Nature-based Solutions
Triple Win Toolkit

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For further information please contact:

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough PE1 1JY

https://jncc.gov.uk/

Communications@jncc.gov.uk

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Contributing Authors:

Executive Summary	Coogan, C., Harris, M. & Wooden, E.
Principles	Coogan, C., Byford, S., Collar, M., Hawker, J. & Wooden, E.
Implementation Guidance	Beagley, L., Scott, S. & Collar, M.
Biodiversity Indicators in Context	Wright, E., Woodcock, P., Hassall, I., Harris, M., Matear, L., Britton, A., Smith, A., Vina-Hebron, C. & Cheffings, C.
Economics and Financial Assessment	Collar, M., Coogan, C., Byford, S., Scott, S. & Wooden, E. van Pul, J., Guzmán Valladares, A., Schep, S., & Süring, C.
Evidence Base	Wooden, E. & Coogan, C.
Future Direction	Wooden, E. & Coogan, C.
Case Studies	Byford, S., Beagley, L., Coogan, C., Collar, M., Hawker, J., Scott, S. & Wooden, E.

Abstract

Nature-based Solutions (NbS) are actions which enlist elements of nature or natural processes to address a particular problem, or suite of problems, faced by society and which deliver multiple benefits in the form of public goods. This Toolkit offers guidance to achieve a 'triple win' to enhance biodiversity, address climate change, and reduce poverty, through NbS in the context of Official Development Assistance spend. The current state of knowledge was assessed from the literature and an analysis of 2,934 projects and 460 indicators was conducted. Principles are provided for the effective and efficient delivery of NbS, which are supported by case studies of NbS projects. Implementation Guidance builds on these Principles to present key considerations and possible tools to achieve the triple win. The Toolkit highlights the need to treat the enhancement of biodiversity as an explicit objective on par with addressing the impacts of climate change and reducing poverty; a review of Biodiversity Indicators provides recommendations to measure the impact of NbS interventions on biodiversity from the project to portfolio scale.

Finally, the Economics and Financial Assessment presents a brief discussion of how benefit-cost ratios and value for money assessments vary for selected interventions. It also outlines barriers to private investment in NbS with possible models for leveraging private finance.

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Executive Summary

Introducing the Triple Win Toolkit

This Toolkit offers guidance to achieve, through Nature-based Solutions (NbS), a 'triple win' to enhance biodiversity, address climate change, and reduce poverty in the context of Official Development Assistance (ODA) spend, especially for the International Climate Finance (ICF) programme. The toolkit is a summary of the current state of knowledge and core **Principles** for effective and efficient delivery of NbS. **Implementation Guidance** builds on these Principles to present key considerations and possible tools to achieve the triple win. The Toolkit highlights the need to treat the conservation or enhancement of biodiversity as an explicit objective on par with addressing the impacts of climate change and reducing poverty. **Biodiversity Indicators in Context** also provides recommendations to measure the impact of NbS interventions on biodiversity from the project to portfolio scale.

Finally, a review of the **Economics and Financial Assessment** presents a brief discussion of how benefit-cost ratios and value for money assessments vary for selected interventions. It also outlines barriers to private investment in NbS with possible models for leveraging private finance.

Background

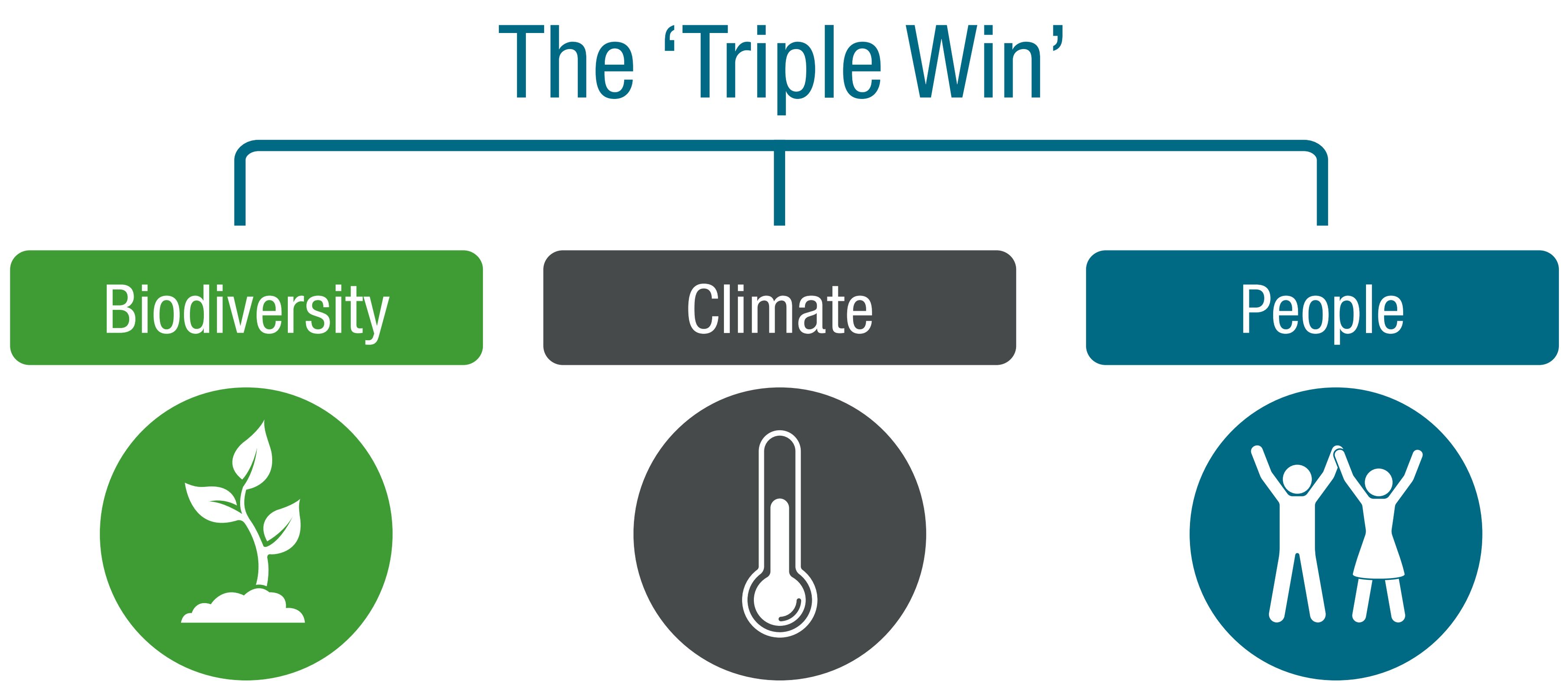
Nature-based Solutions

We define NbS in this context as *actions which enlist elements of nature or natural processes to address a particular problem, or suite of problems, faced by society and which deliver multiple benefits in the form of public goods* (see **Methods**). Nature-based solutions is an umbrella term, and includes interventions to adapt, enhance, or create ecosystems which, along with continued sustainable management or protection, enable society to respond to global pressures and change. NbS may be implemented alone or as a suite of interventions, including in tandem with 'grey' or engineered solutions. NbS may deliver private goods in addition to public goods; however, a key aspect in this context is the provision of a wide range of non-monetisable benefits accessible by all members of a community rather than providing a commercial return on private sector investment. For this reason, NbS are often promoted as cost-effective solutions to wider societal pressures such as climate change, which can sustain healthy ecosystems while balancing human health, livelihoods, or economic growth.

The interventions often collated under NbS – ecological restoration, ecosystem-based adaptation, green infrastructure to name a few – are not new. Rather, the term captures decades of knowledge and experience utilising natural processes and ecological principles to support human well-being and reduce or respond to risks (e.g., restoring wetlands to improve water quality and mitigate flooding). The novelty of NbS is in how it allows for lessons learned from decades of programmatic and project-level experience to be distilled into common principles and guidance.

The 'Triple Win'

In order to address the simultaneous crises of biodiversity loss, climate change, and poverty and security the UK Government set out the 'triple win' for projects to deliver on enhancing biodiversity, addressing climate change, and reducing poverty. Many approaches have previously, in the context of global development, sought to use conservation techniques to achieve economic goals. For instance, funding through ODA and ICF-funds places objectives for people alongside objectives for the planet. However, the focus of several development programmes has been on mitigation or adaptation to climate change and reduction in poverty and less on achieving benefits for biodiversity.



Depiction of the Triple Win. Each objective can be reinforcing, whereby achieving for one can support positive outcomes for the others. The balance between all three objectives is an important aspect for NbS projects.

Biodiversity can be complex to measure, so indicators can be misapplied, or objectives assumed to be achieved with no adequate indicators or monitoring. For example, invasive non-native trees might be planted into naturally treeless ecosystems and be claimed as a benefit for carbon sequestration and even for biodiversity when, in fact, biodiversity has been damaged. Though measuring and appropriately addressing biodiversity can be difficult, the important role biodiversity plays for human well-being – providing ecosystem services, resiliency, and resources – is increasingly well understood. Ecosystems with greater biodiversity often are resilient to changes from climate or stochastic events. Diverse ecosystems also support food security or access to water – fish diversity is linked to higher productivity and fish biomass harvested. Healthy wetlands can provide water purification. Delivering for biodiversity, therefore, can support delivery on climate and poverty objectives for the triple win.

Summary of findings

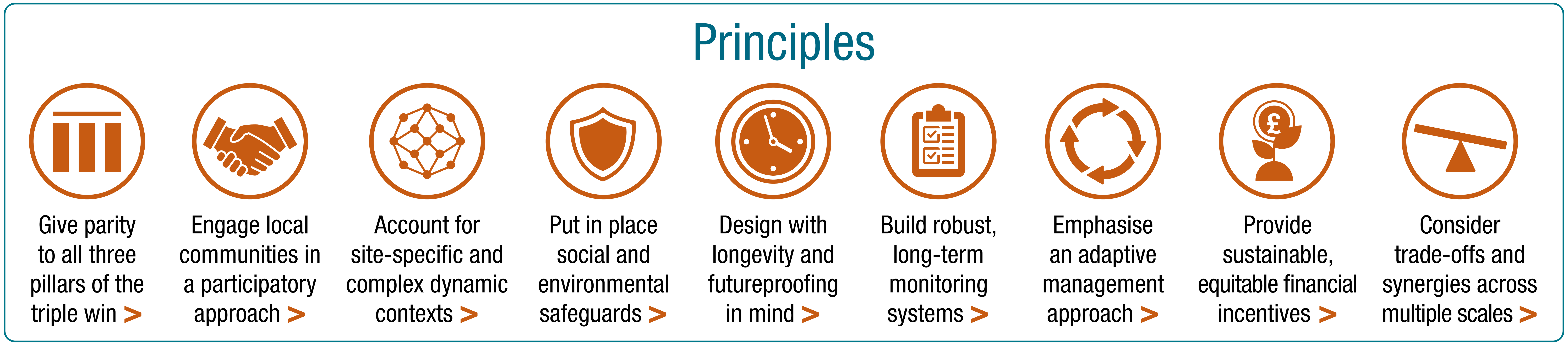
The following are key findings from a review of the relevant literature and case studies (n=2,934) which utilise NbS (n=378), with particular consideration given to those in ODA-eligible countries (n=283). The biodiversity indicators used in these case studies and an additional 66 indicator frameworks were reviewed (n=460) to make specific recommendations for measuring biodiversity benefits. Detailed **Methods** can be found in the supporting material.

Some findings may be attributable to the databases and programmes selected for review and their reporting requirements. However, our general findings were confirmed from literature review and other synthesis and review work of longstanding NbS programmes.

- **Biodiversity benefits from NbS are often inadequately monitored.** Especially for ODA work, tracking climate and poverty reduction outcomes are fairly well understood with established metrics. Biodiversity indicators, however, are often misunderstood or mismatched to outcome objectives. Several case studies that fit selection criteria did provide quantified biodiversity objectives, however these objectives often relied upon activity-based indicators which are insufficient to assess long-term outcomes for biodiversity. This is certainly due to the databases selected for review, which were conservation programmes.
- **Measuring biodiversity is a complex and wide-ranging concept that cannot be effectively captured in single metrics.** There are numerous metrics or measurements of biodiversity currently in use, but a gap is monitoring of biodiversity outcomes for ODA projects. A number of wider considerations should be made when developing biodiversity measurements. Recommendations are made to address the lack of biodiversity monitoring in **Biodiversity Indicators in Context**, including two potential headline indicators and considerations for further indicators relevant from project to portfolio level.
- **Most NbS projects focus on terrestrial ecosystems – especially reforestation or agroforestry**. Marine and urban examples are fewer but could represent less opportunity for scalable solutions or value for money. NbS provide an opportunity to incorporate a greater diversity of ecosystem types through landscape- or multi-ecosystem scale planning. This way the diversity, dynamics, and connectivity of ecosystems can be addressed, and any negative impacts avoided.

- **Very few projects conducted or provided a cost effectiveness or financial analysis**, though the literature provided several reviews of cost effectiveness for coastal or marine projects. The cost-effectiveness evaluations that were available were used to justify a project or to gain project approval. There is little evidence of the economic case for NbS being reassessed after the project has begun to assess whether assumptions were correct or whether costs and benefits accrue as anticipated in the initial assessment.
- **Post-project evaluation was infrequently conducted**, especially for marine and urban settings though marine was slightly more common than urban. This could be due to the reporting requirements of the programmes selected or limits to post-project funding for monitoring and evaluation.
- **NbS are effective when a suite of interventions is used, or when incorporated with other approaches** (e.g., grey infrastructure or specific poverty reduction policies). Most of the case studies utilised several NbS interventions in their project approach. Many also deployed complementary approaches to achieve the triple win – through data improvement and early warning system development or tying activities to local public health work.
- **NbS is mostly financed by the public sector and with grant funding**. This is because the public goods which NbS generate are often difficult to convert into financial returns for the private sector. The risks and uncertainties associated with both NbS interventions and investing in ODA context remain prohibitive in comparison with conventional investment opportunities.

The review of case studies and key literature produced a set of underlying **Principles** (see Figure 2) which describe how an NbS project can contribute to a triple win in the context of ODA funding.



Nine Principles for Nature-based Solutions. These principles are the product of the review and synthesis of core principles from the many interventions that qualify as NbS, other meta-analyses, and lessons learned from the case studies.

Conclusions and future pathways

The presented **Principles**, **Implementation Guidance**, and **Biodiversity Indicators in Context** set out how a project can be designed and monitored to deliver a triple win effectively and efficiently for ODA spending. The selected **case studies** demonstrate success for nature, climate, and people. The interventions considered in this review are not new – but their consideration together means new recommendations can be provided on how best to apply NbS to achieve the triple win.

To maximise the achievement of the triple win, all objectives – especially biodiversity – must be explicitly addressed in project planning and monitoring.

- **Explicit integration of appropriate biodiversity indicators creates an opportunity to move from *no net loss* to *net gain*, setting NbS apart in the ability to maximise returns across the triple win.** In development programmes which focus on climate change and poverty, biodiversity presents opportunity for additional benefit which would otherwise be overlooked. By following the guidance on biodiversity indicators, programmes can ensure adequate outcome- and activity-level indicators and monitoring plans are utilised.
- **Using biodiversity as the lens to approach other ODA projects also achieves balance between the three objectives of the triple win**. By approaching development projects with biodiversity in mind, climate and poverty reduction goals can still be achieved whilst simultaneously creating additional benefits for biodiversity.
- **Value for money assessments of NbS must give appropriate weight to each of the triple win objectives, as well as to non-financial and financial benefits**. The wide range of benefits which NbS deliver are typically in the form of either public goods, which are not ordinarily conducive to private sector finance, or qualitative benefits for livelihoods and biodiversity, which are difficult to monetise credibly. Appropriate weighting promotes NbS projects which monitor both qualitative social benefits imperative to local livelihoods and the financial benefits suitable for the private sector.

However, applying NbS in isolation may not be sufficient to achieve net gain for each objective of the triple win.

- **There may be thresholds to success and scalability**, especially in the face of increasing unpredictability from climate change wherein an NbS cannot offer protection from stronger storms or changing weather patterns. Limitations to scaling up also include where local conditions, political or legal circumstances, limited funding, or spatial scale prevent benefits being realised.
- **Thresholds can be overcome by applying NbS as an integrated approach** – as a suite of other NbS interventions, alongside engineered or technological solutions, or paired with international commitments. With NbS there is no one-size-fits-all approach, and no one intervention is a 'silver bullet'. Using NbS in concert with diverse approaches increases chances of successful implementation.
- **Mainstreaming NbS into a range of sectors can scale up benefits for the triple win**. Considering NbS as isolated solutions overlooks their usefulness as a component of other solutions. NbS can be mainstreamed into programmes or activities which do not have a nature or biodiversity focus – physical infrastructure, national development, humanitarian aid, spatial planning – offering holistic solutions to multifaceted problems and additional benefits for any of the triple win objectives.

These benefits from NbS materialise over longer timescales, but long-term monitoring and evaluation is limited.

- **Partnerships with NGOs in local areas and decentralising decision-making may help resolve long-term monitoring issues.** Engaging local communities, leaders, or institutions can tie NbS to structures already embedded on the ground. This gives communities autonomy over interventions and activities, which can increase buy-in and sustain interventions after project completion. Capacity building and technology transfer is required for maintenance and monitoring after the drawdown or reduction of external funding.
- **Setting outcome indicators in addition to activity-based indicators provides complementary approaches to measuring biodiversity effectively**. Activity-based indicators are worthwhile for short-term monitoring, but do not provide an assessment of whether outcome objectives were achieved. Outcome indicators can more comprehensibly address the larger and longer-term benefits of NbS.
- **Mainstreaming NbS into national policy or international agreements can achieve long-term planning and commitment.** Embedding NbS in national policy extends the timeframes under which commitments are considered. It can also connect NbS to diverse funding schemes, which can support project implementation or continuation. Incentives to continue monitoring are created as NbS is tied into national reporting requirements. NbS can be incorporated into reporting for biodiversity through the Convention on Biological Diversity (CBD); for climate through Nationally Determined Contributions (NDCs) for the Paris Agreement or United Nations Framework Convention on Climate Change (UNFCCC); poverty reduction through the Sustainable Development Goals (SDGs) and resiliency frameworks.
- **Leveraging a focus on biodiversity can open access to resources or funding** as projects contribute to broader policy goals or international reporting requirements. For ODA and ICF spending, NbS implementation feeds directly into the triple win objectives set by UK Government and is fortified by policy such as the 25 Year Environment Plan or reports such as the Dasgupta Review. By emphasising biodiversity, NbS can be a valuable investment for ODA spending by UK Government as it represents added benefits for development projects. Importantly, the case studies demonstrate how benefits for climate and people are not lost with a focus on biodiversity. The delivery of multiple, public benefits and the cost-effectiveness of NbS can also be demonstrated as biodiversity indicators appropriate to project and programme scale are developed.
- **On-going value for money assessments will develop proof-of-concept for NbS and encourage long-term monitoring to support the economic case for NbS**. Understanding the impact of risks and uncertainties on the delivery of benefits from NbS projects requires long term monitoring and comparison with pre-project appraisals. Post-project value for money assessments should test key assumptions and robustness, as well as how key stakeholders have benefited and will continue to benefit when project implementation finishes. This will also develop understanding of the drivers of risk, who assumes risk, and how risk can be mitigated through project design and implementation.

NbS projects intentionally designed to deliver benefits from, and net gain for, biodiversity enhancement can still effectively deliver for climate and people – achieving the triple win. The opportunity presented by NbS is to design and monitor projects or sets of interventions which are able to deliver for biodiversity and nature explicitly and verifiably, without trade-offs for climate or people. Applying intentional biodiversity objectives as part of NbS for assistance programmes and other sectors not focused on conservation can achieve a net gain of biodiversity instead of no net loss or even a reduction in biodiversity. By following the materials in the Toolkit and using a basis of biodiversity, projects can be effectively designed, implemented and monitored to deliver on all three aspects of the triple win.

Nature-based Solutions Triple Win Toolkit: Principles

Many of the interventions and actions that fall under the categorisation of Nature-based Solutions (NbS) have been in practice by conservation science for decades – that history, along with their relatively recent collation under the umbrella term of NbS allow for a summary of lessons learned and refinement of common principles. Nine Principles were thus identified that together support the effective and efficient implementation of NbS. These Principles have been developed through a time-limited literature review and informed by a review of 378 NbS case studies (see **Evidence Base** chapter for further information). The Principles focus on opportunities and barriers to achieving the 'triple win' for biodiversity, climate, and people in countries eligible for Official Development Assistance (ODA).

Each Principle may focus on delivery for one or a combination of the triple win objectives. However, it is important to recognise the potentially reinforcing relationship between biodiversity, climate, and people – delivering on one of these objectives can support the delivery of the others if designed intentionally and effectively. Enhancing biodiversity can provide health and livelihood benefits for local communities – thereby delivering on multiple dimensions of poverty reduction objectives – and support carbon sequestration and disaster risk-reduction – thereby delivering on climate change objectives. The Principles are similarly reinforcing, and when taken together, the Principles guide the effective design and optimal delivery for all three objectives of the triple win.

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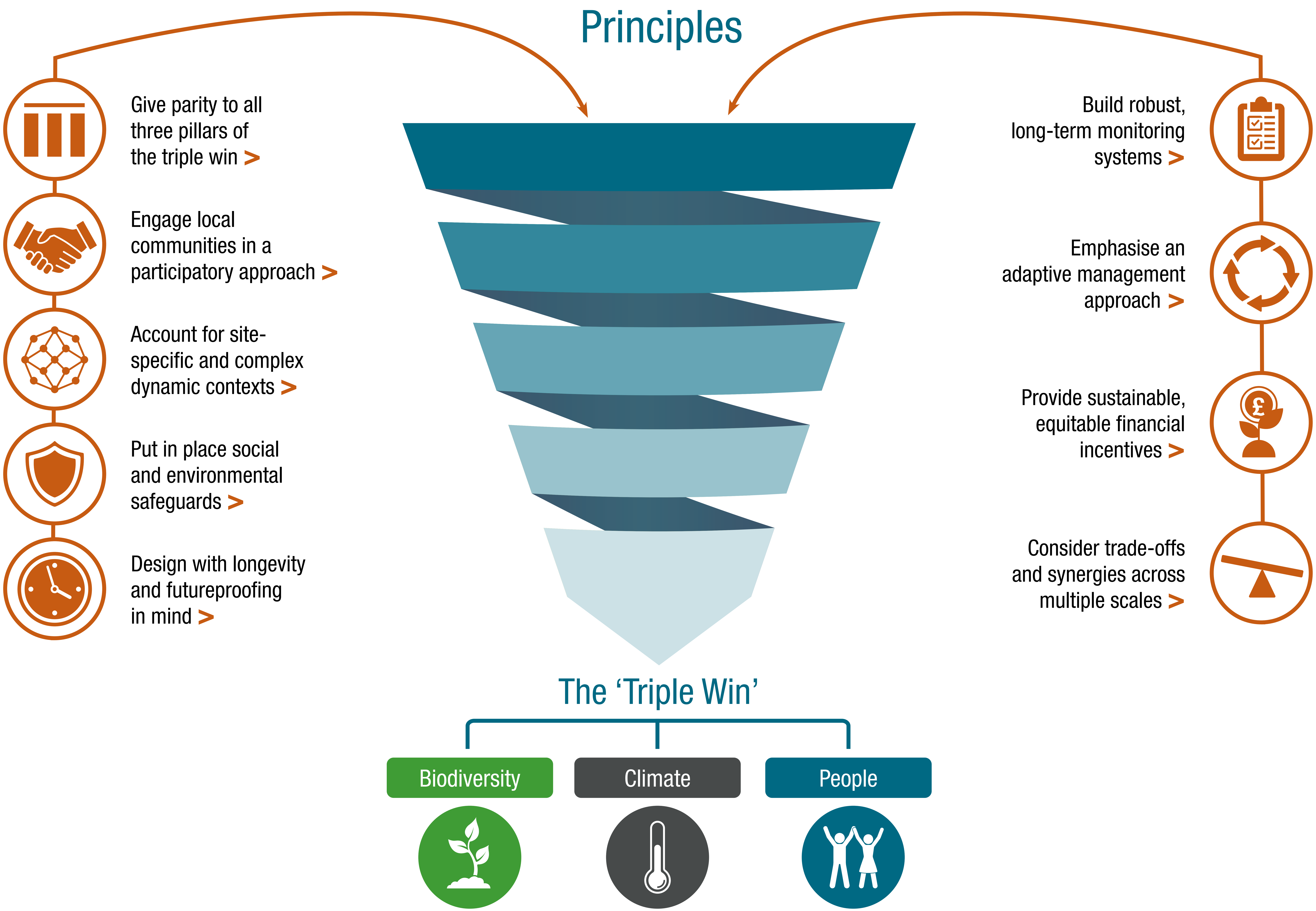
Nature-based Solutions Triple Win Toolkit



Give parity to all three pillars of the triple win

Objectives for biodiversity, climate and people the 'triple win' are common elements of the interventions and approaches that fall under the umbrella term of 'NbS.' However, not every approach addresses the triple win simultaneously, focusing largely on poverty reduction and addressing climate change risks. Enhancing biodiversity is often not directly monitored (see Principle 'Build robust, long-term monitoring systems') or is misapplied (as in cases of planting inappropriate non-native or invasive species or impeding the natural regeneration of an ecosystem with monoculture plantations)[1,2]. Biodiversity is essential for supporting ecosystem functions and services, enhancing ecosystem resilience and building human capacity to adapt to climate change[3]. Interventions should consider the ecological impacts of climate change and be appropriate to the ecosystem; tree planting on naturally open (tree-less) ecosystems, for example, could cause further degradation.

Projects should set specific biodiversity targets and indicators (see **Biodiversity Indicators in Context** chapter) appropriate to the scale, objectives and context of an NbS application[4,5]. Protecting, restoring, or managing a broad range of ecosystems on land and sea, with an emphasis on enhancing biodiversity, can deliver multiple benefits for biodiversity and livelihoods, whilst simultaneously meeting domestic and international climate change objectives and obligations[4,6,7].

View examples:

> Ecosystem-based disaster risk reduction in Haiti
> Mangrove restoration in Madagascar and Indonesia
> Urban reforestation in South Africa

Return to Principles

Engage local communities in a participatory approach

To ensure social equity and justice, as well as long-term success of a project, NbS should engage stakeholders in a participatory approach, from co-designing to co-implementing projects[7,10]. Whilst evidence points to multiple benefits of a participatory approach – including diversity of thought, inclusion, local knowledge, autonomy, dignity, genuine partnership, and ultimate intervention effectiveness[1,8] – it has been identified as a gap in the current application of NbS[9]. To foster the conditions necessary for this approach, stakeholder analysis can identify the local communities, Indigenous people or vulnerable groups who should be engaged[10]. Addressing social barriers, such as balanced gender participation within the project, can help to engage all groups within a society. Where Indigenous peoples may potentially be affected, Free, Prior and Informed Consent must be embedded into the project[11]. Full inclusion in decision-making around project design, governance, and management supports delivery on-the-ground, community buy-in, and equitable benefits sharing[3,4,12,13]. This decision-making should be as decentralised or devolved as possible, which requires appropriate empowerment and capacity building, as well as supportive policy and governance frameworks[3].

View examples:

> Agroforestry in Bolivia

> Integrated water resource management in the Democratic Republic of the Congo

> Coastal afforestation in Bangladesh

Return to Principles

Account for site-specific and complex dynamic contexts

NbS must be adapted to the unique ecological, socio-economic and political contexts of a project location. Though NbS can be implemented as a suite of interventions, they are not a 'one size fits all' approach – just as no two human or ecological systems are exactly alike due to their complex, dynamic interactions. During project design, these interacting factors (i.e. ecological, climate, legal, political, cultural, economic) must be identified within the site and landscape, including those more difficult to monetise or measure[13]. It is important to consider risks and uncertainties, such as fraud, corruption, natural disaster and climate change, and account for vulnerable groups, political or social conflict, and the stability and availability of financial institutions and markets[14]. This approach will highlight the trade-offs between different groups and objectives, allowing for issues to be identified and managed from an early stage (see Principles 'Put in place social and environmental safeguards' and 'Consider trade-offs and synergies across multiple scales'). A good project design will elevate local values and knowledge alongside scientific evidence, consider the complexity of the ecosystem and interactions with the wider environment, engage a diversity of stakeholders and local communities, and account for institutional capacity or political will to carry out interventions[2,10]. Therefore, no one NbS will suit all situations and no one intervention will act as a panacea – interventions must be tailored to the landscape- or site-specific contexts.

View examples:

> Ecosystem-based disaster risk reduction in Afghanistan

> Climate-resilient agriculture in Cambodia

> Ecosystem-based disaster risk reduction in Haiti

Return to Principles

Put in place social and environmental safeguards

Strong social and environmental safeguards – informed by environmental and vulnerability assessments – identify and then try to avoid, mitigate, or minimise unintended consequences. This includes impacts to vulnerable communities[15], biodiversity or ecosystem services[1,13], or displacement of harmful activity[7,16]. Looking at the broader context to identify conflicting objectives and impacted groups helps to incorporate the 'do no harm' principle into NbS projects. In doing so, this moves NbS beyond offsetting harmful activity into generating multiple benefits for environmental and social outcomes and achieving net positive impact[17]. To ensure delivery of equitable outcomes and access to benefits, projects must give parity to social and economic objectives alongside climate and biodiversity objectives (see Principle 'Give parity to all three pillars of the triple win')[18,19]. This integrated approach to NbS can address systemic inequalities while maintaining focus on positive biodiversity and climate outcomes[10,20].

View examples:

> Ecosystem-based adaptation in The Gambia

> Coastal afforestation in Bangladesh

> Mangrove restoration in Madagascar and Indonesia

Return to Principles

Design with longevity and futureproofing in mind

Of major value to any NbS project are factors which ensure sustained benefits beyond the project implementation period. Building local capacity, for example by providing training on implementation, monitoring or the development of sustainable business plans, can enable long-term participation and build ownership. Additionally, developing local or private sector partnerships and aligning with national policy frameworks can provide legitimacy, the potential to influence policies, and the long-term capacity to implement solutions and replicate best practices[7,14,20]. This mainstreaming lays the foundation for project legacy and generating public benefits beyond the project outcomes as policy supports the broader application of NbS across landscapes and time scales[10,21,22,23]. Connecting to the private sector through sustainable financial markets and models also ensures that benefits from alternative livelihoods or connections to markets extend into the future and are not reliant upon temporary subsidies, project grants or donor interests[14] (See **Economics and Finance**). By both building local capacity and mainstreaming at national levels, principles of NbS are embedded across sectors and policy frameworks which provides longevity and futureproofing against shifting political priorities.

View examples:

> Ecosystem-based adaptation in The Gambia

> Wetland restoration and climate-smart agriculture in Uganda

> Mangrove restoration in Madagascar and Indonesia

Return to Principles

Build robust, long-term monitoring systems

While the ideas behind NbS have existed for decades in scientific and local or indigenous knowledge, there remains an opportunity to increase the knowledge base around technical intervention effectiveness and cost-effectiveness[4]. The use of an umbrella term such as NbS presents the opportunity to compare approaches, better understand linkages between ecosystems or sectors, test indicators, and understand limitations or barriers[10]. To strengthen the evidence base and enable adaptive management (see Principle 'Emphasise an adaptive management approach'), projects need robust monitoring and evaluation systems carried out during and after the project life cycle. Models of community-based monitoring (see Principle 'Engage local communities in a participatory approach') are most successful for long-term adoption and positive outcomes for people and nature[4]. Long-term monitoring and maintenance are especially important as the benefits – or unintended negative impacts (see Principles 'Put in place social and environmental safeguards' and 'Consider trade-offs and synergies across multiple scales') – of NbS may not be realised until after a project's activity or life-cycle has ended. Evaluating intervention effectiveness or conducting extended cost-benefit analyses (See **Economics and Finance**), which reflect local value systems, develop trust in local projects and help to mainstream approaches into policy[10]. Project objectives and indicators should be specific to the triple win of enhancing biodiversity, mitigating or adapting to the effects of climate change and reducing poverty, whilst also being appropriate to the scale of an intervention. There is added benefit in aligning with existent ICF Key Performance Indicators or indicator frameworks relevant to the project's investor or overarching programme (see **Biodiversity Indicators in Context** chapter). Assessment frameworks should establish appropriate baselines and targets, be adaptive to change, and disaggregate data (such as for gender) where possible[24]. Evaluations and reporting should acknowledge uncertainty and complexity, communicate all benefits and costs clearly, and be openly accessible and shared, especially with local communities[5,9].

View examples:

> Silvopastoral systems in Colombia

> Mangrove restoration in Viet Nam

Return to Principles

Emphasise an adaptive management approach

Adaptive management is a decision-making approach that incorporates monitoring, feedback and iterative improvements to policy or activities. Feedback and flexibility are critical aspects of NbS due to the inherent uncertainties and interconnectivity of human and ecological systems. Adaptive management allows interventions to be responsive to changes in the local conditions (see Principle ‘Consider trade-offs and synergies across multiple scales’) and aspects of the context which were unexpected, as well as resilient to the effects of climate change – all of which can impact the intended outcomes[4,7,24]. Adaptive management is identified as an area requiring more discussion and uptake[9], perhaps due to high costs and a lack of monitoring or acknowledgment of the complexities and uncertainties which underpin dynamic socio-economic and ecological contexts[9]. Adaptive management in overarching governance can ensure longevity as policy and activities are re-aligned or adapted to new information from community-based monitoring and transparent dialog with stakeholders (see Principle ‘Build robust, long-term monitoring systems’)[12], ensuring that NbS interventions continue to generate benefits in the medium and long term.

View examples:

> Agroforestry in Bolivia

> Mangrove restoration in Viet Nam

Return to Principles

Provide sustainable, equitable financial incentives

The sustainability of NbS – and their delivery of multiple ecosystem services over broad scales – is ultimately dependent on developing diverse income streams for local communities in the short and long term[7]. NbS projects must support ecologically and economically sustainable livelihoods – replacing livelihoods based on activities which degrade or harm the environment with those that are sustainably managed and which protect or enhance the natural environment. The development of livelihoods or incentives should be done in keeping with local ecology and traditional knowledge so as not to simply displace harm or create new pressures (i.e. continued overextraction, monoculture or invasive plantations), and provide long-term connections to local financial institutions and markets, rather than create reliance on short-term sources of income[14,23]. It may be necessary to supply direct financial support if there is a lag between project initiation and the delivery of financial benefits[4,13]. Identifying which costs or benefits are likely to accrue, when and to whom, helps inform the appropriate funding strategy and recognise important time periods when specific financial flows and compensation are required[25,26].

View examples:

> Climate-resilient agriculture in Cambodia

> Ecosystem-based adaptation in The Gambia

> Wetland restoration and climate-smart agriculture in Uganda

Return to Principles

Consider trade-offs and synergies across multiple scales

While NbS should be site- or landscape-specific, they also must be considered within a holistic context. As ecosystems are interconnected, interventions in one landscape can impact ecological or human communities outside the scope of a project across temporal and geographical scales[4,9,24]. With a holistic perspective, leakage or displacement of harm from one community to another can be identified and avoided, minimised or mitigated, supporting implementation of the ‘do no harm’ principle[14,16,23]. Project designers and managers should look for synergies between sectors and policies, but may find ‘win-win’ outcomes are not always feasible[10] due to trade-offs between objectives, communities, or short and long-term benefits[3,27]. Where triple wins cannot be achieved at all scales, alignment with global priorities (frameworks such as the Sustainable Development Goals) or local needs can resolve tensions. Techniques such as spatial planning or extended cost-benefit analysis can help identify and influence the distribution of winners and losers across landscapes, thereby maximising synergies, minimising trade-offs and resulting in positive impacts for equity and overall project effectiveness[18]. Bottom-up and top-down integration of goals and knowledge enables a cross-sectoral, transboundary (ecosystem, regional, or international), and multiple scale approach to NbS[18,23].

View examples:

- Integrated water resource management in the Democratic Republic of the Congo
- Ecosystem-based disaster risk reduction in Afghanistan
- Silvopastoral systems in Colombia

Return to Principles

Nature-based Solutions Triple Win Toolkit: Implementation Guidance and Checklist

The Implementation Guidance reframes each Principle as a set of key considerations when developing a Nature-based Solution (NbS) in an Official Development Assistance (ODA) context. It highlights the importance of each key consideration to achieving the triple win for biodiversity, people and climate, as well as potential barriers and pathways to adoption. It also sign-posts a variety of resources that provide further guidance on how to incorporate the considerations into an NbS project.

The Implementation Guidance is accompanied by a Checklist, which takes the key considerations and organises them under an operational or goals-based framework. The Checklist firstly considers project objectives and the local context, then economics and financing mechanisms, and finally institutions and governance. This approach makes the project objectives central to the intervention, thus ensuring the triple win is effectively and efficiently addressed from the onset. The Checklist contains more considerations than the Implementation Guidance, either breaking considerations down into more specific actions, or highlighting them under several stages of project implementation to emphasise their ongoing importance.

The Implementation Guidance and Checklist may be used to provide guidance on best practices, as an evaluation framework to assess a project's strengths and weaknesses, and as a framework to aid project design and implementation.

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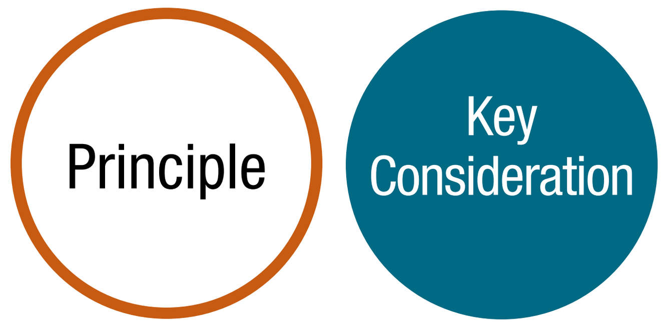
Implementation Guidance: The Key Considerations that Underpin an Effective Nature-based Solution



Key consideration: Does the project include specific objectives for biodiversity?

