Learned

In designing both policy-based and market-driven models that seek to crowd in private sector investment, the following provides an overview of key findings and lessons learned from the seven case studies.

Market-based mechanisms for NbS investment are most effective when their objectives are aligned to policy goals. In England, for example, Nutrient Neutrality regulations prompted the creation of a market mechanism aimed at facilitating housing development while also meeting water quality targets. By aligning the market with government priorities, the government was able to step in and “prime the pipeline” when limited project supply posed challenges. This support came in the form of public funding to assist project developers, which ensured that developers had access to high-quality projects from which to purchase nutrient credits. Similarly, in Australia, when the supply of credits outstripped demand, the Queensland government stepped in to purchase Reef Credits, as the scheme’s objectives were consistent with the government’s goals of improving water quality in the Great Barrier Reef catchment. I.

NbS can generate a wide range of benefits beyond their primary goal of improving water quality or quantity. These diverse outcomes can attract funding from a variety of sources, each interested in different results. Securing multiple sources of funding not only strengthens the financial sustainability of market mechanisms for NbS investment but can also ensures long-term environmental impact. For example, Water Funds attract contributions from public and private sources to support watershed conservation. Interventions made upstream can enhance both water quality and quantity downstream while delivering added benefits such as flood risk mitigation, increased biodiversity, and job creation. By effectively quantifying these co-benefits, Water Funds or models can appeal to a broader range of potential funders.

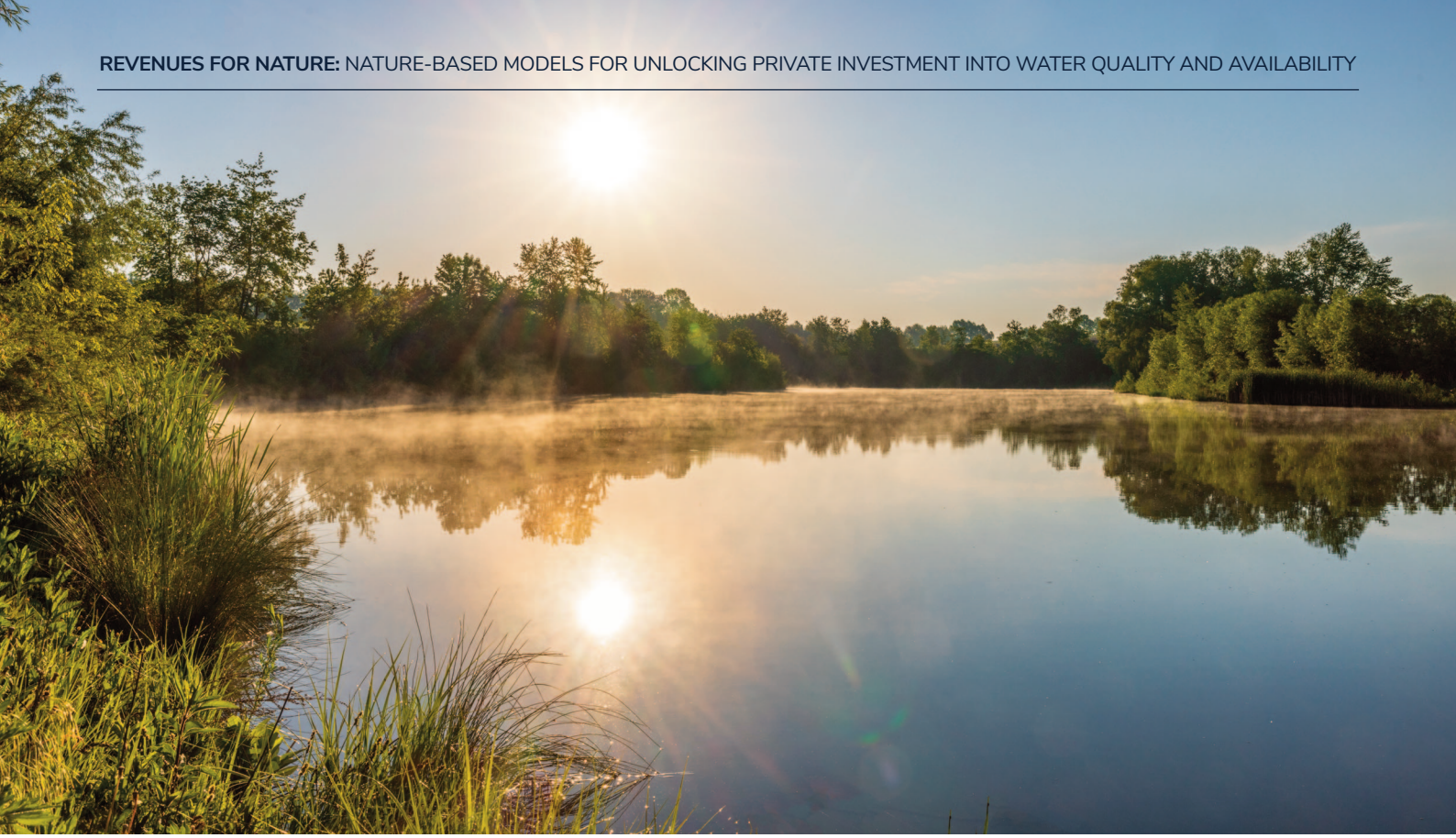
The success of these models requires a deep understanding of local environmental systems and balancing environmental goals with socio-economic needs of local communities. Combining expert scientific research with the local knowledge of farmers, landowners, and communities ensures that interventions are both effective and contextually appropriate. This integrated approach helps achieve environmental objectives more efficiently.

Governments play a critical role in promoting and scaling up revenue models by offering financial and regulatory support. Governments are critical to create an overall regulatory framework on water quality and usage to enable the various models for water financing to function effectively. Additionally, governments can use their budget to incentivise best practices (demand creation for a credit market scheme, provide large investments in a water fund) and disincentivise bad practices (e.g. polluter pays mechanisms).

Developing a clear, robust business case that uses recognised methodologies is crucial for demonstrating the socio-economic and environmental co-benefits of NbS for water. A well-articulated business case helps secure investment from both the public and private sectors by proving the long-term benefits of nature-based conservation over traditional infrastructure.

Current cost-benefit analyses tend to prioritise grey infrastructure. Policymakers and technical experts can support the development of new tools that better account for the long-term benefits and, in some instances, higher returns associated with green infrastructure.

Methodologies for measuring the impact of freshwater interventions should undergo thorough scientific and technical review, alongside public consultation. This ensures usability, accountability, and the highest likelihood of success, while also gaining public trust in the proposed interventions.



Introduction

This Guidebook focuses on revenue models which address the causes and impacts of water quality and availability challenges. The quality and quantity of water are closely linked both in their causes and potential solutions. Water quantity issues, particularly drought-related shortages and over-extraction, often exacerbate water quality issues, concentrating pollutants in smaller volumes of water, leading to higher contamination levels. Conversely, poor water quality can limit the amount of usable freshwater, reducing overall availability.

Similarly, the solutions to these challenges are often connected. For example, afforestation and improving soil health of upstream lands can both decrease sediment runoff and regulate water flow, addressing both quality and quantity issues downstream. Restoring wetlands enhances water holding capacity, which can decrease the impacts of drought, while filtering pollutants to improve quality.
Both governments and the private sector have roles to play in protecting and restoring freshwater ecosystems and can work in tandem to develop and scale effective revenue models which will drive investment into these ecosystems.

Governments

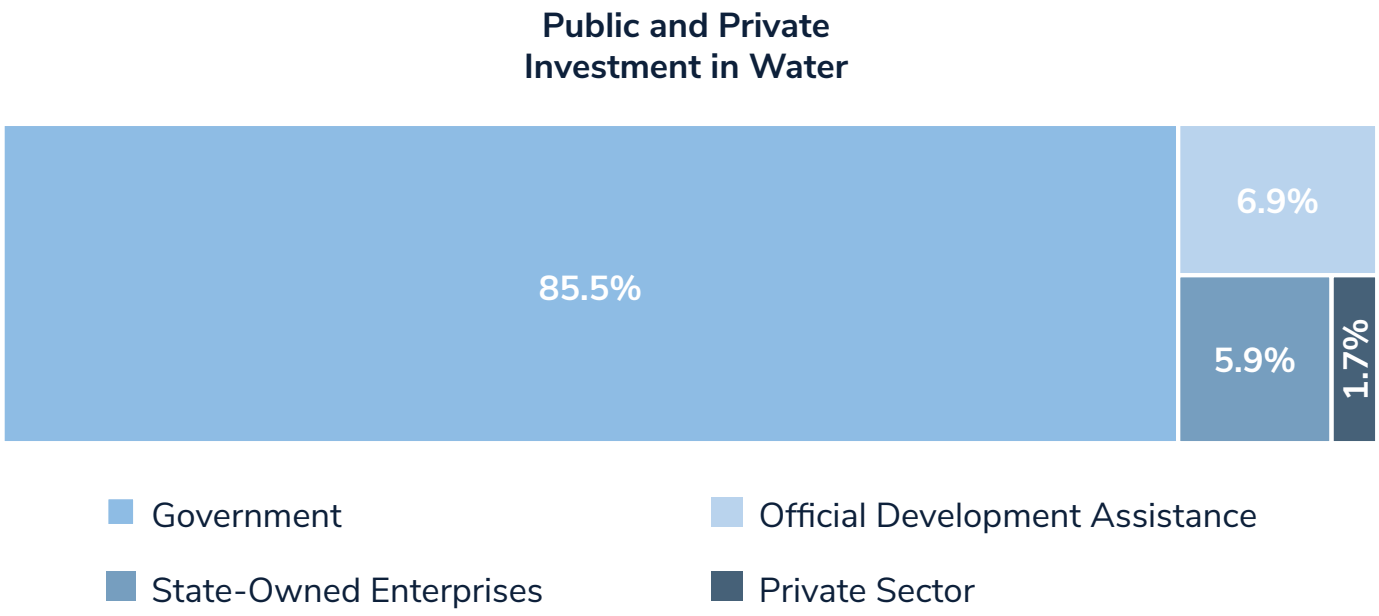
National and local governments play a crucial role in addressing water-related challenges due to the systemic risks these issues pose to public health, infrastructure, and economies. However, government expenditure on water infrastructure and efforts to promote private investment should increase, and environmentally harmful subsidies leading to water pollution and scarcity should be reformed, phased out or eliminated.[11] Investments to prevent water crises are in the interest of governments, as these crises can have far-reaching impacts on societies. They can compromise food security, jeopardise access to sanitation services, and ultimately lead to civil unrest and conflicts.

[11] Signatories to the GBF have agreed to reduce subsidies harmful to biodiversity in a proportionate, just, fair, effective and equitable way by at least USD 500 billion per year by 2030. See the GBF 2030 targets

In addition to domestic considerations, governments are bound by international commitments, including those laid out in the Kunming-Montreal Global Biodiversity Framework (GBF). Parties to the GBF have committed – in Targets 2 and 3 – to restore and protect at least 30% of terrestrial, inland water, marine, and coastal areas by 2030. Achieving these targets will require substantial investment in water-related infrastructure and ecosystem restoration.

Currently, over 95% of funding for water projects comes from public sources, including government, state-owned enterprises and Official Development Assistance (ODA). However, with an estimated global financing gap of USD 6.7 billion for water infrastructure by 2060, governments alone cannot meet these challenges.[12] In accordance with Target 19 of the GBF, which calls on signatories to mobilise at least USD 200 billion per year into biodiversity by 2030, the diversification of financial sources should be achieved to close the water infrastructure financing gap. These financial resources will come from diverse sources including domestic and international, public and private.

Figure 1: Global share of public and private investment in water as of 2024[13]



While water is often considered a public good, only 10% of freshwater withdrawals globally is for domestic use, with the remaining 90% being consumed by agriculture and industry.[14] Sectors across the economy are increasingly recognising the risks posed by water scarcity and pollution, as well as the investment opportunities that green infrastructure present. Governments can play a role in creating the enabling policy environment to encourage private sector investment into nature-based solutions for water.

[12] World Bank (2024). Funding a Water-secure Future: An Assessment of Public Spending

[13] Roughly 91% of annual pending on water comes from the public sector, including 85% by governments and 6% by state-owned enterprises (SOEs). Less than 2% comes from the private sector. See the World Bank's Funding a Water-secure Future: An Assessment of Public Spending.

[14] UNESCO (2024). The United Nations World Water Development Report 2024: water for prosperity and peace; facts, figures and action examples

Private Sector

The private sector plays an essential role alongside governments in addressing water challenges. Industries from agriculture and fisheries to energy and manufacturing depend on freshwater resources, with agriculture accounting for approximately 70% and the industrial sector for 20% of global freshwater withdrawals.[15] Both water scarcity and pollution pose significant risks to business operations and profitability with water-related challenges expected to increase in the coming years due to the destabilising impacts of climate change.

The financial risks associated with water shortages are already being felt in many industries. For instance, the energy and mining sectors already have USD 15 billion in stranded or at-risk assets due to water-related risks.[16] In 2019 alone, water-related losses were estimated to have cost businesses USD 425 billion, a figure expected to grow as climate change exacerbates water quality and availability issues.[17]

As these risks grow, businesses are under increasing pressure from investors, customers, and regulators to assess, report, and act on their environmental impacts. Frameworks such as green taxonomies, the Taskforce on Nature-related Financial Disclosures (TNFD), and the Corporate Sustainability Reporting Directive (CSRD) are driving companies to take a more proactive approach in managing nature-related risks. By investing in NbS for water, businesses can not only address these risks but also contribute to broader environmental goals, enhance resilience, and potentially reduce costs associated with regulatory compliance.

The Private Sector Business Case for Investing in NbS for Water

Investing in NbS presents a compelling business case for addressing water quality and availability challenges, while contributing to global efforts to protect and restore freshwater resources. As water-related risks continue to grow due to climate change, population growth, and industrial demand, NbS provide an innovative, cost-effective, and scalable alternative to traditional water management approaches. By prioritising NbS, businesses can safeguard their operations, enhance their resilience, and reduce costs associated with water risks.

Cost-effectiveness

While grey infrastructure tends to be capital intensive, requiring ongoing maintenance and typically addresses a single issue, green infrastructure and NbS often require lower initial investment while providing co-benefits. A study out of the US found that upfront project costs for green infrastructure projects for water are between 15 – 80% lower than costs for grey infrastructure.[18]

NbS can also enhance the performance of existing grey infrastructure and make it more cost-efficient.[19] For example, upstream forest restoration or riparian buffer zones can reduce sedimentation in rivers, lowering the need for expensive dredging operations or improving the efficiency of downstream water treatment facilities. These natural solutions help maintain the quality of water before it reaches industrial or municipal treatment plants, decreasing the operational costs of these facilities and extending their operational lifespans.

---

[15] Ibid.
[16] CDP (2022). Planet Tracker 'High and Dry: How Water Issues are Standing Assets'
[17] CDP (2020). Cleaning up their act: are companies responding to the risks and opportunities posed by water pollution?
[18] US EPA (2007). Reducing stormwater costs through low impact development strategies and practices.
[19] Cooper, R. & Matthews, J.H. (2020). Water Finance and Nature-based solutions. K4D Helpdesk Report 857. Brighton, UK: Institute of Development Studies.