How will this help me achieve the triple win?

Biodiversity underpins a number of ecosystem services critical for human health and wellbeing, including the regulation of floods and disease outbreaks, and the provision of food, water and space for recreation. Healthy biodiverse ecosystems can also better withstand and recover from disturbance, natural disasters, and the effects of climate change. Enhancing biodiversity and ecosystem health can therefore harness co-benefits for local livelihoods and climate change adaptation and mitigation, and thus NbS projects should ensure biodiversity objectives are central to their approach to maximise the triple win.

However, 19.4% of the NbS case studies assessed that were in ODA-eligible countries had no stated objectives for biodiversity (see the **Evidence Base** chapter for further information). Of those that had biodiversity outcomes, 29.3% were qualitative, 50.9% were quantitative and only 0.4% were monetised. Quantitative and monetised objectives and outcomes better demonstrate the measurable benefits of NbS, which can increase their support and promote further uptake.

Setting specific objectives for biodiversity ensures it is not overlooked or compromised, with priority instead given to poverty reduction or climate change objectives. NbS with low biodiversity value are more likely to result in trade-offs, as species-rich, multifunctional landscapes are central to sustainability. For example, fast-growing monoculture plantations are often used when the primary objectives are timber production and carbon sequestration, causing negative impacts on biodiversity. However, species-rich native forests are superior for carbon sequestration and support a greater variety of livelihoods and biodiversity.

What resources are available?

The **Agroforestry in Bolivia** and **Urban reforestation in South Africa** case studies demonstrate clear biodiversity objectives.

Tools for Measuring, Modelling, and Valuing Ecosystem Services – outlines tools that can be used to measure or model ecosystem services provided by important sites for biodiversity and nature conservation.

The Singapore Index on Cities' Biodiversity – a tool to help cities assess how they can improve their biodiversity conservation efforts over time.

Dasgupta Review: Section 2.10 – Biodiversity and Ecosystem Productivity – summarises the influence of biodiversity on ecosystem functioning and the value of monetising biodiversity.

Setting National Biodiversity Targets – guidance on how to develop biodiversity objectives in line with the Convention on Biological Diversity framework, highlighting the different types of targets and how to monitor their progress.

How Much Is Enough? The Recurrent Problem of Setting Measurable Objectives in Conservation – provides guidance on setting measurable objectives and outlines practical challenges in different social, political, and legal contexts.

Key consideration: Does the project seek to address the underlying drivers of biodiversity loss?

How will this help me achieve the triple win?

If an NbS project's design does not address the underlying drivers of biodiversity loss (e.g. by enforcing laws, protecting lands of Indigenous Peoples or providing incentives to landowners) there is a high risk that the source of pressure will return once the project's interventions conclude. Not only would this reduce the delivery of ecosystem services at the project site, it may cause "leakage", i.e., displacement of threats from protected areas or those under biodiversity management to those that are not, thus undermining any biodiversity outcomes.

Leakage may occur through activity shifting, in which destructive activities are displaced from inside to outside, and/or market effects, in which alterations to the supply, demand or equilibrium of natural resources lead to an increase in their value and create subsequent pressure to convert less well-protected areas elsewhere. This can not only lead to negative consequences for biodiversity, but may also cause negative impacts on livelihoods and ecosystem services related to climate change adaptation and mitigation.

Projects should therefore aim to address the underlying drivers of biodiversity loss to minimise leakage and ensure efforts to address one aspect of the triple win do not undermine another.

What resources are available?

The **Silvopastoral systems in Colombia** and **Climate-resilient agriculture in Cambodia** case studies provide examples of addressing the underlying drivers of biodiversity loss.

Millennium Ecosystem Assessment: Drivers of Ecosystem Change – outlines direct and indirect drivers of ecosystem change.

Understanding and Managing Leakage in Forest-Based Greenhouse Gas Mitigation Projects – provides guidance on leakage from forest projects in developing countries and project level responses and policies.

Drivers of Biodiversity Loss – an overview of the key drivers of biodiversity loss.

Modelling Impacts of Drivers on Biodiversity and Ecosystems – guidance on the models that can be used to assess and predict the impacts of drivers on biodiversity and ecosystems.

Key consideration: Does the project have clearly defined indicators to monitor the impacts on biodiversity at an appropriate scale?

How will this help me achieve the triple win?

Biodiversity indicators are an essential tool for understanding progress towards biodiversity objectives. Whilst proxy measures for biodiversity can be utilised, adopting a range of indicators can help to fully capture the state of different habitats, species populations, or other aspects of biodiversity.

However, data on species or habitats are often scarce or are not spatially explicit. In such cases, the *pressure-state-response* model can be a useful framework for identifying and structuring indicators. *Pressure-state-response* indicators are considered good proxies for monitoring biodiversity because, for example, ecosystems are more likely to be in good condition if the pressures on biodiversity are absent. Similarly, if the responses (i.e. actions) are effective and lead to positive impacts, they should manifest in an improved state of biodiversity. Biodiversity change also often occurs over relatively long time periods that may not be easily detected in typical reporting cycles.

Projects should therefore identify and adopt a range of clearly defined biodiversity indicators to monitor progress towards project objectives and provide early warning of any unexpected impacts on biodiversity.

What resources are available?

Biodiversity Indicators in Context – provides project to portfolio recommendations on biodiversity indicators in reference to ICF and wider ODA spend, and further detail on two proposed key performance indicators: **Hectares under ecological restoration** and **Improvement in status of threatened species**.

Biodiversity Indicators Review – an overview of the relevance of existing biodiversity indicators for ICF programmes and NbS.

Biodiversity Indicator Framework Review – an overview of relevant biodiversity indicator frameworks for ICF programmes and NbS.

The **Silvopastoral systems in Colombia** case study utilises the *Environmental Services Index* as an overall biodiversity indicator (see one of the project's **Annual Reviews** for more detail).

OECD Environmental Indicators: Development Measurement and Use – an overview of commonly agreed upon environmental indicators. Annex II provides guidance on the *pressure-state-response* model.

Linked Indicator Sets for Addressing Biodiversity Loss – details a four-stage *Response-Pressure-State-Benefit* framework for the selection of indicators.

Measuring Ecosystem Services – guidance on developing ecosystem service indicators.

Biodiversity Indicators for Monitoring Impacts and Conservation Actions – outlines a methodology for developing site-level indicators to monitor significant positive and negative biodiversity impacts.

Key consideration: Does the project seek to address the multiple dimensions of poverty?

How will this help me achieve the triple win?

Nature-based solutions should be centred around enhancing biodiversity and ecosystem services to improve the welfare and adaptive capacity of the poorest members of society.

Poverty is a complex, multi-dimensional issue encompassing a variety of different factors, including health, education, food and water security, income and living standards. However, it is often defined by one-dimensional measures, usually based on income. Adequate shelter, public infrastructure, and basic services such as education, healthcare and access to food and water are therefore also important considerations for NbS projects concerned with poverty reduction.

Setting a range of poverty reduction objectives and adopting relevant targets and indicators will help to ensure interventions address the multiple dimensions of poverty. Moreover, integrated nature-based solutions that address climate change and biodiversity loss to improve the welfare of local communities are central to achieving the triple win.

What resources are available?

The **Climate-resilient agriculture in Cambodia** case study uses a *Basic Necessity Score*, as well as food security and crop yields, to measure poverty reduction, whilst the **Mangrove restoration in Viet Nam** case study addressed poverty through access to safe housing.

Poverty and Climate Change: Reducing the Vulnerability of the Poor Through Adaptation – how to mainstream and integrate adaptation to climate change into poverty reduction efforts.

Mainstreaming Poverty-Environment Linkages into Development Planning: A Handbook for Practitioners – guidance on mainstreaming poverty-environment linkages into national development planning.

Global Indicator Framework for the Sustainable Development Goals – goals and targets from the 2030 Agenda for Sustainable Development and associated indicators.

The Key Livelihoods Programme Indicators – a standardised list of 22 outcome indicators for the livelihoods sector grouped by objective.

Key consideration: Does the project seek to address the underlying drivers of climate change?

How will this help me achieve the triple win?

Climate change and biodiversity loss are often treated as separate issues, when in fact they are highly interconnected. Increased human activities are driving ecosystem degradation and global declines in biodiversity, which in turn impact the quality and quantity of ecosystem services. The deterioration of ecosystem services then exacerbates climate change, already the third largest driver of biodiversity loss, resulting in negative consequences for human health and wellbeing. NbS thus have great potential to address the challenges of climate change and biodiversity loss in parallel.

NbS can also facilitate climate change adaptation, either by increasing the adaptive capacity of communities, or reducing their exposure or sensitivity to climate hazards. Working with and enhancing the natural environment through NbS can therefore reduce biodiversity loss and the degradation of ecosystems, and in turn mitigate the impacts of climate change for local communities. Utilising potential synergies with biodiversity enhancement and poverty reduction will maximise the long-term effectiveness of interventions, as well as their contribution towards the triple win.

Identifying and addressing the underlying drivers of climate change, rather than simply climate-proofing communities against short-term climate impacts, will lead to long-term transformational change and greater climate resilience. NbS should not only be reactive interventions, but should also incorporate anticipatory and precautionary measures, based on projected climate impacts and vulnerabilities, to ensure communities are adequately prepared for future unknowns.

Developing clear climate change mitigation and/or adaptation objectives and targets, and using appropriate indicators to monitor progress over time, will help to ensure interventions deliver the intended climate benefits. Whilst climate change mitigation is most often assessed though indicators that measure physical quantities of greenhouse gas emissions avoided, there is no uniform indicator for adaption due to its context specificity. Adaptation is often closely interlinked with sustainable development, and thus adaptation objectives are likely to overlap with those of poverty reduction, requiring indicators which are tailored to the specific purpose and context.

What resources are available?

The **Ecosystem-based disaster risk reduction in Afghanistan**, **Ecosystem-based disaster risk reduction in Haiti** and **Mangrove restoration in Viet Nam** case studies provide examples of using training and infrastructure to improve disaster preparedness and risk planning.

Climate Smart Agriculture Sourcebook – an overview of the role of sustainable forest management in climate change adaptation and mitigation.

AFOLU Carbon Calculator – a tool that allows users to estimate the CO_2 benefits and potential climate impacts of different types of land-based project activities.

Guidance on Integrating Ecosystem Considerations into Climate Change Vulnerability and Impact Assessment (VIA) to Inform Ecosystem-based Adaptation – advice on how to integrate consideration of ecosystems and their services into climate change adaptation interventions.

Twelve Reasons Why Climate Change Adaptation M&E is Challenging – identifies challenges that make monitoring and evaluating climate change difficult and highlights strategies to address each.

Learning to ADAPT – presents existing approaches, methodologies and indicators for the evaluation of climate change adaptation interventions.

CRiSTAL – a project planning tool to identify climate risks and the affected livelihoods, and determine what adjustments can support climate adaptation.

Climate Change Policy Brief: Adaptation Metrics and the Paris Agreement – outlines the different purposes of applying adaptation metrics and provides recommendations for their targeted use.

Key consideration: Has the project conducted a stakeholder analysis?

How will this help me achieve the triple win?

To ensure engagement with local communities is as inclusive as possible, projects should firstly conduct a stakeholder analysis to identify the full range of social groups likely to be affected by the project (e.g. ethnicity, class, age, gender, ability). This allows the needs of the most vulnerable to be put at the centre of NbS projects and helps to ensure activities do not adversely impact marginalised groups or the poor, who are often reliant on the environment for their livelihoods.

By identifying, categorising and understanding the characteristics and nature of various stakeholder groups, potential conflicts can be anticipated and avoided, and livelihood benefits can be maximised.

What resources are available?

The **Ecosystem-based adaptation in the Gambia** case study conducted a stakeholder analysis and produced a *Stakeholder Engagement Plan*.

BiodivERsA Stakeholder Engagement Handbook – considers a three-step stakeholder identification process: identification of relevant stakeholders; assessing and prioritisation; and developing understanding.

Finding Ways Together to Build Resilience: The Vulnerability and Risk Assessment Methodology – allows the root causes of vulnerabilities for distinct social groups to be identified and assists the development of programmes and risk reduction initiatives accordingly.

Multi-stakeholder Management: Tools for Stakeholder Analysis – Ten building blocks for designing participatory systems of cooperation.

Key consideration: Are targets set for ambitious yet achievable participation by both men and women in project activities, and where possible are indicators disaggregated according to gender (and other relevant social criteria)?

How will this help me achieve the triple win?

The vulnerability and capacity of different social or minority groups may vary across populations and communities. For example, women and men may play different roles within their community, have different traditional responsibilities within the economic life of their family, or have unequal access to natural ecosystems and their uses. As a result, differences in gender or other social criteria may influence their vulnerability, adaptive capacity, or ability to contribute to project decisions and activities.

Disaggregating targets and indicators accordingly helps to ensure that vulnerable groups are considered and appropriately accommodated in project design and implementation. For example, to enable women to participate in a project, it might also be necessary to organise childcare, provide additional education, or run workshops for men and women separately.

NbS projects should ensure that targets and indicators are disaggregated according to relevant social criteria to ensure that climate vulnerable people are identified and targeted, and the benefits of the triple win are shared equitably without excluding or posing a cost to specific minority groups.

What resources are available?

The **Ecosystem-based adaptation in the Gambia** case study provides an example of using a **Gender Assessment** to accommodate gender in project design.

Integrating Gender and Social Equity into Conservation Programming – a guide for recognising and integrating gender and social equity dimensions into community-based conservation projects. Appendix 1 lists questions that can help to identify where a project may be strong or weak in addressing gender and social equity.

The Gender Data Portal – provides sex-disaggregated data and gender statistics per country/region, covering demography, education, health, economic opportunities, public life and decision-making, and agency.

Social Institutions & Gender Index – measures discrimination against women in social institutions across 180 countries.

Gender and Inclusion Toolbox – provides guidance and tools on gender sensitive and socially inclusive frameworks for climate change programmes.

Gender Dynamics in a Changing Climate – provides guidance on how gender and adaptive capacity affect resilience and gives examples of how to integrate gender into community-based adaptation approaches.

Transforming Gender Inequalities – guidance for achieving gender transformation in resilient development.

Key consideration: Have all relevant stakeholders, especially Indigenous Peoples and local communities, been engaged in the design, future implementation, management, and monitoring of the project?

How will this help me achieve the triple win?

NbS projects need to acknowledge and integrate into project design a plurality of value and knowledge systems that exist among different cultures regarding human-nature interactions. Humans have used nature to buffer the effects of climate change for millennia, and thus local and traditional knowledge can provide important insights on biodiversity and ecosystem trends that may not be captured by scientists and experts, making it possible to anticipate and improve unexpected negative outcomes before they occur. Engaging a diverse range of stakeholders can also foster mutual learning and knowledge co-creation, which can strengthen relationships and ensure project activities are both socially acceptable and defensible.

To facilitate stakeholder engagement, projects should adopt a participatory approach, whereby everyone who has a stake in the intervention has a voice, either in person or by representation. Participatory approaches may range from simply information sharing and communication of project plans, to more interactive approaches, such as joint analysis and action plan development. Considering the information and communication needs of different stakeholder groups and building a common knowledge base will improve outreach effectiveness.

What resources are available?

The Agroforestry in Bolivia, Integrated water resource management in the Democratic Republic of the Congo and Coastal afforestation in Bangladesh case studies provide key examples of utilising multistakeholder, participatory approaches.

ICAT Stakeholder Participation Guide – a guide to conducting effective stakeholder participation in relation to sustainable development and greenhouse gas mitigation objectives.

Adaption Planning Support Toolbox – provides systematic ways of engaging local policymakers, planners, and citizens.

Indigenous and Traditional Knowledge and Practices for Adaptation – highlights best practices, lessons learned and available tools for the use of indigenous and traditional knowledge and practices.

Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation – provides an overview of the contribution traditional/indigenous knowledge makes to our understanding of global climate change.

Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation – informs participatory strategies and guides the development of locally specific, community-based indicators to measure success.

Applications and Guidelines on the Delphi Technique – a participatory method used for gathering and evaluating stakeholder knowledge and opinions.

Adaptation Planning with Communities – guidance on community adaptation action planning, providing a conceptual overview of the process, as well as explanations and examples of how it works in practice.

Key consideration: Where Indigenous Peoples are likely to be affected, do all activities have Free, Prior and Informed Consent?

How will this help me achieve the triple win?

Free, Prior and Informed Consent (FPIC) is a specific right that pertains to Indigenous Peoples and is recognised in the United Nations Declaration on the Rights of Indigenous Peoples, the Convention on Biological Diversity and the International Labour Organization. It aims to establish bottom-up consultation, allowing Indigenous Peoples to give or withhold consent to a project that may affect their communities or territories. FPIC ensures that all peoples have the right to freely pursue social, cultural or economic development opportunities.

To ensure Indigenous Peoples' rights are protected, NbS projects should ensure they obtain FPIC before project implementation.

What resources are available?

Free Prior and Informed Consent: An Indigenous Peoples' Right and a Good Practice for Local Communities – a practitioner manual detailing a regulatory framework and six-step procedure to facilitate the FPIC process.

Nature-based Climate Solutions Must be Guided by a Rights-based Approach – provides guidance on taking a rights-based approach when developing an NbS.

Akwé: Kon Guidelines – the Convention on Biological Diversity's voluntary guidelines for the conduct of cultural, environmental and social impact assessment regarding developments likely to impact sacred sites or areas traditionally used by indigenous and local communities.

Key consideration: Is the chosen intervention appropriate for the temporal dynamics and complexity of the ecosystem?

How will this help me achieve the triple win?

As NbS are highly context dependent, considering ecological, socio-economic and political interactions and the wider landscape within project activities will improve their effectiveness. Any NbS should be based on the best available scientific evidence and designed in collaboration with expert consultation and local knowledge to ensure there are no unintended consequences from the intervention.

NbS interventions should avoid changing or simplifying an ecosystem in favour of a particular service or resource. For example, replacing natural mixed woodland with a monoculture tree plantation, or planting trees in historic grasslands or peatlands, can reduce water supply, spread invasive species, and increase social inequity. Conversely, selecting appropriate native species and promoting natural regeneration is more likely to maximise ecosystem service benefits and contribute towards achieving the intended outcomes.

NbS projects should carefully consider the temporal dynamics and ecosystem complexity of the target area to ensure that chosen interventions maximise each of the triple win objectives, without negatively impacting another. Actions and decisions should therefore be based on site-specific climatic projections and ecological data acquired from appropriate spatial and temporal scales.

What resources are available?

Biodiversity Indicators in Context – outlines the key biodiversity indicator aspects to consider at the project or programme level in order to achieve a positive impact.

The **Mangrove restoration in Viet Nam** case study provides an example of using natural regeneration and considering site specificity to ensure successful restoration.

Global Tree Search Database – provides a checklist of native tree species per country.

The International Standards for Ecological Restoration – details a 'native reference ecosystem' model to guide restoration actions.

Tree Planting is Not a Simple Solution – highlights why tree planting must be carefully planned and implemented to achieve desired outcomes.

Nature Based Solutions for Disaster Risk Reduction – Table 3.7 lists different NbS categories with corresponding measures and interventions per ecosystem type.

The Restoration Opportunities Assessment Methodology – provides a framework to identify priority areas for forest landscape restoration at national or sub-national level.

Climate Change Knowledge Portal – provides global data on historical and future climate change vulnerabilities and impacts per country, region, and watershed.

Scenario Planning for Climate Change Adaptation: A Guidance for Resource Managers – a step-by-step guide to using scenarios to plan for climate change adaptation.

Natural Climate Solutions World Atlas – a tool to identify countries with high NbS potential in relation to reducing net greenhouse gas emissions.

Key consideration: Have potential socio-economic and political risks been acknowledged and actions to mitigate any risks been identified?

How will this help me achieve the triple win?

Interventions carried out in fragile conflict-associated countries inevitably involve a degree of risk. Events such as political unrest, corruption, fraud, and economic crises impact human societies and cause changes to the way ecosystem goods and services are used. These disturbances can directly and indirectly affect the livelihoods of local communities, for example through higher input prices, reduced production, and lower crop prices, and thus can impact NbS intervention efforts.

NbS projects should aim to identify risks and take appropriate steps to address them, rather than avoid them, as risk avoidance can exacerbate fragility in the long run. Understanding risks in terms of the local context, the interactions that occur between different measures of risk mitigation, and the way in which stakeholders perceive mitigation measures is crucial for the development of effective risk frameworks. Moreover, as no set of risk measures can predict all outcomes, risk frameworks must be flexible and capable of being adapted to changing conditions.

What resources are available?

The **Integrated water resource management in the Democratic Republic of the Congo** case study provides an example of mitigating potential conflict.

Development Assistance and Approaches to Risk in Fragile and Conflict Affected States – provides case studies and examples of specific practices, tools and instruments to manage risks.

Enhanced Vulnerability and Capacity Assessment – an approach to assess risk and identify actions to reduce that risk.

National Mitigation Potential from Natural Climate Solutions in the Tropics – provides an overview of the governance, biophysical and financial factors that influence the feasibility of implementing NbS and identifies countries where international financing has greatest potential.

Key consideration: Has the project identified all necessary social and environmental safeguards to ensure the principle of 'do no harm' is firmly embedded during project implementation?

How will this help me achieve the triple win?

Safeguarding systems define *'do no harm'* principles that outline their coverage, i.e. what to safeguard, or what to safeguard against. The need for credible safeguards directly stems from the interconnected nature of development issues. Safeguards encompass a range of issues including, but not limited to, human rights, gender equality, health and safety, and land tenure.

Adopting appropriate safeguarding mechanisms will help to prevent and mitigate any negative, unintended consequences that may arise from an NbS intervention. Safeguards are particularly important for NbS projects aiming to achieve the triple win, as they can help to ensure interventions have a positive, rather than negative, impact on biodiversity and livelihoods.

NbS projects can implement environmental and social safeguarding systems though Environmental Impact Assessments (EIAs), Strategic Environmental Assessments (SEAs) and Enhanced Vulnerability and Capacity Assessments (EVCAs). Moreover, stakeholder consultations, grievance and redress mechanisms, transparency requirements, and monitoring and verification systems can be implemented to help to avoid any negative impacts on local communities and aid conflict resolution.

What resources are available?

The **Ecosystem-based adaptation in the Gambia** and **Mangrove restoration in Viet Nam** case studies produced safeguards reports to ensure safeguards were respected.

Positive Results, No Negative Consequences: No-harm Options for Article 6 – recommendations on a minimal standard for safeguards for sustainable development interventions. Figure 1 provides an overview of safeguard principles and tools for their implementation.

Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment – aims to help improve the way in which climate change and biodiversity are integrated into EIAs.

Voluntary Guidelines for the Design and Effective Implementation of Ecosystem-based Adaptation to Climate Change Adaptation and Disaster Risk Reduction – section 2.2.2 provides a comprehensive list of safeguards for effective planning and implementation relevant to NbS projects.

REDD+ Safeguards – outlines the safeguards that should be promoted when implementing REDD+ activities and signposts how developing countries are addressing and respecting these safeguards.

Key consideration: Does the project aim to build the adaptive capacity of local communities?

How will this help me achieve the triple win?

The impacts of climate change are often unpredictable, diverse and occur over both long and short-term timescales. Adapting to climate change is therefore extremely challenging, requiring thorough context-specific forward-planning in relation to potential risks, vulnerabilities, and impacts. A local community's adaptive capacity may be influenced by several different factors, such as financial and human resources, education, and governance. Building adaptive capacity is central to improving community resilience to climate change and involves developing procedures and local skills that will enable continued response to changing climatic conditions.

Improving the adaptive capacity of a community can support long-term participation and sustained benefits beyond the project implementation phase. For example, utilising existing community leadership roles and supporting the management of resources helps to build ownership and can improve a community's ability to respond to future challenges caused by climate change. Strengthening local communities' access and control of knowledge, institutions, resources, technologies, partnerships, and decision-making processes is fundamental to successful adaptive capacity building.

Projects can build adaptive capacity through participatory design, implementation, management and evaluation of the intervention. Undertaking baseline assessments of existing skills and institutional capabilities can help to identify gaps where capacity building is required. Workshops and training programmes can then be used to facilitate adaptive capacity building, which may vary from lectures to more participative and practice driven exercises, with hands-on training being particularly valuable.

What resources are available?

The **Ecosystem-based disaster risk reduction in Afghanistan**, **Wetland restoration and climate-smart agriculture in Uganda** and **Urban reforestation in South Africa** case studies provide examples of successful capacity building.

CADRI – a capacity assessment and planning tool for disaster risk management.

Strengthening Voices for Better Choices – a capacity needs assessment process.

Climate Vulnerability and Capacity Analysis Handbook – a tool used to gather and analyse information on community-level vulnerability and capacity, to inform the identification of actions that build climate change resilience.

Gender-sensitive Climate Vulnerability and Capacity Analysis – a framework for analysing vulnerability and capacity to adapt to climate change, with a particular focus on social and gender dynamics.

Strengthening Adaptive Capacity to Climate Change – provides conceptual and practical knowledge on adaptive capacity building drawing on work with vulnerable communities in Niger and Northern Ghana.

Stocktaking for National Adaptation Planning (SNAP) Tool – a tool to assess, enhance, and monitor a country's capacity for adaptation planning.

A Field Practitioner's Guide – Institutional and Organizational Analysis and Capacity Strengthening – supports institutional and organisational analysis and strengthening for the design and implementation of programmes and projects.

Key consideration: Does the project aim to establish local partnerships?

How will this help me achieve the triple win?

Ecosystems often provide services to a range of stakeholders and sectors, yet ecosystem boundaries rarely coincide with those of governance. As such, NbS frequently require cross-sectoral and intergovernmental collaboration.

Establishing partnerships with local governments in developing countries can be extremely challenging due to budgetary, political or capacity constraints, and in some cases, local governments may be non-existent. In such cases, projects can develop partnerships with local community-based organisations and businesses to improve the uptake and sustainability of the chosen intervention, or with local education institutions and universities to foster understanding and support for the intervention. Developing partnerships with other sectors, such as industry or development, and aligning goals and actions accordingly can help to mitigate potentially conflicting interests and ensure that there are net benefits for biodiversity, climate and people. For example, developing partnerships with industry and promoting sustainable growth and decarbonisation can help to maximise the impact of an NbS.

Partnerships that involve multiple stakeholders from a range of sectors (corporates, governments, NGOs, scientists, practitioners, landowners) will be more likely to achieve long-lasting outcomes for poverty reduction, climate change and biodiversity.

Projects should ensure the roles and responsibilities of all partner institutions and stakeholders are clearly defined before project implementation to ensure coordinated and coherent action.

What resources are available?

The **Ecosystem-based disaster risk reduction in Haiti** and **Integrated water resource management in the Democratic Republic of the Congo** case studies provide examples of working with community-based organisations.

Guide on Designing and Facilitating Multi-Stakeholder-Partnerships – provides guidance on how to design, facilitate and manage multi-stakeholder partnerships.

Words into Action Guide – section 1.4.5 highlights the importance of local partnerships to Eco-DRR interventions and provides guidance on developing and mobilising in-country partnerships.

Partnerships for Nature-Based Solutions in Urban Areas – provides examples of multi-stakeholder partnerships, private sector leadership, and citizen engagement, which have supported the development or implementation of NbS in urban areas, highlighting successes and lessons learnt.

Key consideration: Has the project assessed whether the intervention is a national priority or has potential to be mainstreamed into national policy?

How will this help me achieve the triple win?

The implementation of an NbS can be hindered by politically driven short-term action and decision-making cycles, particularly when benefits accrue over long timescales. However, governments are increasingly prioritising climate change and biodiversity within their policy frameworks, and NbS are becoming central to objectives and actions related to sustainable development, climate change adaptation and disaster risk reduction.

Projects should try to align their approach with existing national and global policy frameworks to improve their long-term implementation. Strengthening coherence with relevant policies can increase support for NbS and improve their potential to be mainstreamed into policy, thus futureproofing against shifting political priorities.

For example, there may be opportunity for projects to align with National Biodiversity Strategies and Action Plans (NBSAPs), National Adaptation Plans (NAPs), Nationally Determined Contributions (NDCs), disaster risk management plans, development plans or climate change strategies at a national level. Multi-lateral agreements such as the Sustainable Development Goals (SDGs), the Paris Agreement and the Convention on Biological Diversity (CBD) Strategic Plan for Biodiversity are key policies to align with at an international level.

Many countries also have dedicated national-level bodies to address biodiversity and climate change. Partnering with and strengthening existing national institutions will improve the mainstreaming potential of NbS interventions and may provide the infrastructure and capacity to continue project activities beyond the implementation period. For example, if the intervention can be embedded within mandatory reporting cycles, this may facilitate long-term monitoring and evaluation. Assigning capable government officials or respected members of society as NbS champions can also help to drive support for an intervention and promote legislative change.

What resources are available?

Biodiversity Indicator Framework Review – summarises the biodiversity indicator frameworks of most relevance to NbS projects and the ICF programme.

The **Mangrove restoration in Madagascar and Indonesia**, **Ecosystem-based disaster risk reduction in Afghanistan** and **Wetland restoration and climate-smart agriculture in Uganda** case studies provide examples of how projects can align with global and national objectives.

Tools for Mainstreaming Disaster Risk Reduction – provides guidance on adapting programming, project appraisal and evaluation tools for mainstreaming.

Mainstreaming Adaptation to Climate Change in Agriculture and Natural Resources Management Projects – provides lessons learnt, best practices, recommendations, and useful resources for integrating climate risk management and adaptation in development projects.

Mainstreaming Environment and Climate for Poverty Reduction and Sustainable Development – guidance on effectively mainstreaming poverty-environment issues into planning, budgeting and monitoring.

Integrating Climate Change Adaptation into Development Co-operation – guidance for policy makers and practitioners on how to mainstream climate change into development.

Pathway for Increasing Nature-based Solutions in the Nationally Determined Contributions – provides government guidance on identifying potential NbS to enhance climate mitigation and adaptation action, and how to integrate NbS into NDCs.

Recommendations for Aligning National Adaptation Plan Processes with Development and Budget Planning – provides guidance on how to integrate adaptation to climate change into a country's planning and budgeting system.

Using NDCs and NAPs to Advance Climate-Resilient Development – guidelines on streamlining and leveraging NDCs and NAPs to improve adaptation planning and action.

Important global policies and commitments to align with:

Sustainable Development Goals

CBD Strategic Plan for Biodiversity

The Paris Agreement

Sendai Framework for Disaster Risk Reduction

National Biodiversity Strategies and Action Plans

Countries with Voluntary Land Degradation Neutrality Targets

National REDD+ Strategies and Actions

The Bonn Challenge

Key consideration: Has the project determined how the infrastructure and resources required to carry out the intervention will be mobilised and sustained?

How will this help me achieve the triple win?

The infrastructure and resources required to carry out and sustain the project intervention should be determined and sourced well in advance of project initiation to avoid delays resulting from unreliable supply chains or lack of labour. For example, a key issue faced by many NbS restoration projects is the inadequate supply of plant material. Utilising seed zone maps to identify appropriate sources, establishing tree nurseries to provide a local seed source, and using climate resilient tree species can help to mitigate future problems associated with tree planting interventions. Projects should also aim to use locally available infrastructure and labour when possible, or develop local capacity through training.

The resources and infrastructure required for all aspects of the project, beyond those needed for implementation, should be accounted for in project design, including those required for capacity building, policy and finance support, mainstreaming, and monitoring and evaluation.

What resources are available?

The **Urban reforestation in South Africa** and **Ecosystem-based disaster risk reduction in Afghanistan** case studies provide examples of establishing community-run tree nurseries.

The **Ecosystem-based adaptation in The Gambia** and **Climate-resilient agriculture in Cambodia** case studies provide examples of utilising climate resilient plant species.

CADRI – a capacity assessment and planning tool for disaster risk management.

Adaptation Planning with Communities – guidance on community adaptation action planning, providing a conceptual overview of the process, as well as explanations and examples of how it works in practice.

Strengthening Adaptive Capacity to Climate Change – highlights the analysis and planning processes, information, resources and decisions required for effective capacity building.

The Seed Information Database – provides seed biological trait data that can be used as decision support for seed conservation interventions.

The Millennium Seed Bank Technical Information Sheets – covers various aspects of seed conservation practices and facilities, including collection and storage techniques.

Key consideration: Is value for money assessed throughout the project?

How will this help me achieve the triple win?

Evaluating cost-effectiveness and value for money is an important component of any project. This is especially the case for NbS projects which seek to achieve the triple win, since there are many non-monetisable (or difficult to monetise) benefits associated with the triple win objectives and these, along with the costs of the project, may accrue unevenly across impacted groups.

Where possible, cost-benefit analyses (see *Key Consideration*: **Cost-benefit analysis**) or other value for money assessments, should be performed before, during and after the project. Such assessments should not only justify the intervention, but be repeated to test the validity of any initial assumptions, whether the value for money of the project has changed since its inception, and prospective financial returns on investment.

This will help build the evidence base, serving as blueprints for future project development, highlighting areas where assumptions may be particularly sensitive and where future research and attention is most critical.

What resources are available?

Economics and Finance – includes a review of the research and literature related to the cost-efficiency of NbS projects.

Green Book – HM Treasury guidance on how to appraise and evaluate projects and programmes.

National Audit Office – can be used to assess value for money.

Key consideration: Are robust monitoring and evaluation systems in place, both during and after the project life cycle?

How will this help me achieve the triple win?

The collection of ecological and socio-economic data before, during and after the implementation of an intervention is fundamental to understanding project performance and underpins the development of any evidence base, highlighting best practices and areas for improvement. Yet, 40.3% of the NbS case studies assessed that were in ODA-eligible countries (283 projects) appeared to have no monitoring available (see the **Evidence Base Chapter**).

Monitoring and evaluation processes should assess changes in anticipated or avoided risks, ecological systems and services, and resilience impacts, through a set of predefined indicators. Moreover, they should incorporate feedback loops with targeted communities and local stakeholders to inform changes in activity and identify any capacity gaps or determinantal impacts based on changes over time.

NbS projects should allocate sufficient staff time and budget to monitoring and evaluation to ensure triple win outcomes are either on track to deliver, or actions can be adapted to ensure they deliver by project completion.

The impacts of an NbS may take several years to be fully realised, as many benefits will occur long after project completion. It is therefore important that monitoring and evaluation is carried out after project completion to fully capture the long-term effectiveness of an intervention and assess whether targets and goals have been met.

Many NbS projects fail to conduct post-project monitoring and evaluation, often due to a lack of funding or resources. Integrating local stakeholders and experts into monitoring and evaluation practices is one way of reducing costs, whilst also building local capacity. Developing an ongoing monitoring and evaluation plan that accounts for post-project costs and resources will also help to accommodate monitoring systems that continue beyond the project implementation phase.

What resources are available?

Biodiversity Indicators in Context – provides project to portfolio recommendations on biodiversity indicators in reference to ICF and wider ODA spend, and further detail on two proposed key performance indicators: **Hectares under ecological restoration** and **Improvement in status of threatened species**. Also details how considering each of the *Triple Win Toolkit Principles* in relation to biodiversity monitoring can improve project planning and implementation.

IUCN Global Standard for Nature-based Solutions – provides guidance to assess the effectiveness of NbS interventions, including eight criteria, 28 indicators, and a self-assessment tool.

IPCC Guidelines and Good Practice Guidance – provides supplementary methods and good practice guidance for estimating, measuring, monitoring and reporting on carbon stock changes and greenhouse gas emissions.

Guidebook for Monitoring and Evaluating Ecosystem-based Adaptation Interventions – highlights key considerations and components for each step of monitoring and evaluation and signposts additional tools and methodologies.

Ecosystem-based Adaptation Monitoring and Evaluation – Indicators – provides guidance on developing a monitoring and evaluation system and how to select and develop appropriate indicators.

Impact Evaluation Guidebook for Climate Change Adaptation Projects – an overview of different impact evaluation methods and how they can be applied to climate change adaptation projects.

MAES, **EKLIPSE** and **NUA** provide other examples of monitoring and evaluation frameworks relevant to NbS projects.

Key consideration: Does the project outline how the effectiveness of the intervention will be assessed, i.e. in relation to no action or grey infrastructure?

How will this help me achieve the triple win?

It is difficult to capture and synthesise the effectiveness of an NbS in comparison to alternatives since the benefits are often distributed across a range of stakeholders, sectors, and scales, all of which may be influenced by a range of interacting, context-specific factors. Many of these benefits are not captured in economic appraisals, which are often restricted to a particular area, timeframe, or stakeholder group. NbS projects should therefore seek to assess both monetisable and non-monetisable benefits in relation to each of the triple win objectives and impacted stakeholders to prevent undervaluation and better understand which groups benefit most from the proposed intervention.

Providing evidence on the effectiveness of an intervention can also help to build both public and financial support, which can improve the sustainability of an intervention and promote up-scaling. In particular, ensuring results are accessible and improving knowledge sharing mechanisms will help to promote support for an NbS. Projects should seek to disseminate information on intervention results and effectiveness transparently, using formats that are accessible for both policymakers and local communities, to maximise intervention impact.

What resources are available?

The **Mangrove restoration in Madagascar and Indonesia** case study provides an example of assessing the effectiveness of an intervention in comparison to a 'do nothing' approach. See the project **Business Case** for more information.

Saved Health, Saved Wealth: An Approach to Quantifying the Benefits of Climate Change Adaptation – outlines how to quantify the benefits of adaptation measures in terms of avoided economic damages, illnesses and mortality, which can be used to select the most promising options, or as an evaluation tool.

Ecosystem-based Adaptation Effectiveness – provides guidance on assessing the effectiveness of ecosystem-based approaches to climate adaptation.

Green Infrastructure Effectiveness Database – details the effectiveness of green infrastructure for coastal resilience, as well as measures of effectiveness.

Is Ecosystem-based Adaptation Effective? – demonstrates how assessing local perceptions can be a useful way of measuring intervention effectiveness and provides guidance on success factors and barriers in relation to recognising benefits.

Dredging versus Hedging – an example of how to assess grey and green infrastructure in relation to flooding.

Nature-based Solutions Evidence Platform – an evidence base to compare the effectiveness of different NbS approaches for addressing climate change, allowing a comparison of social, ecological and economic effects.

Key consideration: Has the project adopted an adaptive management approach?

How will this help me achieve the triple win?

As ecosystems and societies are continuously changing in response to complex interactions across a range of scales, management results cannot be predicted with certainty. Management decisions should therefore be flexible, anticipatory, locally contextualised and informed by assessing past, present and projected future conditions.

Adopting an adaptive management approach will help to ensure each of the triple win objectives are efficiently and effectively achieved. Adaptive management involves adjusting goals and actions in response to new information. Incorporating feedback between project implementation phases and including alternative routes can facilitate adaptive management. This can be achieved by developing and monitoring appropriate success indicators at regular time intervals. For example, permanent sample plots can be established in intervention areas to monitor ecological responses over time.

Due to the challenges and costs associated with structured monitoring and any associated changes in activity, adaptive management approaches are still rarely implemented in NbS projects. Ensuring goals and actions are flexible from the onset and allocating excess budget to account for monitoring and any unforeseen activities can help to accommodate adaptive management.

Projects should also put in place mechanisms to allow stakeholders and beneficiaries to provide feedback, or challenge actions and decisions that may negatively impact them. Public workshops and questionnaires can be useful for obtaining feedback and understanding stakeholder views and concerns.

What resources are available?

The **Silvopastoral systems in Colombia**, **Mangrove restoration in Viet Nam** and **Agroforestry in Bolivia** case studies provide key examples of utilising an adaptive management approach.

The Adaptive Management Technical Guide – provides guidance on implementing adaptive management approaches for natural resource management.

The Adaptive Water Resource Management Handbook – provides tools and instruments for adaptive management for the water sector.

Adaptive Management for Ecosystem Services – a framework for the application of adaptive management for ecosystem services.

Integrating Adaptive Management and Ecosystem Services Concepts to Improve Natural Resource Management: Challenges and Opportunities – explores how ecosystem services can be integrated within adaptive management and the associated value.

Key consideration: Has the socio-ecological context been considered within the adaptive management approach?

How will this help me achieve the triple win?

Understanding the situations in which an intervention works is a critical component of effective adaptive management and is especially pertinent to NbS projects with potentially competing triple win objectives.

Socio-ecological modelling can be used to ensure the intervention functions not only in ecological terms, but also in social and economic terms. Participatory modelling and solution-led sustainability assessments can also be useful to identify potential feedback loops across ecological, social and economic dimensions.

What resources are available?

A Conceptual Model of the Social-Ecological System of Nature-based Solutions in Urban Environments – provides guidance on the social and ecological interconnections within nature-based solutions and the range of stakeholders and disciplines involved.

Toolkit for the Indicators of Resilience in Socio-ecological Production Landscapes and Seascapes – provides practical guidance and indicators for engaging local communities in adaptive management of the landscapes and seascapes in which they live.

Scenarios and Models of Biodiversity and Ecosystem Services – provides guidance on the appropriate and effective use of scenarios and models across a broad range of decision contexts and scales.

Key consideration: Has a cost-benefit analysis been prepared?

How will this help me achieve the triple win?

Cost-benefit analysis is an important exercise to understand not only the scale of expected benefits and costs, but also the types of benefits and costs which a project is expected to generate, and to whom they are expected to accrue.

Cost-benefit analysis should be used to inform project designers whether the proposed NbS supports local livelihoods and/or compensates commensurately. By documenting all benefits and costs, cost-benefit analysis can be used to check whether the project delivers in respect of each of the triple win objectives, as well as instigate a comprehensive comparison of NbS projects in ODA-eligible countries and their respective value for money.

Participatory assessments, perceptions analysis, group modelling and integrated sustainability assessments can help to capture some of the benefits that are likely to be missed in economic or quantitative analyses. Multi-criteria analyses can be used to explore the costs and benefits of different management approaches under a variety of scenarios, whilst socio-economic monitoring can be used to ensure payments benefit the target group and mitigate negative consequences.

What resources are available?

The **Mangrove restoration in Madagascar and Indonesia** and **Silvopastoral systems in Colombia** case studies conducted comprehensive cost-benefit analyses, comparing the intervention options against different scenarios. See the **Madagascar and Indonesia Business Case** and the **Colombia Business Case** for more information.

Green Book – guidance on how to undertake detailed social cost-benefit analyses.

Simplified Guidelines for Social Cost-Benefit Analysis of Climate Change on a Local Scale – presents a simplified evaluative framework aimed at local governments and NGO's focussed on climate change adaptation interventions.

ADB Guidelines for the Economic Analysis of Projects – guidance on how to undertake economic and financial assessments of project viability.

Guide to Developing the Project Business Case – provides a guide to developing a project business case.

National Audit Office – can be used to assess value for money.

Cost and Benefits of Ecosystem-Based Adaptation – guidance on the economic effectiveness of ecosystem-based approaches, providing examples of cost-benefit analysis, cost-effective analysis and multi-criteria analysis.

Key consideration: Have the impacts of the project been disaggregated?

How will this help me achieve the triple win?

NbS projects in ODA-eligible countries may operate at scales where the benefits and costs accrue disproportionately across affected communities.

Benefits and costs can be distributed unequally by type, quality, quantity, or access. Not all benefits and costs are the same since their underlying characteristics differ. Understanding how and why these differences manifest is important to ensure that the benefits are shared equitably and that the achievement of the triple win objectives doesn't come at a cost for specific communities. This further strengthens the long-term sustainability of the project post-implementation.

What resources are available?

The **Mangrove restoration in Viet Nam** and **Ecosystem-based adaptation in the Gambia** case studies provide examples of disaggregating benefits by gender.

Green Book – provides guidance on assessing benefit and cost distribution.

Applying the Ecosystem Services Concept to Poverty Alleviation: The Need to Disaggregate Human Well-being – explains why improving ecosystem service flows doesn't necessarily produce wider wellbeing improvements for all local communities.

Application of the Sustainable Livelihoods Framework in Development Projects – describes common methods and approaches to assess livelihoods and their sustainability within different social groups.

Key consideration: Where relevant, has the project considered a plausible alternative sustainable livelihood activity?

How will this help me achieve the triple win?

Some NbS projects involve restricting certain unsustainable activities. Where this is the case, it's important to understand the underlying drivers of the previously damaging activities and to provide alternative sustainable livelihoods. If the drivers are not addressed, there is a risk that the incentives to revert to previously unsustainable activities will render the NbS ineffective in the long-term or displace pressures elsewhere.

For example, Payment for Ecosystem Services (PES) schemes can provide alternative sources of income for activities which protect, restore or enhance nature (and therefore the benefits that flow from it), and non-timber forest products can sometimes be monetised, which may provide a buffer against fluctuating carbon or timber markets whilst simultaneously protecting biodiversity.

The identification of any new livelihoods and/or sources of income should be co-created with local communities to ensure activities work and are accepted within existing socio-cultural structures.

What resources are available?

The **Climate-resilient agriculture in Cambodia** and **Ecosystem-based adaptation in the Gambia** case studies provide examples of implementing sustainable livelihoods. **The Silvopastoral systems in Colombia** case study provides an on-the-ground example of establishing PES schemes.

Guide to Getting Started with PES Schemes – outlines steps to developing PES projects, and associated opportunities and risks.

Making the Market Work for Nature – guidance on biocredits as a market mechanism like carbon credits, and how they can protect biodiversity and reduce poverty.

Guide for Small and Medium Enterprises in the Sustainable Non-Timber Forest Product Trade in Central Africa – provides an overview of different forest products and how to harvest them sustainably.

Local Investments for Climate Change Adaptation – a guide on the types of adaptation activities that use employment intensive approaches, with a focus on inclusive local practices for environmental sustainability.

Key consideration: Has the project considered the short- and long-term financial impact on local communities?

How will this help me achieve the triple win?

The proposed local benefits of NbS projects may take time to materialise. NbS projects should therefore financially support local communities in both the long- and short-term and avoid external shocks into other areas of the local economy. For example, if intensive agriculture is replaced with restoration projects, local food production may decline, causing an increase in food prices and a reduction in food security.

It is important to consider the financing of new activities, their timing, and whether the incentives provided by different activities ensure the longevity of the NbS project. Supporting alternative sustainable livelihoods may require that local people have direct access to carbon markets (or a share of its revenues) or low-interest start-up loans and grants. In some cases, NbS benefits may take several years to become apparent, and short-term costs may accrue. Providing incentives, such as access to secure water sources, can help to off-set any short-term losses.

What resources are available?

Economics and Finance – includes an overview of financial and funding models appropriate for NbS projects.

Investing in Nature – provides a guide to financing conservation and NbS.

The Green Buck – a guide to using economic tools to deliver conservation goals.

BIOFIN Catalogue of Finance Solutions – provides an overview of biodiversity finance instruments, tools, and strategies.

BIOFIN Workbook – guides the identification, development and implementation of financing plans and solutions for nature.

SDG Financing Solutions – a toolkit outlining different sustainable development financing solutions available, as well as their potential advantages, disadvantages, risks and characteristics in different country settings.

Biorights – a financing mechanism for linking poverty reduction and environmental conservation.

Nature-based Solutions Business Model Canvas Guidebook and **Canvas** provide an easy-to-use tool to capture the business model of an NbS (from an urban context).

Catalyzing Climate Finance – a guidebook on financing climate-resilient development in low income countries and developing capacity to enable public and private investment flows.

Key consideration: Have any trade-offs been clearly acknowledged and mitigated as best as possible?

How will this help me achieve the triple win?

Maintaining ecosystem and landscape level ecological processes often comes at the cost of other land use practices, such as provisioning ecosystem services, and trade-offs may arise due to competing triple win objectives. For example, when implementing sustainable land use practices, maximising the spatial extent of an intervention to improve carbon sequestration may conflict with maximising the number or financial need of beneficiaries when funding is limited, as a small number of wealthy individuals may own the majority of land in the target area. Projects should therefore carefully consider potential trade-offs between triple win objectives to ensure funding allocation and beneficiary selection is optimised.

It is crucial that the reasons for any unavoidable trade-offs are substantiated and mitigating actions are based on best practices and scientific guidance. Accountability and regulatory frameworks can be put in place to ensure trade-offs are fair and do not have any unintended negative consequences. Arranging for monitoring to be carried out by third-party actors or through social audits involving local community members can help to improve transparency and impartiality.

What resources are available?

The **Silvopastoral systems in Colombia** case study provides a key example of how partial trade-offs may occur between climate change objectives and poverty reduction objectives.

Enhancing Nature-based Solutions Acceptance Through Stakeholders' Engagement in Co-benefits Identification and Trade-offs Analysis – provides a methodology to detect and analyse trade-offs among stakeholders due to differences in co-benefits perception.

InVEST (Integrated Valuation of Environmental Services and Trade-offs) – provides a tool to assess the trade-offs of different management choices.

ROOT (Restoration Opportunities Optimization Tool) – a tool to evaluate trade-offs among different ecosystem services and visualise where investments in restoration could be made to optimise benefits.

Key consideration: Will the project deliver multiple ecosystem services and co-benefits across a range of spatial and temporal scales?

How will this help me achieve the triple win?

NbS can provide synergies across ecosystem services, and may simultaneously provide co-benefits for biodiversity, climate, human wellbeing, and the economy. Projects should therefore adopt a holistic, landscape approach when possible, considering synergies across wider landscapes and timescales, and in particular, the effect that interventions in one habitat or area have on another. Working at the landscape or watershed scale will maximise intervention reach and the long-term benefits to each of the triple win objectives.

However, working at scale across broad landscapes and seascapes can present significant challenges and therefore thorough forward-planning is essential. For example, environmental and heritage protection laws, administrative and jurisdictional boundaries, technical limitations, planning permits and building regulations may create hurdles and should be considered before project implementation.

Stakeholders and departments with conflicting priorities and interests may be required to cooperate to transform practices and technologies to make them applicable at a larger scale, yet there may be no financial capacity to facilitate this. Aligning with existing national programmes, spatial plans, business models and financing mechanisms can provide the financial incentive to support up-scaling. Furthermore, if the intervention produces co-benefits when up-scaled, these can be used to demonstrate the contribution of the intervention to multiple policy goals to promote up-scaling.

What resources are available?

The **Ecosystem-based disaster risk reduction in Afghanistan**, **Ecosystem-based disaster risk reduction in Haiti** and **Integrated water resource management in the Democratic Republic of Congo** case studies were designed as field-based models to scale-up Eco-DRR in vulnerable countries, providing valuable guidance on the associated considerations and barriers.

Nature Map Explorer – a set of integrated global maps on biodiversity and ecosystem services that can be used to inform policies and interventions aimed at limiting biodiversity loss and greenhouse gas emissions in parallel.

The **TESSA Toolkit** – provides practical guidance on how to identify and assess the ecosystem services provided at a particular site.

ARIES (ARtificial Intelligence for Ecosystem Services) – allows rapid ecosystem service assessment and valuation.

Think Nature Handbook – Table 3.1 outlines various ecosystem services and other NbS benefits at different scales.

Multi-Functional and Multi-scale Assessment of Green Urban Infrastructure – demonstrates the benefits and trade-offs of green urban infrastructures on three spatial scales.

A Framework for Assessing and Implementing the Co-benefits of Nature-based Solutions in Urban Areas – provides a seven-stage process for situating co-benefit assessment within policy and project implementation.

Checklist

The checklist follows a goals-based structure and is divided into three sections with relevant sub-sections. It firstly considers the project goals and local context, then financial arrangements, and then institutions and governance.

Click on the magnifying glass icon to navigate to the relevant section in the *Implementation Guidance* for further information and resources.

Goals and Context		
Define the outcomes to be achieved		
Does the project include quantified or monetised objectives for biodiversity?	🔍	☐
Does the project seek to address the underlying drivers of biodiversity loss?	🔍	☐
Does the project include quantified or monetised objectives for poverty reduction?	🔍	☐
Does the project seek to address the multiple dimensions of poverty?	🔍	☐
Does the project include quantified or monetised objectives for climate change adaptation and/or mitigation?	🔍	☐
Does the project seek to address the underlying drivers of climate change?	🔍	☐
Understand the local context		
Are the project outcomes relevant to the local community?	🔍	☐
Has the project conducted a stakeholder analysis to identify the full range of social groups to be affected by project activities?	🔍	☐
Have all climate vulnerable social groups been identified?	🔍	☐
Have any gender or social equity dimensions been recognised and have targets been disaggregated accordingly?	🔍	☐
Are there existing bodies or policies that manage the problem to be addressed and have they been engaged?	🔍	☐
Have past, present and projected future climatic conditions been used to identify site-specific climate risks and impacts?	🔍	☐
Has expert scientific advice, as well as traditional and local knowledge, been used to identify biodiversity and ecosystem trends?	🔍	☐

Identify an appropriate intervention		
Has the intervention been selected based on scientific advice, traditional knowledge, and local needs?	🔍	☐
Are climate vulnerable social groups central to the chosen intervention?	🔍	☐
Have all stakeholders and social groups been supported to participate in the planning and decision-making process?	🔍	☐
Is the chosen intervention appropriate for the temporal dynamics and complexity of the ecosystem?	🔍	☐
Has the socio-ecological context been considered within the project approach?	🔍	☐
Consider the synergies and trade-offs between outcomes		
Have any trade-offs been clearly acknowledged and mitigated as best as possible?	🔍	☐
Will accountability and regulatory frameworks be used to ensure trade-offs are fair and have no unintended negative consequences?	🔍	☐
Will the project deliver multiple ecosystem services and co-benefits across a range of spatial and temporal scales?	🔍	☐
Are there path dependencies, where one outcome depends on another, and if so, will they be accounted for if one outcome is not achieved?	🔍	☐
Evaluate intervention effectiveness and determine technical risk		
Has the effectiveness of the intervention been assessed, i.e. in relation to no action, grey infrastructure or other NbS interventions?	🔍	☐
Has a value for money assessment been prepared?	🔍	☐
Has the intervention been used in similar settings and does it have a good track-record?	🔍	☐
Has the project identified all necessary social and environmental safeguards to ensure the principle of 'do no harm' is embedded?	🔍	☐
Have potential socio-economic and political risks been acknowledged and actions to mitigate any risks been identified?	🔍	☐
Identify barriers and pathways to adoption		
Have any social, behavioural, or cultural barriers been identified and effectively addressed?	🔍	☐
If appropriate, will the project provide technical assistance to implementation partners?	🔍	☐

Is the project a pilot or does it build upon a previous project?	🔍	☐
Is the proposed scale of the project sufficient to achieve the project objectives?	🔍	☐
Has the project assessed whether the intervention is a national priority or has potential to be mainstreamed into national policy?	🔍	☐
Has the project adopted an adaptive management approach?	🔍	☐
Financial arrangements		
Identify cash flows		
Has a cash flow forecast been prepared?		☐
Has the project identified how much capital is needed and when is it required?		☐
Has a cost-benefit analysis been prepared?	🔍	☐
Have the financial impacts of the project been disaggregated between different members of the local community?	🔍	☐
Where relevant, has the project considered a plausible alternative sustainable livelihood activity?	🔍	☐
Has the project considered the short- and long-term financial impact on local communities?	🔍	☐
Attract private investment		
Has a business plan been prepared, outlining expected impact, market analysis, expected financial returns, and a review of key risks?		☐
Has the project outlined the underlying activity, or activities, to which private finance would be linked?		☐
Has the project considered what type of private finance it requires?		☐
Does the proposed project implementer have previous experience in similar projects involving private finance?		☐
Has the project assessed from whom it wishes to obtain private finance?		☐
Has a projection of financial returns to private investors been prepared?		☐

Does the project have clearly defined indicators which align with private investor metrics?	☐
Is the project replicating a proven model with previous private financing experience?	☐
Is it typically straightforward to obtain private finance for this type of project?	☐
Has the project identified key financial risks and considered how these can be mitigated or eliminated?	☐
Has the project assessed the characteristics of the project against the key considerations of a private investor?	☐
Does the project clearly outline the roles and responsibilities for governance and regulatory processes?	☐

Institutions and Governance		
Consider institutional arrangements		
Does the project aim to establish local partnerships with multiple stakeholders from a range of sectors?	🔍	☐
Will all relevant stakeholders be engaged in the design, implementation and management of the project?	🔍	☐
Have gender and other dimensions of social equity been accommodated within the design, implementation and management of the project?	🔍	☐
Has the project determined how the required infrastructure and capacity will be mobilised and sustained?	🔍	☐
Are the roles and responsibilities of all partner institutions and stakeholders clearly defined to ensure coordinated and coherent action?	🔍	☐
Does the project aim to build the adaptive capacity of local communities to enable long-term participation and sustained benefits?	🔍	☐
Does the project aim to strengthen existing institutions and governing bodies to enable cross-sector planning and decision-making?	🔍	☐
Has the project engaged with relevant policy processes and governance structures to promote and upscale the intervention?	🔍	☐
Where Indigenous Peoples are likely to be affected, do all activities have Free, Prior and Informed Consent?	🔍	☐
Are project activities aligned with global and/or national policy frameworks?	🔍	☐
Can project activities be integrated into local development plans?	🔍	☐

Put in place monitoring and evaluation procedures		
Does the project have clearly defined indicators to monitor the impacts on biodiversity at a measurable scale?		☐
Does the project have clearly defined indicators to monitor climate change mitigation and/or adaptation at a measurable scale?		☐
Does the project have clearly defined indicators to monitor poverty reduction at a measurable scale?		☐
Where possible are indicators for project impact disaggregated according to gender and other relevant social criteria?		☐
Are robust monitoring and evaluation systems in place, both during and after the project life cycle?		☐
Do monitoring and evaluation procedures incorporate a community-based participatory approach?		☐
Are targets for project participation disaggregated according to gender and other relevant social criteria?		☐
Are processes in place to allow continuous feedback between project implementation phases?		☐
Are processes in place to allow stakeholders and beneficiaries to provide feedback or challenge decisions throughout the project life cycle?		☐
Are sufficient resources and budget set aside to facilitate ongoing adaptive management systems and activities?		☐
Does the project outline how the effectiveness of the intervention will be assessed, i.e. in relation to no action or grey infrastructure?		☐

Biodiversity Indicators in Context

Biodiversity is complex, and includes the diversity of ecosystems, species and genetic diversity. Biodiversity indicators are a valuable and powerful tool for understanding the state of the environment, and the impacts of interventions and activities such as nature-based solutions (NbS). Official Development Assistance (ODA) and International Climate Finance (ICF) investments can help tackle the biodiversity crisis through the triple-win of NbS, which addresses biodiversity, climate and poverty challenges simultaneously. However, an acknowledged gap is well-understood indicators to measure the outcome of investment on biodiversity. This is particularly important given that more general environmental management interventions (e.g. sustainable land management) do not always have tangible and direct biodiversity benefits, and given the need to properly recognise projects that do provide such benefits. Here we set out potential options for biodiversity indicators monitoring the contribution of funding activities such as the ICF portfolio of investments. Consideration and context are given to the biodiversity components which they report against, balanced with the applicability of the indicator across a range of ecosystems and programme activities.

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Executive Summary

Two headline biodiversity indicators are recommended, and have been initially developed in the format of draft ICF Key Performance Indicator (KPI) methodology notes. They are designed to complement each other (one being ecosystems focused, one being species focused), but can also be used in isolation. Further development should be based on stakeholder consultation to consider specific implementation to finalise the indicators for operational use:

- **Hectares under ecological restoration as a result of funding** reports the total area for which funded activities have been implemented to restore an area towards a reference ecosystem. Note that the goal is the **integrity** and **intactness** relative to natural ecosystems. This indicator can be extended to includea areas which have seen sufficient improvement to be considered **recovered**.
- **Improvement in status of threatened species as a result of funding** reports the (modelled) cumulative reduction in species' extinction risks as a result of funded activities, including both threat or pressure reduction, and habitat restoration. It is based on the International Union for the Conservation of Nature (IUCN) Species Threat Abatement and Restoration (STAR) metric, and uses global assessments from the Red List of Threatened Species.

There are many additional potential indicators which would add insight and value to an indicator suite. These include more specific indicators such as **pressure** indicators which can report on the reduction of major components of threat to biodiversity. They have not been recommended at the headline level as they are likely to be less widely applicable across a portfolio of funding, however they should be **considered as additional headline indicators** if any are likely to be relevant to a significant proportion of the funded programmes, and/or they are perceived to be a priority to the funders.

Due to the limitations of information from the headline indicators in isolation, and the importance of site-specific context in biodiversity, we strongly recommend that attention should be given to the **planning and implementation of additional biodiversity indicators appropriate to the project or programme**. This will help to ensure the biodiversity implications and potential benefits of the project are well thought-out, can be maximised within the scope of the project, and are more likely to lead to long-term success and increase the value of the project as a whole. Consideration of each of the **NbS principles** can help with project development and determining suitable biodiversity indicators, to ensure a successful programme of work.

The presented recommendations have been made in relation to the ICF portfolio of investments, but could be suitable for other funding programmes including Official Development Assistance (ODA) spend. Further considerations for wider use of the indicators are discussed, including how potential expansion and the relevance of the indicators to national biodiversity reporting by recipient countries as part of multilateral environmental agreements (MEAs).

Introduction

Biodiversity, or biological diversity, describes the variation in life and living organisms including the diversity within and between species, ecosystems and genes. Recognition of the global biodiversity crisis and subsequent ratification of multilateral environmental agreements (MEAs) has pushed biodiversity higher up on the development agenda. As such the importance and contribution of biodiversity objectives is increasingly realised, and for International Climate Finance (ICF) this has manifested in aiming for the 'triple win', putting biodiversity benefits on a par with climate and societal goals, and emphasis on nature-based solutions (NbS) as a mechanism for achieving the triple win. This ambition means that programmes should be actively delivering significant biodiversity gains – a far stronger call than no net loss.

There is increasing understanding of what the scale of the biodiversity problems are, and measures required to reverse historic loss. The complexity and specificity of biodiversity issues makes it extremely difficult to assess against common objectives, particularly across scales. At the broadest level, biodiversity ambition should aim to (i) as a minimum maintain current biodiversity including preventing species extinction and wherever possible increase biodiversity, and (ii) reduce pressures on ecosystems. Guidance and frameworks are available to support planning of development alongside conservation actions, not only to help consider but also prioritise actions, such as the Mitigation and Conservation Hierarchy (MCH) which sets out sequential steps of biodiversity conservation actions and processes, as *Retain, Reduce, Restore and Renew*[23].

The challenge is translating this into actions on the ground. Funded programmes aim to achieve this ambition, but to do so requires monitoring to demonstrate, and preferably quantify, not only no net loss but tangible benefits to biodiversity across systems and scales. Here we set out recommendations for biodiversity indicators suitable for the ICF portfolio of investments, to complement the existing suite of Key Performance Indicators (KPIs). The accompanying **draft KPI methodology notes** set out the technical detail of the indicators that would be used to guide data collection and reporting by programme teams, delivery partners and analysts managing ICF programming, should these indicators be developed into full KPIs. The recommendations included here, and the related methodology notes, are informed by a review of existing biodiversity frameworks[28] and biodiversity indicators[29].

Recommendations also include the considerations which should be given to additional project or programme level indicators, and how planning for monitoring can help achieve greater biodiversity benefits overall. While the focus has been on ICF, we also consider wider benefits including ODA more broadly, and to the recipient countries in their own national assessments, and put the indicator considerations in context of the **principles of the NbS triple win**.

Aims of biodiversity indicators

Indicators are measurements across space and time that are used to report the state or identify change in a variable of interest, such as biodiversity[29]. Indicators can be useful to summarise trends and communicate data to a wide range of audiences. They are not designed to incorporate all information possible about the variable of interest but are intended to be indicative of wider changes[30]. Indicators can be used to monitor progress against targets and to communicate results from monitoring or evaluation exercises. Good indicators should be scientifically valid (widely accepted and based on reliable data), responsive (picking up on changes within the variable of interest), easy to understand (both conceptually and in terms of presentation and interpretation), based on data (sampled/observational data or modelling) that are already available or are feasible to collect (which will allow for regular production of the indicator over time) and relevant to the needs of those who will use them[31].

In the context of the triple win of providing benefits to climate, society and biodiversity, funders such as ICF already have good representation of indicators for the first two objectives, but biodiversity is not yet well represented. Without indicators for monitoring progress, no conclusions can be drawn as to the level of contribution to biodiversity the funded programmes are having. A particular need for this is evident in the common assumption that certain practises (or a focus on specific ecosystem service flows or delivery) are beneficial for biodiversity, but with no evidence to support this. For instance, sustainable land management (SLM) is defined by the UN (and ICF KPI 17) as:

“the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions”

This definition aims to protect the resource and ensure continued provision of ecosystem services, but does not focus on biodiversity directly. Afforestation and reforestation are a form of SLM, however this could include for example the planting of a non-native or low tree diversity plantations. This forest would contribute towards climate objectives (carbon sequestration) and could be a source of timber to support local livelihoods, and may even have further ecosystem service benefits such and soil erosion or flood prevention. However, it would have little biodiversity value, and may even be detrimental to biodiversity. In contrast, if the planting included a diverse range of native tree species, the same climate and societal benefits would be achieved, but with the added value of a significant contribution to biodiversity. The inclusion of biodiversity indicators helps to focus on the biodiversity impact of the projects or programmes, monitors the benefits to biodiversity explicitly, and puts biodiversity priorities on a par with climate and societal objectives.

Indicators are an essential tool for measuring and reporting achievements against objectives or towards targets. In the context of biodiversity, it is not realistic to assume that a holistic understanding of biodiversity is possible to capture, but the aim is that any indicators chosen should indeed be indicative of the status or changes in the environment. If this cannot reflect the environment as a whole, it must be clearly communicated as to the purpose and foci of the indicator or indicator suite.

Biodiversity indicator recommendations

The complexity of biodiversity, and the breadth of ecosystems and interventions that ICF-funded projects may cover means that there is no one-size-fits-all indicator that would effectively capture the contribution to biodiversity of all projects. This is apparent in the many and varied indicators already used in different frameworks[28]. Here, considerations have been prioritised for biodiversity indicators relevant to NbS and that can be aggregated across multiple projects to provide a programmatic summary. These would be relevant for the ICF context, including complementing the existing suite of KPIs. Below are recommendations for **two indicators which could be developed further into headline indicators such as an ICF KPI**. A 'hectares under ecological restoration' indicator focuses on the ecosystems component of biodiversity, and specifically a planned and measurable improvement of the quality of the ecosystem. A complementary indicator considers the 'improvement in status of threatened species', which can include quantifying the direct reduction in species' extinction risk as a result of any habitat restoration, but is also based on the impact of a reduction in other pressures on species and therefore can also be used in isolation of habitat restoration activities.

While the uptake of these would be a major step in representation of biodiversity as part of the triple win, the difficulty in determining indicators that would be appropriate to a range of interventions should be noted, and emphasis should also lie in **selecting or developing indicators at the project level**. Examples of potential project-level indicators are therefore also given.

Recommended indicator 1: Hectares under ecological restoration as a result of funding (see also **method guide**)

Rationale

Ecosystems are defined by a set of attributes, including the species present, physical and chemical conditions, and processes such as nutrient cycling and hydrology. These ecosystem-level attributes are an integral part of biodiversity, both for the value that many people attach to near-natural systems (e.g. primary rainforests or intact coral reefs) and because disruption to ecosystems can increase extinction risk and reduce resilience to pressures such as periods of climate stress[32]. As such, biodiversity policies increasingly emphasise reversing ongoing degradation and restoring ecosystem attributes to more closely resemble the natural or 'intact' state. For example, the draft post-2020 Convention on Biological Diversity (CBD) includes a goal on increasing the integrity of natural ecosystems as well as targets for the area of degraded habitat restored. Complementing this, initiatives such as the **Bonn Challenge** to restore 350 million ha of forest by 2030 represent high profile actions towards international targets. Being able to measure whether funding has contributed to restoring key ecosystem attributes to a more intact state is therefore important in understanding biodiversity benefits: **if programmes result in ecosystems in which the biodiversity and ecosystem processes are substantially closer to a natural state, the funding will have provided genuine benefits to biodiversity**. This is very relevant in the context of NbS, which often involve an element of restoring ecosystem processes because such activities can also bring benefits to people.

Proposed Indicator

The proposed indicator would report the size of the area over which funding supports ecological restoration where the end goal is close to a 'natural' state (note this does not exclude some levels of human use). Because the indicator aggregates information from projects involving different interventions and ecosystems, there is a need to establish consistency across projects as far as possible. As such, the indicator is built around the definitions and approaches developed by the Society of Ecological Restoration (SER)[32]. SER define ecological restoration as a form of restoration that emphasises recovering a range of ecosystem attributes to a natural (or 'reference' state):

"The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" with the aim to *"assist recovery of native ecosystems and ecosystem integrity"*

Since the ultimate goal of ecological restoration is recovering ecosystem integrity relative to natural systems, it is distinct from apparently similar activities such as restoration designed primarily to provide ecosystem services, or changes in management practices in production systems. Importantly, the SER view restoration as the ***activity*** undertaken, with the term 'recovery' being used to describe the ***outcome*** (i.e. the changes in ecosystem attributes that occur as a result of restoration). In this interpretation, ecological restoration is then:

"any activity with the goal of achieving substantial ecosystem recovery relative to an appropriate reference model".

Describing an appropriate reference model is therefore central both to individual projects and to ensuring comparability across projects. The SER define reference models as:

"A model that indicates the expected condition that the restoration site would have been in had it not been degraded (with respect to flora, fauna and other biota, abiotic elements, functions, processes, and successional states). This condition is not the historic condition, but rather reflects background and predicted changes in environmental conditions"

The reference model concept recognises that all ecosystems are the result of co-evolution between people, biodiversity, and environmental processes. In some cases, this means that the reference model can be one in which human use involves management that mirrors natural disturbance regimes (e.g. similarities in fire regimes between natural savannahs and those resulting from burning by indigenous people) or that is needed to support important native biodiversity[32]. The SER guidance also highlights the need to consider climate change when defining reference models, because the historical or current state of a native ecosystem may not be an appropriate (or even achievable) restoration target given future climate change impacts.

Restoration could influence a large number of ecosystem attributes, which can be grouped into six broad categories: *Absence of threats; Physical conditions; Species composition; Structural diversity; Ecosystem function; External exchanges* (see **methods guidance** for detail of these categories). The status of these attributes can be assessed against the SER 5-star scale, which contains definitions for each broad category in a heavily impacted system (1 star) through to a natural or near-natural system (5 stars). The standardised scale facilitates fair comparison and aggregation across projects and ecosystems. Importantly, the definition of ecological restoration emphasises that the aspiration should be 'substantial recovery'. This potentially allows for some level of human use, provided that ecosystem integrity is not compromised. Equally, to demonstrate the intention for substantial recovery and count towards the proposed indicator, a project must document:

- Relevant ecosystem attributes at the project site and at a near-natural reference site (this could be based on field data from a reference site in a similar habitat with low human impacts, or on other sources e.g. historical data, expert opinion).
- Clear and plausible intervention logic and timeline on how the project will cause a substantial change in the relevant ecosystem attributes towards a more natural state. To represent 'substantial recovery' this should be designed over the long-term to achieve and maintain at least 4 stars on the SER scale.
- Evidence that the project activities necessary to achieve the improvement in ecosystem attributes have been implemented and maintained.
- A suitable plan for monitoring changes in the ecosystem attributes.

Important Note: This indicator measures implementation rather than how implementation translates into changes in ecosystem attributes. See Limitations and Challenges for further discussion of this point.

Applicability across systems and projects

The indicator uses standardised definitions and in principle can be applied in any terrestrial, freshwater, or marine ecosystem in which restoration is being planned at a measurable scale. However, there are four broad areas to note with respect to applicability:

i) **Not all restoration projects will aim to improve ecosystem integrity to a sufficient level to meet the criteria for this indicator.** For example, restoration as a general term can also be applied to activities focused primarily on the recovery of production (e.g. in commercial forestry or agriculture) or a specific ecosystem function (e.g. soil erosion prevention). Whilst these activities are potentially important for economic reasons if used appropriately, the benefits to biodiversity are not a given and may be limited. As such, the indicator does not automatically apply to all projects that involve any form of restoration.

ii) **Although the standard is high, it does not preclude human use or management** – it is possible to achieve 4 stars on the SER scale in human-modified systems. Some projects that do not explicitly involve or aim for full ecological restoration may still result in substantial recovery of ecosystem attributes, and so potentially count towards this indicator. For example, conversion of plantation to shade grown coffee is not designed to restore a fully functioning natural ecosystem, but if implemented and managed well it is potentially possible to achieve 4 stars on the SER scale[33,34].

iii) **Projects that aim for more limited effects on ecosystem attributes such as NbS in landscapes that involve high levels of ongoing human use (e.g. urban or agricultural areas) are unlikely to count towards this indicator.** Although these projects are not automatically excluded from the indicator, in practice it will probably be difficult to achieve 4 stars on the SER scale in such environments. As such, it is not appropriate to aggregate projects that provide comparatively minor benefits with those that are expressly designed to have substantial positive effects on biodiversity. Note also that other important benefits from projects in environments with high levels of human use may be identified through indicators such as ICF KPI 17: *Hectares of land that have received sustainable land management practices as a result of ICF.*

iv) **More generally, there needs to be enough understanding of the system that appropriate reference models and activities can be planned** – this can be challenging in some environments where knowledge and resources are limited (also see Limitations and Challenges below).

Limitations, Challenges, and Areas for Further Discussion

Suitability of aggregating across projects

Reference models and a consistent restoration scale allow standardisation across projects, and so facilitate aggregation of the indicator. However, this approach to aggregation does have limitations. Firstly, there will still be subjectivity and variation across projects in how the reference model is defined and in how the restoration scale is interpreted. If this proves problematic, more specific guidance to those reviewing project plans could help improve consistency. Secondly, ecological restoration is likely to be more feasible in some locations and ecosystems than others due to technical and logistical challenges. For example, per hectare costs of coral reef restoration are typically substantially higher than for mangrove, saltmarsh, or seagrass restoration[35]. The benefits of smaller scale restoration in high biodiversity value ecosystems might therefore not be fully reflected by an aggregated area indicator. Disaggregating the indicator by ecosystem type could help to communicate these benefits more clearly and avoid incentivising restoration focusing on only a restricted set of ecosystems.

Feasibility

The proposed indicator may need refining to ensure practical feasibility. In particular, it could be that in practice very few projects implement ecological restoration designed to reach at least 4 stars across the six categories of ecosystem attributes. Potential alternatives to this could be discussed (e.g. the need to achieve at least two ‘levels’ worth of improvement on the SER 5-star scale).

Discussion Point: *Prior to finalising the indicator, discussion with programme managers and those involved in carrying out projects will be important to ensure the indicator reflects true biodiversity benefits without being unattainable.*

Data and Knowledge

To count towards the indicator, projects must have a reference model that describes relevant ecosystem attributes in the natural or near-natural state. The SER provide guidance on approaches to defining reference models, although in practice this might still be challenging in ecosystems where knowledge and/or the ability to collect new data is limited. Projects also need to plan for monitoring the effects of restoration activities on ecosystem attributes. Again, this may not be straightforward for logistical or technical reasons. In marine ecosystems in particular it might be difficult to collect sufficient data on the status of the ecosystem and its threats to be able to reasonably plan and achieve a sufficient level of restoration, although the vast majority of marine-related NbS projects occur in coastal ecosystems[36] where the required data collection is feasible. The counter argument to these challenges is that if a project is unable to describe a natural state to work towards or monitor how the project is affecting key ecosystem attributes, it would be difficult to justify claiming a biodiversity benefit. In practice, a degree of pragmatism will be needed in this respect.