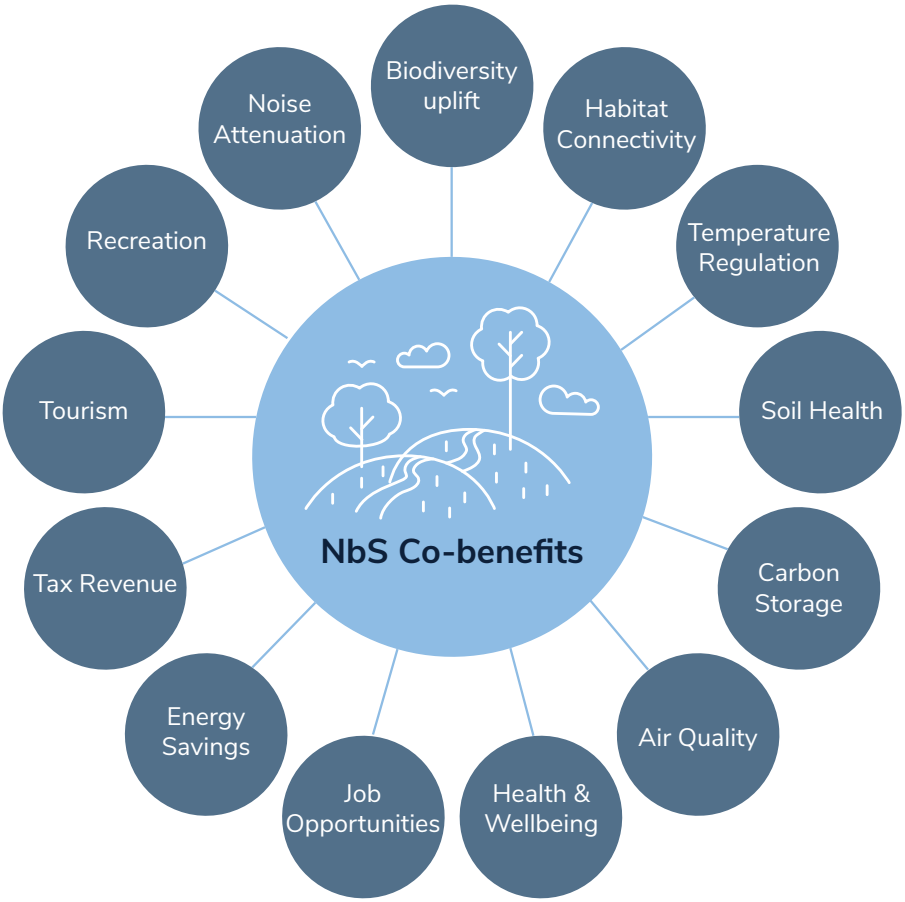
From a long-term perspective, NbS can be adaptable and resilient to the impacts and uncertainties of climate change. Traditional grey infrastructure is often designed based on historical climate patterns, making it less effective in adapting to future environmental conditions.[20] In contrast, NbS are inherently dynamic, able to adapt naturally to changing water flows, weather patterns, and environmental shifts.

Co-benefits

In addition to being cost-effective, NbS offer significant environmental, social, and economic co-benefits. Restoring wetlands, for example, improves water retention while simultaneously boosting fish stocks, benefiting both ecosystems and the fisheries sector. Similarly, lake restoration can reduce sediment and enhance biodiversity.[21] While these co-benefits may not directly align with corporate objectives, they can enhance a company's reputation and strengthen its relationships with local communities.

Quantifying these co-benefits and including them in the analysis of the cost-benefit of these interventions can present challenges as traditional cost-benefit analysis (CBA) only take into account the cost and benefit of the primary impact of an investment. Developing a CBA approach that incorporates the added benefits of NbS is integral to accurately assessing the suitability of NbS alongside or in place of grey infrastructure investments. TNC's Benefit Accounting methodology can help the water industry identify and quantify the ecological and social benefits that can be expected from different NbS interventions.[22]

Figure 2: Co-benefits of NbS for Water[23]



[20] Esraz-Ul-Zannat et al (2024). A review of nature-based infrastructures and their effectiveness for urban flood risk mitigation
[21] NWRM (2015) Benefits Table, 2015.
[22] TNC (2021) Benefit accounting of nature-based solutions for watersheds: guide.
[23] Ommer et al (2022). Quantifying co-benefits and disbenefits of Nature-based Solutions targeting Disaster Risk Reduction

Business Resilience

Investing in NbS for water can significantly enhance business resilience by mitigating the risks posed by water scarcity and poor water quality. Water-related disruptions can have severe consequences on operations, supply chains, and overall profitability, particularly for water-intensive industries such as agriculture, manufacturing, and energy. By investing in NbS, businesses can safeguard their operations against these risks. For example, restoring upstream wetlands or forests can stabilise water flows, reduce the risk of floods, and increase water availability during drought periods. This can prevent disruptions to production caused by water shortages, ultimately ensuring a more stable operational environment.

Furthermore, investments in NbS for water are one of the levers for companies to respond to more stringent regulatory environments and mitigate reputational risks. Regional, national and sub-national regulatory requirements regarding companies' impact on water use and pollution have been increasing in the past years and this trend is expected to continue. Businesses that preemptively invest in sustainable water management practices are better positioned to comply with future regulations and avoid potential fines or sanctions. Additionally, companies seen as leaders in environmental stewardship can strengthen their reputation with consumers and improve their perceived competitiveness among investors.

In the long run, incorporating NbS into business operations not only addresses immediate water-related risks but also builds greater adaptability to future environmental uncertainties. Companies that take a forward-looking approach to water resource management are better equipped to maintain business continuity in the face of increasingly volatile environmental conditions, securing their long-term resilience and profitability.

Revenue Model Typologies

The typologies outlined below are a non-exhaustive list of models which can attract some level of private sector capital into the conservation, restoration and sustainable management of freshwater resources by leveraging natural systems. The models range from voluntary corporate actions and market-driven approaches to those underpinned by governmental regulations and are organised in order most to least government involvement, beginning with water tariffs.

Water Tariffs

Although most water utilities around the world are public sector entities, they have the potential to mobilise private investment by demonstrating reliable revenue streams. Water tariffs are one way to facilitate such investment by offering stable funding for NbS. Reform may be required to support, incentivise or mandate water utilities in utilising tariff revenue to invest in NbS, as seen in the Peru example discussed below. Ring-fencing a portion of tariff revenue for NbS investment embeds conservation within the utilities' financial framework.

Polluter Pays

Polluter Pays programmes are environmental policies which make those entities causing pollution responsible for its remediation, rather than government or downstream users. In the case of water, companies that discharge pollutants into water bodies are required to pay fees that reflect the cost of treating the polluted water to meet environmental standards or must undertake water treatment or habitat restoration themselves. For example, the EU has introduced "extended user responsibility" to its urban waste water treatment directive which will require pharmaceutical and cosmetics companies to contribute to the costs of water treatment if they are contributing to pollution.[24]

[24] Horton & Laville (2024). 'England won't adopt EU river pollution rules for pharma and cosmetics firms', The Guardian. March 22.

Revenues from the fees can pay for water treatment and can incentivise industry to adopt fewer polluting practices or treat water at source. In the context of NbS for water, revenues from the fees can also fund NbS interventions for wastewater treatment such as creating or restoring wetlands or to green infrastructure projects like the installation of green roofs or raingardens.[25] Although this model does not mobilise additional private sector investment, it can generate revenues from private companies for government to undertake NbS.

Water Funds

Investments into conservation and restoration of the broader watershed can address multiple underlying causes of declining water quality and quantity for downstream users. Watersheds are defined as 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.[26] Beyond direct impacts on water quality and quantity, investments in watersheds improve drought resistance and flood control.

Water funds are an innovative way to structure financing upstream water management over the long term, initially designed by The Nature Conservancy (TNC). Since the first water fund was established in Quito, Ecuador, TNC has created 43 water funds in 13 countries across Latin America, North America, Europe, Africa and East Asia.[27] Water funds attract capital from large water users such as water utilities, hydropower plants, beverage and bottling companies, and agricultural users. Those funds are then invested into the financial market with the aim of generating sustainable returns which are then invested into conservation interventions.[28] These interventions are targeted to the major drivers of water pollution and overuse across a watershed:

- **Sustainable Agriculture** – Training farmers in adopting agricultural practices which decrease overconsumption of water upstream
- **Erosion control** – Incentivising farmers to implement erosion control measures such as terracing, tree planting, riparian planting
- **Removal of invasive species** – Removing water-hungry invasive plants to make room for native species
- **Conservation easements** – Funding purchases of land to be set aside for regeneration and restoration
- **Community Engagement** – Knowledge sharing and community initiatives to promote sustainable water use

Water funds offer a versatile and resilient model for multiple stakeholders to address a wide range of issues rising in water catchments.[29]

[25] International Water Association (2021) Nature based solutions for wastewater treatment: a series of factsheets and case studies.
[26] TNFD (2024) Glossary, V2.
[27] TNC continues to work with in-country partners to design and implement water funds. The organisation also established a technical assistance facility, the Nature for Water Facility to provide financial and technical support to countries and municipalities who are interested in developing their own watershed investment programmes.
[28] TNC (2012). Water Funds: conserving green infrastructure.
[29] De Bievre & Coronel (2022). Investing in catchment protection: the Water Fund model. Financing Investment in Water Security

Compensatory Offsetting Schemes

Compensatory offsetting involves compensating for environmental damage by restoring or protecting ecosystems elsewhere. This is typically done in response to policy intervention restricting the extent of damage that can be done to an ecosystem through development or other economic activities. These requirements are expected to increase in the coming years notably driven by multinational companies creating new requirements for better water risk management by their suppliers through supplier contracts, asking for water data, or activities to raise awareness of water issues.[30] As water becomes increasingly scarce due to climate change – with demand expected to outstrip supply by 40% by 2030[31] – corporates are under increasing pressure to mitigate and compensate for their water use.

Compensatory offsetting can take different forms: companies can directly restore ecosystems to compensate for harm or they can pay for a third party to deliver the restoration through credit markets or direct project payments. Compensatory offsetting requirements can develop into 'nature markets' whereby companies seeking to offset their impacts on nature can purchase credits on an open market. These schemes can be compliance-based, such as the Biodiversity Net Gain market in England, or voluntary, like Australia's Reef Credit Scheme.

Payments for Ecosystem Services

Payments for Ecosystem Services (PES) are a type of market-based instrument that is increasingly used to finance nature conservation. PES 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.[32] For example, one of the most well-known PES initiatives is in Costa Rica, where the Fondo Nacional de Financiamiento Forestal (FONAFIFO) directly pays owners of forests and forest plantations to conserve forest ecosystems in recognition of the societal and environmental benefits the forests provide.[33] Financing for the fund comes from a 3.5% fuels tax, along with donations and voluntary corporate contributions. In Uganda, PES is used to protect endangered chimpanzees by compensating farmers who conserve critical habitats who would otherwise have cleared forested land for agriculture.[34] In the UK, some private water companies have developed payment programmes to support farmers in transitioning to more nature-friendly practices, reducing pollution downstream and decreasing treatment costs.[35] See the case study on the Kumamoto PES Scheme for another example.

[30] CDP (2022). Water now a major risk for world's supply chains, reports CDP
[31] World Economic Forum (2023) Global freshwater demand will exceed supply 40% by 2030, experts warn.
[32] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Policy instrument
[33] IIED (2013). Payments for environmental services: lessons from the Costa Rican PES programme
[34] UNEP (2016). Fresh look-back at a Payment for Ecosystem Services (PES) project in Uganda
[35] Severn Trent (2021). Severn Trent environmental protection scheme.

Supply Chain Investments

Corporates are increasingly becoming aware of water-related risks in their supply chains. Ceres found that over 50% of major listed companies face moderate to severe water-related risks.[36] Companies are also under pressure from some investors to assess and respond to those risks.[37] Companies can make investments into NbS within their supply chains to decrease risks to the water resources they rely on for their operations. Differently from Corporate Social Responsibility (CSR), supply chain investments are typically responding to a strategic risk to the company's operations, rather than a philanthropic contribution towards societal or environmental outcomes. For example, a hydropower company which relies on consistent flow levels and limited sedimentation, may invest directly in erosion control measures upstream.

Corporate Social Responsibility

Corporate Social Responsibility (CSR) involves voluntary investments in improving social or environmental outcomes. These interventions can take place within or outside of a company's supply chain. When related to nature they are often used to improve nature resources that a company depends on or decrease negative impacts of a company's operations.

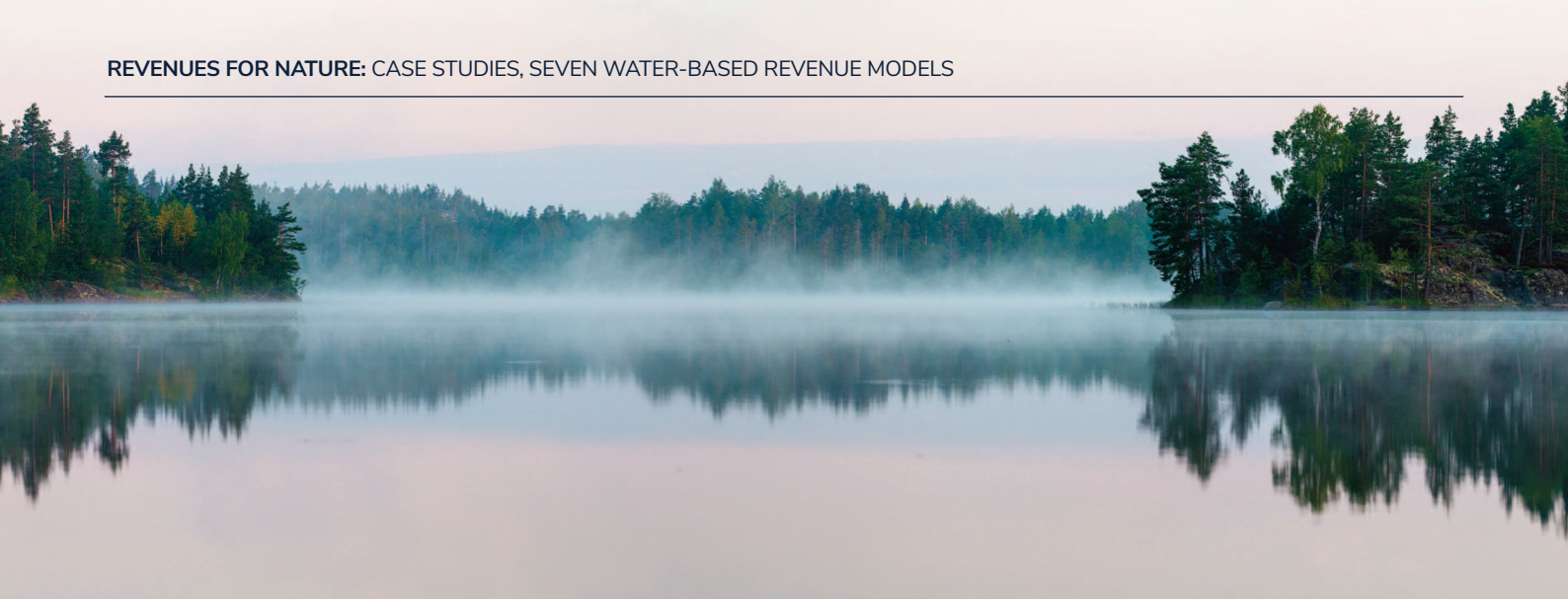
Some industries have faced intense public scrutiny over excessive use or pollution of freshwater. For example, in Kerala, India, local residents successfully shut down a Coca-Cola bottling plant, alleging that the company's operations had significantly reduced both the quality and availability of their well water.[38] Similarly, in Peru, the mining company Newmont faced violent protests against its proposed Conga mine due to concerns that it would further degrade the region's water sources.