Discussion Point: *Prior to finalising the indicator, discussion with programme managers and those implementing projects will be important to ensure the indicator fairly accounts for project-specific challenges without overly compromising the need for suitable reference models and monitoring.*

Restoration vs. Recovery

The focus of the indicator on the implementation of activities rather than on documented effects of these activities on ecosystems is primarily because of the timescale over which ecosystem attributes change. Although the early effects of restoration can occur within a few years, substantial recovery will typically take much longer. Furthermore, the speed of recovery will vary across ecosystems and depend on the pre-project state. Indicators based on documented recovery are therefore unlikely to be reportable for several years, and potentially will show the most important changes after projects have concluded. By contrast, indicators based on the implementation of restoration will be usable from earlier stages in projects. However, the disadvantage of focusing on activities is that these may not always translate into the desired outcomes for a variety of reasons and that the effects may not be permanent. **An important potential complement to the restoration indicator proposed here would be a recovery indicator based on documented changes in ecosystem attributes.**

Discussion Point: *Development of a complementary indicator to report the effects of ecological restoration on ecosystem attributes (e.g. 'Area over which funding has resulted in ecosystem recovery').*

Restoration vs. Avoided Impacts

The proposed indicator focuses on restoring systems that have already been degraded, and so does not incorporate projects that maintain intact natural habitat. However, these projects potentially have important biodiversity benefits if the habitat would otherwise be degraded or destroyed. Avoided impacts are partially tackled through ICF KPI 8 'Number of hectares where deforestation has been avoided through ICF support' although the indicator relates only to forests and does not have an express focus on the biodiversity benefits of avoided deforestation. One potential option might therefore be an indicator describing the area of natural habitat maintained at (for example) 4-stars or above on the SER scale.

Discussion Point: *Development of a complementary indicator to report on the maintenance of intact natural ecosystems that would otherwise have been degraded or destroyed.*

Communication

The reported indicator ('hectares under ecological restoration') should be relatively straightforward to understand, and has parallels with other area-based KPIs (e.g. KPI 17). However, communications should be clear that the indicator represents the area over which restoration activities have been implemented, rather than the area over which recovery has occurred. The emphasis on ecological restoration should also be stressed in communication, because this is an important distinction from other forms of restoration or management that may be less beneficial for biodiversity. Lastly, **the ability to disaggregate the indicator by ecosystem type would be helpful both for communication and for understanding contribution to habitat-specific indicators used by the CBD.**

Recommended indicator 2: Improvement in status of threatened species as a result of funding (see also **method guide**)

Rationale

The world is currently undergoing what many label an "extinction crisis", with unprecedented levels of species loss as a direct result of human activity. The IPBES Global Assessment found that approximately 1 million animal and plant species are at risk of extinction, including 40% of amphibian species, an estimated 10% of insect species and 33% of reef-forming corals[3]. The average abundance of native species in all major biomes has decreased by over 20% since 1900, highlighting the role industrialisation and intensification of human activities has played. The most significant drivers of species loss are habitat destruction or degradation, overexploitation, pollution, climate change and invasive species. Without urgent action a further acceleration in global species extinction rates is expected, causing significant species loss and triggering wider impacts throughout ecosystems.

Tackling biodiversity loss has rapidly become a global target. The CBD post-2020 biodiversity framework aims to stabilise and restore species' conservation statuses, promoting the attainment of the Aichi Biodiversity Target "to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity." The UN SDGs make specific reference to species conservation within wider aims to "halt biodiversity loss", aiming to "protect and prevent the extinction of threatened species."

Monitoring the contribution of NbS towards improving species' conservation statuses is crucial in assessing progress towards achieving these global targets. The proposed indicator **quantifies the global reduction in threatened species' extinction risk** as a result of programme activities, based on the International Union for the Conservation of Nature (IUCN) Species Threat Abatement and Restoration (STAR) metric. The metric could be a valuable headline indicator, as it focuses solely on the impact of programme activities on threatened species, a key target in several global environmental goals. The spatially explicit nature of the metric facilitates efficient aggregation of impacts across projects to a portfolio level, and means that the metric can be reported in a range of ways – numerically, graphically and through mapping. The underlying method outlined by Mair et al. (2021)[37] is highly detailed and has undergone extensive sensitivity analyses and peer review to limit and account for uncertainty. The separate calculation of threat abatement and habitat restoration components within the STAR methodology increases the applicability across NbS, or any programme of work where an aim is to reduce species' pressures across a landscape, while the scaling of restoration scores to account for low habitat recovery rates ensures a realistic estimate of the positive contribution restoration efforts offer towards alleviating extinction risk.

Proposed indicator

The indicator quantifies the potential reduction in terrestrial species' extinction risk as a result of programme activities, based on the programme area and the species' threats it seeks to address. The STAR method provides an additive metric that can be applied at multiple spatial scales to determine the contribution of individual projects, NbS portfolios, or entire nations, to extinction risk reduction. STAR is divided into two components: the STAR threat abatement score ($STAR_t$) and the STAR habitat restoration score ($STAR_r$) that can be combined to determine the potential contribution that threat abatement and habitat restoration would offer towards reducing extinction risk of threatened species. Note that the STAR method is not prescriptive about the definition of habitat restoration, and therefore does not apply the SER definition as with the "Hectares under ecological restoration" proposed indicator, but quantifies the potential contribution of restoration activities towards reducing extinction risk based on the area of restorable habitat at a location relative to the global area of remaining habitat for a particular species. Projects will need to demonstrate that the proposed restoration activities will have a significant positive impact on the area of available habitat for threatened species.

$STAR_t$ is calculated using the number of threatened and near threatened species at a location (for example a grid cell, or project boundary), their conservation status (Near Threatened, Vulnerable, Endangered or Critically Endangered) and the proportion of the global available Area of Habitat (AOH) for each species present at that location. The $STAR_r$ values incorporate the proportion of restorable AOH for each species to estimate the contribution habitat restoration would offer towards alleviating extinction risk at a location. $STAR_r$ scores are scaled to account for the slow and low success rate of restoration efforts. See the **method guidance** and Mair et al. 2021[37] for detailed methods.

$STAR_t$ and $STAR_r$ values have been generated on a global scale for amphibians, birds and mammals and these data are available pre-calculated at 50 km resolution from Mair et al. (2021)[37]. This will soon be updated with additional comprehensively assessed taxonomic groups (including reptiles, cacti, cycads, conifers, freshwater fishes and reef-building corals), but it is already possible to calculate STAR incorporating these and indeed any globally assessed species. It is also possible to calculate the values at any resolution for which relevant land cover or habitat data are available, which is likely to be a required step for landscape scale programmes where 50 km resolution is not suitable.

At a programme level, managers would be required to report on the spatial extent of any threat abatement or restoration activities. These data are then used to calculate the STAR scores. This calculation is the most resource-intensive step of the process and requires technical Geographic Information System (GIS) expertise, so it is envisaged that this step will be performed by ICF analysts but this will be dependent on the analytical capacity of programme teams. STAR scores can then be summed to determine the impact of programme funding, and can be aggregated to report on total reduction of threatened species' risk across a portfolio of investment. This total can be disaggregated according to threat, highlighting the contribution of each threat to extinction risk. To report against this indicator a programme must:

1. Identify which threats are addressed by the programme each year according to the IUCN Threat Classification[38]
2. Provide details of threat abatement activities conducted in each year, and how activities will abate each of the threats within the defined area
3. Document the area over which threat abatement activities are taking place in the reporting year and provide as a spatial extent layer
4. (If applicable) Provide details of habitat restoration activity and provide a spatial extent layer over which restoration is conducted in the reporting year

As the STAR method includes global datasets that can be used to calculate the resulting impact on threat status of species, these steps are the minimum requirement for project-level assessments. If data are available, projects could also provide any species abundance, threat intensity/extent data as well as any available local land cover maps, to provide improved and locally relevant data. Programme teams can apply the Mair et al. (2021)[37] method to project-level and global datasets derived from the IUCN Red List to generate STAR values (see **method guidance** and IUCN examples[39]). In future there will be an option to derive the STAR values using the **Integrated Biodiversity Assessment Tool** (IBAT), thereby reducing the technical expertise required to derive this indicator.

Applicability across systems and projects

STAR is a spatially explicit metric and is applicable at multiple scales from individual projects to national and global scales. To date it has only been used in terrestrial areas (although see **Scope** for more on expansion to include freshwater fishes and reef corals). STAR can be calculated at a landscape scale to assess the impact of individual projects towards improving the status of threatened species using available local data and global datasets. However, the spatial resolution of land cover, elevation and species range data may limit applicability in smaller projects. Smaller projects may have negligible impact to the STAR score for broad-ranging species for example, as the proportion of the available AOH for that species within the project will be small.

The calculated reduction in threatened species risk can be aggregated at the programme and portfolio level. One STAR unit is approximately equivalent to the reduction in extinction risk of one species by one threat category[37]. Alternatively, the output can be communicated as a potential percentage of contribution to averting extinction risk for all species in e.g. recipient countries, or all ODA-eligible countries.

Limitations and Challenges

Data restrictions

The method is dependent on the IUCN Red List for species status, range, habitat associations and threat details. While the global range and availability of these data are important advantages to the indicator, the current coverage of the Red List limits the scope of the indicator metric to sufficiently documented species. At present the method cannot address emerging or worsening threats well, as information on how these may change a species extinction risk will only be made available through Red List re-assessments. The indicator can be generated using global land cover data to estimate available AOH for species, but where available local data would improve the resolution and accuracy of these estimates. It is recommended that global data layers, including the Red List species range estimates, are validated by local observations or field data if available.

Communication

The output unit of the indicator may not be self-explanatory. One STAR unit roughly equates to the reduction in extinction risk of one species by one category, though units can be decimal, and depending on the coverage of the programmes, may be considered small. The units can also be presented as a percentage of total contribution of species' threat removal in a given area. The concept of comparing project STAR scores to counterfactual scenarios, such as sites of the same ecosystem type and land use not benefitting from ICF funding and conservation activities or modelled scenarios, was suggested[39] but this idea requires further development and research to assess the validity and applicability.

Discussion point: *Decision on best units for communicating reduction in threatened species extinction risk. For example the value could be reported as a ICF's contribution to averting extinction risk as a percentage of all species in ICF receiving countries, or, as a raw number with the clarifier "1 = the reduction of 1 species by 1 threat level."*

Scope

At present only terrestrial ecosystems have sufficient global Red List data to have been included in the globally generated STAR estimates, and within terrestrial systems only amphibians, birds and mammals are currently included. The scope is expected to expand to other taxa as more data become available, with likely candidates for imminent inclusion comprising reptiles, cacti, cycads, conifers, freshwater fishes and reef-building corals. The inclusion of freshwater fishes will then make this a suitable indicator for freshwater systems; however it is unlikely to be an adequate indicator for marine systems (beyond marine mammals and birds) other than where a project is directly related to a coral reef system (for a review of more broadly applicable indicator options for marine environment, see marine indicators in context).

It is also noted that for certain species complete threat abatement would not necessarily equate to an improvement in conservation status, as some species are threatened by small population sizes. In these cases, habitat restoration (in addition to threat abatement) is crucial to alleviating extinction risk. Mair et al. (2021)[37] acknowledge the importance of considering factors such as synergies among threats, potential leakage of threats and the complexities introduced by supply chain analyses, but these concepts are outside the scope of the STAR metric calculation.

Assumptions

The method calculates the *potential contribution* to reduction of extinction risk, based on local changes to global data. This is not an outcome indicator that can ascribe the actual change in species threat status within the spatial and temporal scales of most programmes.
In addition, the underpinning method quantifies reduction in extinction risk by assuming that complete alleviation of all threats to a species will stabilise and restore populations to downlist their conservation status to Least Concern. However, Mair et al. (2021)[37] emphasise that the delivery of threat abatement and restoration actions does not equate to the long-term recovery of species and suggests that additional metrics, such as the IUCN Green Status of Species[40] should be used to inform further conservation efforts. It is also recognised that there is significant variation in the feasibility of threat abatement, particularly with irreversible or global threats such as climate change. The Red List assessments upon which the calculations are based comprehensively cover threats, however, the extent to which a reduction in extinction risk can be achieved is dependent on which threats can realistically be addressed.

Threat impacts are assumed to be constant across species' AOH. It is suggested that refinement of this would be possible using global threat heat maps if available. It is also important to note threat abatement in the context of STAR includes both actions to reduce threat extent/intensity and actions mitigating the impact of threats. There are no prescribed thresholds for how much threat reduction/mitigation or habitat restoration activities are required to define inclusion towards the metric, and therefore the programme managers are required to assess whether activities demonstrate an appropriate level of activity to have a probable positive impact to be included, within the context of each project. It should be noted in all STAR reports that complete threat abatement is unlikely but that the metric indicates potential improvement of species status, rather than actual achieved alleviation of extinction risk.

Project or programme level indicators

Ecosystem integrity/intactness

The **hectares under ecological restoration** indicator reports the area over which restoration actions have been implemented but not the improvement in ecosystem intactness that results (see **Restoration vs. Recovery**). A wide range of indicators of ecosystem intactness (and related concepts e.g. quality, condition, integrity, fragmentation) also exist, which could be used for reporting at the project level.
For example, 'Live Coral Cover' is a well-established indicator of the health of reefs[41], and there are a range of standard ecological metrics such as species diversity (also see **JNCC (2021)**[29], which includes a list of potential indicators). Most of these indicators are habitat and/or species-specific and so are well-suited to monitoring impacts at the project level (e.g. as the improvement in the indicator relative to the pre-intervention state) and potentially for aggregating to quantify the impacts of several similar projects within a programme. However, aggregating more project-specific indicators becomes difficult as the

diversity of projects increases – e.g. absolute changes in species diversity are not directly comparable between taxa or ecosystems. The SER restoration scale may provide a way to bridge the gap, because changes in project-level indicators could then be matched against this scale for higher level reporting.

Species

Tracking species responses is a clear and direct way of monitoring the impact of activities on biodiversity. However, it is difficult to aggregate species trends into a headline indicator, as species represented will necessarily differ depending on representative composition, difficulty in surveying, importance of species to the area and likely time lag between activities and impact on species – all of which will be site-dependent. An aggregated KPI has therefore not been recommended for the ICF portfolio of investments, however it could be considered as a valuable addition to project- or programme-level indicators.

Abundance of selected species

At a project level trends in the abundance of selected species can be used to establish impacts of NbS on biodiversity. Project teams would need to select species that are expected to react to the NbS interventions within the project timescales and/or expected to be indicative of the state of biodiversity. Selection of species is challenging, as an “indicator” species may not be truly representative of wider biodiversity, while reporting trends in generalist species will not provide an accurate measure of biodiversity. Species selection may also depend on the ease of collecting abundance data. For considerations specific to marine species, see **marine indicators in context**. The project would need to justify the species selection, preferably with evidence or literature supporting the selection.

The project teams would need to conduct a field survey to estimate selected species’ abundance before NbS interventions began as a baseline, and continue to conduct field surveys throughout the project, reporting change in species abundance at appropriate intervals. This would provide a direct measure of species abundance, but requires less resource than sampling all species at a location, and provides flexibility for projects to select appropriate species to measure.

A particular challenge however is being confident to attribute change in abundance to the direct impacts of the programme activities.

Species richness

An increase in species richness is not necessarily a desirable outcome of interventions. Specifically, certain habitats are naturally less species diverse, and an increase in species richness would be as a result of colonisation by generalists and/or non-native species, potentially at the expense of habitat specialists. It has therefore not been recommended as a headline indicator. However, it is likely to be representative of achieving biodiversity benefits in project areas of degraded habitat that are not aiming to return to a near-natural state, including agroforestry or rotational agriculture projects. An increased species richness in a rotational agriculture area compared to intensive crop production would demonstrate the positive impact these interventions have despite continued anthropogenic land use. If this type of species richness is applicable to many NbS projects, for instance the ICF portfolio benefits a significant area of agricultural lands aiming to reduce negative impacts and improve local biodiversity, **funders may consider developing a species richness headline indicator.**

Pressures

Since pressures are the major contributor to the decline in biodiversity, a reduction or removal of pressures is an important aspect of biodiversity gains, and in many cases is easier to monitor and report than biodiversity components themselves. As such, pressures' indicators are an excellent way to report on the impact of programme funding, however the breadth of pressures across ecosystems is extensive. A consolidated pressures indicator has not been recommended as it is not considered suitably meaningful, however we strongly recommend that appropriate **pressures indicators are considered at the project or programme level** as a valuable and informative way of monitoring project impacts. Further consideration should also be given to the appropriateness of any of these indicators to be **developed into headline indicators if any are likely to be relevant to a significant proportion of the funded programmes, and/or are perceived to be a priority to ICF**. A selection of pressure indicators are described in Table 1.

Table 1. Selection of pressures indicators from ***review of biodiversity indicators***[29].

Ecotoxicology factor	Measures the effects of pollutants on populations within an area of interest.
Extent and quality of water related ecosystems	This is an SDG indicator focusing on rivers, lakes, estuaries and aquifers. It consists of a number of sub-indicators assessing the extent and quality of water in these ecosystems.
Marine trophic index	Measures mean trophic level of fisheries landings as an indication of whether large-bodied fish are being overexploited
Nitrogen pollution	The CBD recognises trends in nitrogen deposition, trends in loss of reactive nitrogen to the environment and trends in global surplus of nitrogen as important indicators against this pressure. Nitrogen pollution is particularly a problem for freshwater biodiversity.
Number of instances of illegal activities	E.g. (burning, killing, trade, etc). Many forms of illegal activity constitute threats to biodiversity, for example through habitat destruction and overexploitation.
Number of invasive alien species	Invasive species are a significant pressure on biodiversity, particularly in specific ecosystems such as islands.
Percentage change in deforestation	The loss of habitat through deforestation is a major driver of biodiversity loss, so measuring changes in deforestation rates in an area will be important.

Value of monitoring

Almost all funding bodies require some level of monitoring and reporting to meet the grant conditions, but the value of biodiversity monitoring should be understood to be far greater than just as a reporting exercise. Ultimately it is a way of gathering information, and provides context and understanding of the state of biodiversity which is not only informative at the site level, but can be used to support progress against national and even international objectives (see also **National biodiversity metrics**). At the project level, careful consideration of appropriate monitoring is a vital step in the planning of the project: What are the biodiversity objectives? What monitoring would be required to ensure objectives are being met? Are the activities of the intervention adequate to realise those objectives? What species might be indicative of the desired changes? Over what time frame would monitoring be required to see changes, and to meet the overall objectives? These questions are required to consider what indicators are most appropriate for projects, and also help to frame the biodiversity impacts expected, and support the development of project plans which maximise the potential biodiversity benefits of a triple-win project by thoroughly thinking through the implications and not assuming that actions, such as planting trees, will automatically bring positive impacts to biodiversity.

In some cases, reporting can be completed using already existing datasets (such as census data, or satellite derived global land cover maps). In many cases reporting can be improved by, or entirely relies on, new and specific data collection. While this may appear to be a burden on a project, it should be seen as an opportunity for greater benefits resulting from the project. Where dedicated surveys and/or technical expertise are required this can bring the additional advantage of building in-country capacity, which is likely to have wider indirect benefits in participating ODA countries beyond the project space and timeline. Depending on the nature of the reporting, monitoring can be a good opportunity to get the local communities involved in the nature recovery work. Not only does this improve **people's engagement with nature**, but it also increases awareness of the project, helps to embed the project objectives within the local communities, and is likely to improve the chance of successful outcomes. Normalising the process of in-depth consideration of biodiversity indicators within project planning, and consideration of the level of participation within the planning and monitoring process helps with mainstreaming conservation of biodiversity.

Measuring additionality and displacement

Additionality (or attribution) describes comparisons between project impacts and what would have happened without the project. This may take the form of a business-as-usual projection, or a control site elsewhere, which can again be used to distinguish any impacts as a result of project's actions from any changes that would have happened in the absence of the project. From a biodiversity perspective, determining additionality will require a good understanding of the ecosystem and wider socio-political context, because it involves not only predicting a business-as-usual scenario for the project area but also predicting how that scenario would then affect different aspects of biodiversity. Both of the indicators recommended as potential KPIs include this additionality aspect: projects must show the restoration or improvement in a species' habitat due to the project funding, not changes that would have occurred anyway.

Displacement (or leakage) refers to cases where stopping an impact in one place simply means it starts somewhere else. Indirect land use change is a significant displacement effect, whereby land lost to production in one area leads to additional land conversion in another area. This is of particular relevance to NbS, many of which focus on restoration of natural habitats. For example, if tree planting or wetland reconstruction takes place in an area that was previously used for the production of commodities, the action of reconstructing these habitats does not reduce the overall demand for these commodities. Therefore, because of market pressures, a similar amount of commodity will likely end up being grown elsewhere. This may take place in previously undisturbed habitat leading to land conversion and no real difference caused by the NbS at a global scale. Some discussion of how this can be accounted for is given within the technical guides, but it is likely to be under-reported.

Information gaps

The recommendations recognise the difficulties of capturing the variety of biodiversity impacts from a broad range of interventions. It should also be noted that there are additional areas that have not been considered within the recommendations above but could also enhance a suite of indicators.

People and nature

The level of engagement between people and their natural environment is increasingly recognised as important, both for people's well-being, and to increase the likelihood of success in achieving ecosystem restoration. As such, indicators of people's engagement with nature are incorporated into biodiversity frameworks, such as Defra's 25 Year Environment Plan (YEP) or CBD (see Box 2 for examples). Considering these kinds of indicators has not been within the scope of this work, which has concentrated on direct benefits to biodiversity, but could be an informative part of any biodiversity indicator suite, particularly where the societal benefits are also a priority.

Box 1 Examples of indicators considering interactions between people and nature

Defra's 25 Year Environment Plan includes:

- Engagement with the natural environment
- People engaged in social action for the environment
- Environmental attitudes and behaviours
- Health and wellbeing benefits

CBD Aichi Target 1 "…*people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably",* including possible indicators under the headings of "Trends in awareness and attitudes to biodiversity" and "Trends in public engagement with biodiversity".
Specific potential indicators listed include:

- **UEBT Biodiversity Barometer**
- Online interest in biodiversity (Google Trends)
- WAZA global visitor survey

Urban green & blue spaces and green infrastructure

NbS implemented in urban environments may not have an effect size great enough to be picked up by the headline indicator recommendations included here. Many of them are small scale, and although can make local improvements, would not be changing the land cover designation or quality of land enough to count towards 'hectares under ecological restoration', and not down-scaling any threats on a large enough scale (compared to the threat of the urban area overall) to make an impact on the 'status of threatened species' indicator. Although the creation and/or improvement of green spaces (such as parkland) or blue spaces (such as rivers and lakes) could potentially contribute towards 'hectares under ecological restoration', given the likely desire for it also to be an area of recreation for the surrounding neighbourhood, it is probable that in most cases the area would not meet the requirements due to the management of the land for recreational benefit with high levels of human disturbance (for full details see **methods guidance**). While it is difficult to make generic indicators that capture the range of urban interventions in a way to capture the benefits at the scale of a portfolio of investments, there is plenty of potential for biodiversity benefits within urban settings and at local scales, particularly where widely implemented. The emphasis once again is on considering project-level indicators appropriate to the biodiversity objectives of the project itself. Good examples of these are demonstrated by EKLIPSE[42] and Singapore Index on Cities' Biodiversity[43].

Genetic diversity

Currently, although genetic diversity is internationally recognised as an important component of biodiversity, the conceptual and practical difficulties of monitoring genetic diversity mean that it is poorly represented in biodiversity frameworks beyond domesticated species[29]. Recent progress means that there have been recommendations made for three potential genetic diversity indicators in the CBD post-2020 Global Biodiversity Framework[44], however an in-depth review of this and wider genetic diversity considerations has not been included in the scope of these recommendations. This would be an important area to consider in future – e.g. when CBD goals and national targets are more established – and should be informed by projects that attempt to increase and monitor genetic diversity in wild populations.

Relevance of NbS biodiversity indicators to wider ODA spend

The focus of this work was in consideration of the ICF KPI suite, and in particular the emphasis on NbS as a mechanism for achieving the triple win. To that end the indicators drawn up represent ICF KPI methodology notes, and recommendations are made with regard to the ICF programme process, and to complement the existing KPIs. Broadly, however, the recommendations made here would be suitable for wider consideration across ODA spend, where scale and activities are relevant (i.e. those that result in any ecosystem restoration and/or reduction of any threats to species). Similar to the relevance of project-level indicators to ICF, the guidance provided here may frame deliberation on the objectives and outcomes of projects, and subsequently if there is more that can be done to enhance the biodiversity benefits of activities, and if the appropriate monitoring is in place to ensure the objectives are achieved. In particular, none of the pressures-related indicators have been recommended as a KPI as they are less generic (i.e. individual pressures objectives are less widely applicable than a broad objective for ecosystem restoration). However, if addressing certain pressures is a particular priority for ODA, such as reducing pollution levels, it would be valuable to consider making relevant metrics a core indicator.

Further considerations would include the applicability of the indicators to systems benefitting from ODA. A significant example is marine – the focus on NbS of ICF means that the programmes to date are largely terrestrial or coastal. Offshore regions introduce significant challenges for marine monitoring, most notably the difficulty in understanding the system of interest and collecting data (particularly on biodiversity components), and the connectivity of the ocean meaning that it can be difficult to understand flows, and certainly difficult to define attribution and contribution of impacts.

The focus on NbS by ICF means that all interventions considered should be providing a benefit to nature. Programmes that support similar activities such as described here (e.g. ecosystem restoration, reduction of threats) would also therefore be achieving biodiversity benefits even if they were not overtly aiming for NbS, and therefore the recommendations can be considered more widely. However, the converse is that where NbS are not a particular objective of the intervention or programme is that negative impacts are also a possibility, such as increased clearance of land, or intensification of agriculture. Therefore, outside of an NbS context greater consideration needs to be given to negative impacts and net effects (e.g. as some pressures decrease, others may increase) to give a holistic picture of the biodiversity impacts of programmes.

A major challenge to the ICF indicators is that the indicators are a result of reporting within a project life-cycle, which in biodiversity terms is often very short and not long enough to ensure the outcomes (a functioning near-natural ecosystem; improved species range, numbers and composition) are achieved. As such many of the recommendations are well-qualified *activity* indicators (implementation of actions to improve the quality of ecosystems and/or reduce and remove threats to species) but do not comprehensively monitor whether the outcome objectives are achieved (for example planted saplings may die before they mature, or species' range and abundance may not increase due to connectivity and dispersal issues). The larger and longer-term nature of ODA is a real opportunity to consider the adoption of *outcome* indicators, such as those based on actual land use change and improvement, or actual species' trends. A combination of activity and outcome indicators would complement each other well, and it is likely that outcome indicators would be more relevant to MEA commitments and reporting (see **National biodiversity metrics**).

Biodiversity indicator considerations and the NbS Principles

The nine NbS principles focus on opportunities and barriers to achieving the 'triple win' for biodiversity, climate, and people when implementing NbS in an ODA context, however they are also relevant to biodiversity considerations, and specifically, indicator planning and development. Here we expand on the Principles to illustrate how they are applicable to biodiversity monitoring, and that consideration of these will ultimately result in better planned and implemented projects, and maximise the scale of benefits as part of programme activities.

A. Give parity to all three pillars of the triple win

To date the emphasis from ICF has been on addressing the challenges of climate change and poverty reduction. Recognising the inclusion of nature as part of the triple win requires KPIs that would capture the progress made towards positive biodiversity impacts. However, the broad and complex qualities of biodiversity cannot be fully captured in a KPI. Consideration needs to be given to project-level biodiversity objectives and likely impacts (both gains and losses), and to therefore build-in monitoring that will assess these specifically, rather than assume biodiversity benefits are a passive side-effect of NbS activities that are implemented to address climate and social challenges.

B. Engage local communities in a participatory approach

Involving the local community in the design and implementation of projects can lead to many positive impacts, particularly in ensuring longevity. This also holds true when it comes to designing and undertaking monitoring, and community based monitoring (CBM) is seen as an increasingly important tool[45]. Combining results from CBM with regional and global datasets can provide a particularly rich source of information for building project and programme indicators, and this information could be built into any of the indicators recommended.

C. Account for site-specific and complex, dynamic context

The complexity of the implications to biodiversity are compounded by the individual qualities of the site itself – the ecosystem, the species composition, the nature of any threats on those, and the interactions with the local communities, all of which cannot be fully captured in a KPI. Consideration needs to be given to project-level biodiversity objectives and likely impacts (both gains and losses), and therefore to build-in monitoring that will assess these specifically, to capture contextually relevant considerations.

D. Put in place social and environmental safeguards

It is important to identify potential risks of the interventions, and therefore be able to mitigate for them. Environmentally, this is likely to include unintended consequences, such as the unknown impact of planting non-native species, which can easily be mitigated for by using locally appropriate native species, or providing a deliberated justification as to why not. Once risks have been identified, consider: does the project plan safeguard against these risks? Would the biodiversity metrics included in this project capture any adverse effects as a result of these risks, and be likely to for any that have not been explicitly considered? A specific and difficult safeguarding example is that of displacement – particularly when restoration of habitat requires a reduction of intensity of use by local communities. Mitigation measures should consider how to reduce the demand of the services provided by that ecosystem (such as firewood, grazing, or fishing), else supply is likely to shift to another area thereby only moving the environmental problem rather than reducing it.

E. Design for longevity and futureproofing in-mind

Not only does the long timeframe of biodiversity impacts need to be considered in terms of what features should be monitored, but also likely changes over time of any of the biodiversity components (to the ecosystem, species or ecological functions). Programme managers should consider the adaptive capacity of biodiversity (to e.g. climate change) both in direct actions (e.g. consider climate tolerance of planted species) and non-direct (e.g. sea-level rise may alter the optimum area for mangroves, so in planning allow space for natural shift of mangrove extent). If these are not considered, indicators may show a decline over time in spite of project interventions. Building in long-term partnerships and involving multiple stakeholders increases the likelihood of successful outcomes over the longer-term, and in the face of unexpected changes.

F. Build robust, long-term monitoring systems

Long-term monitoring is vital to ensure intended biodiversity outcomes are achieved, and remain. This is often not practical within a project life-cycle, but putting longer term monitoring in place can still be an aim of a project, and is potentially more likely to be realised with integration of community based monitoring and long-term partnership organisation involvement. It is also more likely to be directly relevant to national reporting such as for MEAs.

G. Emphasise an adaptive management approach

Indicators developed to measure intended objectives should be robust to changes in the site context which in turn may require adaptation of the interventions, so consideration needs to be given to adaptability of indicators. Outcome indicators may therefore be more appropriate with an adaptive management approach as they are likely to be more robust to adjusted programme activities.

H. Provide sustainable, equitable financial incentives

There is increasing uptake of Payments for Ecosystem Services (PES). Commonly in these cases, managers are paid for the maintenance of the ecosystem service flows provided usually as a result of upkeeping good-quality ecosystems and minimising pressures to those systems. Monitoring will be required to ensure those outcomes are met (e.g. the habitat is in an adequate condition for functioning ecosystem service flows) in order to validate payments, and relevant components to monitor would include ecosystem, species and/or pressure metrics.

I. Consider trade-offs and synergies across multiple scales

Even within the biodiversity pillar of the triple win there are trade-offs that need to be considered, both spatially and temporally, and it should be an aim that chosen indicators should be able to capture the trade-off to inform future activities. For instance, displacement is likely to be a factor of any programme which seeks to reduce human impacts on an ecosystem if the programme does not also mitigate by reducing the human demand. Generally, biodiversity indicators do not capture this well as they work at a different scale than the displacement occurs. In this case, it may be appropriate to include programme-level indicators which report on the demand aspect of the land, to better understand if displacement is likely to be occurring. Temporally, the duration of a project life cycle is often mismatched with the impacts of biodiversity benefits which can have a time-lag of decades. This illustrates the value of establishing long-term monitoring as part of the programme, which if well-embedded can continue beyond the end of the programme.

National biodiversity metrics: Relevance of recommendations to MEAs

The proposed indicators are designed to facilitate reporting and communication of the direct biodiversity benefits of ODA spending. A potential indirect benefit of the funding and proposed indicators would be in helping ODA-eligible countries with their own national reporting when assessing progress on the Sustainable Development Goals (SDGs) and Multilateral Environmental Agreements (MEAs) – in particular the Convention on Biological Diversity (CBD). The indicators proposed here have been recommended in part **because of their potential alignment with these major MEAs, meaning that programme or portfolio-level biodiversity objectives of ODA funding should also support domestic biodiversity agendas**. However, although indicators of the impact of ODA funding could contribute to national-level assessments for MEAs, such indicators only the reflect the project areas and not other parts of the country, and so cannot be used in isolation. The usefulness of the proposed indicators will also critically depend on ensuring the data collected are accessible and clearly communicated to relevant countries. The intention would be that the data collection would directly assist in national-level reporting, and therefore to avoid double-counting any ODA-level reporting should not be considered as additive to contributions also recorded in national reports.

Relevance to the Convention on Biological Diversity

The CBD has three main objectives: **(i)** conserving biological diversity, (ii) sustainable use of the components of biological diversity, and **(iii)** fair and equitable sharing of the benefits from utilising genetic resources. From 2011-2020, these objectives were tackled through the Strategic Plan for Biodiversity (2011-2020) with its five Strategic Goals and its subsidiary set of 20 Targets (the ‘Aichi Targets’). At a national level, countries developed their own national biodiversity strategies and action plans (NBSAPs) with targets and indicators designed to be consistent with the global framework. The post-2020 CBD framework is still being negotiated and so future national level CBD indicators and targets are not agreed. In any case, the approach to national reporting will vary depending on country-specific priorities and practicalities. However, initial drafts of the high-level goals for the post-2020 framework include the following:

“increasing the area, connectivity, and integrity of natural ecosystems… supporting healthy and resilient populations of all species while reducing the number of species that are threatened…, and maintaining genetic diversity”[46].

This ambition encompasses biodiversity at several levels:

- Ecosystems (Extent, Connectivity, Integrity)
- Species (Extinction risk, Populations)
- Genes (Genetic diversity, Conservation of genetic resources)

All countries will therefore need to set targets and indicators in their NBSAPs that contribute to achieving the goals and targets of the post-2020 global biodiversity framework.

At the ecosystem level, the proposed indicator *‘Hectares under ecological restoration’* is relevant for understanding the area over which actions to increase the extent and integrity of natural habitats have taken place. The emphasis of the proposed indicator on ecological restoration is important to the CBD ambition, because ecological restoration expressly aims to recover the integrity of natural systems.

Target 1 in the current draft framework also directly relates to restoration, with an ambition to:

"...restore [X%] of degraded freshwater, marine, and terrestrial natural ecosystems, and connectivity among them"

The proposed indicator is therefore potentially relevant for national targets to restore habitats, and could help measure progress towards this type of target (particularly if the area restored is disaggregated into broad ecosystem types). Such restoration targets are often a feasible way for countries to track ongoing actions that may take many years to translate into ecosystem changes (e.g. see national reports). **Importantly, the indicator documents the implementation of restoration activities rather than the outcome.** Consequently, it is not an appropriate indicator to use for any targets that involve reporting changes in ecosystem integrity unless a sufficient level of restoration has been reached (e.g. as set out as an objective by the project) – this may be years beyond the project span. Prior to this, the indicator may be useful to the recipient country in understanding the expected scale and locations of areas for future reporting on improvements to ecosystem integrity.

At the species level, the proposed indicator *'Improvement in conservation status of threatened species'* is relevant for understanding how extinction risk may be changing. **Data from this indicator would help countries understand progress towards any national targets that focus on improving IUCN conservation status**. However, note that the proposed indicator is the modelled change in status based on the activities carried out by projects. This has the advantage of being more immediate than documenting e.g. population changes and subsequent shifts in Red List assessment, but is not empirically determining conservation status and so should be reported and interpreted accordingly. It is therefore less likely to be directly relevant for assisting national reporting.

In addition to the direct relevance of the proposed indicators, the process of data collection could contribute towards other potential CBD targets in two ways:

i) **Understanding the state of species (e.g. population trends) and ecosystems (e.g. integrity)**. The indicators do not directly report this information, but relevant data are collected. For example, the indicator *'Hectares under ecological restoration'* requires a monitoring plan that would involve collecting data on species and ecosystems: in some cases, this might contribute to national datasets used to report on status and trends. This underscores the importance of ensuring that data collected as part of reporting on ODA indicators are made available and accessible.

ii) **Increasing capacity, data, and knowledge on biodiversity**. There is potential to build local monitoring capacity (e.g. training) during the data collection used to produce the indicators. Similarly, the indicators will generate data and knowledge (e.g. on species abundances, effects of interventions, etc.). If this potential does translate into increased capacity, data, and knowledge, it could be used by countries as part of documenting progress against other aspects of the CBD on increasing understanding of biodiversity.

Relevance to Sustainable Development Goals

The Sustainable Development Goals (SDGs) are a set of 17 globally agreed goals to address global challenges and achieve *'a better and more sustainable future for all'*. Each of the 17 goals has a set of targets and indicators, with the indicators reported for each country annually. At the national level, Voluntary National Reviews allow countries to assess and review progress towards the SDGs by describing country-specific activities and indicators that are relevant to the global SDG targets. Information from either of the proposed indicators could contribute to these national level assessments of progress, particularly in relation to the following SDGs:

Goal 14: "Conserve and sustainably use the oceans, seas and marine resources for sustainable development"

Goal 15: "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"

Goal 14 and Goal 15 emphasise conservation, restoration, and halting biodiversity loss, and so both of the proposed indicators could contribute to Voluntary National Reviews of progress towards these goals. There are two general types of situation in which the proposed indicators could be helpful:

i) **By providing information that directly demonstrates progress towards the SDG target.** The proposed *'Hectares under ecological restoration'* indicator should contribute directly to understanding progress for any targets that specifically refer to restoration – particularly if data are made available by ecosystem type. The proposed *'Improvement in status of threatened species'* indicator should contribute directly to understanding progress for any targets that specifically refer to improving biodiversity. Also note that this indicator is based on the same data as the Red List Index (already a global-level indicator for SDG target 15.5) but focuses on evaluating the contribution of activities to threat status rather than tracking threat status.

ii) **By providing information that could be relevant to the target for certain types of project, but might require some disaggregation** e.g. because the target and the proposed ODA indicator do not completely overlap. For example, the *'Hectares under ecological estoration'* indicator potentially includes projects that reduce pollution or remove invasive species but also covers many other types of intervention. Similarly, some projects that contribute to the *'Status of threatened species indicator'* will involve restoring habitats or reducing threats that are part of SDG targets (e.g. habitat degradation or poaching) and so will involve collecting data that could be used as part of reporting against SDG targets, but the relevance of this will vary between projects.

Table 2 summarises the links between the proposed indicators and SDG targets. Note that the number of relevant SDG targets is not necessarily the best measure of the relative value of a proposed indicator for national reporting – this will also depend on how well-understood each target is already, which in turn may vary between countries.

Table 2. SDG targets[47] that the proposed indicators could provide information on. For some targets, proposed indicators are directly relevant for understanding progress towards at least one aspect of the target (Yes), and for others the proposed indicators could provide some information depending on the projects carried out and the ability to disaggregate data (Possible). Marine systems are currently not well represented in the data from which the threatened species indicator is calculated but potentially could be applied in future as Red List coverage improves

SDG	Target	Target Detail	Hectares of ecological restoration	Improvement in conservation status of threatened species
6	6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Yes	Possible
14	14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	Possible	Possible
14	14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Yes	Possible
14	14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	No	Possible
15	15.1	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	Yes	Possible
15	15.2	By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Yes	Possible
15	15.3	By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation neutral world	Yes	Possible
15	15.4	By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	Possible	Yes
15	15.5	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	Yes	Yes
15	15.7	Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	Possible	Possible
15	15.8	By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	Possible	Possible

Economics and Finance

The triple win NbS is characterised by the wide range of benefits it can generate for local communities via poverty reduction, climate change mitigation or adaptation, and biodiversity. The economic case for considering ecosystem services in project and policy appraisal has been raised in numerous studies over the previous two decades and generally investing in nature is discussed as a cost-effective intervention. These benefits are often qualitative in nature and difficult to quantify and compare across projects. This can make standard evaluation techniques such as cost-effectiveness or cost-benefit analyses challenging. Despite the economic case for nature, there is a significant funding gap for biodiversity and conservation projects. Given the importance of public funds for NbS, it is important to understand what barriers are stopping private finance from investment in NbS. This chapter looks at the current evidence base for the economic case for investment in nature and NbS and discuss key barriers to and solutions for increasing private investment in NbS projects.

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Executive Summary

NbS projects are characterised by the multiple benefits they can achieve across the triple win objectives, many of which are difficult to monetise credibly but are critical for the livelihoods of local communities. As recommended in the Principles and Implementation Guidance, parity must be given to each of the three strategic objectives within the triple win. Focusing the business and economic case on only those benefits which generate cash or can be monetised risks relegating the importance of poverty reduction and biodiversity benefits.

Benefit-cost ratios and cost-effectiveness estimates vary between geographies, ecosystems and intervention types. Most of the issues which NbS seek to address (with the exception of climate change mitigation) are locally specific, so interventions should be tailored to biogeography, socioeconomics, or political systems. Though the evidence base is also varied, there is stronger evidence for the effectiveness of ecosystem-based protection of coastlines through EbA or mangrove restoration, although there are still few on-the-ground ex-post analyses. Reforestation and avoided deforestation may also provide promising, cost-effective options for maximising climate change mitigation in specific parts of the world. This may require converting or restoring land (or avoiding the conversion of land) previously developed or cleared for high value use such as agriculture. In these instances, opportunity costs may be higher to compensate local landowners, driving up the cost of NbS. Across all NbS projects and global studies, the total benefits arising from NbS are likely understated since many of the co-benefits and capacity building activities are not routinely monetised and included in project appraisals.

For NbS projects which deliver monetisable benefits, benefit-cost ratios or cost-effectiveness metrics are useful tools to assess value for money. It is critical to continue undertaking these types of analyses to increase the evidence base and build the business and economic case for NbS investment by the public sector, especially given the wide range of co-benefits for biodiversity, climate and people. Additionally, such metrics help overcome an important information barrier to incentivising private sector finance by providing concise evidence about the financial returns available from NbS and revenue-generating activities.

However, such tools often do not reflect the many benefits arising from the triple win which are still very difficult to monetise credibly. Given the importance of local impacts, such metrics are still used in a way which obscures who receives which benefits, who incurs which costs, where and when the benefits are realised, and elevates the relative attractiveness of NbS projects which generate benefits which are more easily monetisable – often those which reduce future GHG emissions or protect economic assets.

Since the Green Book recommends that optimising value for money is a case of balancing costs, benefits, risks, and unmonetisable factors, more work needs to be undertaken to a) rigorously assess and document and the qualitative but strategically significant objectives across ecosystems and intervention-types, b) fund ex-post economic assessments which test key assumptions made at the project proposal stage, and c) continue attempts to monetise to other significant benefits, including biodiversity, capacity building and resilience, which are often treated as co-benefits rather than the principal objectives of NbS projects.

Introduction

Since the monetised value of ecosystem services across the globe was first highlighted in 1997[47], the economic case for restoration and considering ecosystem services in project and policy appraisal has been raised in numerous studies. Investing in the restoration or protection of nature has historically been viewed as being poor value for money since public benefits which are not typically or easily monetised in markets (e.g. ecosystem services) are not ordinarily included in conventional cost-benefit analyses and project appraisals[48]. By including a very broad range of benefits, these studies demonstrate that there is a strong economic case for investment in nature when incorporating both market and non-market benefits.

Despite the fact that the proposed economic case for nature is often referenced as strong, there is a significant funding gap for adaptation and NbS. In its Adaptation Gap Report 2020, the United Nations Environment Programme (UNEP) identified adaptation investment needs of more than $140 billion (USD) per year by 2030[49]. The Climate Policy Initiative (CPI) estimates that only $30 billion (USD) per year in mostly public funding was spent on adaptation in 2018[50], and another report estimates a current biodiversity conservation financing gap of between $598 billion (USD)and $824 billion (USD) per year[51].

The financing shortfall contrasts with the Paris agreement commitments: 62% of Nationally Determined Contributions (NDCs) include NbS as adaptation actions, and 63% declare protection of ecosystems and/or biodiversity as an intended outcome for adaptation projects and planning[6]. Given the importance of public funds for NbS and the current funding gap, it is important to understand what barriers are stopping additional finance from entering ODA countries for NbS projects.

This chapter presents the evidence base for the economic case for investment in nature and recommendations to address the challenges around comparing the wide range of qualitative benefits which NbS deliver. The evidence represents both large-scale modelling studies as well as economic analysis presented for individual NbS case studies for six intervention types cross referenced with the case study database. Key barriers to increased private investment in NbS, as well as solutions and financial models which may help bridge significant funding gaps, are also presented.

Analytical approach

The approach to analysing the cost-effectiveness and value for money of NbS considered both global-scale grey and published literature, as well as local-level NbS case studies and research projects. There have been numerous large-scale global analyses over the past two decades which have evaluated the economic case for nature[47,48]. These studies often include a broad range of public benefits, highlighting the monetary value of ecosystem services and the benefits from nature not ordinarily captured in market transactions[48]. These are used to promote and compare the potential of NbS in different biomes across the globe.

In comparison, local NbS projects and research provide evidence of the effectiveness of a given intervention in a specific location, ecosystem or geography on-the-ground. The review of NbS case studies and databases included selection criteria for evaluation of costs and benefits (see **Methods**). The data upon which case study analyses are generally based are either locally generated or observed or else modelled based on local conditions (e.g. local agricultural yields, market prices). These studies are examples of either local NbS projects which already been started, undertaken or completed, or they are published research into the effectiveness of a given intervention in a specific location, ecosystem or geography. This contrasts with the large-scale studies which synthesise data from studies across a variety of geographical regions, ecosystems and NbS interventions to estimate the value of ecosystem services arising from several land use scenarios.

Large-scale studies, whilst promoting the economic case for nature, are not always indicative of the realities of conducting NbS projects on-the-ground in ODA-specific contexts. Similar approaches are unable to fully capture socio-political, geographical and ecological variation which drive local-level project costs and variations between countries and biomes. It is assumed that benefits will flow if the appropriate costs are paid and don't capture the important institutional, governance and local barriers which likely influence the investment decision for such projects and how well they function in practice. Such studies should be viewed as useful in directing the strategic case for NbS as a tool for resolving societal problems on a global scale, rather than instrumental in guiding individual investment decisions. The research questions typically addressed are related to making the case for nature in an economic context and lay the foundation for local research and detailed analysis.

Similarly, local-scale analysis is useful in evidencing specific local examples of successful project implementation and delivery of benefits, as well as key trade-offs and uncertainties. Case study results, however, are difficult to extrapolate into different contexts, geographies and socio-economic scenarios. The combined suite of models and local projects therefore serves as an evidence base which highlights the potential returns from nature and where these have been, or are proposed to be, achieved in practice.

The Economic Case for NbS

The case studies which passed selection criteria were reviewed for benefit-cost ratio information (see **Methods**). Along with key literature reviewing the cost-effectiveness of various NbS approaches, an evidence base for the cost-effectiveness of NbS was developed. The tables below reflect this evidence base for the focal areas defined in the initial case study search. Table 1 presents marine and coastal evidence, and Table 2 presents terrestrial evidence. There were too few urban cases to present as a standalone table.

Six intervention types were selected for further discussion by selecting those interventions with at least 20 instances in the **Database of Case Studies** that were also found in the evidence base below. It does not necessarily follow that these six are the most effective or cost-effective NbS; simply that there is a stronger evidence base behind them for additional consideration and discussion. Several of the interventions listed below relate to reforestation, afforestation, and agroforestry. These often seem like cost-effective solutions with relatively short timescales for benefits. However, there may be an overemphasis on such interventions when there are other pristine ecosystems to protect and other systems which may provide equivalent or even higher carbon and greenhouse gas (GHG) sequestration rates – such as grasslands or peatlands. These do not, therefore, make up a set of recommendations, but rather useful examples to consider additional factors, trade-offs, or conditions which could impact the effectiveness of a given intervention.

Table 3 Details of local and global scale research assessing the economic efficiency of NbS in the coastal environment.

Project description	Country of project	Type of intervention	Study type	Discount rate (%)	Benefit cost ratios	Benefits valued
Local scale studies						
Blue Forests Initiative	Madagascar & Indonesia	Mangrove restoration	NbS project	10 (3.5 for carbon)	6	• GHG emissions avoided • Increased incomes • Ecotourism • Recreation • Biodiversity • Coastal protection
Building the Resilience of Wetlands in the Province of Datem del Marañón, Peru	Peru	Wetland management	NbS project	7	1.2	• GHG emissions avoided. • Increased incomes
Ecosystem-based Adaptation in the Indian Ocean	Comoros, Madagascar, Mauritius, Seychelles	Ecosystem based adaptation	NbS project	5	8 - 11	• Increased incomes • Water provision
An economic analysis of ecosystem-based adaptation and engineering options for climate change adaptation in Lami Town, Republic of the Fiji Islands (Rao et al, 2013)	Fiji	Mangrove restoration	Grey literature	3	9 - 19	• Avoided household losses • Avoided business losses • Avoided health costs • Avoided environmental costs • Ecosystem services
Comparing the cost effectiveness of natural and built coastal adaption in the USA (Reguero et al, 2018)	USA	Ecosystem based adaptation	Published literature	2 & 10	<=10	• Avoided losses from coastal protection

Cost and Benefits of Ecosystem Based Adaptation: The Case of the Philippines (Baig et al. 2016)	Philippines	Mangrove restoration	Grey literature	5, 8, 15	4 - 70	• Avoided economic losses
Ecosystem based adaptation for climate change in Melekeok, Republic of Palau (Franco et al, 2017)	Meleokek	Ecosystem based adaptation	Grey literature	5	<= 2.4	• Freshwater availability
Ecosystem based adaptation for climate change in Pakin, Federated States of Micronesia (Franco et al, 2017)	Pakin	Ecosystem based adaptation	Grey literature	5	<= 2.5	• Freshwater availability • Increased income
Ecosystem based adaptation for climate change in Malem, Federated States of Micronesia (Franco et al, 2017)	Malem	Ecosystem based adaptation	Grey literature	5	1.2 - 1.4	• Coastal protection
Ecosystem based adaptation for climate change in Tamil, Federated States of Micronesia (Franco et al, 2017)	Tamil	Ecosystem based adaptation	Grey literature	5	1.3 - 6.5	• Avoided water costs • Avoided medicinal costs • Alternative livelihoods • Improved freshwater
Ecosystem based adaptation for climate change in Oneisomw, Federated States of Micronesia (Franco et al, 2017)	Oneisomw	Ecosystem based adaptation	Grey literature	5	2.5 - 5.3	• Improved freshwater availability • Avoided health costs
Ecosystem based adaptation for climate change in Ahus, Papua New Guinea (Franco et al, 2017)	Ahus	Ecosystem based adaptation	Grey literature	5	1.9 - 3.8	• Fisheries • Coastal protection • Alternative livelihoods

Cost-benefit analysis of mixing gray and green infrastructures to adapt to sea level rise in the Vietnamese Mekong river delta (Thi Oanh et al, 2020)	Viet Nam	Ecosystem based adaptation	Published literature	3	<= 250	• Avoided costs (coastal damage)
Cost–benefit analysis of mangrove ecosystems in flood risk reduction: a case study of the Tana Delta, Kenya (Karanja and Saito, 2017)	Kenya	Mangrove restoration	Published literature	5	<= 2	• Avoided damage and revealed preference approaches • Housing • Crop cultivation • Fishing and businesses
Cost–benefit analysis of mangrove restoration in Thi Nai Lagoon, Quy Nhon City, Vietnam (Huu Tuan and Duc Tinh, 2013)	Viet Nam	Mangrove restoration	Grey literature	10	2 - 4	• Increase in income (aquaculture, fishing) • Ecosystem services • Carbon sequestration • Shoreline stabilisation
Cost-benefit analysis of mangrove restoration for coastal protection and an earthen dike alternative in Mozambique (Narayan et al, 2017)	Mozambique	Mangrove restoration	Grey literature	Various	23 - 157	• Carbon sequestration • Increased income from project activities • Coastal protection
Mangrove plantation in Viet Nam: measuring impact and cost benefit (IFRC, 2010)	Viet Nam	Mangrove restoration	Grey literature	Various	3 - 68; 28 - 104 (including carbon pricing)	• Carbon sequestration • Increased income from project activities • Coastal protection

Global scale studies						
Benefits of Investing in Ecosystem Restoration (De Groot et al. 2013)	Global	Coastal systems Coastal wetlands Inland wetlands	Published literature	2 - 8	0.1 - 11	Numerous ecosystem services
Restoration of natural capital: A key strategy on the path to sustainability (Blignaut et al. 2014)	Global	Coastal systems Coastal wetlands Inland wetlands	Published literature	2 - 5	0.4 - 166	Numerous ecosystem services
Financing coastal resilience by combining nature-based risk reduction with insurance (Reguero et al. 2020)	Global	Coral reef protection	Published literature	0 - 5	6	Coastal protection
Enhancing the climate risk and adaptation fact base for the Caribbean (Caribbean Catastrophe Risk Insurance Facility, 2010)	Caribbean	Various NbS interventions	Grey literature	N/A	2 - 5	Coastal protection

Table 4 Details of local and global scale research assessing the economic efficiency of NbS in the terrestrial environment

Project description	Country of project	Type of intervention	Study type	Discount rate (%)	Benefit cost ratios	Benefits valued
Local scale studies						
Low Carbon Agriculture for avoided deforestation and poverty reduction - Phase 2	Brazil	Agrosilvopastoral system	NbS project	10 (3.5 for carbon)	30	• GHG emissions avoided • Increase income from project activities • Numerous ecosystem services
Silvopastoral Systems (SPS)	Columbia	Silvopastoral system	NbS project	10 (3.5 for carbon)		• GHG emissions avoided • Increase income from project activities
Resilient Landscapes and Livelihoods Project	Ethiopia	Reforestation	NbS project	5	3-4	• Increase income from project activities • GHG emissions avoided • Soil erosion avoided
TWENDE: Towards Ending Drought Emergencies: Ecosystem Based Adaptation in Kenya's Arid and Semi-Arid Rangelands	Kenya	Climate-resilient agriculture	NbS project	12	<=1.5	N/A
Promoting climate-resilient forest restoration and silviculture for the sustainability of water-related ecosystem services	Honduras	Agroforestry	NbS project	12	3-5	• GHG emissions avoided • Increase income from project activities • Water production

Transforming the Indus Basin with Climate Resilient Agriculture and Water Management	Pakistan	Climate-resilient agriculture	NbS project	10	<=2	• Increase income from project activities • Improved water security • GHG emissions avoided
Programme for integrated development and adaptation to climate change in the Niger Basin (PIDACC/NB)	Numerous around the Niger Basin	Agroforestry	NbS project	10	<=1.6	• Avoided costs from impacts of climate change
Strengthening Climate Resilience of Rural Communities in Northern Rwanda	Rwanda	Climate-resilient agriculture	NbS project	10	1.3 - 3	• GHG emissions avoided • Saved costs from reduced pollution and poor water quality • Reduced soil erosion and siltation • Reduced losses from disaster
Building climate resilience of vulnerable and food insecure communities through capacity strengthening and livelihood diversification in mountainous regions of Tajikistan	Tajikistan	Afforestation	NbS project	6	3-5	• Increase income from project activities
Poverty, Reforestation, Energy and Climate Change Project (PROEZA)	Paraguay	Reforestation	NbS project	5-20	<=2.4	• GHG emissions avoided • Watershed values • Existence value

Development of arganiculture orchards in degraded environment (DARED)	Morocco	Afforestation	NbS project	6	1.7	N/A
Large-scale Ecosystem-based Adaptation in The Gambia: developing a climate-resilient, natural resource-based economy	The Gambia	Climate-resilient agriculture	NbS project	N/A	4	• Increase income from project activities
Increasing the resilience of ecosystems and communities through the restoration of the productive bases of salinized lands	Senegal	Climate-resilient agriculture	NbS project	0	3	• Increase income from project activities
Increased climate resilience of rural households and communities through the rehabilitation of production landscapes in selected localities of the Republic of Cuba (IRES)	Cuba	Climate-resilient agriculture	NbS project	12	<=5	• Increase income from project activities

Strengthening Climate Resilience of Subsistence Farmers and Agricultural Plantation Communities residing in the vulnerable river basins, watershed areas and downstream of the Knuckles Mountain Range Catchment of Sri Lanka	Sri Lanka	Climate-resilient agriculture	NbS project	6	2	• Erosion and sediment prevention • Water management • Value chain upgrade • Forestry conversion and tourism • Community strengthening
Watershed Development in India (WRI, 2013)	India	Watershed management	Grey literature	N/A	2.3 - 3.7	• Avoided travel costs for drinking water • Improved agricultural yields • Carbon sequestration
Economic analysis of forest landscape restoration in Kenya (Cheboiwo et al, 2018)	Kenya	Forest landscape restoration (various interventions)	Grey literature	7	3 - 30	• Carbon sequestration • Prevention of soil erosion • Water flow regulation • Income from project activities • Aesthetic value • Shade provision • Storm protection
Who uses sustainable land management practices and what are the costs and benefits? Insights from Kenya (Dallimer et al, 2018)	Kenya	Sustainable land management	Published literature	3.5 - 10	<=3	• Increase income from project activities

Planting broom grass in degraded grasslands; planting timur (bamboo-leaved prickly ash) on private land; gabion wall construction and revegetation to protect against erosion and downstream siltation (UN, 2015)	Nepal	Ecosystem based adaptation	Grey literature	10	1.3 - 1.6	• Increase income from project activities
EbA livestock and rangeland management practices at three sites (UN, 2015)	Peru	Sustainable grassland management	Grey literature	4	<=2.7	• Increase income from project activities
Wetland and rangeland restoration (proactive scenarios) using various treatments, including direct seeding, mulching with plant material, micro-catchments and brush packing with Galenia Africana (UN, 2015)	Peru	Wetland restoration	Published literature	1.2 - 8	<=2.4	• Increase income from project activities
Assessing ecological infrastructure investments (Adamowicz et al, 2019)	Panama	Agroforestry	Published literature	2.34	4.9	• Toll revenues from water quantity and reduced sedimentation

Global scale studies						
Benefits of Investing in Ecosystem Restoration (De Groot et al, 2013)	Global	Tropical forest Temperate forest Woodlands Grasslands	Published literature	2 - 8	1 – 35	Numerous ecosystem services
Restoration of natural capital: A key strategy on the path to sustainability (Blignaut et al, 2014)	Global	Tropical forest Temperate forest Woodlands Grasslands	Published literature	2 - 5	6.2 – 71	Numerous ecosystem services
Time, space, place, and the Bonn Challenge global forest restoration target (Verdonne and Seidl, 2017)	Global (Bonn Challenge signatories)	Forest restoration	Grey literature	1.3 - 4.3	2 – 30	• Timber products • Non-Timber Forest Products • Carbon sequestration • Recreation • Passive use
Protecting 30% of the planet for nature: costs, benefits, and economic implications (Waldron et al, 2020)	Global	Protected areas	Published literature	0	<= 6	• Financial revenues from protected areas • Avoided costs from disaster recovery • Other ecosystem services
Cost-effectiveness of dryland forest restoration evaluated by spatial analysis of ecosystem services (Birch et al, 2010)	Latin America	Forest restoration	Published literature	5	0.5 - 100	• Carbon sequestration • Non-Timber Forest Products • Timber • Tourism • Livestock production

[Consultation and Net Zero (WEF and McKinsey, 2021)]()	Global	Various NbS interventions	Grey literature	10	Range from \$2 - 80/tCO_2e(USD). Significant estimates are: Avoided deforestation in DRC and Bolivia (\$10/ tCO_2e[USD])	Cost estimates based on 1) land costs, 2) initial project costs, 3) recurring project costs, and 4) carbon credit monetisation costs.

					Peatland restoration and protection in Indonesia ($10-25/ tCO_2e[USD]) Reforestation in Madagascar ($10 - 15/ tCO_2e[USD]) Avoided deforestation and reforestation in Brazil ($20 – 30/$tCO_2e$[USD]) Avoided deforestation in Indonesia ($40 – 55/ tCO_2e[USD])	

Review of selected intervention types

Ecosystem-based Adaptation

Description of intervention

Ecosystem-based adaptation (EbA) is a broad intervention that can be applied in multiple contexts (e.g., urban, agricultural) and ecosystems (e.g., forests, coastal, mountains). It involves the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change[52]. It may involve conservation, sustainable management, and/or restoration – and is especially applied to support communities dependent on natural resources and ecosystem services and vulnerable to climate change impacts[53].

Monetised benefits

- Revenue from sustainably harvested products (e.g., medicines, fuel, food)
- Revenue from recreation or tourism opportunities
- Carbon sequestration, storage or carbon markets
- Disaster risk reduction and prevention of natural disaster

Benefit-cost ratios and cost effectiveness evidence

The range of benefit-cost ratios reported is between 1.2 and 11, although some estimates can be much higher when valued in context of economic assets protected over longer timescales[54]. Benefits valued and valuation techniques, along with the relevant cost-effectiveness estimates, vary depending on the objectives of adaptation, but often relate to improved incomes for local communities or avoided costs from coastal protection. In particular, high benefit-cost ratios can arise where a) valuation is based on costs of damages to, or replacement costs of, coastal economic assets, and b) annual damages avoided from ecosystem-based adaptation are proportionally higher than annual maintenance costs, so longer periods of assessment typically lead to higher benefit-cost ratios.

Non-monetised benefits

- Maintenance of local knowledge
- Conservation or protection of biodiversity and increased resilience
- Recreation potential
- Sustainable water management
- Food security

Further discussion

The use of the term EbA slightly predates the use of NbS, officially defined in 2009 which is the earliest use of the term in the database (see Evidence Base). It encapsulates ecological principles with a main focus on sustainable development and social benefits[55,56]. Much of the success of EbA comes from community-based knowledge and participation and empowerment of the local communities the intervention is intended to support. Consideration of winners and losers, disaggregating data by gender, and evaluating the vulnerability of marginalised groups (e.g., women, the elderly, disabled, Indigenous peoples) are important factors when implementing EbA[57,58] but are often either overlooked in the economic assessment of EbA or noted anecdotally.

EbA is often promoted, instead of hard or grey infrastructure and interventions, as a potentially more cost-effective alternative solution to achieve climate adaptation[57,59]. This cost-effectiveness stems from the multiple uses, a greater flexibility than hard engineering solutions, and the delivery of co-benefits for biodiversity and people. EbA can often deliver higher benefit-cost ratios when a more comprehensive set of ecosystem services and other monetised benefits are included in the economic assessment. Cost-effectiveness is often understated when monetising such benefits is not possible[59].

The inflexibility of hardened structures may not allow for adaptive management under changing conditions and future climate change scenarios[57,59], whereas EbA often allows for the functioning of dynamic ecological or biogeochemical processes such as sediment flows or forest regeneration[59] which are more resilient to change and capable of delivering benefits under uncertain conditions over longer timescales. There may be additional drawbacks for biodiversity and ecosystem services from hardened structures. Considering the coastal zone, 'sprawl' of hardened substrates can create stepping stones for invasive species[60] or even increase damaging energy of storms and waves and increase shoreline erosion[61]. Hardened infrastructure can reduce structural heterogeneity, reducing biodiversity and other ecosystem services[62,63]. As with other NbS interventions, more analysis of the limitations and thresholds of efficiency for EbA – as well as unintended negative impacts – is necessary, especially under changing climatic conditions[58,59].

Reforestation

Description of intervention

Reforestation is a common NbS intervention based on the re-establishment of forest through planting and/or deliberate seeding on land classified as forest[64]. Reforestation is an effective strategy for carbon sequestration and is often noted as an attractive, low-cost option for climate mitigation activities[65,66]. Reforestation can also support local communities through provisioning of non-timber forest products (NTFPs), selective harvesting, and can also be deployed for soil or riverbank stabilisation, water filtration and to support biodiversity[67].

Monetised benefits

- Carbon sequestration, storage or carbon markets
- Revenue from sustainably harvested products (e.g., medicines, fuel, food)
- Revenue from recreation or tourism opportunities

Benefit-cost ratios and cost effectiveness evidence

The range of benefit-cost ratios reported is from 3 (in Latin America) to 20 (in Kenya). From a global perspective, reforestation has the reported greatest total cost-effective (<$100 [USD] social cost of carbon[68]) potential for climate change mitigation of all NbS interventions[65]. Together with avoiding deforestation, they offer approximately half of the total carbon mitigation opportunities arising from natural solutions costing less than $10 (USD) per tonne of CO_2e. However, a greater proportion of projects involving avoided conversion of coastal, peat and forested land is more cost-effective than reforestation[65,69] since opportunity costs can be high where reforestation is taking place due to the high value of alternative land uses. This may make reforestation less cost-effective than avoided deforestation since establishment costs may be higher, although this is context specific and depends on local land use (i.e. deforestation rates per country or region), efficiency and transaction costs[65,66,69]. Reforestation offers the second most cost-effective NbS option in the tropics[70], with the greatest reforestation potential arising in Brazil, India, Mexico, Myanmar, Colombia, and Indonesia. Cost estimates are reported to vary between \$8/tCO_2e (USD) in Indonesia and \$25/tCO_2e (USD) in Brazil[69].

Non-monetised benefits

- Provision of habitat
- Local climate control or cooling effects
- Air quality
- Reduced soil erosion
- Cultural and traditional values and well-being
- Food and water security

Further discussion

Reforestation may be undertaken in a variety of ways but can come with many pitfalls. Monoculture plantations can cause adverse effects, reducing biodiversity and increasing water insecurity if the species chosen is maladapted to the local ecosystem[71,7]. Reforestation does not include afforestation – establishing forest through planting or seeding on land that was not previously classified as forest – but it can encompass both new deliberate/ artificial planting as well as natural regeneration. Natural regeneration is seen as passive management, whereby a previously forested area is allowed to naturally re-seed or develop. Natural regeneration often encourages greater diversity at multiple levels, resilience to climate change, and structural heterogeneity[70]. Natural regeneration is also more likely to be cost-effective since the only costs associated are opportunity costs and maintenance costs are lower[69,72].

Utilising reforestation as a cost-effective tool for carbon sequestration is widespread, as evidenced in literature and the evidence base of case studies. This evidence base does not suggest that reforestation is the most cost-effective or most effective intervention; simply that it is often selected. It can offer short-term benefits for carbon sequestration at low costs[62,67], but can also result in biodiversity loss, greater water insecurity, and potential reductions in income from switching from agriculture to forest-based activities[72,73,74]. A focus on reforestation can also obscure the benefits from initially protecting intact ecosystems and forests, and can divert resources away from other ecosystems potentially more efficient at carbon sequestration[71,7]. Peatlands are often raised as one such example. Only two case studies in the database focused on peatland while sixty-two focused on tropical forests, temperate forests, or montane ecosystems including forests. Avoiding the destruction of or restoring peatlands has comparable carbon sequestration potential to reforestation[65]. However, re-wetted peatlands may also be a net contributor of methane, a powerful greenhouse gas (GHG), an effect also influenced by climate change and seasonal variation[75]. While forests cover more of the globe, in terms of the efficiency of carbon sequestration and potential for biodiversity benefits, there are other ecosystems and interventions that warrant as much study and application as has been awarded reforestation efforts.

Agroforestry

Description of intervention

Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and animals, in some form of spatial arrangement or temporal sequence[76]. Agroforestry is an alternative to conventional agriculture, and can increase productivity, carbon sequestration, provide income and livelihood benefits, and decrease the need for pesticides and fertilisers.

Monetised benefits

- Carbon sequestration and GHG emissions avoided
- Increased crop yields
- Increased incomes

Benefit-cost ratios and cost effectiveness evidence

The range of benefit-cost ratios reported is between 2 (around the Niger Basin) and 30 (Brazil) where the upper range is driven by the social cost of carbon. Trees in croplands or cover crops can also provide low cost ($10[USD] – $20t/$CO_2$e[USD]) climate mitigation potential, albeit the total cost-effective potential is much less than avoiding deforestation, reforestation, peatland or mangrove impacts and is concentrated in fewer countries such as India and Mexico[69]. Agroforestry can provide simultaneous benefits for climate change adaptation for local communities by providing resilient livelihoods, climate change mitigation through carbon sequestration, and biodiversity. Notably, whilst globally communities may benefit from GHG emission reductions, in the absence of markets these do not translate into immediate local financial returns. Therefore, analyses likely understate local opportunity costs and willingness to adopt such practices[76].

Non-monetised benefits

- Food security
- Water security
- Reduced vulnerability to pests, diseases, droughts, and other climate-related risks
- Climate change adaptation
- Reduced pollution
- Spiritual and cultural benefits
- Maintenance of local knowledge
- Shade provision
- Soil erosion prevention, soil nutrient cycling and soil biodiversity protection
- Increased habitat for wildlife

Further discussion

Agroforestry deals directly with provisioning services in the form of crops for market (e.g., shade-grown cocoa or coffee) or for subsistence (e.g., home gardens). The use of agroforestry techniques can be applied to other forms of agriculture, supporting productivity and yields through nitrogen fixation, supporting nutrient cycling and soil health, or acting as physical protection in the form of wind breaks or soil stabilisation[77].

These techniques require significant investment in terms of labour, knowledge, technology and time in order to see benefits accrue as trees reach maturity. Timescales and the discount rate are therefore critical components of the cost-effectiveness analysis – both private and social payback periods may be longer. With heavier investment and potentially longer payback periods, farmers may be unwilling in certain circumstances to implement agroforestry[78].

As agroforestry has the capacity to produce a monetisable and marketable good however, payment for ecosystem services (PES) can be utilised to connect farmers to markets and steady incomes[79].

Studies of agroforestry focus on the balance between provisioning and regulating services; though benefits from agroforestry may accrue over the long-term, food and health benefits from short-term crops likely take priority for local communities[80]. In systems that provide shade-grown crops, maximising carbon sequestration may jeopardise crop yields, as greater density of trees increases carbon uptake but creates too much shade for crop species.

In contrast to agroforestry, some systems rely on setting aside some land for conservation purposes and investing in high intensity agriculture in the remainder of the plantation. This land sparing can reduce species richness and carbon storage compared with agroforestry, but results in higher agricultural yields and local incomes[81]. There is also a risk with agroforestry of planting monocultures, exotic species, or species maladapted to local ecosystems which can reduce both species diversity, carbon storage capacity[82,83] and therefore its cost effectiveness. The agroforestry techniques selected (e.g., species to use, density of planting, 'land sparing') and their effectiveness will depend on local ecosystems, the scale of the plantations, and the goals of project managers and local communities. Local knowledge of species and ecological functioning and best practices is critical to success[84,85].

Climate-smart/resilient agriculture

Description of intervention

An integrated approach to increase food production sustainably and optimise productivity with efforts to strengthen the resilience to climate change and variability and reduce agriculture's contribution to climate change[86]. Techniques can include pest-resistant and drought-tolerant seed varieties, crop diversification, planting ground cover for soil management, drainage systems for flood-prone areas, agroforestry, and traditional irrigation methods. Managing cropland, livestock, forests and fisheries through climate-smart agriculture can address the interlinked challenges of food security and accelerating climate change, whilst protecting or enhancing biodiversity.

Monetised benefits

- Carbon sequestration and GHG emissions avoided
- Increased crop yields
- Increased incomes
- Water security and efficiency

Benefit-cost ratios and cost effectiveness evidence

The range of benefit cost ratios found in the case study review vary between 1.5 and 5 for climate smart agriculture, although these ratios are very site specific because they are based on local agro-ecological conditions and land use[76]. Such interventions are often implemented alongside capacity building activities which, whilst non-technical in nature and difficult to monetise, can be extremely cost effective (benefit-cost ratios of 13 – 28 in India and Asia)[87].

The principle benefit addressed by climate-resilient agriculture projects is improving local livelihoods and resilience (i.e. improved food security) to current and future impacts of climate change. In some cases, there may be low regret interventions[77] such as improved agronomic and nutrient management which can generate net benefits per unit of carbon saved without the need for a carbon price, for example in India[69] or Malawi[88]. In general, benefits may be delivered over a longer period of time and, for more resource intensive interventions, there is likely to be relatively high up-front costs and problems with access to resources and inputs before the net benefits are realised[88]. High opportunity costs and foregone income may therefore act as a barrier to adoption despite the likely wider benefits to society[76].

Non-monetised benefits

- Climate change adaptation and resilience
- Food security and nutrition
- Reduced vulnerability to pests, diseases, droughts, and other climate-related risks
- Reduced pollution
- Spiritual and cultural benefits
- Maintenance of local knowledge
- Shade provision
- Soil erosion prevention, soil nutrient cycling and soil biodiversity protection
- Increased habitat for wildlife

Further discussion

Climate-smart agriculture (CSA) aims to address the intertwined challenges of food insecurity and climate change[89]. CSA has three predominant goals: (i) sustainable agricultural intensification to support an equitable increase in incomes, food security and development; (ii) adapting and improving the resilience of food systems to climate change, and (iii) where possible, reducing agricultural GHG emissions[90,91]. There are often trade-offs between CSA objectives due to the complexity of agricultural food systems and the interdependencies which arise between agroecology and socio-political importance of agriculture in local communities. Advancement in towards one objective may negatively impact another[92], for example CSA efforts often focus on climate change mitigation hotspots, which risks inappropriate intervention types which pay less attention to the socio-economic background or vulnerabilities of farmers in the target area[93].

As with many NbS, relatively high upfront costs for land, labour, plant material or specialised equipment can create barriers to CSA adoption, particularly in subsistence economies[94]. Farmers living in poverty are often unable to increase their farm size or access the financial markets required to facilitate the adoption of new practices or technologies required for CSA, and thus are unlikely to reap improvements in income and food security[93]. Moreover, gender inequalities especially in terms of land inheritance, insurance, and collateral may limit how women access and benefit from CSA[93]. Benefit-cost ratios and cost-effectiveness studies often do not address such factors, but disaggregation of these factors is of critical importance for NbS in this area.

The applicability of CSA also often varies extensively between different countries, regions, and sites. For example, particular agricultural techniques may be more appropriate and effective in drylands in comparison with areas with greater annual rainfall, due to an increased risk of wind-blown soil loss or water erosion[95]. Agro-ecological conditions, pre-project land uses and the cost structure of the proposed activities will also influence the cost of CSA in different regions of the world[93], and thus it is important to tailor activities to both the ecological and socio-economic context of the target site.

Mangrove restoration

Description of intervention

Mangrove forests are under threat from unregulated harvesting (for firewood) and deforestation (to enable coastal development and aquaculture)[94]. Applying the intervention of mangrove restoration involves the regeneration of mangrove forest ecosystems in areas where they have previously existed but have since been degraded and/or removed entirely[95].

Monetised benefits

- Increased sustainability and provision of timber and forest products
- Supports local tourism
- Supports local fisheries through providing habitats for a variety of commercially important fish species
- Carbon sequestration, storage or carbon markets
- Provides coastal protection and shoreline stabilisation by decreasing the exposure to storms and flooding.

Benefit-cost ratios and cost effectiveness evidence

Generally, the evidence for cost-effectiveness of mangrove restoration is strong, with benefit-cost ratios reaching as high as 160. As with EbA, typically higher benefit-cost ratios are associated with either GHG emissions avoided and the associated social cost of carbon, or avoided losses from coastal assets. Often economic analyses include increased incomes from activities within the ecosystem, for example aquaculture or tourism. Mangroves provide a wide range of local co-benefits for biodiversity, soil health and water quality[69] which are not typically monetised[98].

Several other studies have also sought to quantify the wider impacts of mangrove forests and coral reefs across the globe. The global benefits of mangroves may be as high as $65 billion (USD) per annum, with 15 million people affected if mangroves were lost to alternative land uses since large numbers of the population live on the coast[99]. The exact benefits derived from mangroves varies across the world due to differences in flooding characteristics, ecosystem extent and the degree of exposure of coastlines to natural hazards[100]. Countries which have the highest value of economic assets protected by mangroves (USA, China, Mexico) are very disparate from those countries where the greatest number of the populace are protected (Viet Nam, Bangladesh, India), where the greatest proportion of GDP is protected (Belize, Suriname, Mozambique), or where the population is most vulnerable (Guinea, Mozambique, Sierra Leone and Madagascar)[100].