To mitigate reputational and legal risks, companies may choose to make voluntary investments that improve environmental conditions in the areas where they operate. For example, an agricultural company could invest in environmental education in the farming communities that produce for them in order to both improve local knowledge of water conservation measures and contribute to community well-being. Another example could involve a beverage company funding upstream water-saving interventions such as wetland creation, to help ensure sustainable access to water for both the company and local residents.

[36] Ceres. Feeding Ourselves Thirsty.

[37] The Valuing Water Finance Initiative, led by Ceres and the Government of the Netherlands is a coalition of investors who engage companies with a large water footprint to take action on their water related risks. The Initiative currently represents over 100 investors representing over USD 17 trillion in assets, engaging a priority 72 global companies.

[38] Balan (2022). Protest against Coca-Cola: Why the 20-year struggle of Kerala's Plachimada goes on. The News Minute.



Case Studies, seven water-based revenue models

The following case studies explore examples of different typologies for investment into NbS for water with a diversity of private sector financing modalities. These examples represent multiple geographies, GDP levels and address different pressures on water quantity and quality. Key lessons learned are drawn out to for water sector actors interested in developing similar schemes and highlight core characteristics for effective scaling or replication of these models. The case studies are presented in decreasing order of regulatory oversight, beginning with a compensatory offsetting scheme which requires legislative underpinning.

Compensatory Offsetting: England's Nutrient Neutrality

Nutrient pollution, particularly from nitrogen and phosphorus, is a significant environmental challenge in England, where only 16% of rivers are in good ecological condition and none are in good chemical condition.[39] These nutrients primarily come from agricultural run-off (including agrochemicals and livestock waste) and wastewater treatment. Excess nutrients can lead to eutrophication – excess algal growth – which degrades water quality and reduces aquatic biodiversity, which can have severe ecological and economic impacts.[40]

In England, the Conservation of Habitats and Species Regulations 2017 regulates 'protected sites' - nature sites and areas of countryside that have special status due to their natural or cultural important.[41] The Regulations stipulate that development cannot increase nutrient load to waterways within these protected sites and require 'competent authorities' to assess the environmental impact of planning projects and only approve those that demonstrate nutrient neutrality.[42] These regulations had been slowing development in areas of England facing challenges with housing availability. A market mechanism was developed by the government in 2022 to help unlock housing while contributing to the country's environmental targets. Developers are now able to demonstrate nutrient neutrality by purchasing nutrient 'credits' from landowners in the same catchment area who decrease their nutrient run-off. This can be done by directly decreasing their use of agrochemicals or by implementing nature-based solutions such as planting buffer strips or creating wetlands.

[39] UK Environment Agency (2024). State of the water environment indicator B3: supporting evidence

[40] USEPA. The Effects: Dead Zones and Harmful Algal Blooms

[41] HMG. Find protected areas of countryside.

[42] A competent authority is defined by Natural England as including planning decisions-makers such as LPAs, the Planning Inspectorate and the Secretary of State. It also includes all government departments, public bodies (such as the Environment Agency and Ofwat), Statutory Undertakers (such as water companies) and persons holding public office.

Design of the programme

In order to demonstrate that a development will have no negative impact on the nutrient load in local waterways, the scheme allows property developers to pay land managers in the catchment to reduce their nitrogen or phosphate run-off to compensate for the additional nutrients expected from housing. This is measured in nutrient credits (1kg of total nitrogen or total phosphate). The scheme is enforced across 74 Local Planning Authorities (LPAs), which have waterways in unfavourable condition. LPAs are responsible for administering the scheme, setting requirements for new developments and assessing how many credits developers must purchase. Natural England – a non-departmental public body sponsored by the Department for Environment, Food and Rural Affairs – designed a generic methodology for calculating the number of credits required by a development, but LPAs can customise their measurement methodologies to suit the needs of the area.[43]

Supply of credits

Land managers generate credits by reducing their agricultural run-off. This can be through reducing application of agrochemicals, planting buffer strips or riparian trees to filter run-off or planting cover crops to reduce leaching. Credits are priced through negotiations between seller and buyer and have been going for between £1,800 – £4,000/ kg of nitrogen and £14,000 – £100,000/kg of phosphate.[44] The reductions are meant to be permanent, with local authorities setting the number of years used to define perpetuity, ranging from 80 to 125 years.[45]

Land managers can combine nutrient neutrality payments with Biodiversity Net Gain (BNG) payments, allowing land managers to develop diversified income streams from delivering interventions with multiple environmental benefits.[46]

Challenge: Capacity and Supply

The Local Government Association estimated in 2022 that the scheme had kept 20,000 new homes from being built each year from regulations on nutrient pollution.[47] Some of this bottleneck was due to the regulations themselves but capacity and resourcing in LPAs and a lack of supply has also created challenges.

In response to the low supply of credits available to LPAs, Natural England created a national Nutrient Mitigation Scheme, which would develop publicly funded nutrient mitigation projects to then sell to developers.[48] The Scheme has so far delivered credits to build 4,730 homes by creating 260 hectares of habitat.[49]

[43] Natural England (2022). Nutrient Neutrality Generic Methodology.
[44] Green Finance Institute (2024) Farming Toolkit for Assessing Nature Market Opportunities
[45] Green Finance Institute (2024) Farming Toolkit for Assessing Nature Market Opportunities
[46] Defra (2023). Combining environmental payments: biodiversity net gain (BNG) and nutrient mitigation
[47] Local Government Association (2023). Stuck in neutral: A call for partnership working on river quality and water quantity
[48] Natural England & Department of Environment, Food and Rural Affairs (2023). Natural England's nutrient mitigation scheme for developers
[49] Natural England (2024). Delivering for nature and the economy (Blog)

Replicability & Scalability

The Nutrient Neutrality scheme offers a promising model for compensatory offsetting that can be adapted and scaled in other regions facing similar issues of nutrient pollution and urban development pressure. The scheme's core design – allowing property developers to purchase nutrient credits from landowners – addresses a pressing challenge: balancing environmental protection with housing development. In a country where nutrient pollution, particularly nitrogen and phosphorus run-off, severely affects water quality, this scheme offers a structured approach to both mitigating ecological impacts and unlocking stalled housing projects.

As of 2022, 74 LPAs across England were implementing the scheme, demonstrating its scalability across a broad geographic and administrative range. The inclusion of Natural England's national Nutrient Mitigation Scheme has further scaled the initiative.

The ability to combine nutrient neutrality payments with Biodiversity Net Gain payments highlights the model's potential to be integrated with other environmental markets, creating multiple income streams for land managers. Land managers and farmers have put pressure on the government to further expand stacking and bundling potential across multiple nature markets (carbon, biodiversity, nutrients, flood risk). This should be a key consideration for other jurisdictions designing a compensatory offsetting scheme as it can increase the attractiveness and financial viability of participation in the scheme.

Given that nutrient pollution from agricultural run-off and wastewater is a global problem, this model has significant potential for replication in other countries and offers a pathway to achieving nutrient pollution reduction targets. For example, the European Commission set a target as part of the European Green Deal to reduce nutrient losses from both organic and mineral fertilisers by at least 50% by 2030.[50] A market approach can offer farmers compensation for reducing their use of agrochemicals which may impact their yields in the short term.

Lessons Learned

- A lack of capacity and resourcing in LPAs has hindered the scheme's implementation and led to delays in planning approvals. When designing a compliance mechanism for NbS, it is crucial to ensure that the implementation and enforcement authorities have sufficient resources to take on this new set of responsibilities.
- Government support can help 'prime the pipeline' of projects by financially supporting land managers in developing nutrient mitigation strategies and connecting buyers to sellers.

[50] European Commission. Sustainable use of Nutrients.

Water Tariff Reform: Peru

Investment into Nbs for water has grown substantially in Peru since the mid-2000s both by the public sector and by downstream water users such as water utilities. Between 2014 and 2020, investments into nature interventions increased 13-fold, reaching USD 13 million in 2019 before a decline during the Covid-19 pandemic.[51] This substantial increase was facilitated by early experiments in water tariff reforms, followed by legislative and regulatory reforms to promote NbS investments for water and a reframing of nature as an asset to combat water-related risks. Peru's water tariffs, which act as mechanisms for payments for ecosystem services have grown to cover over two thirds of the country's utilities.

Early tariff reforms

In the early 2000s, Moyabamba's water utility faced declining water quality and rising operational costs, prompting consideration of water restrictions. Local advocacy organisations and international institutions launched public campaigns highlighting the importance of watershed conservation for water security. A 2007 study found the public was willing to pay for conservation through water tariffs.[52]

In 2009, after a public hearing showed broad support, SUNASS implemented a 1 PEN (USD 0.33) tariff to fund nature-based interventions in the watershed. A management committee, comprising community groups, NGOs, and government officials, negotiated with upstream land managers to improve land practices. In exchange for technical assistance and materials for agroforestry systems, farmers and land managers agreed to implement forest conservation measures aimed at improving water retention and reducing erosion.

[51] Forest Trends (2022) Opening the Tap: State of finance for natural infrastructure for water security in Peru, 2021.
[52] Gammie et al (2021). Mobilizing funding for nature-based solutions: Peru's drinking water tariff.

Legislative reform

Following the success of the Moyabamba tariff reform, a similar reform took place in the watershed serving Cusco. These two examples started to generate the evidence for the model. National legal frameworks were not in place however to facilitate and encourage tariff reforms. Prior to Moyabamba and Cusco implementing their reforms, investment in watershed conservation above a water utility's intake was broadly considered outside of their jurisdiction and responsibility.[53] Additionally, public sector water utilities did not have a mechanism through which to compensate upstream water users.

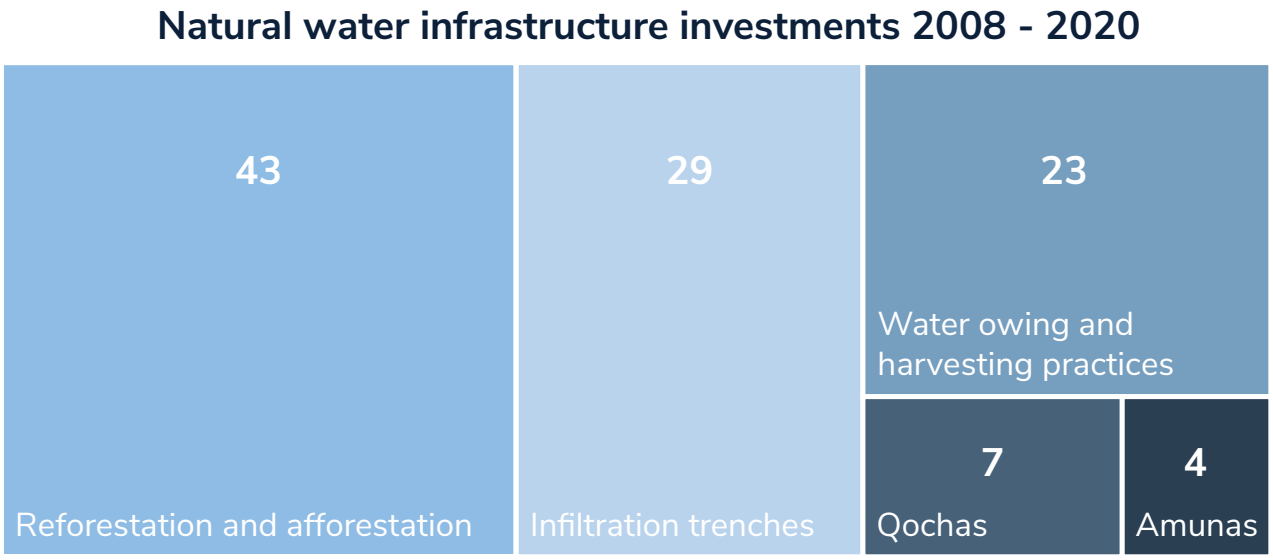
In 2012, during the comment period for the modernisation of the Sanitation Services Law, SUNASS proposed adding a provision to legally recognise and promote the role and responsibilities of water utilities in funding watershed conservation.

The Sanitation Services Law, approved in 2013 requires all water utilities to at minima, consider funding NbS alongside funding grey infrastructure projects when developing their 5-year master plans and budgets. The law states that SUNASS should support water utilities in assessing the cost-effectiveness of these interventions and ensure due consideration of such investments in their master plans. The requirement for water utilities to consider NbS, along with SUNASS's mandate to support utilities in this process, creates institutional demand to develop internal capacities for designing and implementing NbS interventions, and generates earmarked revenue for NbS.

Mechanisms of Rewards for Ecosystem Services (MRSE) Law

While the reform of the Sanitation Services Law created the legal framework to support water utilities to raise funds for watershed conservation, the mechanism through which utilities could pay upstream users was not in place at the national level. In 2014, the Law on Compensation for Ecosystem Services Mechanisms formalised compensation for ecosystem services within the forestry, agriculture and water sectors and explicitly permits the use of public funds for this compensation.

Figure 2: Natural infrastructure interventions funded by public investments in Peru: 2008 – 2020[54]
Source: Forest Trends, 2021



[53] Ibid.

[54] Qochas are rustic, often permeable microresevoirs used for holding water. Amunas are ancestral, constructed infiltration canals. See Forest Trends' Opening the Tap: State of Finance for Natural Infrastructure for Water Security in Peru, 2021 for more detailed descriptions of interventions.

Challenges and Bottlenecks

Despite success in mobilising investment into NbS, challenges remain in operationalising projects and monitoring their benefits. Many utilities face delays in project execution, with significant gaps between allocated and executed funds.[55] This is attributed to a capacity gap within utilities, as they may lack the expertise to develop, implement and manage a new type of investment and unfamiliar NbS interventions. To address this, Forest Trends has been working with the Peruvian government and water utilities to increase capacity and develop supportive institutional frameworks to streamline the process of investing in NbS through their National Infrastructure for Water Security project.

There are also inconsistencies across utilities and projects in the estimation and monitoring of hydrological and other benefits. While legislative changes have integrated NbS into infrastructure planning, there is no requirement in the public investment system to quantify and report on the hydrological benefits of these investments.[56] Future reviews of the Sanitation Services and MRSE laws could include requirements to monitor and report on these benefits, which would improve transparency and accountability.

Replicability and Scalability

Since the implementation of the first water tariff reform in Moyabamba, the model has scaled significantly. As of August 2024, over USD 50 million has been committed for investments in ecosystem services by 40 utilities, representing two thirds of the water utilities in the country. An additional USD 112 million has been allocated from water tariffs for climate change adaptation and disaster risk reduction, much of which is expected to be invested in NbS.[57]

The most ambitious tariff reform in Peru took place in Lima in 2015, when the city's water utility, Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL), approved its 2015 – 2020 master plan. The plan included a 1% increase, earmarked for NbS, in addition to a 3.8% increase for climate change adaptation and disaster risk reduction which can also be used to fund NbS. This is the largest commitment by any Latin American water utility to fund NbS, with the 1% increase representing USD 25 million in revenue over the 5-year period.

The Peruvian model has proven to significantly increase investments into NbS for freshwater and provides a cost-effective model for water utilities to sustainably manage the water resources on which they depend. Although Peru's water utilities are public entities, the model could also prove to work for private companies, which represent approximately 10% of global water operators.[58]

[55] Forest Trends (2022) Opening the Tap: State of Finance for Natural Infrastructure for Water Security in Peru, 2021.
[56] Forest Trends (2021) Opening the Tap: State of Finance for Natural Infrastructure for Water Security in Peru, 2021.
[57] Gammie et al (2021). Mobilizing funding for nature-based solutions: Peru's drinking water tariff.
[58] AquaFed. Private Water Operators.