Non-monetised benefits

- Supports climate regulation
- Increased food and water security
- Spiritual and cultural benefits
- Supports water quality maintenance

Further discussion

Like many NbS interventions and projects which operate across the timespan of multiple decades, coastal NbS projects are sensitive to uncertainties and the assumptions driving economic and ecological analysis (i.e., the growth rate and survival of seedlings)[101]. These assumptions impact both the extent and quality of protection which mangroves provide coastal populations and assets in the short- and long-term. Net benefits may only arise after several years in the case of restoration, although this is common amongst NbS interventions. These factors impact the accuracy of cost estimates, since low growth rates and survival may require a repetition of restoration activities, and on the delivery of other ecosystem services associated with the restored habitat. In the early years of protection projects, grey infrastructure may be more effective in protecting local populations and a combination of green and grey infrastructure is often proposed as especially cost-effective[102].

Where monetisation is based on damage to economic assets on the coastline, a large number of assumptions are required to value the expected damage or replacement costs required, including the probability of different types of extreme weather events and the damage that this is expected to cause with and without ecological infrastructure. Since the timing of benefits and costs are variable based on the success of the intervention, it follows that the discount rate and carbon prices are of particularly importance. Of the NbS projects noted, the upfront costs of restoration are estimated to be much higher than ongoing maintenance and can be variable. As the benefits begin to increase, both absolutely and relative to the ongoing maintenance costs, the weighting placed on these future benefits by the discount rate impacts on the benefit cost ratios and therefore economic efficiency of the project in comparison with other interventions. Similarly, the inclusion of the carbon benefits is noted to increase the benefit-cost ratios of mangrove restoration by up to six times (assuming a price of \$25/tCO_2e[USD])[103,104].

Wetland restoration

Description of intervention

Wetland ecosystems face numerous threats which have resulted in the ecosystem becoming severely degraded or lost entirely. The primary threats which wetland ecosystems face are climate change (shifting rainfall patterns, extreme weather events, droughts and floods), pollution, unsustainable development (i.e. habitat conversion and loss from the development of homes, industry or agriculture) and invasive species[105,106]. Restoring wetland ecosystems predominantly involves the manipulation of a formerly degraded wetland's physical, chemical, hydrological or biological characteristics to return to its natural functions through the regeneration of the wetland itself[107].

Monetised benefits

- Increased sustainability and provision of timber and forest products
- Supports local fisheries through providing habitats for commercially important fish species
- Carbon sequestration, storage or carbon markets
- Provides coastal protection and shoreline stabilisation by decreasing the exposure to storms and flooding
- Supports water quality maintenance
- Improved water storage for domestic livestock and agricultural use

Benefit-cost ratios and cost effectiveness evidence

There was little evidence found in the case study review of the cost-effectiveness of wetland restoration, with only a handful of case studies reporting benefit-cost ratios between 1.2 and 2.4. In the global analysis, inland wetlands are considered to have large ranges between 1 and 11[92], but wider literature analysing the total economic value of wetlands reports a median economic value range (USD per hectare per year) of between $145 and $374, with the majority of value residing in amenity and recreation, flood control services, recreational fishing and water filtering[108]. The largest areas of wetlands are in North and Latin America, but the greatest value wetlands are in Asia (53% of total economic value), likely due to the intensity of the use and dense populations relying on their services[108]. Finally, wetlands, whilst less expansive than forests, hold the highest carbon stocks (per unit area) and significant potential for hydrological ecosystem services[70]. From a country perspective, Indonesia holds 76% of the total worldwide cost-effective potential for carbon mitigation from wetlands[65].

Non-monetised benefits

- Increased food and water security
- Supports climate regulation

Further discussion

Restoration of wetland ecosystems can include non-tidal wetlands – predominately freshwater (e.g., riverine, vernal pools) though also brackish – and tidal wetlands – predominately coastal (e.g., saltmarsh) which may be freshwater, brackish, or saline. In this consideration, mangroves/mangrove restoration and peatlands/peat restoration were treated as separate ecosystems and intervention types (see Methods).

Evaluations of the cost-effectiveness of wetland restoration compared to grey or hardened infrastructure can be found throughout the literature[109]. They are often an ecosystem of interest as wetlands are inherently tied to human development; generally human settlements cluster around water sources for the direct services they provide in the form of water and water quality, subsistence in the form of fisheries and other food products[107]. Benefits from wetlands are therefore inherently or easily monetisable. Increasing human settlement and density especially in urban areas, however, directly threatens the benefits wetlands provide. Human settlements and assets alongside bodies of water are often at risk from increasing floods, mudslides, erosion, encroaching salinity, or sea level rise[109].

Wetland restoration must be planned carefully to avoid unintended negative impacts to social, cultural, or climate goals. Wetlands may provide vectors for disease from stagnant waters or zoonotic vectors (i.e., mosquitos carrying malaria) – though increases in transmission of disease has been tied to a loss of biodiversity and degraded wetlands[110]. Cultural and social values may lead to the perception of wetlands as dangerous ecosystems with pressure to turn land over to production or development, thereby generating high opportunity costs[111,112]. Wetlands can be an incredibly efficient sink for greenhouse gases (GHG) in the long-term in the form of carbon dioxide stored in soil and plant matter but in the short-term, some wetlands may be net GHG emitters through methane and nitrous oxide release[113,114]. These emissions can be mitigated through maintenance of soil conditions and different restoration practices[115,116]. If managed in keeping with ecological and biogeochemical processes healthy wetlands can provide a range of important services and functions.

Common themes and findings

Large range of cost-effectiveness results

From both the global and local studies, there is a large range in benefit-cost ratios, ranging from 1 up to 250, and cost-effectiveness estimates between negative cost per intervention and upwards of $80 per tonne of CO_2e(USD)[65]. This variation appears to derive from both differences between different interventions (i.e. the benefit-cost ratios for mangrove restoration are typically higher than agroforestry or climate-resilient agriculture) as well as within ecosystem (i.e. cost per CO_2e for avoided deforestation varies between $10[USD] in Democratic Republic of the Congo and $80[USD] in Malaysia)[65]. Both the global-scale models and NbS case studies show these substantial ranges but are particularly sensitive to carbon prices and the high value of coastal economic assets.

With the possible exception of social cost of carbon, the specific characteristics and values of the benefits and costs associated with NbS are likely to vary between project sites. NbS benefits are modified by local ecosystems, which are characterised by biodiversity, interconnectivity between adjacent ecosystems, and the interaction with local communities (i.e., dependence on resources and ecosystem services). With NbS highly dependent on local contexts, the costs and benefits of the same intervention in different ecosystems or geographies can vary greatly, especially where alternative land use practices are prevalent.

Whilst there is no one individual cause for high benefit-cost ratios or cost-effectiveness estimates, three specific trends are noted:

1. **Longer periods of economic assessment are typically associated with higher benefit-cost ratios**. The Green Book states that 'costs and benefits should be calculated over the lifetime of the proposal', recommending the periods of assessment such as 30 and 60 years for building refurbishment and infrastructure projects[117]. Three studies with high benefit-cost ratios performed analysis over a 50 and 80-year time-period. Of the case studies identified as having prepared economic analysis, and across the global analysis, timescales are typically between 15 and 30 years.

NbS timescales may require longer lifetimes to be considered since the benefits of biodiversity, carbon regulation and ecosystem adaptation are likely realised over longer periods of time. This depends in part on whether the NbS intervention concerns the protection of ecosystem or restoration, since the benefits of protecting an ecosystem before degradation are realised sooner, and perhaps with less uncertainty than those arising from the recovery of an ecosystem.

However, the inclusion of future benefits comes with greater uncertainty and risk. Evidence from the case studies suggests that NbS projects begin to generate net benefits towards the end of the project implementation and often numerous years after the project begins. Several case studies projected benefits and costs beyond the project implementation period to support the economic case for intervention. Since most of the economic analysis is prepared before the project is undertaken, it is often either implicit or weakly evidenced that the project will generate sustained benefits beyond the life of the project, or that local communities will continue to use and apply new technologies or different practices without further project support. This risks overstating the benefit-cost ratio and cost-effectiveness and underlines the importance of post-project reviews to understand a) the sustainability of the NbS intervention post-implementation, b) the accuracy of the initial ecological and economic predictions at project outset, and c) the extent to which project conclusions can be extrapolated for other similar NbS projects.

2. **Avoided cost methods typically generate larger benefit-cost ratios**. NbS which protect (often coastal) economic assets or prevent degradation (and further carbon emissions) may deliver benefits earlier in the project lifecycle than other NbS which require the restoration of ecosystems over longer timeframes. The extentto which this impacts the benefit-cost ratio will depend on the price of carbon used in the project appraisal[118], as well as the level of assumptions underpinning any avoid cost calculations.

   From an economic perspective, the discount rate is particularly important because of the timing profile of benefits and cost. Evidence from the case studies suggests that many NbS projects have high upfront costs in the early years of a project, proportionally lower maintenance costs in later years, and generate benefits over a long period of time. Since cost-benefit and cost-effectiveness analyses weight the benefits and costs more heavily in early years in comparison with later years, high up-front costs, or high up-front benefits in the case of avoided cost approaches, are attributed greater economic importance.

   Whilst the Green Book has specific guidance on the discount rate to be used for UK projects, and a consultation is out in 2021 refining specific guidance around the discount rate in respect of projects with impact on the environment, it is of particular importance that the impact of the discount rate is well understood for each individual project. Sensitivity analysis of prospective projects and post-project assessments can illuminate the impact of the discount rate, as well as which benefits and costs are most likely to be impacted.

3. **Most of the benefit-cost ratios are below 10 and have a focus on improvements in local livelihoods**. The focus of valuation for most NbS projects in on quantifying additional income for local communities, whereas the global studies look predominately at avoided damages and the benefits of carbon mitigation.

   It is challenging to compare the economic impact of NbS on local revenue-generating impacts due to the distinct local economic conditions of each location. Similarly, alternative approaches and interventions proposed to achieve the same strategic objectives are not available to analyse, making it difficult to understand the NbS investment case in comparison with other rejected proposals.

The economic and strategic case for NbS is likely to be understated if the full suite of benefits and costs are not integrated into the economic assessment. This is particularly relevant for qualitative non-market benefits such as biodiversity and social benefits which are difficult to define but are significant considerations for local communities and important strategic objectives of UK Government.

In addition, benefits selected for assessment under the triple win headlines may differ significantly in spatial scale, from addressing global trends to adapting to local conditions. The economic case for investment in a given region or ecosystem may be driven by the high social cost of carbon emissions, but this does not immediately translate into either local financial or social benefits even if local communities benefit from reducing carbon emissions. This is particularly the case where NbS projects targeting climate change mitigation (e.g. reforestation) require the cessation of activities which are essential for local livelihoods but degrade local ecosystems. It does not consider the reality for local communities of NbS projects on a landscape scale nor feasibility of mechanisms (i.e. carbon credits or payments for ecosystem services) which may be required to adapt to such changes.

To facilitate study comparisons, especially from the perspective of the triple win, it is as important to document and evaluate the benefits which have not been quantified in an economic assessment as it is for those which are valued. Techniques such as cost-benefit analyses make it challenging to standardise and give parity to the qualitative benefits which NbS can deliver.

Methodological challenges with assessing cost-effectiveness of NbS

The economic case for investment in NbS is reported using different metrics, as evidenced in the cases above. Some report benefit-cost ratios, which compares the monetisable benefits as well as costs[102]. Other studies report the value of ecosystem services per annum or per hectare[108] or compare the cost of different interventions, assuming the delivery of either the same benefits or benefits of commensurate value to society[65,69]. Similarly, some studies report the technical unit cost for different interventions with different metrics, such as flood adaptations ranging from cost per unit of adaptation option (e.g., building or groin) to cost per area of intervention, or simply an aggregated total cost of the project or intervention[119].

Comparing across different metrics is not immediately possible since they are often generated to answer different research questions (e.g. cost comparison of specific NbS interventions vs net benefit valuation of a given ecosystem) and include different data types or requirements. Whilst each of these metrics are useful, this makes the evidence base for NbS disparate and challenging to draw upon for practical conclusions and recommendations.

NbS, in the context of the triple win, is not immediately suited to a typical cost-effectiveness analysis. Cost-effectiveness analysis attempts to identify the relative net cost of one or many interventions capable of achieving a certain objective. Cost per CO_2e (\$/tCO_2e) has been used to assess cost-effectiveness for NbS for mitigation-type interventions. Since the social cost of carbon is equal across the world, projects can be compared across different geographies and locations. This is particularly important since it gives decision makers key strategic information in respect of which projects around the globe generate benefits for climate at the lowest possible cost to the taxpayer.

Given the widespread lack of monetisation of benefits such as poverty reduction and biodiversity, solely using \$/tCO_2e when assessing NbS projects risks elevating the importance of climate change mitigation by ranking more favourably those projects which sequester or avoid carbon emissions. Where cost effectiveness estimates are used, it is often noted that there are other significant benefits which have not been included in the monetisation process[65,69], therefore care should be taken to understand which co-benefits exist in the local context, how important they are and to whom they accrue.

The fact that NbS likely deliver hard-to-monetise social benefits also makes a comprehensive cost-benefit analysis approach challenging. They require a significant investment of resources to complete (see next section), especially when complex valuation exercises are undertaken. The qualitative benefits vary largely between contexts which creates an issue of cross-comparison where there are no (or few) appropriate comparable metrics to assess.

Difficulties assessing NbS costs and benefits

Benefits

Evidence from NbS case studies illustrates not only the breadth of benefits that can achieved by NbS projects across the triple win objectives, but also the depth of benefits per objective. The 12 case studies exemplify how NbS can achieve a wide breadth of benefits simultaneously.

To address the breadth of social benefits NbS can provide, the Green Book distinguishes between three different classifications of benefits, primarily based on the ability to quantify and/or monetise the benefit[18]. These are:

- **Monetisable benefits, including cash benefits**. These are benefits which can be valued with market or non-market prices. Some of these can be cash-releasing, meaning that they correspond to returning real monies into the hands of their beneficiaries.
- **Quantifiable but not monetisable benefits**. These are benefits which can be quantified (e.g. extent of land cover protected per hectare) but are difficult to value credibly in project appraisal.
- **Qualitative unquantifiable benefits**. These are benefits which are difficult to quantify or value, and which are often discussed descriptively in the context of wider project benefits

Of the benefits which NbS deliver, only three are regularly monetised and included in economic analysis of NbS.

- **GHG emissions sequestered or avoided**. Where calculated, this can generate large benefit-cost ratios in favour of intervention due to both the high social cost of carbon and potentially large areas of carbon sinks available for protection and enhancement. This is not always fungible; carbon markets and offsetting credit schemes are required to generate cash flow.
- **Increasing income**. Higher incomes can stem from climate-resilient crops generating more reliable income streams, higher prices for new higher yielding crop varieties, improved productivity of fisheries or associated land. Increasing incomes arises from either higher revenues or lower input costs.
- **Avoided costs**. These could arise from reduced risks to downstream areas from protecting upper catchment, reduced flood damage alongside rivers, reduced economic impacts of crop losses due to diversification on farms, or reduced cost of inputs due to intervention.

As discussed, many of the social, poverty reduction and biodiversity benefits captured and discussed in economic assessments are described as additional co-benefits of NbS projects and often afforded inappropriate weight in the economic argument for intervention in comparison with monetisable benefits. This is a weakness if decision-makers rely on benefit-cost ratios exceeding an arbitrary threshold as it encourages potentially disproportionate attention to be afforded to those benefits which are easy to monetise and potentially biases the choice of projects (and therefore specific communities) which display these characteristics. It also risks precluding potentially successful NbS projects which deliver strategically across the triple win but do not deliver high benefit-cost ratios or cost-effectiveness estimates. Since the qualitative benefits are numerous, understanding, recording and continuing attempts to monetise these in a standardised and comparable manner is critical for credibly assessing the true social value for money assessments of NbS projects.

With the exception of activities which directly improve local incomes, many of the poverty reduction and biodiversity benefits are difficult to define, monitor, quantify and subsequently value. In particular, both biodiversity and poverty are typically characterised by:

1. **Spatial definition**. Biodiversity is heavily dependent on the ecosystems, or sets of interconnected ecosystems, in a delineated spatial area. What constitutes poverty varies largely across a given catchment area.
2. **Multiple facets**. Biodiversity can be measured in numerous ways depending on local context, the strategic case and available data (see **Biodiversity Indicators in Context**). Poverty is not simply characterised by income below a given threshold. Rather, it incorporates social protection, rights to and dependency upon economic and natural resources, access to basic services, ownership and control over land and assets, and financial services[75].
3. **Non-market goods**. In particular, the benefits and associated values of biodiversity and ecosystems are not typically reflected in market goods[120]. Similarly, benefits such as health are not typically captured directly by traditional markets.

Since qualitative benefits are significant in the context of a triple win NbS, it is difficult to conclude meaningfully on the overall cost-effectiveness of NbS since the value for money varies with context and is likely understated if reliance is placed on monetised benefits. Attempts have been made to value broader, difficult-to-quantify concepts such as climate resilience and upskilling from capacity building. A recent review the evidence base of various intangible aspects of climate resilient development suggests that benefits accrued are expected to outweigh the costs by a factor of 2 and can reach as high as £50 (GBP) to every £1 (GBP) invested, although confidence in such findings is typically low as resiliency is particularly context specific[76].

Cost

Historically it has been difficult to estimate costs globally as there are no common standards for such reporting[48]. With no common standard, it is difficult to compare NbS with non-NbS projects. The challenges arising from cost data inconsistencies are well documented in the literature[100,122]. Of the most important cost categories is opportunity cost since it is highly-site specific, very variable (even negative) and is often the cost category which represents the highest proportion of costs for projects which seek to avoid deforestation[122]. Different studies take different approaches to estimating opportunity costs. Large-scale studies which focus on available average or cost estimates to approximate opportunity cost may overstate the economic case of on-the-ground NbS projects where there are high-value alternative land uses or large local institutional barriers to setting up NbS projects[48,65].

Not only does the lack of information make it difficult to ascertain the true costs of NbS projects, but also it makes comparison between NbS projects (with differing activities, focal areas, interventions) and between NbS and non-NbS projects nearly impossible. Furthermore, this level of disaggregation makes it difficult to understand the key drivers of cost, when these costs are incurred, to whom they accrue and therefore the barriers to implementation and success of NbS projects.

Ignoring or using simplified metrics to capture opportunity cost risks incorrectly addressing the principal drivers of environmental degradation by private landowners and investment by the private sector. It may also encourage inappropriate project designs which do not engage – economically or pragmatically – with understanding why local land use changes (and, by extension, climate change and the reduction in biodiversity) occur in a given region or country. In the absence of this information however, such models would not be possible. What is important is therefore being able to understand the source of the cost information per ecosystem and NbS intervention, what drives costs in the local context and therefore the caveats of extrapolating locally generated data or simplifying assumptions across large spatial scales.

Use of proxy studies for economic efficiency of NbS

Since it is often recognised that data required to perform detailed economic analyses are not obtainable and such analyses are complex, in many cases the benefits of a comprehensive economic analysis may not be proportionate to the cost of collecting, interpreting and synthesising the data from disparate sources with varying levels of reliability[122]. Analyses are contingent on local data, capacity and resources which may be too costly or technically challenging to undertake for individual, smaller scale projects. The temporal and spatial scale, along with the proposed costs of the NbS project, may also preclude a rigorous economic assessment from being deemed a cost-effective use of resources.

For this reason, the Green Climate Fund guidance states that whilst economic and financial efficiency or effectiveness should be demonstrated in project proposals, a formal cost-benefit analysis is not mandatory[123]. The guidance provides a range of evidence deemed ‘acceptable’, which varies from formalised economic analysis which include the full suite of monetised benefits, costs and modelling assumptions, to qualitative evaluations which compare the project proposal with similar project which did complete economic analysis.

Many case study project proposals rely on the results of similar studies which have either already performed a similar type of analysis required to demonstrate cost-effectiveness or value for money or make the broad economic case for similar types of NbS projects. These studies are often referenced to demonstrate that a) the wider economic case for investment in ecosystems is strong[48], b) ecosystem-based interventions can be more cost-effective than grey infrastructure[102], or c) climate services, modelling and risk information can be extremely cost-effective[124].

The use of similar studies to justify intervention is perhaps reasonable if the economic case is strong for local livelihoods or other strategic objectives important for the donor and recipient. In the absence of strategic objectives for biodiversity, there is a risk that benefits for biodiversity continue to be misapplied or unquantified, rather than measured and incorporated actively into project planning and appraisal. At the same time, a reliance on monetised benefits to guide the decision-making process risks the qualitative but strategically significant benefits being ignored. In addition, publication dates of the studies most regularly referenced date back to 2013[48,102,124]. Continued reliance on the same studies risks stagnating the evidence base for NbS.

Other considerations

Interaction of NbS project appraisal with Green Book review 2020. One of the core findings of the review of the Green Book in 2020 was that many project proposals lacked a strong strategic direction. This leads to undue reliance being placed on benefit-cost ratios which may demonstrate poor strategic alignment. The triple win provides the strategic direction but there remains a risk that projects with monetised benefits (e.g. avoided cost approaches which value carbon or economic assets) will be prioritised over projects with qualitative evidence for the triple win. The review makes clear that there should be no threshold test for a benefit-cost ratio to pass in order for a project to achieve funding. Further, it states that business case reviewers should be open to projects with lower benefit-cost ratios if they have a stronger strategic fit. It is important to note that cost-effectiveness of benefit-cost ratios are only one part of the consideration into choosing between projects. There are other strategic factors which guide the decision-making process. Equally, cost-effectiveness metrics are an important way to ensure (or maximise the likelihood) that taxpayer money is spent as efficiently as possible given the data available and the prevailing uncertainties.

However, more resources should be directed to both understanding and quantifying the significant impacts of the qualitative benefits which NbS generates and how these can be delivered and monitored across multiple locations and contexts, as well as the risks and uncertainties which are inherent in projects which engage with natural processes. More time and resources invested in these areas will strengthen the evidence base for the NbS qualitative benefits, the understanding of the risks and uncertainties of NbS projects in different locations and ecosystems across the world, and ensure that projects competing for funding are doing so in pursuance of wider strategic objectives both domestically and internationally. More business cases assessing the qualitative benefits of NbS and the continued attempts to quantify key benefits arising from NbS projects will also help build a framework for assessing NbS projects which gives appropriate weight to the qualitative and monetised benefits across each of the triple win objectives.

Lack of distributional impact assessment in NbS projects. Different types of NbS benefits have very different characteristics and manifest in different capacities for different stakeholders. An important limitation with using conventional benefit-cost ratios in NbS projects is that they are typically not disaggregated or weighted by who is the recipient of the benefits and who incurs the costs. This is especially relevant where benefits are both local (e.g. impact on local ecosystems and communities) and global (e.g. an NbS projects with a climate mitigation focus). It is important to understand the extent to which a high benefit-cost ratio arises because of global benefits which are less important or accessible by local stakeholders but are of interest and importance for public or global institutions, or because of the project activities which return cash or other social benefits to local communities.

The majority of economic assessments of NbS are conducted before the project begins. It is important to note that many case studies found which demonstrate evidence of economic analysis are either a) relatively new and yet to report substantially on their results so far, b) academic studies which are designed to research the economic case for NbS, or c) conducted before the project begins. Whilst nearly all evidence of economic analysis found in the case study search includes some level of sensitivity analysis, such evidence should still be viewed as prospective. As mentioned in the previous subsection, there is clearly an underinvestment of rigorous ex-post economic analysis. To develop the evidence base and allow NbS to be compared with other projects requires investment in ex-post analysis and comparison with ex-ante appraisal to understand where benefits and costs are under or overestimated, and how NbS projects can be designed and run better in the future.

Multiple interventions and project activities. Many of the studies found in the case study review did not focus on a single intervention; rather project activities comprised many different components which often have differing impacts on each of the triple win objectives. Most NbS projects include significant elements of capacity building, with larger investment projects incorporating climate and risk monitoring systems. Such activities are important for the continuation of project activities post-implementation by helping increase local autonomy and ability of communities to sustainably manage their local resources under the impacts of climate change. In countries which are susceptible to climate change, these benefits are likely to be more valuable over time as the locked-in impacts of climate change are realised.

Different activities and cost components make it challenging to separate causality between specific project activities and the benefits which a given project activity generates. Whilst this is a common issue, it is particularly the case for the triple win since many NbS projects include upskilling, training, market preparation and other similar activities. With many different activities and components, it is challenging to extrapolate conclusions across projects, NbS or not, unless activities and local conditions are sufficiently similar.

The Financial case for NbS

Introduction

Out of the $133 (USD) billion annually that was invested in NbS in 2020, only $18 billion (USD) was invested by the private sector, equalling just 14%[125]. Compared to the share of private finance in climate investments, which equalled 56% in 2019, this share of 14% for NbS forms a striking contrast[125]. To overcome the global investment gap in NbS and reach the international targets, mainstreaming of private sector investments in NbS is a crucial and urgent challenge to address.

The following section explores the type of barriers that currently prevent more private sector investments in NbS, and which solutions could help overcome them. For this purpose, an evidence base of 50 recent papers and reports on the topic of NbS have been studied. The various barriers and solutions identified are categorised under three categories: Financial and administrative, political and legal, and environmental and socio-economic.

Types of financial flows in ODA NbS projects

In the ODA NbS case study review, most of the case studies were funded by public sector grants or heavily concessional capital (i.e. loans with low interest rates). This matches a recent study which found that, for the three years analysed, up to 85 percent of all tracked funding for NbS was categorized as ODA grants[126].

It is not clear from all of the case studies why public sector grant is the most popular type of funding support, but where this information was provided, there appear to be three key reasons why grant, or heavily concessional, funding is most prevalent in NbS currently. It is probable that these reasons arise because of the focus on ODA countries, which inherently attracts public finance both domestically and overseas.

- **Underlying population** – many projects target the improvement of livelihoods of highly vulnerable population which suffer from food or natural resource shortages or are at extreme risk to the impacts of climate change. In many cases, poverty is pervasive and a large number of the population are living in poverty or below the poverty line. There is a high dependence on activities such as subsistence agriculture, which is already suffering, and will suffer more severely over time, from the impacts of climate change, namely unpredictable rainfall, rising temperatures or extreme flooding risk. The majority of such projects include technical assistance to help local, cash-constrained small-holder farmers adjust and strengthen capacity resilience to a changing environment and reduce poverty and vulnerability in local areas. As such, there is limited attraction for private investment.
- **Project activities** – the types of activities which are targeted by NbS projects are wide-ranging in their nature and characteristics. Many are public goods, for example the conservation of biodiversity. For such activities, the incentive to invest in such goods which, in the absence of alternative market arrangements, do not generate cash flow, does not exist. Many of the activities do not generate cash but are critical in the context of adapting to the impacts of climate change, for example technical expertise and upskilling. Where activities do generate cash, for example improving agricultural yields or cost-saving measures, such cash flows are not typically amenable to private investment since these financial flows are required to reduce local poverty. Returning such financial improvements from local populations to private investors would not improve the local poverty position. Similarly, many other activities require high up-front costs which generate benefits over longer periods

of time and after a time lag. This makes debt financing problematic in the short-term since there is no revenue to which repayments can be linked.

- **National governments and institutions** – some ODA countries do not have the fiscal capacity to support many of the NbS projects we have seen. From many countries, there are very high levels of both indebtedness and costs of borrowing. Public spending is already stretched and the amounts required to make sustainable change at a landscape level are often not available. For many, the nature and size of the hazard(s) which NbS seeks to overcome already dwarfs domestic capacity to resolve societal problem(s). Both the availability of resources to direct to non-revenue generating activities and ability to borrow on international capital markets are limited in many cases. In additional, there are often weak regulatory structures, informal property rights arrangements, contract enforcement issues and inefficient policy and legal frameworks. Such conditions are not conducive to private investment nor risk-taking finance (for examples, loans or equity).

Where non-grant funding has been seen (loan or equity finance) the following is typically noted:

- Loan financing is typically complemented with grant financing. Where both are combined, it is typical that grant financing targets those activities which are in their early stages, for example market development. Loan financing is often directed where there are short to medium term income benefits and these are expected to manifest quickly;
- The loan financing is targeted at a specific revenue-generating activity or infrastructure project. Grant financing is often spread across all activities, including those which are capacity building and upskilling, and other activities which generate non-market benefits (for example, climate benefits).
- Whilst there has been some evidence of loan financing, these are typically concessionary in nature. There are often grace periods during which the capital investment does not have to be repaid, term rates are particularly long (in excess of 20 years), and the interest rates are lower than market rates.

In general terms, the wider literature refers to NbS (and generally nature-related projects) as not being *bankable* or investable. *Bankable* projects are referred to as those which are financially viable and support the development of climate resilient and sustainable landscapes and economies[127]. In other words, a bankable triple-win NbS project delivers for biodiversity, climate change and poverty reduction objectives, whilst simultaneously delivering positive financial returns suitable for private investment and positive social returns for wider society.

For an NbS project to be suitable for private finance, there are a variety of different characteristics it requires. The extent to which these are important will vary depending on the type of investor and the individual investor themselves. Generally, such NbS projects should have the following characteristics[127].

- Cashflow generating activities
- A clearly defined probability of success
- A clear exit strategy for investors
- An acceptable risk-adjusted rate of return
- A clear proof of concept and track record

It is the task of project managers and those designing NbS projects to develop a financial model which is sustainable both during and after project implementation. The following section discusses the enabling conditions necessary to facilitate NbS investments, and the barriers which are currently present in increasing the prevalence and relevance of private finance in NbS projects.

Enabling environment for private sector investments in NbS

Given the wide range of societal, biodiversity or climate change related benefits that NbS may provide, there should be sufficient collective and common benefits achievable without the involvement of private sector financing.

However, if the private sector is to invest in NbS, the environment in which it is operating needs to be sufficiently facilitative to produce monetisable and financial benefits, among other conditions.

For this to be the case, much of the reviewed evidence stresses that a favourable policy and regulatory system is imperative. Private investments in the type of projects and geographic areas of an NbS must be allowed or stimulated legally – and need to be recognised officially by governments as a viable option to contribute to conservation, sustainable development and climate targets.

Furthermore, the enabling actors need to be available and able to fulfil their designated roles during the NbS project. The most prominent actors mentioned in the reviewed evidence typically include:

- Local governments and NGOs, capable of supporting the project with capital and technical assistance in the planning phase,
- Financial institutions (e.g. banks, or pension funds) to make long-term capital investments, and
- Local project developers and communities, which are in continuous collaboration throughout the whole project.

Finally, contributing towards an NbS project will only garner interest if there truly exists ecological potential from which the benefits can be unlocked by implementing and scaling a particular NbS. If private financing is to support this scaling, monetisable benefits of the NbS must be able to generate a positive financial return (i.e., profit), and a clear vehicle must exist into which investments can be transferred and from which debt can be repaid by the investee[127].

Barriers preventing private sector investments in NbS

Institutional awareness gap

An overarching barrier to attract investments to NbS is the lack of understanding within the public and private sector that natural assets underpin their own performance and outcomes, as well as the broader economy in which they operate. This includes possible misperceptions of risks of biodiversity loss, dependencies on nature, financial and economic benefits obtained from ecosystems, and financial risks of investing in NbS. For example, this is reflected in government or private sector decisions that do not incorporate the fact that biodiversity loss and climate change can negatively affect (i.e., pose a risk to) long term investment outcomes or benefits to local or national economies. The lacking awareness of how much public and private investments depend on nature can drive investments in projects that are implemented at the expense of biodiversity and the natural environment, rather than NbS.

This institutional awareness gap can drive the lack of incentivising regulations, limited political support and scarce private sector involvement, among other barriers to private financing of NbS that are listed in subsequent sections.

Financial and administrative barriers

Private finance investments require NbS projects to be perceived as sufficiently 'bankable' by investors. This is discussed in the previous section, but is likely determined by factors such as the predicted cash flows of the project and its associated risk profile. As in other investments, resulting risk/return profiles of an NbS project will indicate the size of the potential returns and the level of uncertainty that will form the basis on which an investment decision can be made. The following two factors are commonly reported as the main barriers that prevent NbS from having a positive bankability and thus being able to access private financing:

- **Insufficient project scale:** Many institutional investors require investments in NbS projects to be of a certain scale. This is because small projects often do not justify transaction and due diligence costs, or might not generate traditional financial returns[128,129,130]. For example, a blue carbon project that aims to generate carbon credits by planting mangroves will in practice need to cover a sufficient area to compensate for the costs of administrating the credits (for instance by registering the project through the Plan Vivo standards).
- **High risk profile for debt or equity financing:** Low or uncertain revenue streams, as well as the typical time lag between investment and repayment are factors that are often cited to make an NbS project too risky for private finance investment. Since non-financial investment outcomes (e.g. on biodiversity) are not incorporated into the risk assessment process, the associated risk profile of non-NbS investments is positively underestimated without considering any nature-related risks, which makes these options more attractive to investors than NbS projects[129,132,132,134]. An agroforestry NbS, for example, may need large funds at the beginning of the project, while the financial returns (e.g. through selling timber or rubber, such as in the Royal Lestari Utama project[127]) may emerge after several years – which negatively affects its risk profile.

These types of financial barriers are often underpinned by administrative factors that prevent more NbS projects from being developed and meeting general conditions to attract private financing. Common administrative barriers of this kind include:

- **Limited capacity for NbS project development:** Not having the right capacity, expertise, and financial literacy on the project side hinders adequate project design. This can result in the absence of clearly mapped financing needs across the project lifecycle, a well-described model for revenue generation, engagement with the necessary partners and stakeholders, or the development of a proof of concept that demonstrates the feasibility and practical potential of the NbS. Overall, this limits the viability of developing a bankable NbS project[127,133,135,136,137].
- **Limited standardisation:** The lack of common definitions of NbS, and standardised tools and metrics to track and quantify their benefits prevents them from being adopted more broadly and structurally as an investment opportunity both within the private and public sector. This issue also results in a lack of replicable financial products and communicable data (e.g. suitable KPIs) for project due diligence and performance monitoring[129,133,136,138].

Political and legal barriers

The political and legal landscape plays a crucial role in catalysing private sector investments in NbS, but it can also pose the following barriers:

- **The absence of policies at supra-national, national and sub-national levels** which require public or private compliance with certain environmental standards (e.g. preventing resource mismanagement in commodities and raw materials).[131]
- **The lack of suitable regulations** that require, or provide incentives for, financial institutions to incorporate biodiversity risks in investment decision-making.[131]
- **The use of public procurement frameworks** that favour default investing in conventional, 'grey' infrastructure without systematically evaluating natural infrastructure alternatives (i.e. NbS).[139]
- **The limited coordination between ministries and departments** responsible for investment decisions (e.g. ministry for planning, energy or transportation) and those managing natural capital (e.g. a ministry of environment).[137]
- **The presence of legal frameworks** that limit the extent to which private investments are allowed in public or communally held assets – which NbS and their benefits usually revolve around – may pose a barrier to the flow of private financing to NbS.[49]

Environmental and socio-economic barriers

Since NbS are embedded into specific economic, social and environmental contexts, barriers related to any of these components can strongly influence the viability of scaling an NbS project with the support of private financing at local, national and global levels. These barriers can include:

- **Lack of support from local communities and stakeholders:** A specific NbS may induce significant alterations in the way local stakeholder interactions and communities are organised. For some stakeholders, such alterations may cause a loss (e.g. financial or cultural) compared with the business as usual scenario or be misperceived as such. This can result in opposition to the NbS or in limited support, which are crucial factors for the viability and design of a bankable and scalable NbS. Such a lack of support may for example come from incumbent project developers that do not have engineering manuals describing required 'green' methods or the specific expertise to undertake NbS projects, or from local communities that do not wish to make potentially transformative changes to their livelihoods.[126,133]
- **Complexity of gathering and communicating underlying socioeconomic evidence:** The theoretical basis that is needed for designing an NbS is often absent. This is because conducting the required type of research and gathering the right data is usually time consuming, costly and demands specialised expertise. In addition, valuation exercises and results can vary to a great extent based on the method applied. The outcomes from these assessments can easily become too technical for stakeholders or project intermediaries to understand and are difficult to organise into a compelling and convincing message that illustrates the value of an NbS.[138,141]

Solutions to enable private sector investments in NbS

In the context of the various barriers described above, several opportunities to overcome them and enable private sector investments in NbS are mentioned in the reviewed evidence.

These solutions range from systemic transformations that span governments and institutions to more specific tactics that can be applied by a catalysing entity at a project level:

Financial and administrative solutions

- **'Pooling' projects to achieve scale:** Even though specialised investors may invest in small-scale NbS, the wider spectrum of financial institutions that can potentially mobilise larger funds to NbS require these investments to have a certain scale (varying with the type of NbS, the risk profile and specific investor type[125,137]). To create pipelines of investment opportunities that meet these scale requirements of financial institutions, designated financial facilities can aggregate projects of different sizes into pooled funds. These professionally managed funds are invested in purpose-specific projects and allow investors to benefit from the economies of scale of investing in larger project portfolios. Doing so can decrease financial risk through diversification and lower transaction costs faced by investors[127,128,130].

  The Kenyan Pooled Water Fund (KPWF) (see **Model F**) is an example of such a facility, whose aim is to provide local Water Service Providers (WSPs) access to long-term financing for sanitation infrastructure projects via the local capital markets. The issuance of a bond to local institutional investors will allow KPWF to on-lend the bond proceeds to WSPs to fund projects. The loans will then be repaid by the WSPs over a 15-year repayment period, thus providing bondholders with a return on investment. The pooling of these loans by the fund allows for the creation of adequate investment scale and lowers the default risk for institutional bondholders through diversification[127].

- **Risk mitigation tools:** Different tools can mitigate risk and ensure risk-adjusted returns in line with investor requirements. In particular, blended finance arrangements can make use of grants, concessional loans and different types of guarantees by public and philanthropic actors to rebalance the risk-return profiles of investments. Concessional loans typically feature below-market interest rates or particularly long grace periods, and can be used as co-investments to attract private capital by lowering the overall risk profile of investments. First-loss guarantees are another common type of credit enhancement tool, whereby a third party agrees to bear the first loss of an investment by compensating lenders in the case of default. Besides mitigating risk, such tools can help private investors bridge the prolonged lead times until projects generate cashflows. Local governments can also provide investment tax credits on large capital investments required for NbS projects, thereby lowering the investment cost to compete with traditional investments[127,129,131,136].

- The Althelia Biodiversity Fund (ABF) (see **Model E**) is an example of a blended finance facility which channels venture and growth finance into transformational businesses in the Brazilian Amazon. A more detailed description of this fund can be viewed in Financial Model E within this Toolkit. The fund's structure allows investors with varying risk-return requirements to invest in corresponding investment products. While the riskier investments are made by public investors, private investors provide financing for low-risk investments. Additionally, USAID is providing a 50% portfolio-level credit guarantee to investors[127].

  Furthermore, **Model D** illustrates how Resilience Bonds or other insurance products can help mitigate investment risks for NbS.

- **Technical assistance:** Capacity building on the project developer level can help ensure that projects meet investors' financial and impact objectives, thus increasing the number of investable projects. Technical assistance facilities (TAFs) are capacity solutions aimed at providing grants, training and advice to potential investees to strengthen their operational and financial capacity to deliver impact and decrease projects' commercial and environmental, social and governance risks[131,140].

The AGRI3 Fund was created to mobilize private funds for forest protection and sustainable agriculture. Next to its financial vehicle aimed at attracting private capital, the fund uses grants by public donors to provide technical assistance to food value chain actors through a TAF. The TAF strengthens a project developers' capacity to maximize and monitor their environmental and social impact while reducing project risk[131].

- **Adoption of standard methods and metrics:** The development of standardized approaches and metrics to measure the impact and financial performance of NbS will be indispensable to mainstreaming investments in NbS, and in creating replicable financial products. The building of an evidence base and sharing of data across stakeholders is necessary to inform the development of standardized guidelines and measurement frameworks[131,142].

  By way of example, the Coalition for Private Investment in Conservation (CPIC) developed a series of investment 'blueprints' to guide the replication of model financial transaction structures in conservation[142].

  The Financial Models B, C and D displayed in this Toolkit illustrate examples that advance an NbS using clear financial (fixed income) products and pre-defined metrics, KPIs and verified standards.

  The clear conditions, data and predictability that support these products are sufficient for institutional investors to make a favourable risk/return assessment and investment decision.

Political and legal solutions

- **Policy and regulatory reform:** International and national organisations that regulate investment practices can reform laws and regulations to better enable NbS investments. Actions to achieve this include reforming harmful agricultural subsidies, modifying current legal restrictions on investments in public held assets and requiring financial institutes to incorporate and report on nature-related risks[49,51,131,132].

- To facilitate the latter, an international working group of public and private entities called the Taskforce on Nature-related Financial Disclosures (TNFD) was launched in June 2021, and is working on delivering a reporting framework that includes nature-related risks by 2023.[132]

  Adjusting the processes by which public procurement decisions are made: NbS can be integrated into national and subnational government planning processes so that they are placed on a level playing field with their 'grey' alternatives. Ministries responsible for planning, financing, and implementing infrastructure projects require sufficient capacity and technical know-how to routinely evaluate NbS as a procurement option, and prompt downstream actors (e.g. project developers) to win contracts and deliver projects that are in line with green policies – thereby increasing the overall NbS uptake[126,139,143].

The Bahamian government, for example, has created a Sustainable Development Master Plan for Andros Island, which aims to reshape the island into a nature-based economy. This is an overarching framework for cross-sectoral planning that guides the future development of the island while balancing conservation and economic development[143].

Environmental and socio-economic solutions

- **Early and equitable stakeholder engagement:** When the environmental and socioeconomic contexts of an NbS are sufficiently clear, the relevant local stakeholders and communities can be identified and targeted. To ensure their effective collaboration, they need to be involved in the project design and convinced of the positive outcomes the NbS can provide for them. Such partnerships form an intrinsic part of a scalable and bankable NbS project[127,133,139,141,143].

  As an example, a 'social forestry' NbS project developed by Fairventures in Indonesia secured the support of local communities through providing them exclusive labour rights, standard wages and a profit-sharing agreement[127].

  The Financial **Model A** that is described in this Toolkit illustrates another example where offtake agreements are used to create a strong financial incentive for local farmers that participate in the NbS development.

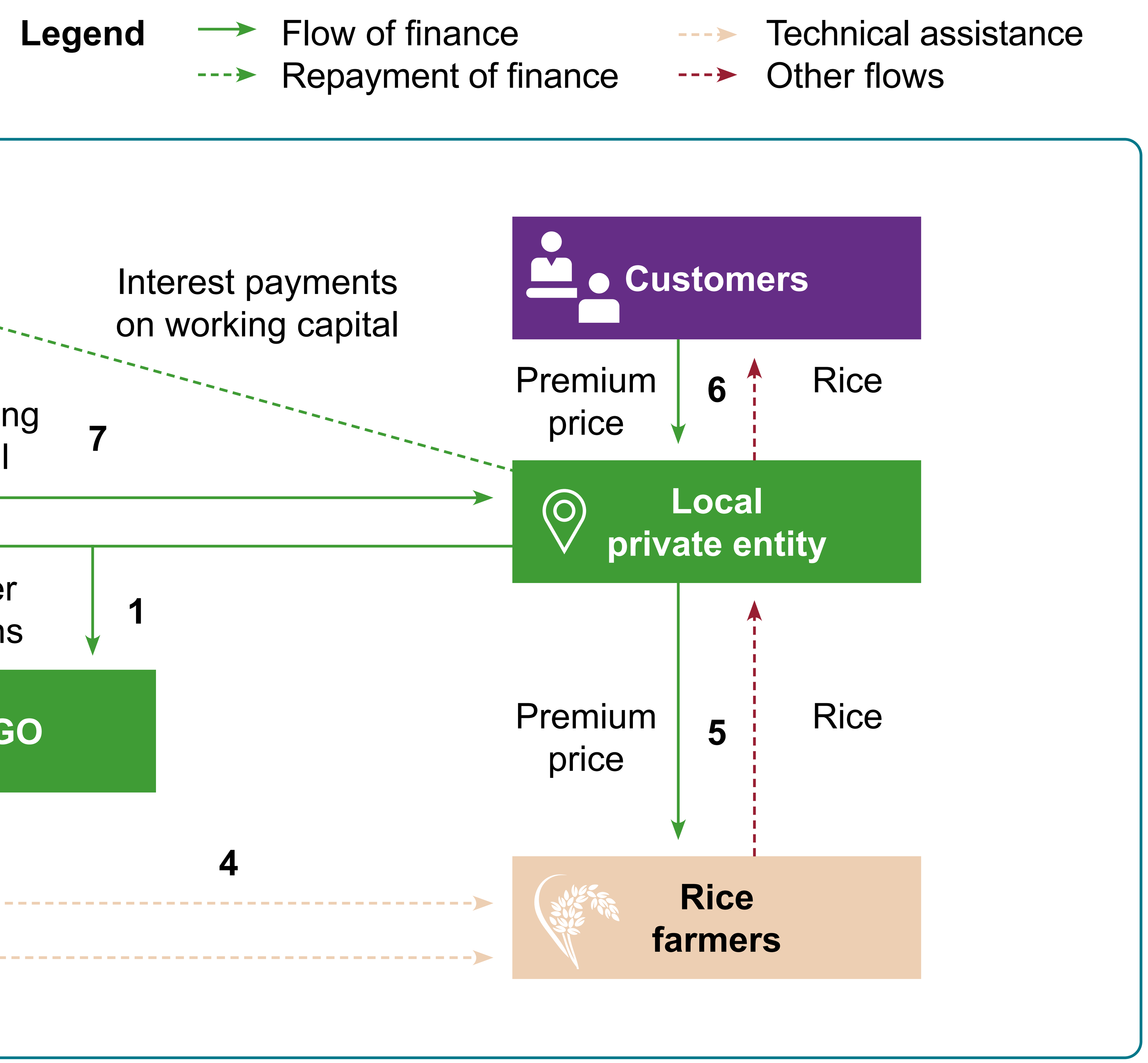
- **Mapping and valuation of environmental and socioeconomic evidence:** This type of information can identify cross-sectoral (co) benefits of NbS and provide the theoretical evidence that an NbS is economically, environmentally, and socially preferable to alternative investment options. A valuation study can form the backbone of successful engagement with the necessary stakeholders such as public and private entities, as they will be able to recognize the systemic value that the NbS brings to beneficiaries at an early stage[131,139,141,143].

  For example, The International Institute for Sustainable Development (IISD) has created The SAVi assessment tool, which facilitates the structured gathering of NbS evidence and has been successfully applied to valuate the contributions of Senegal's Saloum Delta to local livelihoods and regional developments[141].

Suggested financial models which combine private and public NbS monies

Model A – Offtake agreements

Click the number on each arrow to see description of model.



Adapted from World Wildlife Fund (WWF). 2014. *Capitalising Conservation*.

Model A – Offtake agreements

Background

Kulen Promtep Wildlife Sanctuary, in Cambodia's north-western province of Preah Vihear, is home to the critically endangered Giant Ibis, Cambodia's national bird. Destructive activities like logging for timber and agricultural purposes, and illegal killing can be financially lucrative activities for local people. This conflict creates severely negative consequences for the Giant Ibis and the integrity of the ecosystem, and threatens their future existence.

Description of model

Wildlife Conservation Society (WCS) founded a local NGO (Sansom Mlup Prey [SMP]). SMP trains farmers in sustainable farming practices **4** whilst WCS helps monitor and verify compliance within the various arrangements **3**. These activities are funded **1,2** by a local entity (Ibis Rice Conservation Company [IRCC]) which receives funding from an interest-bearing working capital facility **7,8**.

IRCC agrees to purchase locally grown rice produced according to conservation friendly standards at premium prices; farmers are paid an average 30 to 40% more than standard market prices for their harvest. **5**

Since the rice is certified as environmentally friendly, the rice is sold onward by IRCC to customers around the world at premium prices. **6**

Further reading: https://www.3ieimpact.org/sites/default/files/2020-03/IE106-DPW1.1045-Cambodia-PES.pdf

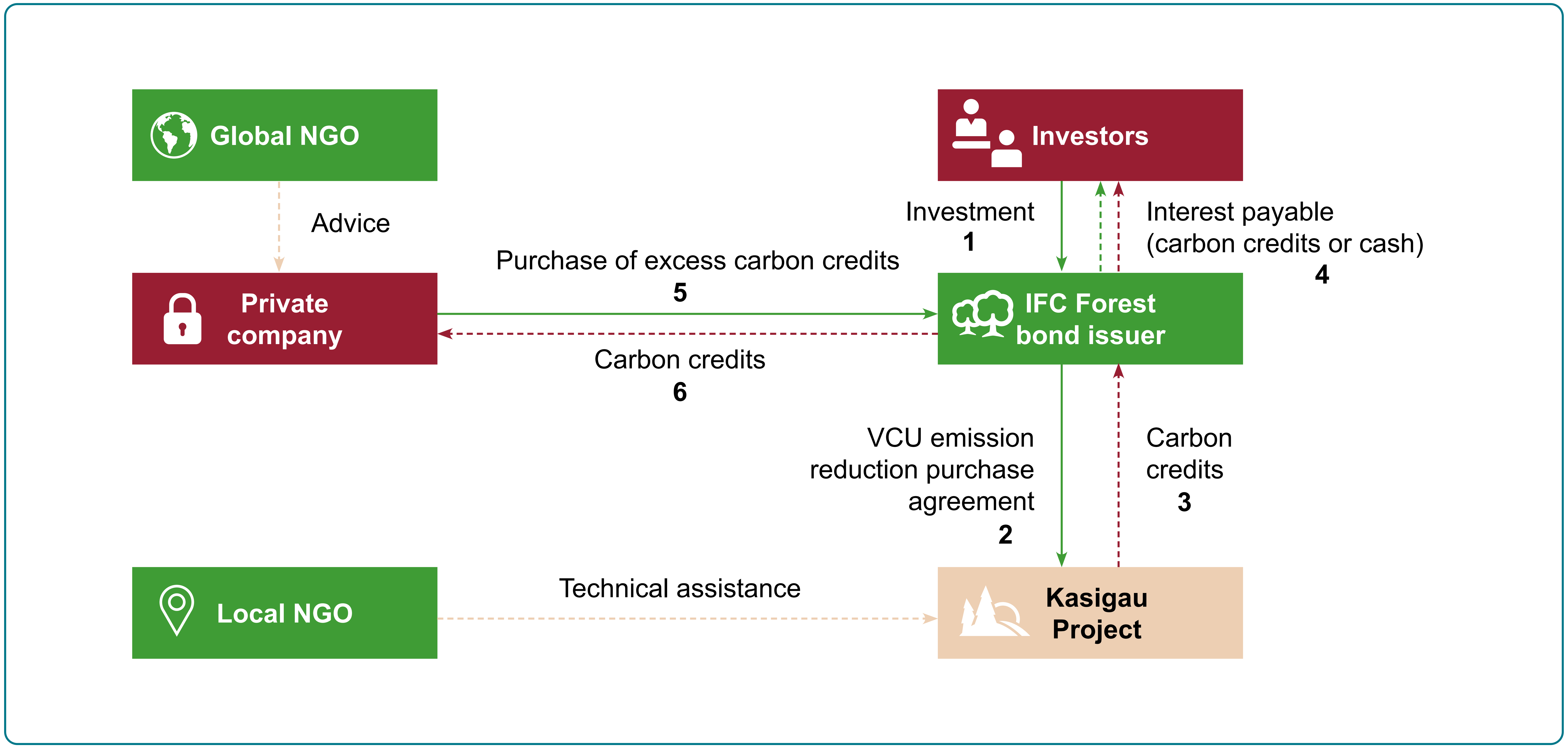
https://cambodia.wcs.org/Initiatives/Sansom-Mlup-Prey.aspx

https://www.sansommluppreykh.org/ibis-rice

Model B – Bond financing carbon credits

Click the number on each arrow to see description of model.

Legend → Flow of finance ⇢ Repayment of finance ⇢ Technical assistance ⇢ Other flows



Adapted from International Finance Corporation (IFC). 2016. *Forests Bond*.

Model B – Bond financing carbon credits

Background

The community surrounding the Kasigau Corridor region in East Kenya used to rely on deforestation for land use. Cattle had grazed the fields into dust and much of the dryland forest had been cut for firewood and farmland.

In 1998, Wildlife Works—the world's leading REDD project developer established the Rukinga Wildlife Sanctuary in the Kasigau Corridor. Today, wildlife and flora that had left the diminishing forest have returned. The sanctuary provides income to the local community for protecting the land, creating jobs in activities like wildlife monitoring and sustainable agriculture. The protected area covers over 200,000 hectares. The project is expected to offset 1.4 million tons of CO2 emissions each year for the next 30 years.

The International Finance Corporation (IFC) Forests Bond will support the Kasigau Corridor Project.

Description of model

IFC issues a forest bond to private investors **1**, investing proceeds in viable REDD ready projects **2** which generate verifiable carbon credits **3**.

Investors in the IFC Forests Bond choose between a cash or carbon credit coupon **4**. If they elect the carbon credit coupon, they can choose to retire the credits to offset corporate greenhouse gas emissions, or sell them back onto the carbon market.

A price support mechanism **5,6** ensures that the project can sell the necessary amount of verified carbon units until the bond matures. In this specific case, this is achieved by a commitment by a multinational organisation to purchase excess credits.

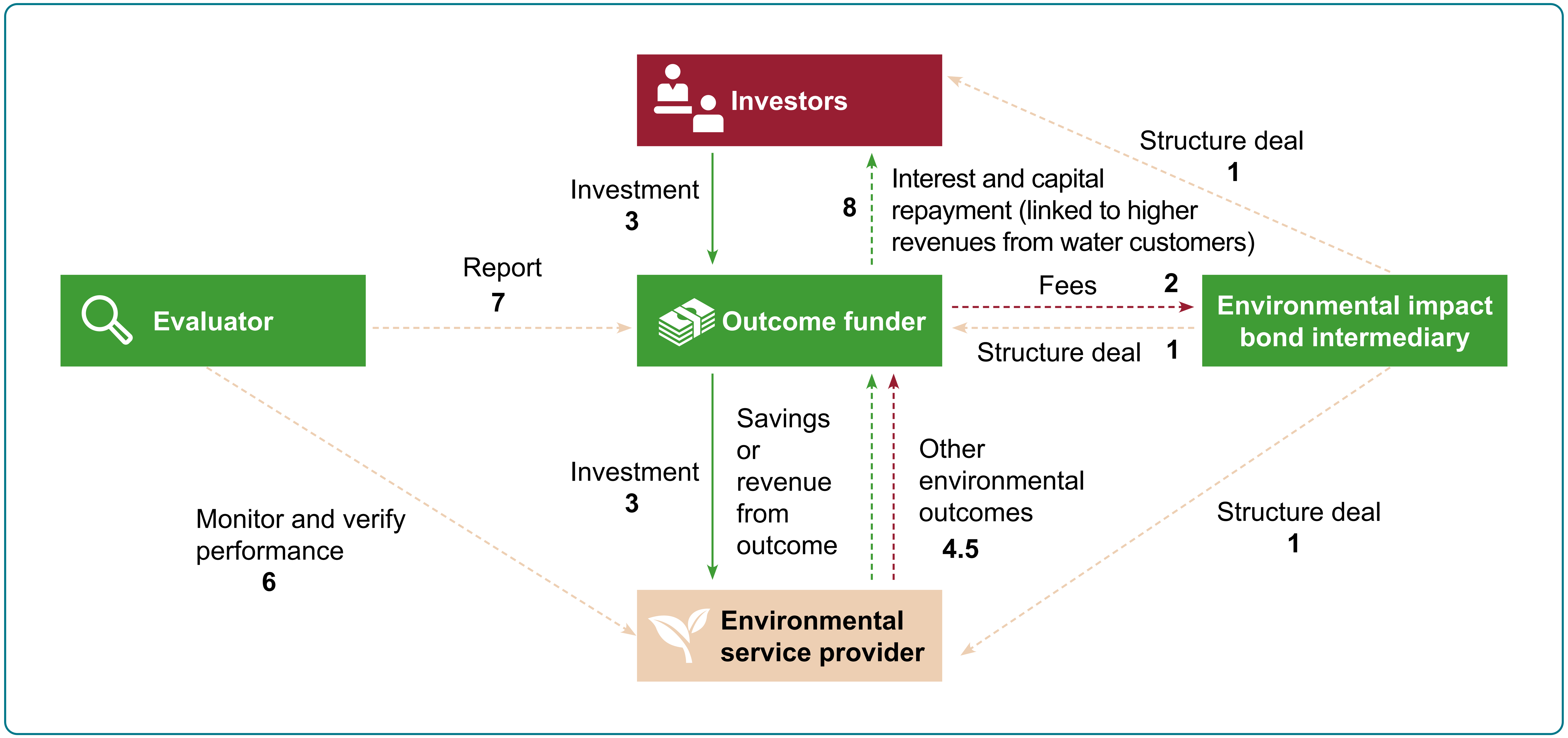
Further reading: https://www.ifc.org/wps/wcm/connect/982eb7ef-1daa-49ca-b9c0-e6f3a2ddcd88/FINAL+Forests+Bond+Factsheet+10-5.pdf?MOD=AJPERES&CVID=lxS1w0E

https://www.aces-org.co.uk/what-we-do/

Model C – Environmental Impact Bond

Click the number on each arrow
to see description of model.

Legend
- Flow of finance
- Repayment of finance
- Technical assistance
- Other flows



Adapted from Coalition for Private Investment in Conservation (CPIC). 2019. Conservation Investment Blueprint: *Environment Impact Bond for Green Infrastructure*.

Model C – Environmental Impact Bond

Background

Washington, D.C. rests on the banks of two rivers – the Potomac and the Anacostia – that flow into the Chesapeake Bay. Washington D.C. has a sewer system that mixes stormwater runoff with household sewage. In the case of severe storms or weather events, the combination of runoff and sewages pollutants into the two rivers, damaging aquatic life and limiting recreational use and fishing of the river.

Description of model

An Environmental Impact Bond (EIB) is a form of debt financing which links the financial returns of the investor to desired and verifiable environmental outcomes from projects **4,5** which are financed by the bond **3**. In the case of this project, bond repayments **8** are made from increased water charges from water customers in the surrounding area.

An intermediary organisation designs and structures the deal between the private investors, the environmental service provider(s), and the outcome funder **1,2**. The intermediary organisation determines the transaction structure, the appropriate outcome metrics and indicators which trigger investor repayments, the size of payments, and thresholds for outcomes that trigger performance payments. Benefits which accrue to water customers include cleaner drinking water, reduction in floods, and cleaner waterfronts.

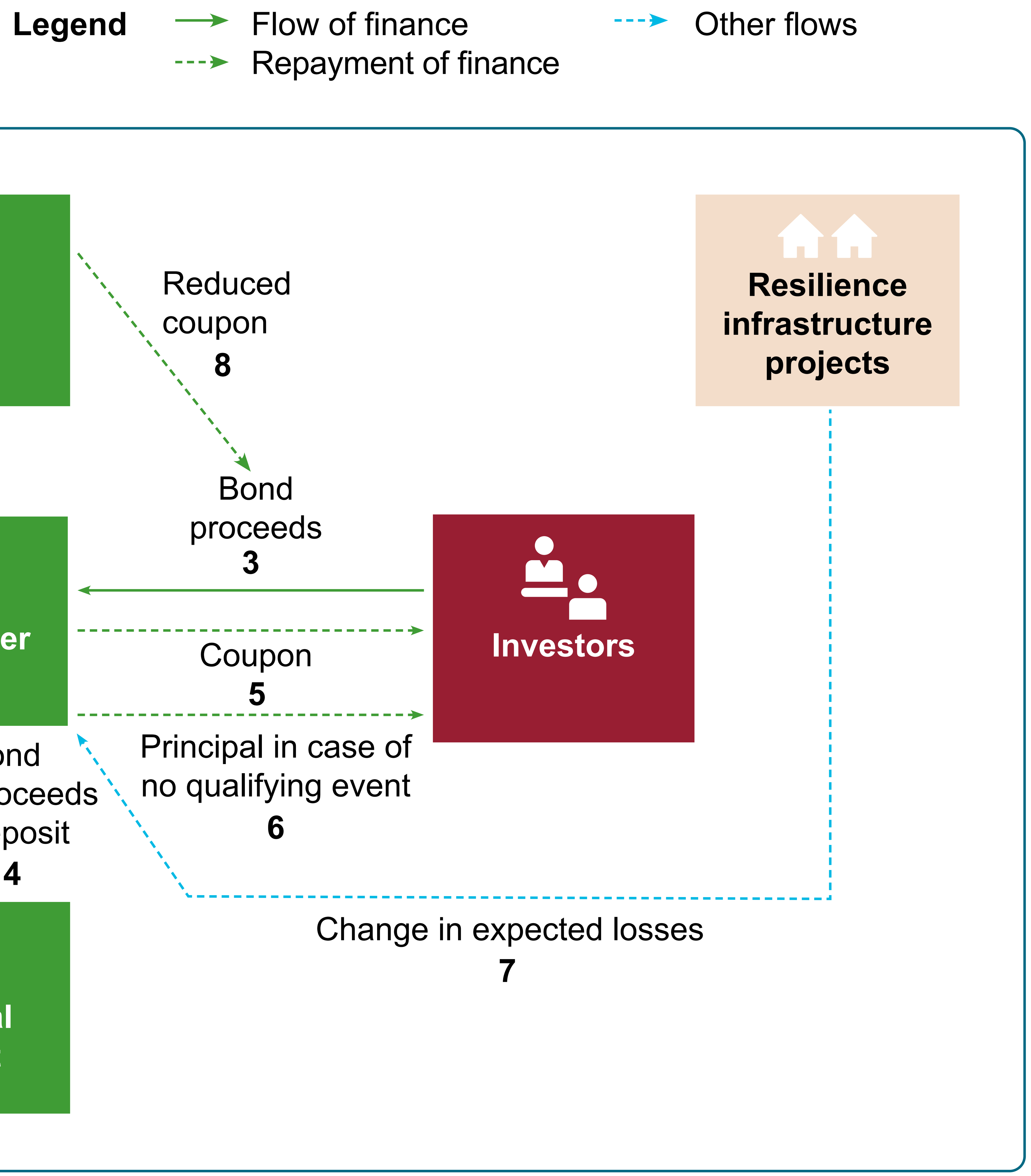
Return to the investor **8** will generally include the initial investment (principal), interest (or coupon), and a possible performance payment. The level of the performance payment may be fixed (i.e., triggered by achieving a threshold on the outcome metrics) or variable (i.e., depending on the level of impact achieved). An independent evaluator will monitor performance of the project against the metrics and indicators to determine success and the level of payment **6,7**.

There are generally two types of performance payments: a "success payment" that is shared with investors and possibly other stakeholders if projects are successful or hit certain thresholds, or a "risk share payment" that is paid from investors to the issuer if the project fails to achieve outcomes. This risk share payment can also be called a "claw back."

Further reading: http://cpicfinance.com/wp-content/uploads/2019/01/CPIC-Blueprint-Case-Study-Environmental-Impact-Bond-for-Watershed-Green-Infrastructure-by-Quantified-Ventures.pdf

Model D – Resilience Bond

Click the number on each arrow to see description of model.



Adapted from Coalition for Private Investment in Conservation (CPIC). 2020. *Conceptual blueprint snapshot. Resilience Bond for risk reduction*.

Model D – Resilience Bond

Description of model

A resilience bond is a new insurance instrument designed to protect government from financial pay-out and the physical impacts arising from natural disasters. Such bonds create a link between insurance coverage and capital investments in resilience projects (green or otherwise) that reduce the expected losses from disasters.

The resilience bond model is based on the conventional catastrophe bond. It comprises:

- an insurance product providing coverage to the project sponsor **1**, with insurance pay-out **2** in the case of a qualifying event (e.g. natural disaster); and
- a debt instrument sold to investors **3** to provide the collateral for insurance coverage (i.e. cover payment to project sponsor in case of a qualifying natural disaster).

The issuer deposits the proceeds into a collateral account **4** and makes fixed coupon payments to investors **5**. It returns the initial payment (principal) to investors when the bond comes to maturity **6**, unless a qualifying natural disaster occurs, in which case it uses the principal to pay out the sponsor.

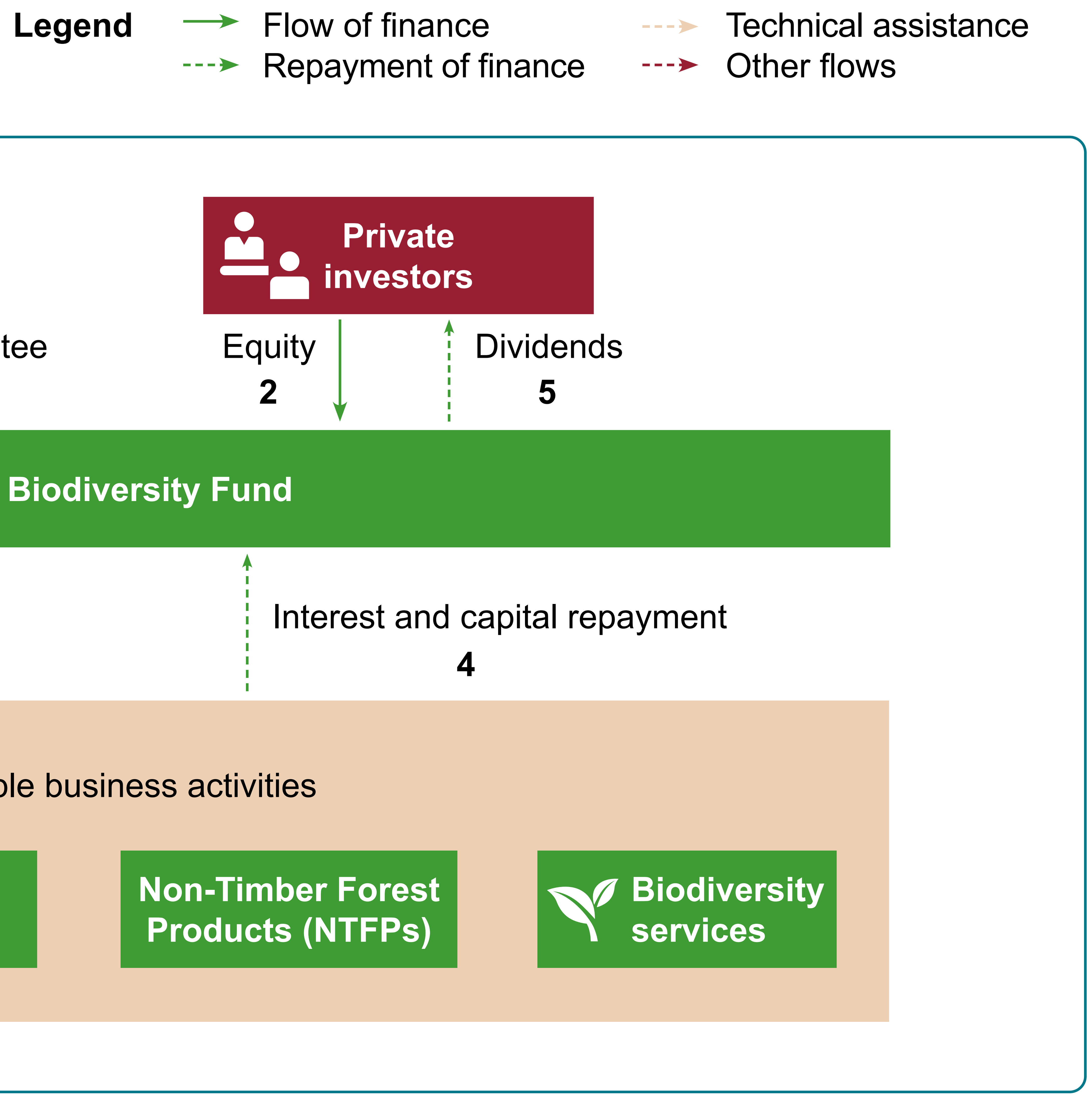
Bond investors agree at the outset to discount the coupons they receive when specific risk-reducing projects **7** are completed during the bond term **8**. The bond issuer uses modelling to validate whether a resilience project is expected to reduce losses arising from natural disasters. This sets the reduction in coupon payments to investors. The cost savings from this reduction are distributed back to the project sponsor in the form of reduced insurance premiums **9**, which can be used to finance further risk reduction investments.

Further reading: http://cpicfinance.com/wp-content/uploads/2020/12/Resilience-Bond_Blueprint-1.pdf

http://cpicfinance.com/wp-content/uploads/2020/12/Resilience-Bond-for-risk-reduction-Blueprint_refocus-partners.pdf

Model E – Impact fund

Click the number on each arrow
to see description of model.



Adapted from World Wildlife Fund (WWF). 2020. *Bankable Nature Solutions*.

Model E – Impact fund

Background

Illegal deforestation in the Amazon has increased markedly at the end of 2010's. The Althelia Biodiversity fund promotes sustainable business models which reward sustainable products and decreases the prevalence of products derived from illegal activities. It seeks to address the global drivers of deforestation whilst simultaneously providing alternative and resilient livelihoods for local communities which depend on local resources.

Description of model

The Althelia Biodiversity Fund is a $100 million (USD) blended finance fund which pools finance from both the private sector and the public sector **1,2**. The fund is split into two different types of investments; those which are very-early stage and are thus higher risk with greater chance of failure or lower cash flow potential, and those investments which generate positive cash flow.

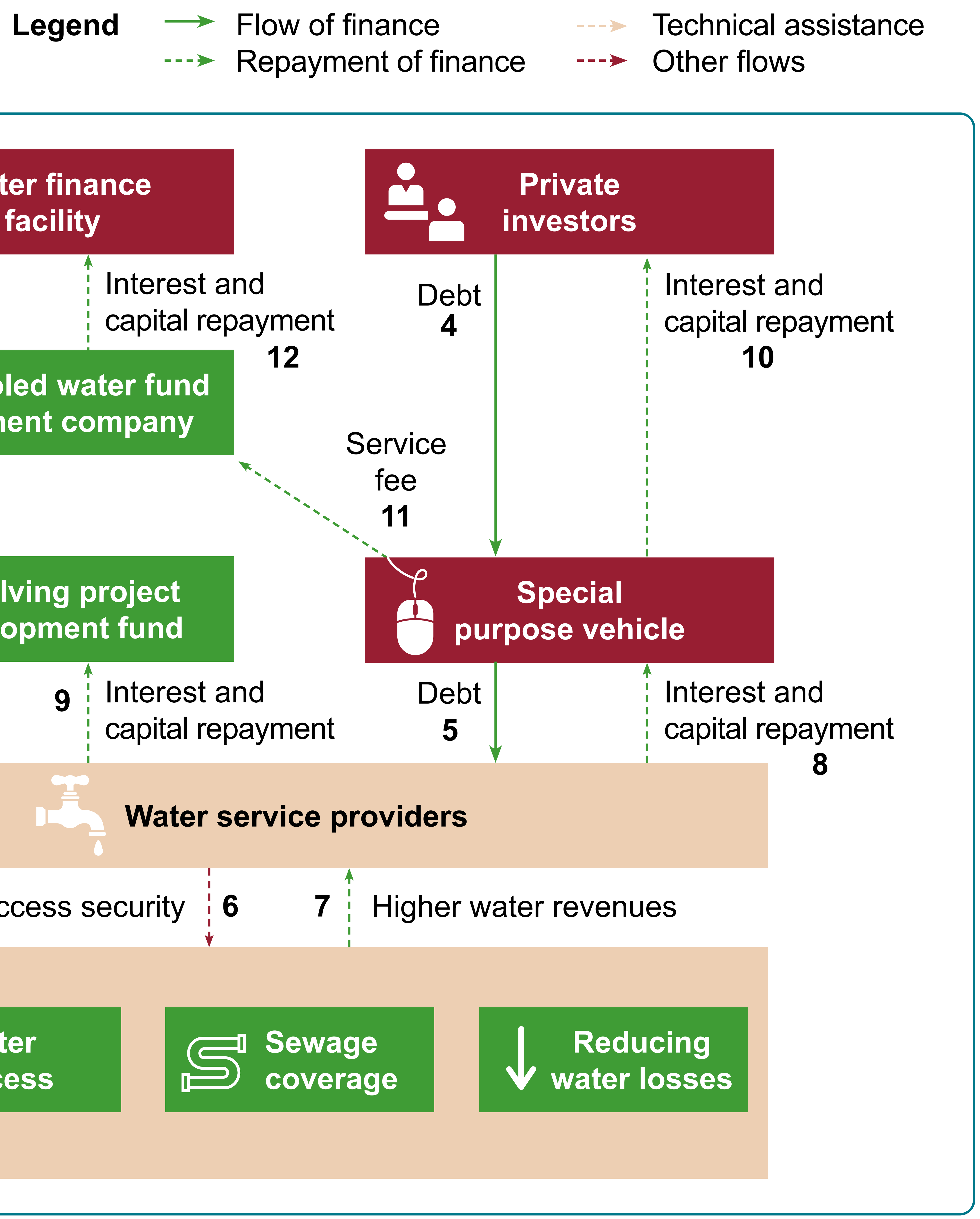
The public sectors de-risks the private sector investment by allowing investors to invest in different financial instruments and activities with varying degrees of risk and return. The fund achieve this through the use of subordinated debt (e.g. The International Centre for Tropical Agriculture [CIAT] invest in junior debt which is repaid last) and credit guarantees (e.g. USAID cover up to half of the initial debt capital paid into to the fund) which allows the public sector to cover risky investments and losses, improving the risk profile and therefore attractiveness of the investment for the private sector.

The fund uses a mixture of financial instruments, including equity, convertible debt, and variously bespoked debt instruments **3** to invest in projects which protect, restore and improve biodiversity andthe resilience and sustainability of local livelihoods, whilst avoiding further deforestation and the release of CO_2, monetised through the creation of marketable carbon credits. Projects repay the fund **4** based on the type of investment made by the fund and the project activities. Repayments are advanced to the initial public and private sector investors **5** based on the type of investments made.

Further reading: https://www.blendedfinance.earth/blended-finance-funds/2020/11/16/amazon-biodiviersity-fund

Model F – Water Fund

Click the number on each arrow to see description of model.



Adapted from World Wildlife Fund (WWF). 2020. *Bankable Nature Solutions*.

Model F – Water Fund

Background

In 2017, water coverage delivered by Water Service Providers (WSPs) stood at 55%. Sewage coverage was even lower (16%). The Kenyan population is expected to continue to grow driving further industrialisation, urbanisation and water demand. The Kenyan government is aiming to provide water and sanitisation service to its entire population by 2030. However, WSPs often struggle to finance infrastructure projects since loans are often short term with high interest rates. By pooling several loans to WSPs into a single bond transaction, a Pooled Water Fund (PWF) can attract private investment and simultaneously provide loans to WSPs with more attractive terms i.e. longer pay-back periods and lower interest rates.

Description of model

The Water Finance Facility (WFF) established the Kenya PWF **1** with equity and a first-loss contribution. A Revolving Project Development Fund (RPDF) **2** was set up to assess and finance credit worthy WSPs for project development activities for the WSPs **3**, including feasibility studies, project design and tendering works. To facilitate private finance, a Special Purpose Vehicle (SPV) is established to issue a bond **4** which will fund projects by selected WSPs **5** which reduce excess water losses, improve sewage coverage and water access to more of the Kenyan population **6**. Financial returns should be generated by the WSPs since they reduce non-revenue generating water flows and increase revenues from tariffs extending to more of the Kenyan population **7**. WSPs service the loans from the RPDF and SPV **8,9**, with the SPV making payments to investors from the proceeds **10**. The SPV also pays a service fee to the Kenyan PWF for its operational costs and coordinating viable WSP projects **11**. If relevant, repayments are made to the WFF **12** and the bond placement is de-risked with reserve funds and guarantees **13** if the bond placement doesn't generate enough funds.