Lessons Learned

- The adoption of policies explicitly earmarking some tariff revenue to finance NbS can contribute to closing the financing gap for water, and to overcome low levels of investments in water NbS due to unfamiliarity with these NbS and perceived high costs for their implementation.
- Early engagement with all interested stakeholders is key to assessing willingness and ability to pay an additional tariff and identifying NbS interventions which will address the needs of local communities.
- Current CBA prioritises grey infrastructure investments. Policy and technical assistance can support the development of new tools for accurately assessing the costs and benefits of green vs grey infrastructure for water.
- Without a requirement to consistently monitor and report on hydrological and ecological benefits, it will be difficult to demonstrate the impact of the model and learn from the experiences of other utilities. Monitoring and evaluation should be integrated from the beginning into water tariff models

Reforming Water Tariffs

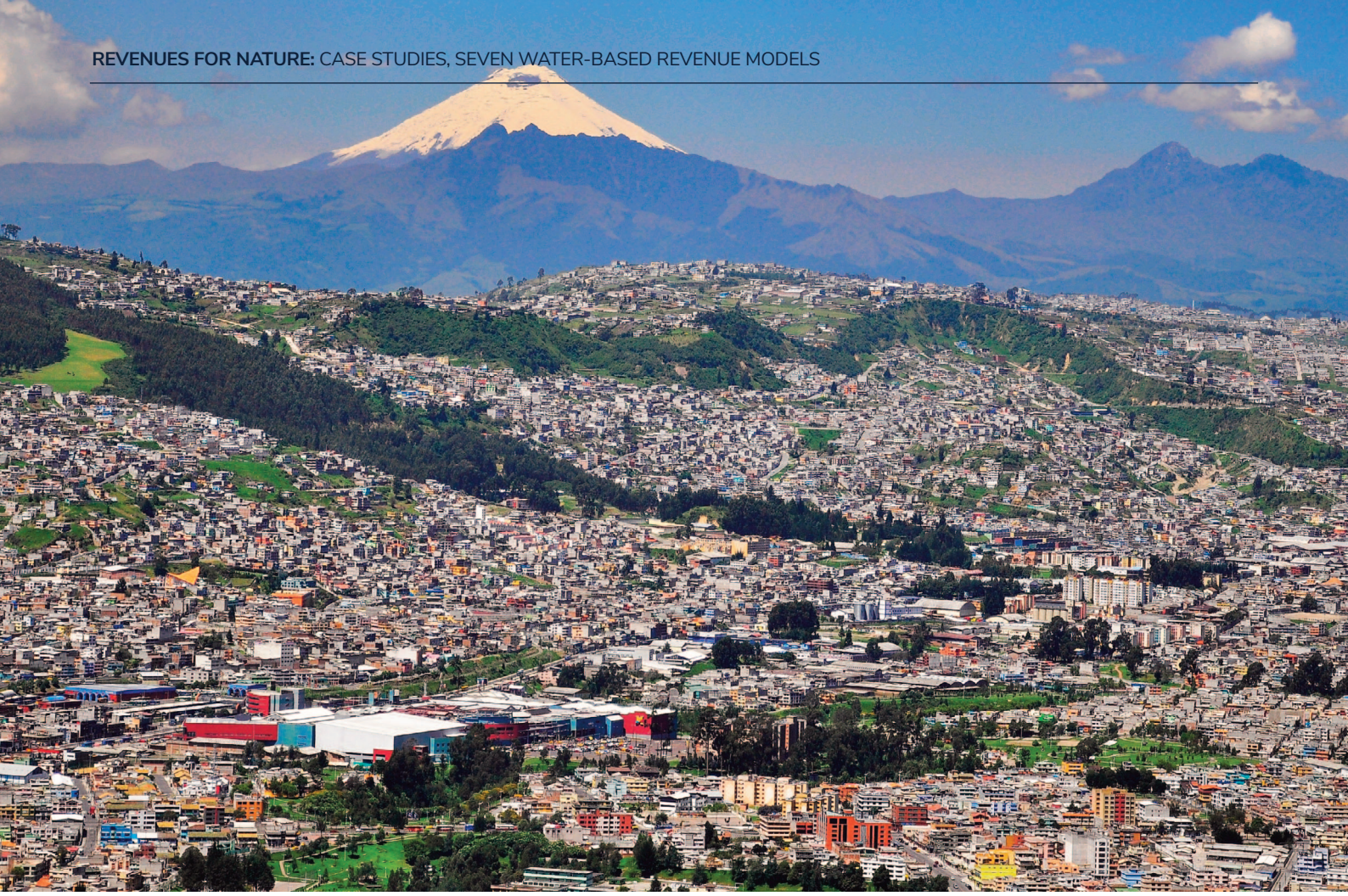
Assessing affordability and willingness to pay

Before implementing water tariff reforms, it is crucial to assess the willingness to pay and affordability of the proposed tariff on the target user groups. This is particularly important in lower income countries and regions where small increases in the price of water can make a substantial impact on household finances. Assessing the willingness and ability of user groups to pay for NbS interventions is crucial for generating buy-in and ensuring that proposed reforms do not disproportionately burden low-income households.

Identifying NbS interventions

Appropriate and cost-effective NbS interventions will depend on the ecological, hydrological, political and economic context of the region. When determining appropriate interventions, an ecological and cost-effectiveness assessment should be undertaken on multiple potential interventions to ensure they meet the needs of local communities and have the highest chance of delivering on the intended environmental outcomes.

There are many open-source tools to assist utilities and others in the water sector to assess the impact and cost-effectiveness of proposed interventions. The Water Action Hub's NbS Explorer Tool and TNC's Benefits Accounting for NbS for Watersheds are two widely used supportive resources for assessing impact of NbS interventions and designing investment programs to fund them.



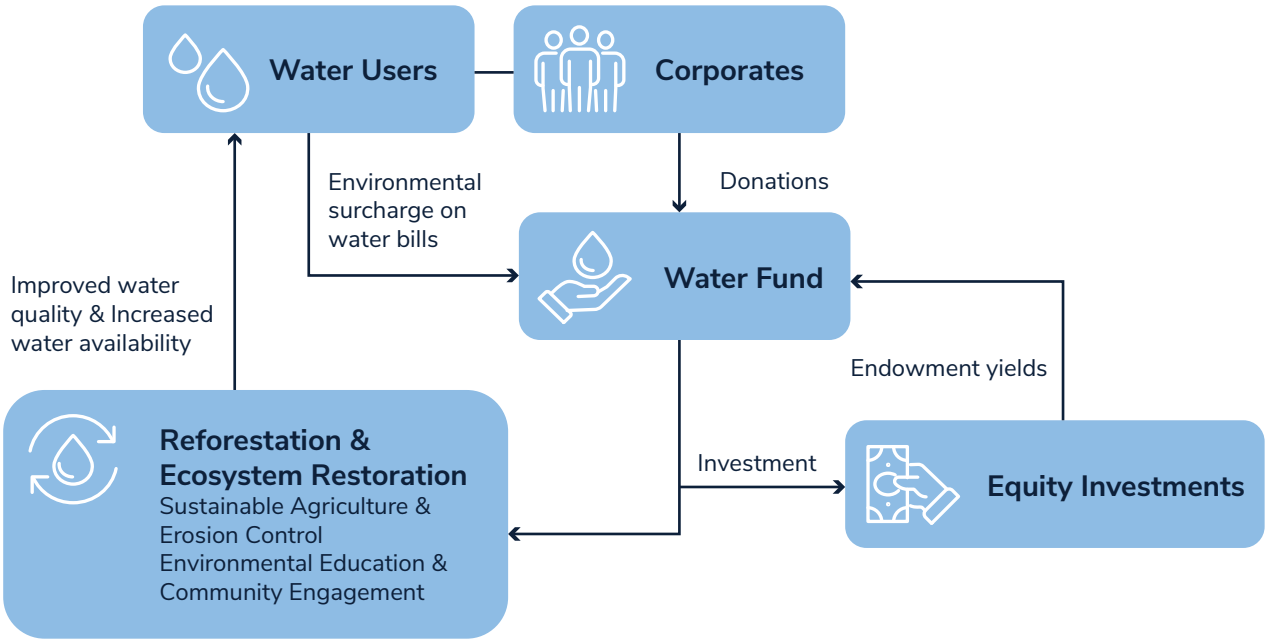
Water Fund with Environmental Surcharge: Quito, Ecuador

The high-altitude city of Quito relies on the surrounding páramo ecosystems of tropical grasslands to supply water for its 2.7 million inhabitants. In the 1990s, these ecosystems were under increasing threat from deforestation, agriculture, and urbanisation.

In 2000, the city's water utility company, Empresa Pública Metropolitana de Agua Potable y Saneamiento (EPMAPS), implemented a reform to the city's water tariff system, introducing a 1% charge on water bills, specifically earmarked for environmental protection.[59] The additional charge was allocated to a newly established fund: Fondo de Protección del Agua (FONAG), the first water fund in the world.[60] FONAG operates as a trust fund dedicated to the conservation and restoration of Quito's watersheds. In addition to the surcharge on water bills, it receives contributions from private companies who rely heavily on the city's surrounding watershed, including breweries, bottled water companies and the electricity sector. The fund is structured as a private mercantile trust, using the yields of its equity to finance conservation projects to protect and restore the watersheds.[61] The fund's board includes representatives from public and private sectors, as well as civil society.

[59] TNC Resilient Watersheds. (2020). The story of Quito – the first "water fund".
[60] Latin American Water Funds Partnership. (2018). Fondo para la proteccion del agua - FONAG
[61] Lorena (2019). The Path of Water — FONAG: work and lessons.

Figure 3: FONAG Structure



Interventions

The Fund invests in a wide range of NbS aimed at preserving and improving the health of Quito's watersheds, both in lands owned by the utility and by engaging with private landowners. The Fund manages about 20,000 hectares of its own lands where park rangers are posted to conduct restoration activities.[62] In privately-owned lands, the Fund developed conservation agreements which could include support for sustainable productive activities. In utility or Fund-owned land, the land is used only as a source of water with no productive activity.

Reforestation and Ecosystem Restoration: FONAG invests in the restoration of degraded lands in the páramos. This includes planting native tree species, restoring riparian zones, and creating wetlands.[63] These efforts improve water infiltration, reduce soil erosion, and enhance biodiversity.

Through the Fund's Vegetation Cover Recovery Program (PRCV), native tree species like the Polylepis tree are planted to increase overall vegetation cover and improve water filtration.[64] Healthy forest and riparian zones serve as natural buffers that reduce sedimentation and erosion, allowing rainwater to be absorbed gradually, which recharges aquifers and helps ensure a stable water supply for downstream areas. FONAG also funds the creation and restoration of wetlands which act as natural water reservoirs and filters. Restored wetlands enhance the páramo's ability to retain water during rainy periods and release it slowly during dry seasons, contributing to year-round water availability.

Sustainable Agriculture & Erosion Control: FONAG works with local farmers to promote agroecological practices that minimise the sector's impact on water resources, improve the water holding capacity of soils and reduce erosion. This includes training in agroforestry and sustainable livestock management and the implementation of erosion control measures such as terracing and contour plowing. Through these programs, FONAG has provided training and technical assistance to over 3,500 farming families, improving agricultural productivity while mitigating environmental degradation.[65]

[62] Lorena (2019). The Path of Water — FONAG: work and lessons.
[63] Latin American Water Funds. Fund for the Protection of Water (FONAG)
[64] ProAmazonia. FONAG: a benchmark in the ecological restoration of water source ecosystems
[65] Lorena (2019). The Path of Water — FONAG: work and lessons.

Environmental Education and Community Engagement: FONAG has a strong focus on environmental education and raising awareness among local communities about the importance of watershed conservation. The fund supports environmental education programs for members of the water sector, community workshops, and participatory planning processes that involve residents in decision-making and conservation activities.

Initially, the focus was on primary school children, using diverse educational approaches such as school visits to the Cachaco Ecological Park, visits to rural schools and creating camping experiences for urban schoolchildren. These interventions aimed to foster emotional connections to nature, combined with value-based education and experiential learning. Each child was appointed as a "Water Guardian" to instill a sense of responsibility for protecting water resources.[66]

Other initiatives introduced community members and educators to the critical role of watersheds through guided tours and workshops. Using a combination of experiential learning, popular education, and emotional engagement, the program has evolved to address the specific needs of different stakeholders.

Water Quality Monitoring and Research: FONAG invests in monitoring and research initiatives to assess the health of the watersheds and the effectiveness of conservation measures. The data collected helps inform future interventions and helps to quantify the return on investment of conservation measures.[67] The Monitoring and Surveillance of Protected Areas program started in 2004 with monitoring activities focused on both water quantity and quality to evaluate the impact of interventions and ensure that ecosystems storing and regulating water resources remain in a healthy state.[68] Water quantity monitoring is focused on understanding the regulation of water flow within ecosystems, detecting variations that might indicate issues, while water quality monitoring analyses physical-chemical characteristics to ensure compliance with standards for human consumption.

Status of the Fund

Although the original agreement for EPMAPS to add an environmental charge to water bills was done at their own behest, in 2007 the Metropolitan Ordinance No.199 and No. 213 ratified the 1% contribution to conservation into law and set out that this would increase by 0.25% annually until it reached 2%, where it stands today.[69] This created a long-term source of revenue for the Fund. The Fund has so far leveraged USD 22.5 million, benefiting over 3,500 farming families and implementing NbS across over 28,000 ha.[70] Comparative studies have found that in areas managed by FONAG, suspended solids are significantly lower (from 4 – 11 mg/l) than areas not managed by the Fund (6 – 70 mg/l).[71] From the perspective of the water utility, UNEP found that for each dollar invested in the Fund for conservation activities, EPMAPS saved USD 2.15 over 20 years of the Fund's operation.[72]

Replicability & Scalability

FONAG's success as the world's first water fund demonstrates the replicability of this model for addressing watershed conservation in urban areas dependent on natural ecosystems for their water supply. The Fund's design ensures a steady source of revenue to pursue watershed conservation, environmental education and monitoring. By embedding conservation funding into a public utility system, this approach offers a sustainable financial solution that other cities can adopt. The Fund has already inspired similar initiatives globally, particularly in Latin America, where cities like Bogotá, Lima, and São Paulo have developed water funds modelled after FONAG's success.

[66] Lorena (2019). The Path of Water — FONAG: work and lessons.
[67] Ibid
[68] Ibid
[69] Lorena (2019). The Path of Water — FONAG: work and lessons.
[70] Latin America Water Funds Partnership (2018). Fonda para la protección del agua - FONAG
[71] Ibid
[72] UNEP (2021). In Ecuador, an innovative financing tool secures water supplies

FONAG successfully navigated designing interventions for multiple land ownership contexts. While lands owned by the utility are reserved solely for water production, private landowners are engaged through conservation agreements that incorporate sustainable productive activities like agroforestry, allowing them to generate income while protecting critical water resources. This adaptability makes the FONAG model suitable for various land-use contexts, balancing economic needs with conservation goals.
The Fund's engagement with multiple stakeholders through its educational activities complemented the direct NbS interventions by creating a sense of shared ownership and shared responsibility for the watershed.

FONAG's focus on monitoring and demonstrating the cost-effectiveness of NbS ensures that the interventions are evidence-based and can attract future investment. The success of the Monitoring and Surveillance of Protected Areas program in showing tangible improvements in water quality and ecosystem health highlights the importance of collecting and sharing data to measure the return on investment. This data-driven approach is crucial in securing ongoing funding and expanding the model to other regions.

Lessons Learned

- Monitoring impact of NbS for water is key to demonstrate cost-effectiveness and attract additional investment.
- The economic and social needs of local communities need to be balanced with conservation. In the case of FONAG, interventions proposed on utility-owned land differed from those implemented on privately-owned land, with private owners supported to adopt sustainable productive activities such as agroforestry which would provide income while protecting and restoring the watershed.
- The Quito Water Fund illustrates how a water-based revenue model can be designed at the city level, as in this case the mayor's support was central to the launch of the Fund, illustrating the diversity of public governance levels that water-based revenues can relate to (e.g. State level for the Reef Credits scheme in Australia, Federal/National level for England's Nutrient Neutrality Scheme).
- Setting an independent financial manager for the Quito water fund ensured that conflicts of interest of the various stakeholder groups financing and impacted by the Fund are adequately managed. This is a key aspect of the success of water funds.
- Water Funds such as this one enable the implementation of localised interventions for improved water quality from passive interventions (e.g. the elimination of invasive species) to active restoration strategies (e.g. restoring native paramo vegetation and wetland habitat).
- For countries implementing water funds in context of socio-economic uncertainty, the Quito Water Fund demonstrates the importance of long-term public support for the mechanism which enabled this Water Fund to overcome the macroeconomic crisis faced by Ecuador since 1998. In Sri Lanka for example, a similar scheme is going through a re-launch due to private sector companies withdrawing their contributions when the country suffered from a severe macroeconomic crisis.

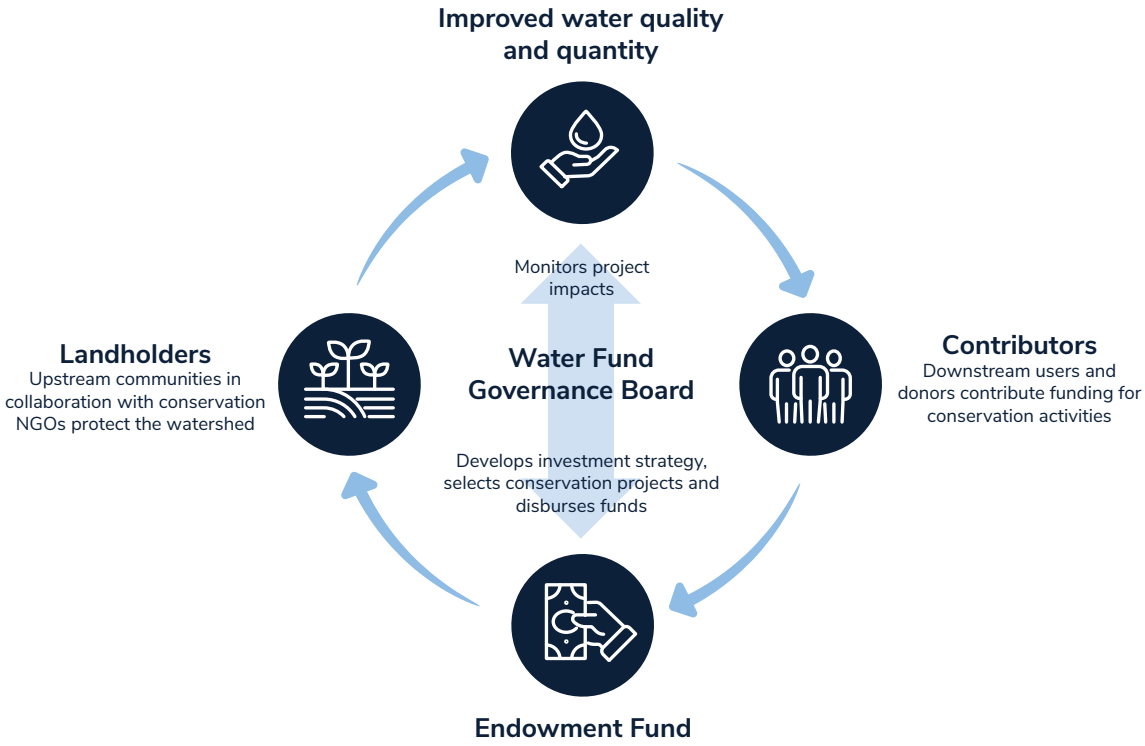
Water Fund: Upper Tana-Nairobi Water Fund

The Upper Tana-Nairobi Water Fund (UTNWF) is the first water fund developed in Africa to manage the Upper Tana River's watershed which provides drinking water for Nairobi's residents. The Tana River plays a major role in the health and economic development of Kenya. The river supplies water to the county's key national parks, generates half of the hydropower produced in the country, provides 95% of water used in Nairobi and underpins the country's most productive agricultural areas, supporting over 300,000 smallholder farmers.[73]

Since the 1970s, the expansion of agriculture in the Upper-Tana's watershed was leading to lower water levels and hydropower output as well as declining water quality due to increased sedimentation. Forests on the steep hillsides along the Tana River had been slowly cleared for agriculture, while reduced soil productivity from intensification of farming had pushed farmers onto steeper slopes.[74] This resulted in soil being washed into the river, further reducing agricultural productivity and clogging hydropower facilities and water management infrastructure.[75]

[73] Upper Tana Nairobi Water Fund Trust (2021). Upper Tana Nairobi Water Fund Strategic Plan 2022 – 2026
[74] The Nature Conservancy. Upper Tana-Nairobi Water Fund: Innovation at the nexus of water, food energy and business.
[75] Ibid.

Figure 4: Structure of Upper Tana-Nairobi Water Fund



Setting up the UTNWF

Led by The Nature Conservancy, a steering committee was created in 2014 to assess the business case for setting up a water fund and analysed the potential benefits and costs of implementing upper watershed conservation activities around the Upper Tana.[76] The steering committee consisted of TNC, Nairobi City Water and Sewerage Company (NCWSC), Kenya Electricity Generating Company (KenGen), International Centre for Tropical Agriculture (CIAT), Tana and Athi Rivers Development Authority (TARDA), Water Resources Management Agency (WRMA), along with downstream corporates such as Coca Cola and East Africa Breweries.[77] To model the investment opportunity, the costs and benefits of different interventions, and the potential economic benefits, the analysis used:

i. **Resource Investment Optimisation System (RIOS)**: an open-source tool for targeting investments in conservation activities[78]
ii. **Soil and Water Assessment Tool (SWAT)**: a tool to assess the likely impacts of different land management practices
iii. **A range of economic valuation tools**: to assess the potential economic benefits of the interventions on upstream and downstream communities.

The analysis concluded that investment into conservation measures in the watershed, administered through a water fund would deliver a viable return on investment and deliver substantial ecological and economic benefits, such as a 50% reduction in sediment concentration, up to a 15% increase in water yields and a USD 250,000 in annual cost savings for NCWSC.[79] The study also found that farming communities would benefit financially from changing management practices with up to USD 3 million per year in increased agricultural yields. Overall, the committee estimated that a USD 10 million upfront investment in the Fund could yield USD 21.5 million in economic benefits over 30 years.[80]

[76] TNC (2015). Upper Tana-Nairobi Water Fund Business Case. Version 2. The Nature Conservancy: Nairobi, Kenya
[77] Ibid.
[78] TNC Water Funds Toolbox: Tools for Analysis
[79] TNC (2015). Upper Tana-Nairobi Water Fund Business Case. Version 2. The Nature Conservancy: Nairobi, Kenya

The Fund was officially launched in 2015 with funding from the Coca Cola Foundation and the Kenyan Government, and the International Fund for Agriculture (IFAD) acting as the implementing agency. In 2016, the Global Environment Facility (GEF) contributed USD 6 million in grant funding and secured an additional USD 25 million in co-financing to set up the Fund.[81] The Fund was incorporated as a Trust in 2017, with funds managed as an endowment to ensure a stable source of funding over the long term. Overall, the Trust has been able to mobilise and deploy over USD 15 million in public sector funding and over USD 4 million from the private sector and foundations. [82]

Interventions

The Fund focused its interventions on shifting agricultural practices to decrease erosion into the Tana.[83] Funding was used to train farmers in new practices and to provide them with materials and input. The primary interventions are:

- Introducing vegetation buffer zones along riverbanks
- Training and materials to implement agroforestry systems
- Terracing steep farmlands to decrease erosion
- Reforestation of degraded lands at forest edges
- Planting grass buffer strips in farmlands
- Mitigating erosion from dirt roads

In September 2021, the Fund became an independent, Kenya-registered organisation, no longer under the TNC umbrella. The Fund is now managed by local leadership as an independent Trust. The Fund's interventions are designed not only to improve water quality but also to benefit farmers and build on existing conservation tools such as Rainforest Alliance Certification for conservation measures, with support to 8,500 smallholder coffee farmers on the obtention of this certificate in the project first three years.[84]

Replicability and scalability

As the first of its kind in Africa, the Upper Tana-Nairobi Water Fund has been a knowledge tool to inform the design of new water funds across the continent, for example in the Great Rift Valley in Kenya, in Addis Ababa in Ethiopia and in the Sebou Basin in Morocco or in Tanga in Tanzania.[85] The UTNWF provides a proven model to work at scale with a large number of local stakeholders, a critical criteria for the implementation of nature-based revenue models notably in low-and middle income countries – in this instance the project involved 165,000 local farmers to plant over 3 million trees to stabilise soils and increase carbon sequestration in the area.[86]

Beyond the inclusion of farmers and the local communities, one of the strengths of the project is the integration of a women's empowerment component. At its launch the project provided support to 39% women-led households, in comparison with the average of 24% women-led households in the region.[87]

[80] Ibid.
[81] Global Environment Facility. Food-IAP: Establishment of the Upper Tana Nairobi Water Fund (UTNWF)
[82] Earthly. Agroforestry – Upper Tana, Kenya
[83] Fondas de Agua. Upper Tana-Nairobi Water Fund: Innovation at the nexus of water, food, energy and business.
[84] International Water Association. The Upper Tana-Nairobi Water Fund
[85] IFAD (2022) Project Implementation report – Food-IAP: Establishment of the Upper Tana Nairobi Water Fund (UTNWF)
[86] Earthly. Agroforestry – Upper Tana, Kenya
[87] Ibid.

The inclusion of capacity building activities for farmers is at the core of this scheme's success and contributes largely to the sustainability of the UTNWF by helping farmers improve their positive impact/reduce their negative impact on water as well as becoming more resilient.

Lessons Learned

- Developing a robust business case using recognised methodologies is an integral part of designing an investment proposition for NbS for water. The business case is necessary for demonstrating the cost-effectiveness and potential economic, environmental and social co-benefits of proposed interventions. This is an essential tool for attracting investment in watershed conservation programmes.
- The Upper Tana-Nairobi Water Fund is a strong example of the economic opportunity that investments in green rather than grey infrastructure represent for better water quality and availability. Research carried out on behalf of the Fund found that a USD 10 million investment in the Fund's conservation activities could return USD 21.5 million in economic benefits over 30 years.[88]
- The UTNWF illustrates the ability of water fund schemes to engage a large number of smallholder farmers and to combine better environmental outcomes and increased livelihoods for these communities. Training farmers on the reduction of soil erosion which resulted both in higher agricultural yields and improved downstream water quality ensured the sustainability of the project.
- Active communication around the project both locally and internationally is a strong tool to mobilise more support for the project from funders to the general public. The UTNWF used a combination of media engagement, community outreach, school groups presentations and marathon sponsorships.[89]

[88] Blended Finance Taskforce, Case Study, Paying for nature, Nature Funds.
[89] International Water Association. The Upper Tana-Nairobi Water Fund

Payments for Ecosystem Services: Kumamoto, Japan PES scheme

In Kumamoto prefecture on Kyushu island in southern Japan, over one million inhabitants, along with agriculture and other industry, rely on groundwater reserves for their water supply. Population growth and the expansion of industry has led to increased abstraction of groundwater in the region, while urbanisation and changes in farming practices has hindered groundwater recharge.[90]

Rice production is key to groundwater recharge in Kumamoto with one third of recharge being due to the irrigation of rice paddy fields with water diverted from the Shirakawa River.[91] Conversion of paddy fields to produce upland crops and paving over fields to accommodate an expanding urban population exacerbated the decline in water availability downstream. In 2001, a semiconductor plant, Sony Semiconductor Manufacturing, began operations at its Technology Centre in the area, requiring significant amounts of water to be abstracted from the groundwater reserves.

[90] Shivakoti, Ichikawa and Villholth (2018). Incentivising groundwater recharge through payment for ecosystem services (PES): success factors of an offsetting scheme in Kumamoto Japan.

[91] OECD (2017). Payments for groundwater recharge to ensure groundwater supply in Kumamoto, Japan

Design of the Scheme

The Technology Centre was approached with a proposal from a local NGO, Kumamoto Environmental Network (KEN) to address the declining water availability in the area and have the company compensate for its additional pressure on the groundwater reserves. The Technology Center, in collaboration with KEN started making agreements with upland farmers to pay them to flood their unused rice fields, allowing groundwater to recharge.[92] Declining rice consumption in previous years had been leading farmers to at times, leave their fields fallow or change to alternative, more lucrative crops. This made payments for flooding their unused fields an attractive source of revenue for fields which may have been unprofitable and a suitable intervention for an ageing farming community.[93]

The agreements between the farmers and the Technology Centre were voluntary, allowing farmers to exit at any time. Participating farmers were paid JPY 11,000 (USD 100), JPY 16,500 (USD 150) and JPY 22,000 (USD 200) for flooding a 1,000m2 rice field for 1, 2 and 3 months, respectively.[94] By 2009, the groundwater that had been extracted by the Technology Centre since the scheme began (9.8 million tons), had been successfully recharged.[95]

Seeing the success of the scheme, other small and medium-sized companies that relied on groundwater joined the initiative. By 2017, 38 companies and organisations in the Kumamoto and Kyushu regions were taking part in the scheme by paying for their own offsetting and promoting and purchasing eco-labelled products.[96] Managed groundwater recharge is now also a key water management priority for the Kumamoto City Government. Additionally, the demonstrated ecological impact of the scheme has led to a parallel approach for incentivising rice production for groundwater recharge. Farmers are now selling rice produced adjacent to the Shirakawa River as eco-labelled products, which can fetch a premium price on the market.[97]

Nature-based revenue models are critical to address the challenges resulting from the development of water-intensive industries such as semiconductors with their sales forecasted to reach USD 602 billion in 2024. Some of the largest producers such as Taiwan are already experiencing droughts and Asia notably will need to continue investing in models which enable the continent to match its water needs and growth aspirations.[98]

[92] Okiria, E.; Zaki, M.K.; Noda, K. (2021). A Review of Payment for Ecosystem Services (PES) in Agricultural Water: Are PES from the Operation of Agricultural Water Control Structures Ubiquitous? Sustainability, 13, 12624.

[93] Shivakoti, Ichikawa and Villholth (2018). Incentivising groundwater recharge through payment for ecosystem services (PES): success factors of an offsetting scheme in Kumamoto Japan.

[94] UNESCO (2021) Managing aquifer recharge: a showcase for resilience and sustainability

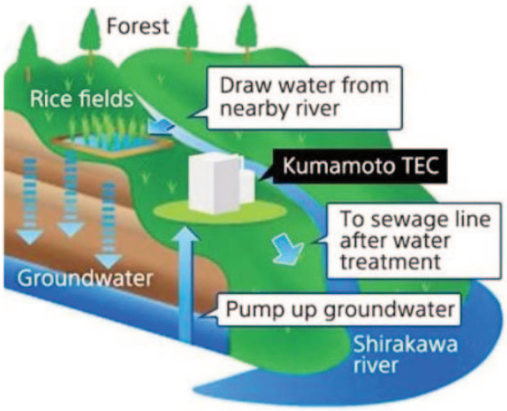
[95] Okiria, Zaki, Noda (2021). A Review of Payment for Ecosystem Services (PES) in Agricultural Water: Are PES from the Operation of Agricultural Water Control Structures Ubiquitous? Sustainability, 13, 12624.

[96] Shivakoti, Ichikawa and Villholth (2018). Incentivising groundwater recharge through payment for ecosystem services (PES): success factors of an offsetting scheme in Kumamoto Japan.

[97] Ibid.

[98] CDP, Financial Sector Water Knowledge Hub.

Figure 5: Conceptual diagram of the scheme's hydrology[99]



Replicability & Scalability

The Kumamoto PES scheme demonstrated that nature-based interventions for groundwater recharge can be a cost-effective, economically and socially viable pathway to improved water quality and availability in water-stressed areas. The success of the scheme first relied on the development of a thorough scientific understanding of the groundwater system in Kumamoto. The initial analysis was conducted by experts and researchers from local universities, which then informed the design of the payments scheme. To generate buy-in from farmers, the scheme was administered by the local agricultural association, Midori Network Ookiku (MNO), which negotiated flooding contracts between farmers and companies, monitored the flooding condition of fields and distributed payments.[100]

Proposing appropriate interventions and setting appropriate payment rates was also crucial to the models' success. For the aging farming community, leaving their fields to flood was a relatively low-effort commitment which would also allow them to improve the profitability of potentially fallow fields. Payment rates needed to be sufficient to incentivise adoption while being cost-effective for buyers. With a high market risk for rice production, the payment (typically averaging to about USD 925/year per family) was sufficient to incentivise participation of farmers who had multiple sources of income. For the water utility and private sector, estimated increased pumping costs due to declining groundwater storage was estimated at JPY 61.4 million (USD 0.54 million) over a decade, which is less that one tenth the cost of the PES scheme for the private sector.[101]

There may also be space to specifically engage the semiconductor industry in investing into water conservation. Global semiconductor manufacturing is expected to grow by 6% in 2024 and 7% in 2025, driven in part by the proliferation of AI processing.[102] Engaging this industry in designing market solutions to water scarcity can provide significant opportunities for communities to both attract manufacturing and secure access to safe and sufficient freshwater resources. By aligning industry interests with local ecosystem services, the PES model offers a scalable solution for other water-stressed regions.

[99] Dillon, Pavelic., et al (2006). Role of aquifer storage in water reuse.
[100] UNESCO (2021) Managing aquifer recharge: a showcase for resilience and sustainability
[101] UNESCO (2021) Managing aquifer recharge: a showcase for resilience and sustainability
[102] SEMI (2024) Press release : Global Semiconductor Fab Capacity Projected to Expand 6% in 2024 and 7% in 2025

Lessons Learned

- The scheme proved highly cost-efficient when compared to alternative solutions. The estimated expenses for the utility and private sector to engage with the scheme were less than one-tenth of what would have been required to expand pumping capacity.
- A robust scientific understanding of the local groundwater system, provided by experts, was crucial for designing a scheme with the highest likelihood of success. Involving both the scientific community and individuals with local knowledge is essential to identify effective interventions that can achieve the scheme's environmental objectives.
- This PES demonstrates the importance of public private dialogues to identify innovative schemes which can increase private sector financing for nature in accordance with companies specific interdependencies with nature. The Kumamoto PES scheme came from a proposal from a local environmental NGO which was attending a summit held by the semiconductor manufacturer.[103]
- The scheme tailored interventions to align with the region's demographics, particularly addressing the needs of an aging farming community. It offered low-effort actions that increased the profitability of fallow fields, making participation attractive. The scheme also provided flexibility, allowing farmers to opt out at any time.

[103] Japan Ministry of Environment. (2010). Conserving water by recharging groundwater in Kumamoto.

Metric Development for Voluntary Offsetting: Reef Credits

Reef Credits is a voluntary Australian nature market that incentivises landholders to undertake land management activities that improve water quality in the Great Barrier Reef catchment. These improvements, in turn, generate Reef Credits – tradable units that each represent a quantifiable volume of nutrient or sediment prevented from entering Great Barrier Reef catchments, which can be sold to investors. Although ultimately, the goal of the scheme is to improve marine water quality around the Great Barrier Reef, the interventions undertaken by farmers upstream are designed to improve the rivers and lakes in the Great Barrier Reef catchment. The design of methodologies to quantify the impact of upstream interventions can provide key lessons for diverse programs for investing in NbS for freshwater.

The Reef Credit Scheme was initially designed by environmental markets investor GreenCollar, alongside natural resource management organisations, Terrain NRM and NQ Dry Tropics. The scheme is now independently administered by Eco-Markets Australia, which issues credits once water quality outcomes are achieved and verified, manages a public registry where Reef Credit projects, credit issuances, transfers and retirements are logged, and acts as the Reef Credit Secretariat. A Technical Advisory Committee (TAC), acting independently from Eco-Markets has provided feedback and technical advice on all stages of the scheme's development, including reviewing credit generation methodologies.

Figure 6: Eco-Markets Australia Reef Credit

Methodologies

The program currently has four approved methodologies that project developers can use to develop Reef Credit projects.

Figure 7: Reef Credit Methodologies

Methodology	Nitrogen Use Efficiency Method	Gully Method	Wastewater Method	Grazing Land Management Method	Constructed Wetlands Method (Method Under Review)
Pollutant	Dissolved Inorganic Nitrogen	Sediment	Dissolved Inorganic Nitrogen	Sediment	Dissolved Inorganic Nitrogen
Activities	Soil and nutrient practice change	Landscape rehabilitation and construction	Algal bioremediation at sewerage treatment plant	Fine sediment savings through improved grazing land management practices	Utilise constructed wetlands to prevent dissolved inorganic nitrogen from entering waterways
Crediting period	10 years	25 years	15 years	25 years	25 years
Credits issued	Annually	On rainfall event	Quarterly	On rainfall event	On rainfall event
Independently audited	Annually	On rainfall event	Quarterly	On rainfall event	On rainfall event

The DIN Method, also called the Nitrogen Uptake Efficiency Method, measures the reduction of Dissolved Inorganic Nitrogen (DIN) through soil and nutrient practice change activities. These projects generate Reef Credits annually over a 10-year crediting period.[104]

The Gully Method measures the sediment reduction entering the waterways in the Great Barrier Reef catchment. Project activities under this methodology include landscape rehabilitation and construction. Projects under this methodology generate Reef Credits on a rainfall event and have a project crediting period of 25 years.[105]

The Wastewater Method measures the reduction of Dissolved Inorganic Nitrogen (DIN) entering the waterways in the Great Barrier Reef catchment through wastewater treatment plants. This methodology uses algal bioremediation technology within wastewater treatment plants to reduce the amount of DIN entering the Reef catchment waterways. Projects under this methodology issue Reef Credits quarterly and projects have a 15-year crediting period.[106]

The Grazing Land Management Methodology measures the reduction of sediment run-off due to improved grazing practices. The aim of the methodology is to increase ground cover ahead of rainfall events. Enhanced ground cover will then decrease sediment runoff into waterways adjacent to grazing lands. Practices under this method could include rotational grazing, matching stocking density to forage budgets, land remediation or infrastructure investments such as fencing.[107]

Methodologies for **Constructed Wetlands** are currently under review.[108]

Anyone can develop new methodologies for Eco-Markets to assess for potential inclusion, or suggest changes to approved methodologies. New methodologies are first screened for adherence to the Reef Credit Guide and Reef Credit Standard, before being submitted to the TAC for independent peer review and go through a public consultation.

The first Reef Credits were issued in 2020, from a pilot project developed by GreenCollar in the Tully River Catchment. The project, in collaboration with a cane farmer, generated 3,125 Reef Credits. HSBC and the Queensland Government purchased these first credits. As of mid-2024 over 50,000 Reef Credits have been generated, representing over 50 tonnes of Dissolved Inorganic Nitrogen being prevented from entering the waterways leading to the Great Barrier Reef. Over 40,000 of those credits have been retired which has generated more than USD 1.8 million (AUD 2.7 million) in returns.[109]

More on the Reef Credits scheme can be found in its case study in the R4N Database here.

[104] Schultz & Sinclair (2020). Method for accounting reduction in nutrient run-off through managed fertilizer application – version 1.1.
[105] Brooks et al (2020). Method of accounting for reduction in sediment run-off through gully rehabilitation – version 1.4.
[106] Mulder, Neveaux & RegenAqua Pty Ltd. (2023). Method for accounting DIN reduction in wastewater through managed algal bioremediation operations – version 1.3.
[107] Silverwood & Yates (2024). Reef Credit method for accounting fine sediment abatement through improved grazing land management. v 1.0.
[108] Eco-Markets Australia. Methodologies.
[109] Eco-Markets Australia (2023). EMA quarterly snapshot – Dec 23.

Replicability & Scalability

The Reef Credit Scheme offers a replicable and scalable voluntary model for improving water quality through market-based incentives that could be adapted to other regions facing similar water quality challenges. This mechanism is relevant to improve the conservation or restoration of natural resources at the intersection of public and private management, in this case Federal and State governments are responsible for water quality which is a public good, but the lands at the source of the pollution issues are owned by private entities.

The Reef Credit Scheme's adaptable methodology framework allows for the development of new, context-specific approaches to addressing water quality issues. These methodologies could be customised and expanded to target different pollutants or environmental stressors in other watersheds globally.

The Reef Credit Scheme's governance, including the independent oversight by Eco-Markets Australia, ensures transparency and builds public trust. For replication, this model of independent oversight can be critical for ensuring credibility, particularly in new regions where environmental markets may face scepticism. Establishing an independent body to review methodologies, verify outcomes, and maintain a public registry would be essential to maintaining the legitimacy and transparency of the scheme in other areas.

Voluntary participation lowers the barriers to entry for landholders who might otherwise be resistant to regulatory requirements. By creating a market-driven mechanism, the scheme allows participants to enter or exit based on their capacity and willingness to implement sustainable practices. Although a voluntary approach may come up against challenges in generating sufficient demand, a mechanism that is not designed to offset harm elsewhere can result in a net uplift in water quality.

Lessons Learned

- Any methodology should go through rigorous scientific and technical review, including public consultation to assess usability.
- Governments can benefit from delegating the administration of the reef credit scheme to an independent entity, in this case a not-for-profit company, to maintain its focus on overall water quality regulatory requirements that the scheme will comply with.
- Local or central governments play a central role in the start-up phase of nature credit scheme providing more time for private sector demand to emerge.
- Building supply for such schemes require the implementation of pilots with voluntary farmers to test the methodologies associated with the scheme and ensure the credibility and robustness of the scheme.

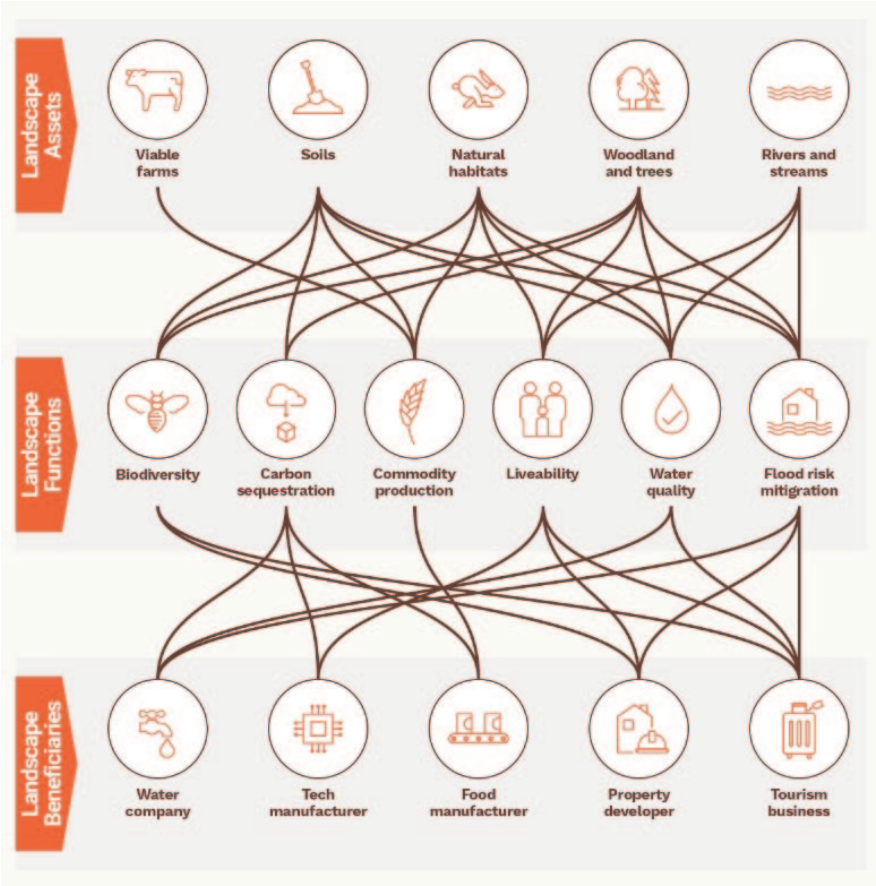
Landscape Enterprise Networks

Landscape Enterprise Networks (LENs) are an initiative launched through a collaboration between Nestlé and 3keel, with additional support from Diageo and PepsiCo, to promote sustainable agriculture and improve the environmental performance of supply chains. LENs now include multiple strategic and regional partners, across Europe.

As the name suggests, LENs bring together beneficiaries of landscape scale environmental change together with farmers in an aggregation model. LENs broker negotiations and transactions between groups of businesses with common demands for nature-based solutions, and groups of land managers - farmers - who can deliver those solutions. The programme then directs funds and technical assistance to farmers to help them transition to more regenerative agronomic practices, and to establish nature-based solutions – such as tree-planting or the creation of wetland habitats.

The program also involves collaboration with local governments, non-governmental organisations, and other regional stakeholders to ensure LENs: (1) support and complement the delivery of sustainable agriculture and land management policies, and (2) shape ecosystem service markets that are responsive to regional needs and conditions.

Figure 8: How LENs Work[110]



Currently, there are regional LENS trading groups in East Anglia and Yorkshire in England, in West Transdanubia in Hungary, Greater Poland and Lubusz in Poland, and Veneto e Friuli Venezia Giulia in Italy. There will be a new LENs initiative in the Leven region of Scotland in 2025.

New LENs regions are established by match-making businesses with land dependences in overlapping geographies. For example, in LENs Yorkshire Nestle Purina, PepsiCo, and Diageo have overlapping sourcing regions, with farms supplying feedstock to all of their respective manufacturing facilities, and Yorkshire Water is interested in water quality and quantity management in the same locations. In Vento e Friuli Venezia Giulia, Nestle Purina and The Prosecco Consortium source wheat and grapes from overlapping farms.

Match-making multiple businesses in this way provides the basis for sharing costs, and for defining and delivering more joined-up, whole-rotation and whole-landscape solutions.

The volume of LENs transactions is growing by 80%, year on year, across LENs regions; reaching EUR 15million in 2024, involving 350 farmers, and delivering regenerative farming practices and nature-based solutions on 45,000 hectares of land.

[110] Landscape Enterprise Networks. How LENs Work

Replicability & Scalability

The LENs model has been replicated following its initial implementation in England to Hungary, Poland and Italy. In all these settings the structure of the transactions is similar. This structure is set around a four-stage process:

1. A shared demand specification is defined, matching the overlapping needs of the various demand parties; typically based on a combination of outcomes such as Scope 3 greenhouse gas emissions, supply chain resilience, improved nutrient management
2. Groups of farmers propose packages of on-farm activities designed to deliver those outcomes
3. Deals are negotiated, by LENs, to create multi-party contracts linking demand and supply
4. Monitoring Reporting and Verification (MRV) arrangements are established and contracted, according to LENs protocols (which align with external protocols, such as FLAG and other SBTi protocols).

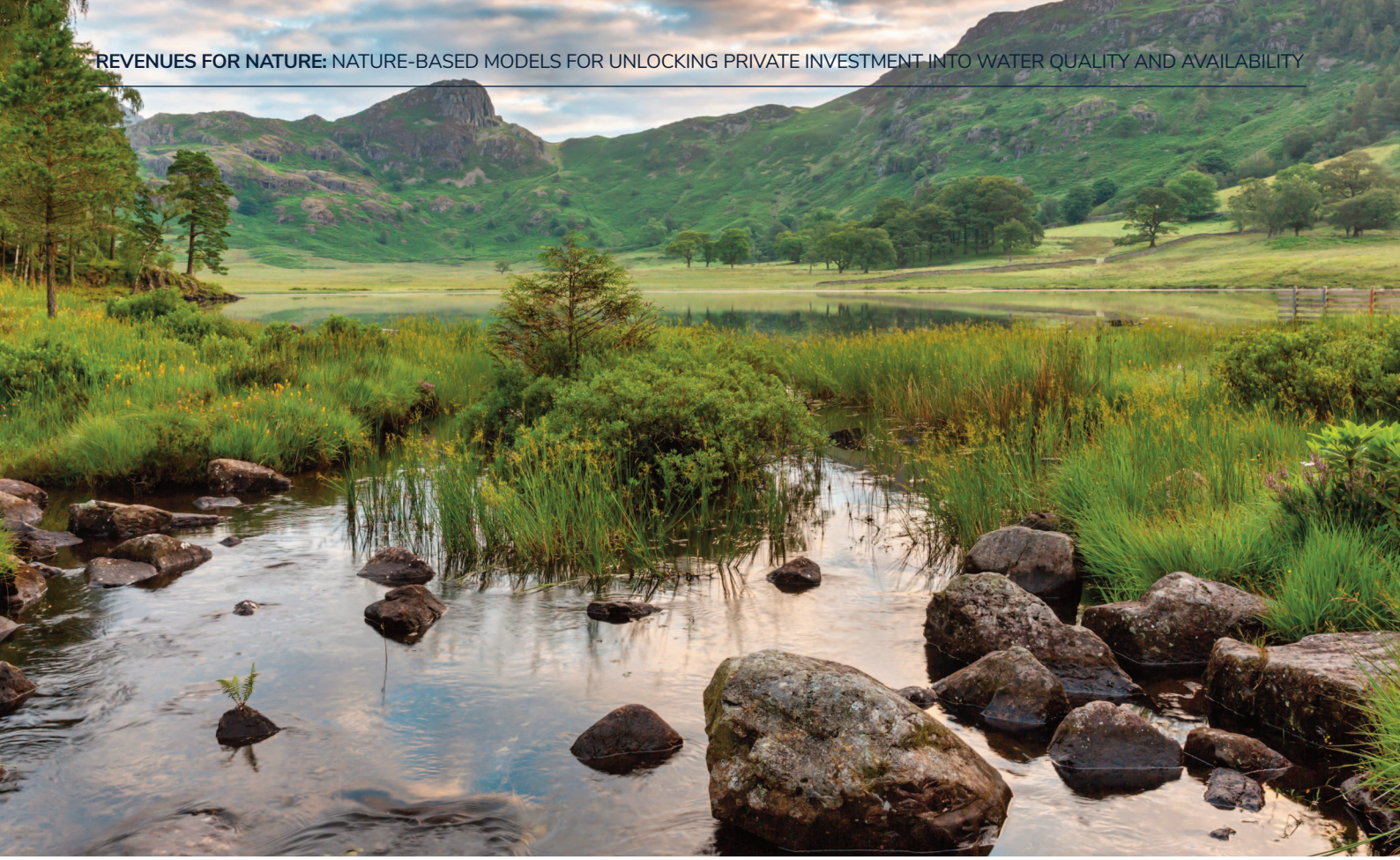
The LENs model is planned to expand into Scotland in 2025. It enables aggregation on both the demand and supply sides for achieving landscape-level environmental outcomes. On the demand side, companies with overlapping sourcing regions and shared environmental objectives can collaborate to financially support large-scale impacts. To replicate this model in new regions, businesses need to identify peers with similar environmental goals within the same geographical area and begin building a technical understanding of their common interests.

On the supply side, the LENs model establishes a governance structure that facilitates collaboration among farmers. Successful replication requires farmers to be willing to adapt their management practices and work collectively to achieve landscape-scale impacts. Engaging service providers with expertise in local agricultural practices is crucial to ensure that selected interventions are effective in meeting environmental goals and align with the needs of the participating farming communities.

In addition to aligning businesses and farmers, LENs can support civil society, governments, and other stakeholders in achieving their environmental objectives. By involving these stakeholders early in the process, LENs can help design interventions that address a broad range of environmental outcomes while meeting regional needs and priorities. Reviewing relevant legislation, environmental targets, and land-use plans ensures that projects contribute to broader environmental goals and complement existing policies.

Lessons Learned

- The LENs program brokers negotiations between groups of businesses with common demands for nature-based solutions and groups of land managers—farmers—who can deliver those solutions. The model illustrates opportunities in matching the needs of various stakeholders across supply chains to ensure that nature-positive outcomes can be reached alongside beneficial economic outcomes. The LENs approach of building multi-party contracts ensures that these specific needs - whether related to net zero targets, supply chain resilience, or nutrient management - are addressed while directing funds and technical assistance to relevant stakeholders, in this instance farmers.
- Aggregating farmers into groups can help them – especially small-scale farmers - access and navigate private nature markets, negotiate with their buyers, and improve their aggregated impact to landscape scale.
- Similarly, aggregating buyers can help spreading costs and de-risking nature-related investments for companies, while creating a multiplier effect of environmental outcomes.



Conclusion

There are significant opportunities for the private sector to invest in NbS to address freshwater quality and availability challenges. This Guidebook has demonstrated that such investments present a strong business case due to the cost-effectiveness of natural interventions, their potential to deliver co-benefits for the environment and society, and their role in mitigating risk while enhancing business resilience in the face of climate change. The models presented illustrate diverse mechanisms for mobilising private sector investment in the protection and restoration of freshwater ecosystems.

However, replicating and scaling these models is not without challenges. Project developers and local communities may lack the sufficient scientific and financial knowledge to develop investable NbS for water projects; local authorities or other oversight bodies may face capacity or resourcing issues if given administrative oversight of new NbS markets and regulations. Corporates may find it challenging to demonstrate the cost-effectiveness if NbS interventions when traditional CBA prioritises grey infrastructure.

Government can play a key role in addressing these challenges by creating effective enabling policies that incentivise NbS for water. Proactive policies, capacity development within local authorities, and government support for project pipelines are essential to making NbS for water a viable and attractive option for corporate investment. Furthermore, continuous monitoring of environmental and economic outcomes is vital for building transparency and demonstrating the long-term benefits of NbS for water projects.

Collaboration and alignment between government and the private sector can help swiftly mobilise private investment into NbS, allowing governments to achieve their nature-related targets and for the private sector to mitigate and respond to water-related risks. By addressing both environmental and business needs, NbS can offer scalable solutions that provide sustainable water management while delivering significant benefits for environment and society, both now and into the future.

Glossary

Adaptation, adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.[1]

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.[2]

Ambient environment, non-resource environmental factors that modify the availability of resources or the ability of organisms to acquire them.[3]

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.[4]

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.[5]

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).[6]

[1] TNFD Glossary, V2.0 June 2024, adapted from Fourth National Climate Assessment Glossary
[2] TNFD Glossary, V2.0 June 2024, from FAO, On Definitions of Forest and Forest Change (2020)
[3] Global Ecosystem Topology (IUCN), Glossary of selected terms
[4] TNFD Glossary, V2.0 June 2024, from International Financial Reporting Standard, Conceptual Framework: Elements of Financial Statements – Definitions and Recognition (2015)
[5] TNFD Glossary, V2.0 June 2024, from SBTi Beyond value chain mitigation
[6] 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.[7]

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.[8]

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.[9]

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.[10]

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).[11]

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.[12]

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.[13]

Certification programme provides procured volumes of a product with an official document attesting to a status or level of achievement against a certain standard.[14]

Conservation, an action taken to promote the persistence of ecosystems and biodiversity.[15]

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.[16]

[7] 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)
[8] The Convention on Biological Diversity, Article 2. Use of Terms,
[9] TNFD Glossary, V2.0 June 2024, from ISO ISO 14021:2016 (2016)
[10] TNFD Glossary, V2.0 June 2024, from Keith A. et al. (2020) IUCN Global Ecosystem Typology 2.0 (2020)
[11] TNFD Glossary, V2.0 June 2024, from European Environment Agency, EEA Glossary
[12] TNFD Glossary, V2.0 June 2024
[13] 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)
[14] TNFD Glossary, V2.0 June 2024, adapted from CDP (2022) Forests Reporting Guidance
[15] TNFD Glossary, V2.0 June 2024, adapted from Levin, S. A. ed., The Princeton Guide to Ecology Princeton (2009)
[16] 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.[17]

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.[18]

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.[19]

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.[20]

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).[21]

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.[22]

Double materiality has two dimensions, namely: impact materiality and financial materiality.[23]

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.[24]

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).[25]

---

[17] TNFD Glossary, V2.0 June 2024, from Accountability Framework initiative, Terms and Definitions (2020)
[18] TNFD Glossary, V2.0 June 2024, from International Finance Corporation, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012)
[19] UNDP BIOFIN, Catalogue of Finance Solutions
[20] Shortened from TNFD Glossary, V2.0 June 2024, from Accountability Framework initiative (Afi), Terms and Definitions (2024)
[21] TNFD Glossary, V2.0 June 2024, from Accountability Framework initiative, Terms and Definitions (2020)
[22] TNFD Glossary, V2.0 June 2024, adapted from Science Based Targets Network, SBTN Glossary of Terms (2023)
[23] TNFD Glossary, V2.0 June 2024, from European Commission, Directive 2022/2464 (CSRD) (2023)
[24] 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'.[26]

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.[27]

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.[28]

Ecosystem means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.[29]

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.[30]

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.[31]

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.[32]
Ecosystem extent, area coverage of a particular ecosystem, usually measured in terms of spatial area.[33]

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.[34]

---

[25] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[26] TNFD Glossary, V2.0 June 2024 from Hilty, J., et al., Guidelines for Conserving Connectivity through Ecological Networks and Corridors, IUCN (2020)
[27] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[28] TNFD Glossary, V2.0 June 2024 adapted from Bennett, G. and K.J. Mulongoy (2006).
[29] The Convention on Biological Diversity, Article 2. Use of Terms
[30] TNFD Glossary, V2.0 June 2024 from Adapted from UN et al., System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA) (2021)
[31] TNFD Glossary, V2.0 June 2024 adapted from UN et al., System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA) (2021)
[32] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[33] TNFD Glossary, V2.0 June 2024 from United Nations et al. System of Environmental-Economic Accounting – Ecosystem Accounting (2021)
[34] 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.[35]

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.[36]

Ecological integrity is defined as the system's capacity to maintain structure and ecosystem functions using processes and elements characteristic for its ecoregion.[37]

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.[38]

Endangered species are species considered to be facing a very high risk of extinction in the wild.[39]

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.[40]

Ex-situ conservation means the conservation of components of biological diversity outside their natural habitats.[41]

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.[42]

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.[43]

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.[44]

---

[35] The IUCN Global Ecosystem Typology
[36] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[37] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3, from Dorren et al. (2004)
[38] UNDP BIOFIN, The Little Book of Investing in Nature, from Daly and Farley, 2004; Voldoire and Royer (2004)
[39] TNFD Glossary, V2.0 June 2024 adapted from International Union for Conservation of Nature, IUCN Red List Categories and Criteria: Version 3.1 (2012)
[40] TNFD Glossary, V2.0 June 2024 from United Nations et al., System of Environmental-Economic Accounting – Ecosystem Accounting (2021)
[41] The Convention on Biological Diversity, Article 2. Use of Terms
[42] TNFD Glossary, V2.0 June 2024 from European Commission, Annex 1 to the Commission Delegated Regulation, supplementing Directive 2013/34/EU (2023)
[43] 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)
[44] 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%.[45]

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.[46]

Freshwater, all permanent and temporary freshwater bodies as well as saline water bodies that are not directly connected to the oceans.[47]

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.[48]

Habitat means the place or type of site where an organism or population naturally occurs.[49]

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).[50]

Habitat loss is the reduction in the amount of space where a particular species, or group of species can survive and reproduce.[51]

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.[52]

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.[53]

[45] TNFD Glossary, V2.0 June 2024 from FAO and UNEP, The State of the World's Forests (2020)
[46] TNFD Glossary, V2.0 June 2024 from FAO, Forest Resources Assessment - Terms and Definitions (2020)
[47] 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)
[48] TNFD Glossary, V2.0 June 2024 from Bardgett, R.D. et al., Combatting Global Grassland Degradation. Nature Reviews Earth & Environment 2: 720–735 (2021)
[49] The Convention on Biological Diversity, Article 2. Use of Terms
[50] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[51] TNFD Glossary, V2.0 June 2024 from UC Berkeley, Understanding Global Change
[52] 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)
[53] 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.[54]

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.[55]

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.[56]

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.[57]

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.[58]

Key Biodiversity Area, a site contributing significantly to the global persistence of biodiversity.[59]

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.[60]

Landfilling refers to the final depositing of solid waste at, below or above ground level at engineered disposal sites.[61]

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).[62]

[54] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3 from World Parks Congress (2003)
[55] Biodiversity Credit Alliance: Glossary of terms, Definition of a biodiversity credit, issue n.3 from Expert Mechanism on the Rights of Indigenous Peoples (2017)
[56] TNFD Glossary, V2.0 June 2024 from International Council for the Exploration of the Sea, Glossary of Terms (2022)
[57] The Convention on Biological Diversity, Article 2. Use of Terms
[58] Ibid.
[59] 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)
[60] TNFD Glossary, V2.0 June 2024 from IUCN, Global Ecosystem Typology (2023)
[61] 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)
[62] 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.[63]

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.[64]

[63] 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

[64] 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.[65]

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." [66]

Naturally regenerating forest, forest predominantly composed of trees established through natural regeneration.[67]

Nature, the natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment.[68]

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).[69]

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.[70]

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.[71]

[65] TNFD Glossary, V2.0 June 2024 adapted from Cross Sector Biodiversity Initiative (2015) and Science Based Targets Network, Step 4. Act (2023)
[66] UNDP BIOFIN, The Little Book of Investing in Nature, from the Natural Capital Coalition
[67] TNFD Glossary, V2.0 June 2024 from FAO, Forest Resources Assessment - Terms and Definitions (2020)
[68] TNFD Glossary, V2.0 June 2024 adapted from Díaz, S et al., The IPBES Conceptual Framework – Connecting Nature and People (2015)
[69] From WWF and South Pole, Common Success Factors for Bankable Nature-based Solutions, (2022)
[70] TNFD Glossary, V2.0 June 2024 adapted from IUCN, The IUCN Global Standard for Nature-based Solutions (2020)
[71] 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.[72]

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.[73]

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.[74]

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.[75]

Ocean, all connected saline ocean waters characterised by waves, tides, and currents.[76]

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.[77]

Peat is a deposit of partially decayed organic matter in the upper soil horizons.[78]

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.[79]

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.[80]

[72] TNFD Glossary, V2.0 June 2024
[73] TNFD Glossary, V2.0 June 2024 from Cross-Sector Biodiversity Initiative (2015) A Cross-sector Guide for Implementing the Mitigation Hierarchy
[74] Ibid
[75] UNDP BIOFIN, Catalogue of Finance Solutions
[76] TNFD Glossary, V2.0 June 2024
[77] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Policy Instrument, Retrieved 11 September 2024
[78] Global Ecosystem Topology (IUCN), Glossary of selected terms
[79] 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.[81]

"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.[82]

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.[83]

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.[84]

Reforestation is the conversion to forest of land that has previously contained forests but that has been converted to some other use.[85]

[80] TNFD Glossary, V2.0 June 2024 from FAO, Forest Resources Assessment – Terms and Definitions (2020)
[81] Ibid.
[82] TNFD Glossary, V2.0 June 2024 from Convention on Biological Diversity, Glossary of Relevant Terms (2018)
[83] TNFD Glossary, V2.0 June 2024 from IUCN, Guidelines for Applying Protected Area Management Categories (2018)
[84] The IUCN Global Ecosystem Typology
[85] 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.[86]

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.[87]

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.[88]

Resources, five fundamental resources in the environment that are essential to sustaining all life: water, nutrients, oxygen, carbon, and energy.[89]

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).[90]

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.[91]

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.'[92]

[86] 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)
[87] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[88] 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)
[89] Global Ecosystem Topology (IUCN), Glossary of selected terms
[90] TNFD Glossary, V2.0 June 2024 from IPBES Glossary
[91] TNFD Glossary, V2.0 June 2024from CBD, Guidance on using the indicators of the monitoring framework of the Kunming-Montreal Global Biodiversity Framework (2024)
[92] 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.[93]

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.[94]

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.[95]

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.[96]

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.[97]

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.[98]

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.[99]

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.[100]

---

[93] TNFD Glossary, V2.0 June 2024 from IUCN Issue Brief: The Benefits and Risks of Rewilding (2021)
[94] TNFD Glossary, V2.0 June 2024 from FAO, Global Forest Resources Assessment Update (2005)
[95] 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)
[96] TNFD Glossary, V2.0 June 2024 from FAO, Global Soils Partnership
[97] TNFD Glossary, V2.0 June 2024 from Van Noordwijk M , Climate Change: Agricultural Mitigation, Encyclopedia of Agriculture and Food Systems (2014)
[98] TNFD Glossary, V2.0 June 2024 from Kumar and Droby, Microbial Management of Plant Stresses (2021)
[99] TNFD Glossary, V2.0 June 2024 from Levin, S. A. ed., The Princeton Guide to Ecology (2009)
[100] 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.).[101]

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.[102]

Supply chain, the linear sequence of processes, actors, and locations involved in the production, distribution, and sale of a commodity from start to finish.[103]

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.[104]

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.[105]

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.[106]

Threatened ecosystem is an ecosystem assessed as facing a high risk of collapse in the medium-term. [107]

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.[108]

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.[109]

---

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

[102] 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)

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

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

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

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

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

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

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

References

AquaFed. Private Water Operators.

Balan (2022). Protest against Coca-Cola: Why the 20-year struggle of Kerala's Plachimada goes on. The News Minute

Blended Finance Taskforce. Case Study, Paying for nature, Nature Funds.

Brooks et al (2020). Method of accounting for reduction in sediment run-off through gully rehabilitation – version 1.4.

Ceres. Feeding Ourselves Thirsty.

Ceres. Valuing Water Finance Initiative,

CDP. Financial Sector Water Knowledge Hub.

CDP (2020). Cleaning up their act: are companies responding to the risks and opportunities posed by water pollution?

CDP (2022). Planet Tracker 'High and Dry: How Water Issues are Standing Assets'

CDP (2024) Navigating Troubled Waters

Cohen-Shacham et al. (2016). Nature-based Solutions to address global societal challenges. 10.2305/IUCN.CH.2016.13.en.

Conservation International. Green-grey infrastructure.

The Conservation of Habitats and Species Regulations (England) 2017

Cooper, R. & Matthews, J.H. (2020). Water Finance and Nature-based solutions. Institute of Development Studies.

De Bievre & Coronel (2022). Investing in catchment protection: the Water Fund model. Financing Investment in Water Security

Defra (2023). Combining environmental payments: biodiversity net gain (BNG) and nutrient mitigation

Dillon, Pavelic., et al (2006). Role of aquifer storage in water reuse.

Earthly. Agroforestry – Upper Tana, Kenya

Eco-Markets Australia. Methodologies.

European Commission. Sustainable use of Nutrients.

European Environment Agency (2015). Briefing: Freshwater quality.

Esraz-Ul-Zannat et al (2024). A review of nature-based infrastructures and their effectiveness for urban flood risk mitigation

Forest Trends (2022) Opening the Tap: State of finance for natural infrastructure for water security in Peru, 2021.

Gammie et al (2021). Mobilizing funding for nature-based solutions: Peru's drinking water tariff.

Global Environment Facility. Food-IAP: Establishment of the Upper Tana Nairobi Water Fund (UTNWF)

Global Water Partnership. Brief on Water and Corporate Social Responsibility.

Green Finance Institute (2024) Farming Toolkit for Assessing Nature Market Opportunities

HMG. Find protected areas of countryside.

Horton & Laville (2024). 'England won't adopt EU river pollution rules for pharma and cosmetics firms', The Guardian. March 22.

IFAD (2022) Project Implementation report – Food-IAP: Establishment of the Upper Tana Nairobi Water Fund (UTNWF)

International Water Association. The Upper Tana-Nairobi Water Fund

International Water Association (2021) Nature based solutions for wastewater treatment: a series of factsheets and case studies.

IPBES. Policy instrument: Payment for ecosystem services

IIED (2013). Payments for environmental services: lessons from the Costa Rican PES programme

Japan Ministry of Environment. (2010). Conserving water by recharging groundwater in Kumamoto.

Latin America Water Funds Partnership (2018). Fonda para la protección del agua - FONAG.

Local Government Association (2023). Stuck in neutral: A call for partnership working on river quality and water quantity

Lorena (2019). The Path of Water — FONAG: work and lessons.

Mulder, Neveaux & RegenAqua Pty Ltd. (2023). Method for accounting DIN reduction in wastewater through managed algal bioremediation operations – version 1.3

Natural England (2022). Nutrient Neutrality Generic Methodology.

Natural England (2022). Nutrient Neutrality and Mitigation: A summary guide and frequently asked questions (NE776)

Natural England & Defra (2023). Natural England's nutrient mitigation scheme for developers

Natural England (2024). Delivering for nature and the economy (Blog)

Nuclear Energy Institute Statistics

Okiria, Zaki, Noda (2021). A Review of Payment for Ecosystem Services (PES) in Agricultural Water: Are PES from the Operation of Agricultural Water Control Structures Ubiquitous? Sustainability, 13, 12624.

OECD. (2020). Nature-based solutions for adapting to water-related climate risks

OECD (2016) OECD council recommendation on water

OECD (2015). Policy Framework for Investment, 2015 Edition

OECD (2024). Assessing the enabling conditions for investment in water security: Scorecard pilot test in Asian countries.

ProAmazonia. FONAG: a benchmark in the ecological restoration of water source ecosystems

Schultz & Sinclair (2020). Method for accounting reduction in nutrient run-off through managed fertilizer application – version 1.1.

SEMI (2024) Press release : Global Semiconductor Fab Capacity Projected to Expand 6% in 2024 and 7% in 2025

Shivakoti, Ichikawa and Villholth (2018). Incentivising groundwater recharge through payment for ecosystem services (PES): success factors of an offsetting scheme in Kumamoto Japan.

Silverwood & Yates (2024). Reef Credit method for accounting fine sediment abatement through improved grazing land management. v1.0.

Stockholm International Water Institute (2024) Water and Peace

Tanentzap & Fonvielle (2024). Chemodiversity in freshwater health: Dissolved organic matter may offer a way to track and restore the health of fresh waters. Science, 383: 6690

TNC Conservation Gateway. Corporate water Use.

TNC Fondas de Agua. Upper Tana-Nairobi Water Fund: Innovation at the nexus of water, food, energy and business.

TNC Resilient Watersheds Toolbox

TNC Upper Tana-Nairobi Water Fund: Innovation at the nexus of water, food energy and business.

TNC (2012). Water Funds: conserving green infrastructure.

TNC (2015). Upper Tana-Nairobi Water Fund Business Case. Version 2. The Nature Conservancy: Nairobi, Kenya

TNC (2021) Benefit accounting of nature-based solutions for watersheds: guide.

TNC Resilient Watersheds. (2020). The story of Quito – the first "water fund".

TNFD (2024) Glossary, V2.

UK Environment Agency (2024). State of the water environment indicator B3: supporting evidence

UN Department of Economic and Social Affairs. Fund for the Protection of Water (FONAG)

UN Water (2021). Summary Progress Update 2021: SDG 6 — water and sanitation for all.

UNEP (2016). Fresh look-back at a Payment for Ecosystem Services (PES) project in Uganda

UNEP (2021). In Ecuador, an innovative financing tool secures water supplies

UNESCO (2018). Nature-based solutions (NBS) and water in The United Nations world water development report 2018: nature-based solutions for water.

UNESCO (2021) Managing aquifer recharge: a showcase for resilience and sustainability

UNESCO (2024). The United Nations World Water Development Report 2024: water for prosperity and peace; facts, figures and action examples

Upper Tana Nairobi Water Fund Trust (2021). Upper Tana Nairobi Water Fund Strategic Plan 2022 – 2026

US EPA. The Effects: Dead Zones and Harmful Algal Blooms

US EPA (2007). Reducing stormwater costs through low impact development strategies and practices.

World Bank (2023). Scaling Up Finance for Water: A World Bank Strategic Framework and Roadmap for Action

World Bank (2024). Bank's Funding a Water-secure Future: An Assessment of Public Spending.

World Economic Forum (2023) Global freshwater demand will exceed supply 40% by 2030, experts warn.

World Water Council (2015). Water: fit to finance? Catalyzing national growth through investment in water security

Appendix 1: Supportive Tools

NGOs, international organisations and private companies have developed a number of supportive tools to aid water sector stakeholders in assessing the enabling environment for water investment and designing appropriate models to mobilise investment into NbS for water.

OECD Scorecard for Water Investment

The OECD and the Asian Development Bank have developed a Scorecard for Water Investment which is a tool that assesses the enabling environment for investment in water security. Through a questionnaire, across four dimensions that is rated out of 5, the scorecard identifies the conditions necessary to attract and maintain investments in water security. The scorecard is for policymakers and investors so that they can identify and solve barriers to water investment and understand how to use existing capital or mobilise additional investment.

The scorecard collects and evaluates mostly publicly available data but also primary data on the following themes:

Dimension 1: Overall policy framework for investment

- This dimension evaluates if a country is attractive for investors using a modified version of the OECD Policy Framework for Investment (PFI). It looks at macroeconomic, credit markets, policy and governance indicators to assess a country's investment environment.

Dimension 2: Water policy framework for investment

- This section assesses a country's investment opportunities and risks in relation to water security. It evaluates a country's water sector policies, market conditions, policy barriers, and regulations that may have an impact.

Dimension 3: Bankability and sustainability of projects

- Dimension 3 assesses whether the necessary structures are in place to support projects that are commercially viable. It assesses the roles of institutions involved and their capacity in developing projects.

Dimension 4: Contribution of other economic sectors to water security

- This section looks at other sectors such as agriculture and measures their economic impact on water security. It assesses how they consider their impacts and what their risks are on water resources.

The tool was pilot tested in seven Asian countries and was successful in identifying the conditions for investment in water.

TNC Resilient Watersheds Toolbox

The TNC Resilient Watersheds Water Fund Toolbox is a resource developed by The Nature Conservancy (TNC) to guide the development and management of Water Funds. The Toolbox offers practical tools, methodologies, and best practices to help organisations and governments establish Water Funds. The toolbox is structured into four main sections.

1. **WIP Project Cycle** – A step-by-step guide for setting up a Water Fund based on a 4-phased cycle: pre-feasibility, feasibility, design and execution, including tools templates for each stage.
2. **Introduction to Watershed Investment Programs** – Resources to learn the basics of how water funds work. NbS can be used to improve water security, along with representative case studies.

3. **Resources** – A library of case studies, guidance documents, scientific articles and templates.
4. **Trainings and Network** – The Resilient Watersheds Network offers a community of practitioners to connect and share lessons learned and best practices for developing NbS projects for water and for designing and implementing water funds.

The Resilient Water Accelerator

The Resilient Water Accelerator is a global initiative that aims to attract private and public finance into water projects. The initiative focuses on market conditions and support countries in designing water security programmes, identifying investment opportunities, and bringing together relevant stakeholders, including governments, financial institutions and corporates to strengthen the enabling environment. The initiative has developed a pipeline of projects for investors and comprehensive programmes that is intended to be replicated and scaled.

NbS Benefits Explorer Tool

The NbS Benefits Explorer Tool was created for organisations wanting to invest in nature-based solutions (NbS) for watersheds. The interactive tool provides the types of activities and processes that can be undertaken and the benefits that are generated as a result. The tool is for public and private sector actors that want to develop either effective policies, programs, or projects. The tool also includes a valuation projection tool, and a benefit forecast for users to understand where and when benefits will occur. This tool is part of a wider project that looks at investing into water NbS.

WBCSD NbS Blueprint

The World Business Council on Sustainable Development (WBCSD) developed the Nature-based Solutions Blueprint, which provides a six-step process for developing the business case for NbS across sectors and biomes, including wetlands, and rivers and lakes.

Alongside the Blueprint, WBCSD launched the Nature-based Solutions Map a tool to support companies in identifying the types of NbS interventions that best address their priority challenges and opportunities for business growth and impact.

Disclaimer

This report has been made available to you for information purposes only. Nothing in this report is to be construed as legal, tax, investment, financial or any other advice by Green Finance Institute Limited ("GFI"). This report does not constitute, and is not intended to constitute, an invitation, solicitation, recommendation, endorsement by GFI or any third party to take any particular course of action (including, but not limited to, entering into any financial arrangements) in the United Kingdom or in any other jurisdiction. It is not intended to be relied upon by users in making (or refraining from making) decisions of any nature (including financial or investment decisions).

The information contained in this report is of a general nature and does not address the circumstances of any particular individual or entity. Certain information contained in this report has been obtained from or is based on sources that GFI believes to be accurate and complete. This report is not, and does not purport to be, a comprehensive or complete statement or reflection of the matters set out herein. Although reasonable care has been taken to check the accuracy of the information contained in this report, GFI cannot guarantee and does not take responsibility for the accuracy or completeness of the information contained in this report. Any opinions set out in this report may be incorrect and may change at any time.

In reading and accessing this report, you alone assume the responsibility of evaluating the merits and risks associated with the use of any information contained herein before making any decisions on the basis of such information or content. GFI accepts no liability for any losses or damages (whether direct, indirect, special, consequential or otherwise) arising out of opinions, errors or omissions contained in this report, and it excludes all liability arising from this report to the fullest extent permitted by law.

You should not base any investment or financial decision solely on the basis of the information contained in this report. Where relevant, you should seek appropriate legal, tax, investment, financial or other professional advice.

GFI is not a registered investment adviser and it is not regulated by the Financial Conduct Authority.

Green Finance Institute

CONTACT US

info@gfi.green

greenfinanceinstitute.co.uk