Further reading: https://www.oecd.org/water/OECD-GIZ-Conference-Background-Document-Water-Finance-Facility.pdf

https://kpwf.co.ke/

Evidence Base

The evidence base for this Project has included an analysis of 2,934 Nature-based Solution (NbS) projects, extensive literature reviews, and through using expert input and review. In addition to identifying examples of NbS implementation in countries eligible for Overseas Development Assistance (ODA), the case study analysis was used to inform other work across the Project, to support and verify findings from the literature.

For further information on this data collection and analysis, please see the **Methods Document**.

In addition, 460 indicators were reviewed to provide context for biodiversity indicators measuring the impact of NbS interventions and to develop biodiversity indicator guidance. Interim reports are available which summarise this evidence base.

JNCC

Case study analysis

The case study analysis was undertaken to identify projects implementing NbS in ODA-eligible countries and, of those, which had achieved or were aiming to achieve the triple win for biodiversity, climate and people.

2,934 projects were reviewed from 34 databases. To identify relevant case studies, all 2,934 projects were assessed as to whether they met the definition of an NbS. Those projects that did meet this definition (792 projects) were then reviewed further using JNCC's selection criteria:

1. The case study demonstrated objectives which address UK Government's (i) climate change (adaptation and/or mitigation); (ii) biodiversity loss; and (iii) poverty reduction policies. The projects could address two or more objectives directly or one directly and two indirectly.
2. The project aims or objectives were clearly defined and indicative of positive future impacts.
3. There was sufficient information provided about the case study to complete a more in-depth review.
4. The project must be active or completed. Cancelled projects were not reviewed.

Those projects which met both the definition of an NbS and the selection criteria (378 projects) were then subject to a detailed assessment. Two databases were produced to summarise the available information and assessments.

The **'Database of NbS Case Studies'** contains information on the projects (378) that met both the definition of an NbS and the selection criteria. This database provides a range of information on each case study, including the geographic location, the NbS intervention type and an assessment of whether the project had achieved or was aiming to achieve the 'triple win' for biodiversity, climate and people.

The **'Library of Projects'** contains all 2,934 projects assessed for this Project. The project title, the database it is hosted in and a link are provided, as well as whether the project incorporated a clearly defined NbS.

Summaries of **12 NbS case studies** selected from the Database of NbS Case Studies are provided.

Statistics from the database of NbS case studies

External databases hosting the case studies were selected to provide examples of NbS implementation in ODA-eligible countries, with additional databases included to increase the evidence base for urban examples. This selective evidence base represents NbS implementation in this defined context and does not necessarily represent global NbS implementation.

When the Database of NbS Case Studies is filtered to projects in ODA-eligible countries (283 projects), it can be used to understand trends which could be confirmed from literature review and expert consultation. Of the NbS projects assessed in ODA-eligible countries:

67% **specified benefits for biodiversity, climate, and people.**

64% **were in the terrestrial environment.**

58% **were ongoing and yet to be completed.**

The following sections provide further analysis and conclusions which can be drawn from the Database of NbS Case Studies.

The triple win in ODA-eligible countries

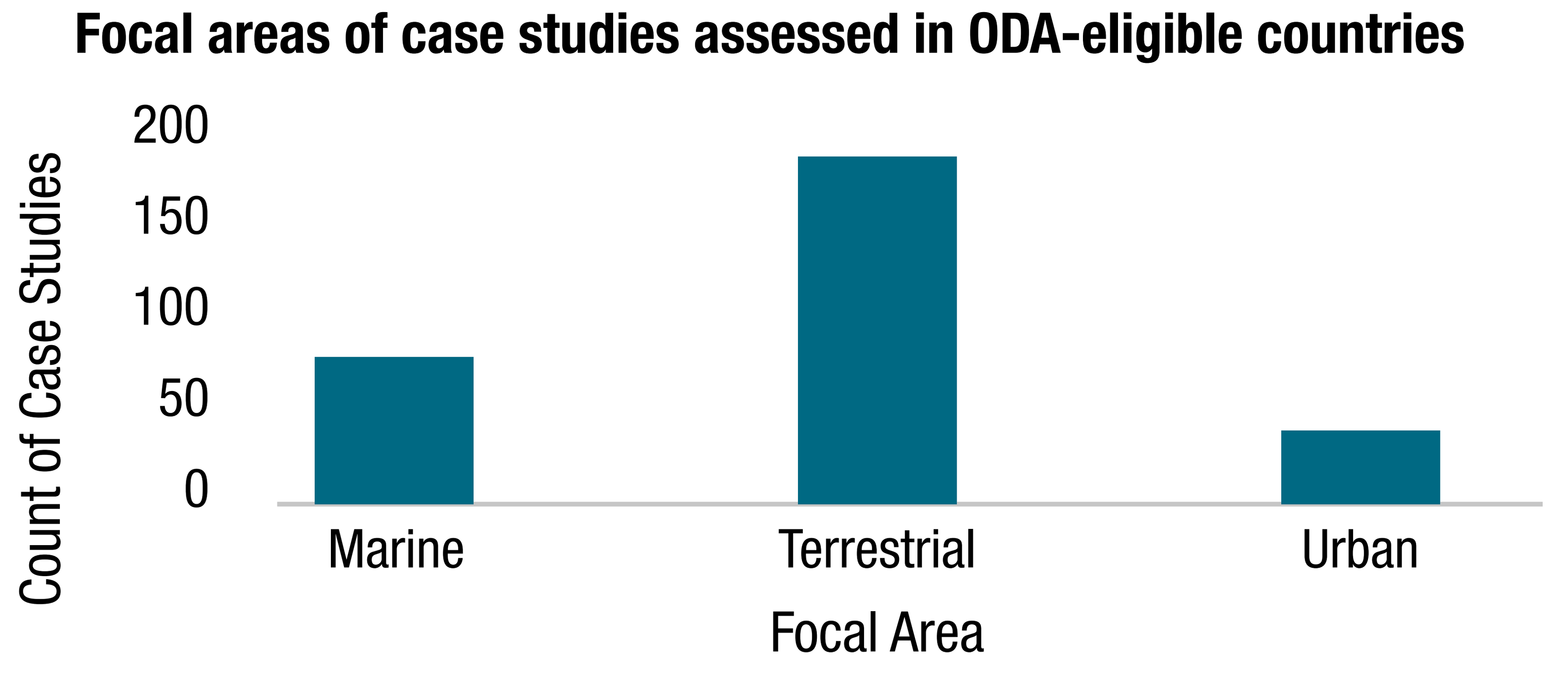
The specification of objectives for biodiversity enhancement, climate change mitigation and/or adaptation and poverty reduction were recorded for NbS case studies which passed JNCC's selection criteria. This table shows the percentage of case studies in ODA-eligible countries (283 projects) which were recorded as 'unspecified', 'qualitised', 'quantified' or 'monetised' for each of the three objectives in the triple win.

	Biodiversity enhancement objective (%)	Climate mitigation and/or adaptation objective (%)	Poverty reduction objective (%)
Unspecified	19.4	20.8	9.5
Qualitised	29.3	38.9	32.2
Quantified	50.9	38.2	54.1
Monetised	0.4	2.1	4.2

This highlights that monetisation of benefits is largely lacking, particularly for biodiversity related objectives. Of the projects selected for review, those with objectives for poverty reduction or biodiversity enhancement often used quantified metrics. The higher percentage here does not reflect quality of the indicator used. Metrics were mostly area-based proxies or reflective of activities rather than outcomes. The literature review, expert evidence, and biodiversity indicators review suggest biodiversity metrics are often inadequate, relying on activity-based rather than outcomes-based indicators. Climate change and biodiversity also had higher proportions of objectives that were unspecified – meaning the project did not mention benefits related to that objective.

Focal areas of NbS projects in ODA-eligible countries

Of the 283 projects in the Database of NbS Case Studies which were in ODA-eligible countries, the majority have been implemented in the (rural) terrestrial environment (n=180). Significantly fewer NbS were found to be implemented in the marine (n=67) and urban (n=36) environments.



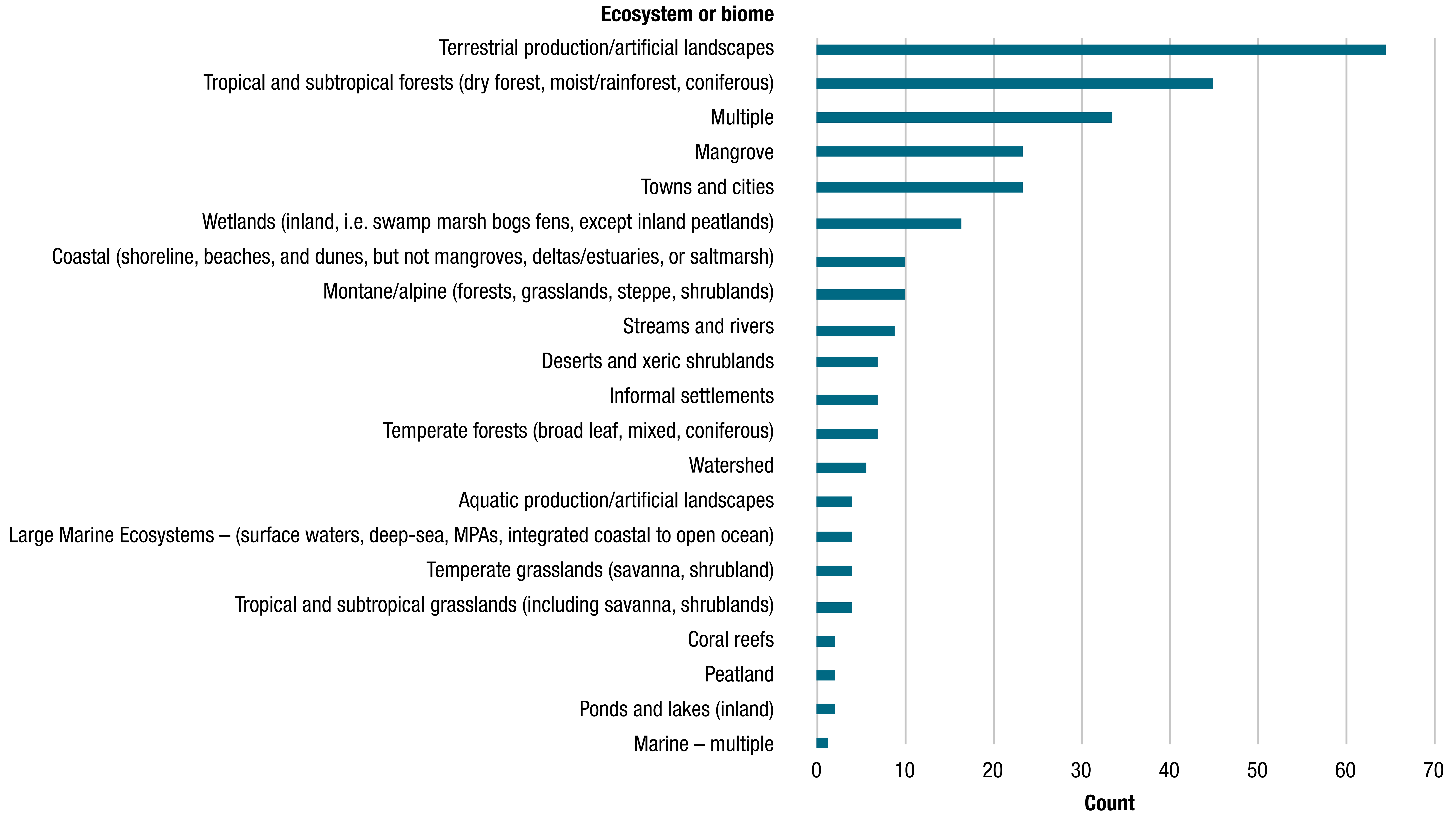
Focal Ecosystems of NbS Projects in ODA-eligible Countries

The predominant ecosystem or biome in the 283 projects in ODA-eligible countries analysed was terrestrial production or artificial landscapes (n=64), mostly agriculture. Tropical and subtropical forests made up the second most common ecosystem or biome (n=45). Several projects covered 'multiple' ecosystems (n=33), with projects using landscape, seascape and ridge to reef approaches.

Apart from coastal wetlands and mangroves, most marine ecosystems ranked among the least represented ecosystems (n=4 for Large Marine Ecosystems; n=2 for coral reefs). Grasslands (n=4 for temperate; n=4 for tropical and subtropical) and peatlands (n=2) were also seldom the ecosystem of focus. It is important to note that, whilst some ecosystems appear underrepresented, they may be in proportion to their global extent.

NbS projects in different ecosystems and biomes provide different but broad ranges of monetisable and non-monetisable benefits. For example, peatlands are estimated to store 32 percent of soil carbon on 2.7 percent of the global terrestrial area[143], and thus a small project could have a considerable impact on climate change mitigation through carbon storage. The ecosystem or biome of a particular location will be critical to determining the most appropriate intervention type, as a critical factor of the ecological context (See Principle **Account for site-specific and complex dynamic contexts**).

Ecosystem or biome of NbS projects assessed in ODA-eligible countries



Types of NbS interventions

Primary NbS intervention types were recorded for the case studies which passed the selection criteria (378 projects). The terminology recorded in our database was largely what was provided in the project documentation, or a similar such term which had already been recorded in the database. Several case studies utilised more than one intervention; in such cases the main activity or most broad category was selected as the intervention type.

The term NbS covers a broad range of interventions, with no clear dominant type. Some of the most used interventions are focused around forestry, agriculture, or infrastructure.

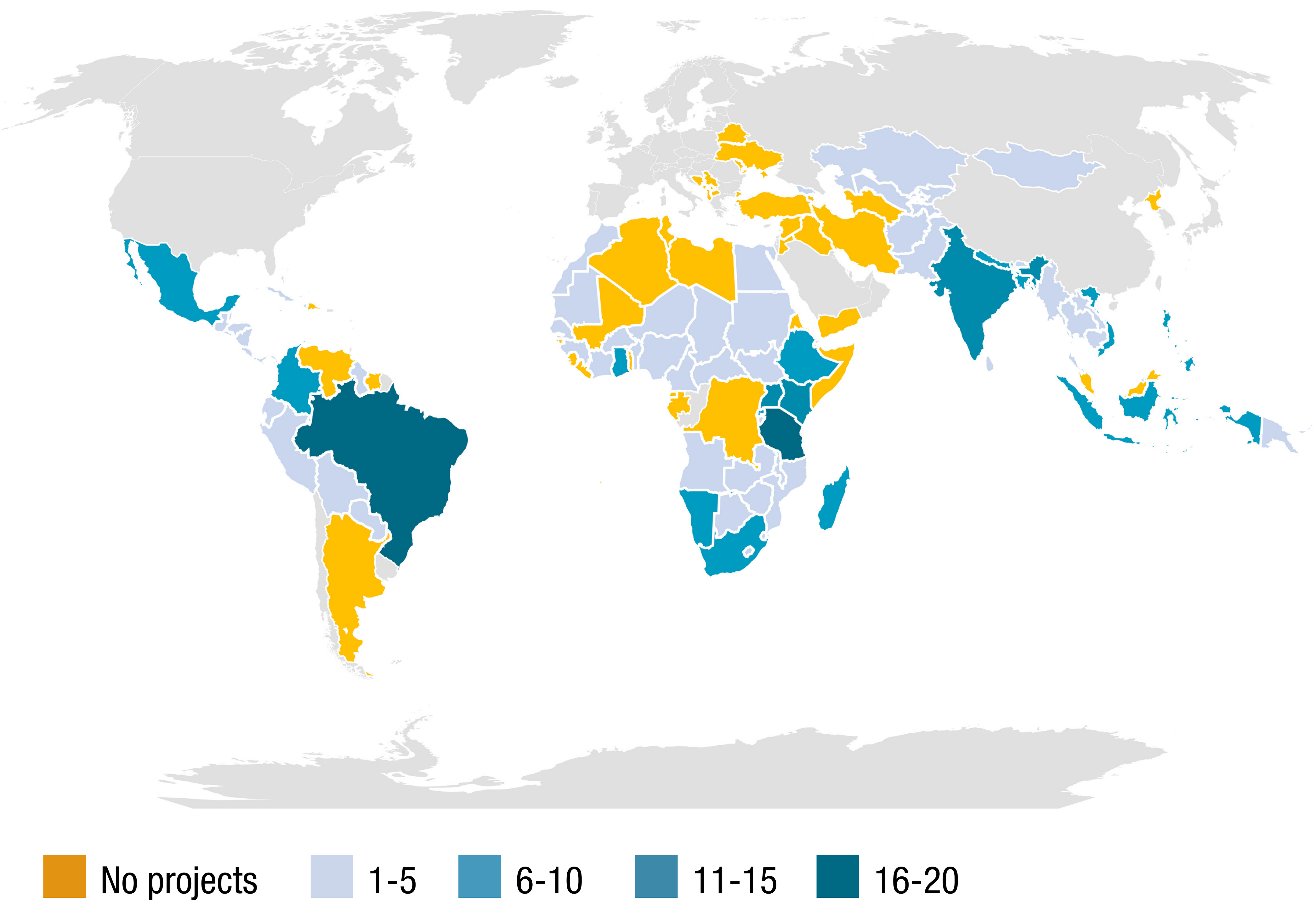
The most common NbS intervention types, (at least five recorded instances), are as follows (with a count of projects):

- Ecosystem-based Adaptation (33)
- Reforestation (31)
- Agroforestry (25)
- Restoring degraded land (25)
- Climate smart/resilient agriculture (23)
- Sustainable Drainage Systems (22)
- Urban parks (22)
- Mangrove restoration (20)
- Wetland restoration (20)
- Ecosystem-based Disaster Risk Reduction (9)
- Protected area management / establishment (9)
- River restoration and/or realignment (9)
- Tree planting (8)
- Watershed restoration (8)
- Ecosystem-based Management (6)
- Forest management (6)
- Native plant restoration, seed banks (6)
- Allotments and community gardens (5)
- Dune restoration (5)
- Integrated Water Resource Management (5)

Spread of NbS projects in ODA-eligible countries

The map shows the geographic distribution of projects in the Database of NbS Case Studies which were in ODA-eligible countries (283 projects). The distributions of projects underscore how NbS are globally applicable, but with differential uptake in different areas. Any apparent gaps – such as in North Africa or the Middle East – would need to be properly investigated before suggested for prioritisation.

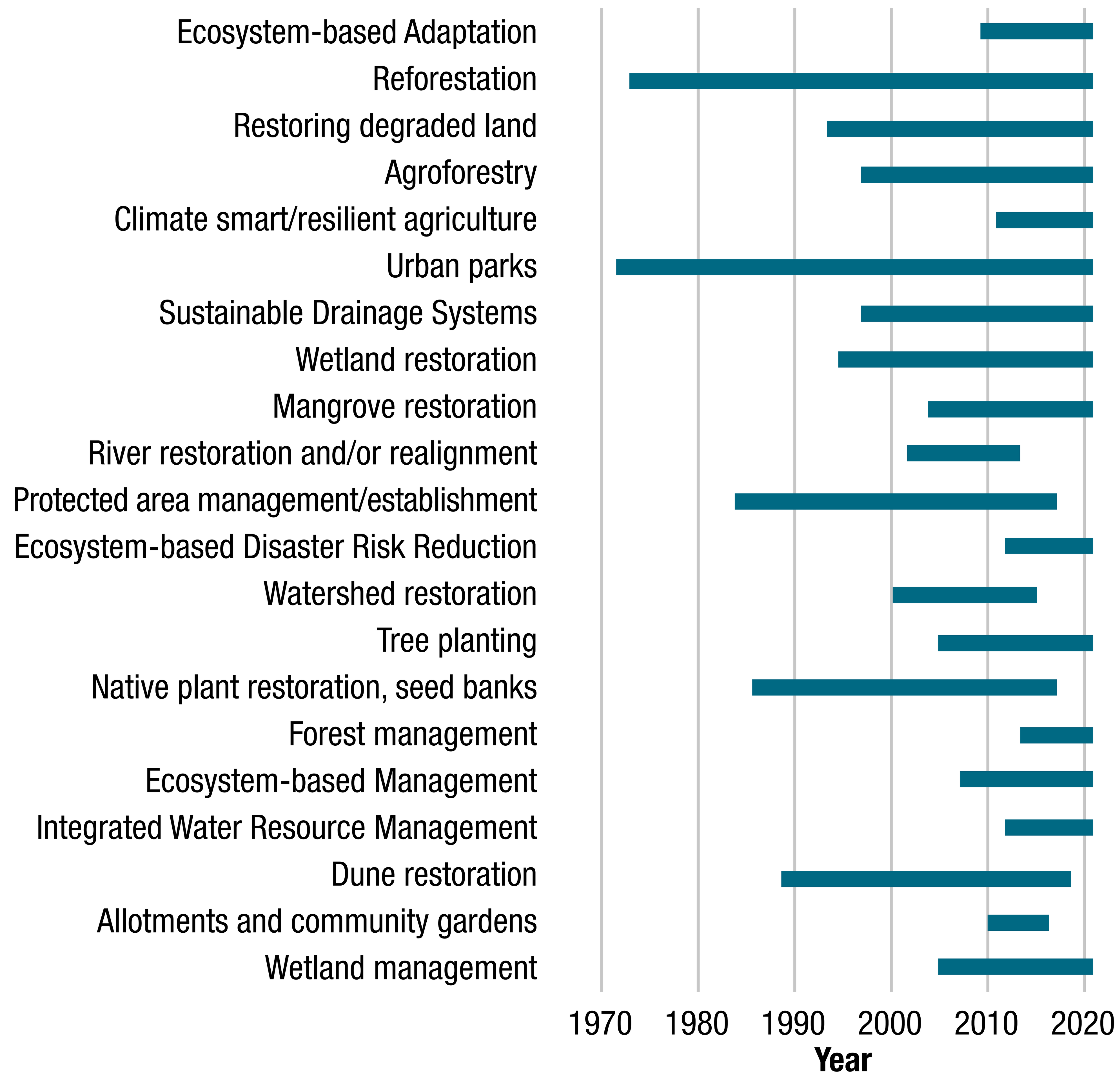
Spread of NbS projects in ODA-eligible countries



Implementation of NbS interventions assessed

The figure provides the earliest start date and latest end date of project implementation for each NbS intervention type with five or more projects recorded.

Terminology for NbS interventions in case studies assessed



This illustrates how terminology evolves through time. It does not imply that these interventions have only been used over the indicated time periods. It also highlights that some terms which fall under the umbrella of NbS have been more commonly used for longer than others, e.g. 'Reforestation' vs. 'Eco-DRR'.

Frameworks and indicators review

To inform the development of potential headline biodiversity indicators, research was undertaken into frameworks and indicators which are already operational and designed to report on biodiversity components. Indicators used in the NbS case studies identified as above were reviewed along with further 66 indicator frameworks, for a total of 460 indicators reviewed and synthesised.

While the focus of this work has specifically been on applicability to International Climate Finance (ICF) and NbS, it should be noted that much of the reviews could be relevant to other funding mechanisms, and to broader biodiversity considerations. A review of existing indicator frameworks was conducted to understand key characteristics which can help identify approaches that might be adapted for biodiversity indicators as well as understanding where problems could arise. The **Biodiversity Indicator Framework Review** aims to review existing indicator frameworks and:

- Identify key indicator frameworks to align with.
- Identify approaches to producing indicators that might be particularly relevant for headline indicators of funders.
- Identify key strengths, weaknesses, and important characteristics of indicator frameworks in relation to monitoring the performance of NbS projects.
- Provide a short summary of the most relevant indicator frameworks for headline ICF biodiversity indicators.

To recommend effective indicators for reporting impacts of funding on biodiversity, it is first valuable to understand indicators that have been designed and implemented previously. This can help ensure indicator development takes advantage of the wealth of information already available, including an understanding of the relative advantages and disadvantages of different approaches in the funding context. The **Biodiversity Indicators Review** therefore aimed to review existing biodiversity indicators in order to:

- Identify different types of biodiversity indicator that are already implemented, particularly considering which aspects of biodiversity are measured and which different approaches can be taken to measure biodiversity.
- Review and evaluate the design and implementation of the indicators, where information was available.
- Summarise the strengths, weaknesses, important characteristics of and likely effort required to calculate different types of indicator identified (in relation to ICF in particular).
- Provide a short summary of the most relevant specific biodiversity indicators identified within the review for their potential relevance to investment in NbS projects.

Spreadsheets containing collated data specific to each of the reviews is available from JNCC upon request. Key findings of the **Biodiversity Indicator Review** and **Biodiversity Indicator Framework Review** are available as supporting interim reports, and presented in the **Biodiversity Indicators in Context** chapter.

Future Directions

Based on the project's evidence and findings, several knowledge gaps and actions that can improve the uptake and effectiveness of Nature-based Solutions (NbS) have been identified. This chapter summarises these gaps, and offers suggestions to strengthen the evidence base, reduce barriers to implementation, and scale-up solutions.

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Future Direction: Support the planning and implementation of biodiversity indicators appropriate to the project or programme.

Biodiversity indicators are often insufficient or misapplied or biodiversity benefits of a project assumed. While Biodiversity conservation has been considered in Official Development Assistance (ODA) funding and other development projects for decades, it is often not directly considered or monitored – with benefits reliant on qualitative information – or monitored using indicators inadequate for indicating ecosystem function – relying solely on activity-based measurements. In some cases, harmful activities, such as habitat alteration, are treated as biodiversity benefits – such as the use of non-native species or tree-plantation in non-forested ecosystems. The **Biodiversity Indicators in Context** chapter recommends two indicators that may be more indicative of ecosystem functioning or the status of threatened species. These indicators could be developed and incorporated into project or programme design to monitor future ODA projects success in the achieving biodiversity elements of the triple win.

Future Direction: Evaluating thresholds of effectiveness for NbS to inform selection of appropriate interventions and potential complementary approaches to maximise benefits to society.

There is a lack of understanding of when NbS interventions may be insufficient in the face of climate change and disaster risk management, or where uncertainty limits uptake and scalability. Inherent uncertainties regarding NbS performance remain, given the complexity and dynamic nature of the natural systems that underpin them. Certain NbS may perform sufficiently up to a certain threshold of pressures exerted upon them, such as the strength of storm surge a mangrove or wetland will regulate. Testing or evaluating these thresholds will improve understanding of which interventions are appropriate to address particular challenges. This knowledge can help build trust with local stakeholders and assess risk exposure of investments in NbS. Identification of potential NbS shortcomings provides an opportunity to identify inclusion of other measures needed to improve long-term performance, such as incorporating storm-resilient infrastructure and early warning systems into project design.

There will be limits to the scale at which NbS present effective investments and how benefits are maximised. For instance, expanding the spatial scale of a project can result in constricted finances being stretched too far to be effective. One of the selected case studies (**Silvopastoral Systems in Colombia**) exemplifies this; as the intervention expanded across a broader spatial extent and included more communities, funding became too thinly spread and limited effectiveness in addressing poverty reduction. Greater understanding of the thresholds for upscaling projects is critical to ensure projects realise the benefits delivered.

Future Direction: Understanding the role and benefit of complementary approaches can enhance the overall effectiveness of NbS and other interventions in response to uncertain changes and building confidence to increase uptake across sectors and beyond ICF and ODA funding.

NbS can constitute one part of a suite of complementary engineered or technological approaches, including: early warning systems for disaster-risk management, remote sensing for detecting change and informing prioritisation, or building hard 'grey' infrastructure with NbS integrated. Another selected case study (**Mangrove Restoration in Viet Nam**) recognised certain limitations to mangrove restoration in protecting coastal communities from storm surges. Using local knowledge and experimentation, the project determined parameters of replanting (such as adequate spacing, root structures, and species selected) that would offer greatest protection against stronger storms. However, it was also recognised that non-NbS interventions would be necessary. Storm-resilient housing design was developed and piloted, protecting recipients of newly built homes from impacts of typhoons. Viewing NbS as complementary and not in isolation can embed NbS as a viable solution across multiple sectors, including those not focussed on biodiversity conservation or sustainable development.

Future Direction: Development of a standardised framework to assess how projects and programmes contribute to international targets and obligations to support mainstreaming of NbS.

The implementation of NbS still lacks integration and uptake in policy and across sectors. Building an evidence base which recognises the co-benefits which NbS can deliver will be critical for realising the broad range of societal problems which NbS can address. Exploring how NbS contribute to the achievement of multiple obligations under a range of Multilateral Environmental Agreements may further support mainstreaming (**NbS Principle: Consider trade-offs and synergies across multiple scales**), particularly for NbS inclusion across ODA-funded programmes. Tying NbS implementation and objectives to international agreements provides clear policy levers and strengthens the call for monitoring and reporting performance at the national level. Adequate technical capacity, training and guidance must be provided if a coherent picture is to be built via project monitoring and reporting.

Future Direction: Adaptive management approaches adopted to allow for adjustment and flexibility to work confidently with uncertainty and accommodate change as required.

Inability to accurately predict the outcomes of NbS intervention, due to complex and changing environments and socio-political contexts, creates uncertainty. NbS performance varies over temporal scales, including seasonal variability and as interventions mature over years, decades and potentially centuries. Carbon sequestration or biodiversity benefits from restoration projects will not be at peak performance at time zero. Understanding fluctuations in performance will require appropriate metrics and indicators (see **Biodiversity Indicators in Context**). Adopting an adaptive management approach enables interventions to be tailored to ongoing changes in ecological and social conditions, incorporate new knowledge as it becomes available, and cope with uncertain effects of climate change. Reviewing intervention performance and weighing benefits over extended timescales enables lessons learned to be captured and policies adjusted at relevant scales (see **NbS Principle: Emphasise an adaptive management approach**). Use of adaptive management approaches was a recognised gap in the existing literature. Robust indicators and long-term monitoring must be in place to inform adaptation to change and recognise effective pathways to replicate and ensure sustainability of benefits post-implementation.

Future Direction: Identification and analysis of approaches to maintain post-project monitoring and longevity could help reveal how best to ensure benefits are sustained long-term.

Post-project evaluations of outcomes present a significant gap in available information. The lack of post-project evaluations, especially after five-to-ten years post-implementation, leads to uncertainty around project impact as the objectives for the triple win and NbS are often delivered on longer timescales. This gap is likely due to a lack of funding post-implementation. Funders should consider cost effective means for monitoring and reporting long-term impacts. Funders could request that extended cost-benefit analyses be included in project plans or consider investment in local institution capacity building to a level sufficient that ensures long-term monitoring and maintenance of project activities (see **NbS Principle: Design for longevity and futureproofing)**. Ways to extend the longevity of NbS performance monitoring and benefits delivery might include:

- Long-term funding or requirement to provide extended cost-benefit analysis
- Building local capacity and creation of participatory approach
- Partnership with local NGOs or other established institutions

These approaches must be contextually tailored, consider multiple scales, and societal equity. For example, project-level capacity development plan can result in newly trained experts leaving for other opportunities. Creating a plan to train a critical mass of relevant specialists at the local or national level introduces resiliency to carry out long-term monitoring, evaluation and maintenance.

Future Direction: Understanding shortcomings and failure is critical to the collective learning process. Documenting and sharing knowledge on these factors can enhance the delivery of NbS overall.

The existing evidence base for NbS primarily comes from reports to donors, skewing the evidence towards positive stories and outcomes. Examples of projects with negative consequences exist in scientific literature but, as projects are linked to donors, the unexpected outcomes are not necessarily discussed openly at the fund and forum level. Ecosystem disservices are unintended negative consequences arising from project delivery, whereby human wellbeing and the ecosystem are undermined or detrimentally harmed. Failure to recognise and address potential harm caused by NbS may constrain or undermine the links between ecosystem services, biodiversity and human wellbeing[144]. This knowledge gap highlights the importance of incorporating a ‘do no harm’ principle into project planning and implementation, and the need for project safeguards (see **NbS Principle: Put in place social and environmental safeguards**).

Future Direction: Diversify interventions and ecosystems for NbS implementation.

Marine ecosystems and urban environments are underrepresented in NbS implementation, as are NbS in non-forested ecosystems in the terrestrial environment. From the assessment of NbS projects, the majority of projects reviewed were implemented in terrestrial environments. This is likely due to easier implementation, monitoring, and the direct and discernible impact they have on poverty reduction in local communities. Given the scale of urban interventions, they are less likely to have meaningful positive impacts at programmatic scales, especially for biodiversity. In the marine context, identifying appropriate interventions that qualify as NbS and operate beyond the coastal or intertidal zones is a challenge. Additionally, once an NbS is implemented, understanding benefit flows to beneficiaries and monitoring can be particularly complicated in a marine context. Therefore, ascertaining the benefits returned from investments designed to achieve the triple win are hard to determine in marine cases outside coastal or intertidal areas.

Of the terrestrial projects implemented in ODA-eligible countries, approximately half involved primary intervention types which focused on tree planting. There appears to be an under-representation of non-forested ecosystems within the terrestrial environment, such as grasslands and wetlands, which often host high biodiversity and significantly contribute to carbon sequestration[145]. Diversifying the ecosystems in which NbS are implemented could result in strong positive impacts for achieving the triple win. Spatial prioritisation may once again play a role in selecting ecosystems to pilot NbS interventions.

A key aspect of NbS is considering implementation at landscape- or multi-ecosystem scales which could incorporate this diversity. Furthermore, implementing NbS to address broad societal problems necessitates thinking about upstream or downstream effects. To address water security in one community, solutions such as riparian buffers may need to be implemented upstream. To prevent displacement of harm from a project site to another location, the connectivity of the broader ecosystem must be recognised. Funding NbS implementation could contain an element of research and innovation, emphasising diverse ecosystems as well as novel approaches to improve connectivity of multiple ecosystems and diversity of interventions utilised. Existing ‘Ridge to Reef’ and watershed-scale approaches offer a potential starting point.

Future Direction: Capturing the wide range of benefits in NbS project appraisal can help demonstrate the cost-effectiveness of NbS, highlight suitable financial benefits and opportunities for private investors, and improve project design.

Economic evaluations – including cost-effectiveness or value for money – of NbS have been rarely conducted, particularly as part of post-project evaluations. Where economic cases are developed, they often do not account for the full range of benefits of NbS. Co-benefits, especially biodiversity, are underrepresented in the economic case for NbS or not valued appropriately. This contributes to the uncertainty regarding the cost-effectiveness of NbS in comparison with engineered solutions or business as usual practices. Economic assessments at project appraisal stage which more accurately and comprehensively reflect the quantitative and qualitative benefits encourage the design of projects which explicitly target, monitor and monetise qualitative aspects of a triple win NbS. Additionally, this informs public sector investment in projects equally beneficial across the triple win objectives, as well as private sector and impact investment by highlighting both the financial benefits and social returns in parity. This is especially valuable when attempting to evaluate interventions across a diversity of ecosystems and geographies. Making a comprehensive economic assessment a prerequisite for funding would develop the evidence base and ensure non-monetisable benefits are given parity with monetised or financial benefits.

Future Direction: The public sector can foster the necessary enabling conditions for investment in NbS by the private sector.

There is a large gap in the funding required to undertake NbS projects across the globe to help meeting domestic and international climate and biodiversity targets or obligations. Whilst the public sector is unlikely to be able to fill this gap itself, it can create the conditions necessary to stimulate further private sector involvement in appropriate NbS projects. Pre- and post-project economic assessment which measure and monitor both the social and environmental benefits, as well as the financial benefits in which the private sector can invest, is likely to demonstrate the viability of NbS projects for a wider range of potential investors. Increasing evidence and performance data available to the private sector which align with reporting metrics and KPIs, as well as regulating investment practices (e.g. by requiring compliance with reporting frameworks that incorporate nature-related risks) will advance the mainstreaming of NbS investments by the private sector.

Glossary

Glossary

Adaptation (to climate change) = The process of adjustment toactual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects[77].

Adaptive management = A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices. In active adaptive management, management is treated as a deliberate experiment for purposes of learning[147].

Adaptive capacity = The general ability of institutions, systems, and individuals to adjust to potential damage, to take advantage of opportunities, or to cope with the consequences[147].

Afforestation = Converting grasslands or shrublands into tree plantations. Afforestation is sometimes suggested as a tool to sequester carbon, but it can have negative impacts on biodiversity and ecosystem function[147].

Agroforestry = Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and animals, in some form of spatial arrangement or temporal sequence[147].

Alternative livelihoods = An approach to conserve biodiversity by substituting one livelihood activity that is causing harm to a species or habitat (such as bushmeat hunting or firewood collection) with another activity, or resource, that will cause less harm. Although its primary outcome is to alleviate threats to biodiversity, a strong secondary outcome is to improve the wellbeing of certain targeted groups of people[148].

Benefit-cost ratio = The ratio of the present value of benefits to the present value of costs. It provides a measure of the benefits relative to costs[117].

Biodiversity = 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[149].

Carbon market = A market where carbon shares are traded. Carbon shares are also known as pollution or carbon credits. Carbon market functions with a limit on allowable level of emissions. Polluters who are under this set cap can sell their excess emission rights to those concerns who have crossed this cap[150].

Carbon sequestration = The long-term storage of carbon in plants, soils, geologic formations, and the ocean. Carbon sequestration occurs both naturally and as a result of anthropogenic activities and typically refers to the storage of carbon that has the immediate potential to become carbon dioxide gas[147].

Carbon storage = The biological process by which carbon in the form carbon dioxide is taken up from the atmosphere and incorporated through photosynthesis into different compartments of ecosystems, such as biomass, wood, or soil organic carbon. Also, the technological process of capturing waste carbon dioxide from industry or power generation and storing it so that it will not enter the atmosphere[147].

Carrying capacity = In ecology, the carrying capacity of a species in an environment is the maximum population size of the species that the environment can sustain indefinitely. The term is also used more generally to refer to the upper limit of habitats, ecosystems, landscapes, waterscapes or seascapes to provide tangible and intangible goods and services (including aesthetic and spiritual services) in a sustainable way[147].

Climate risk = A measure of the probability of harm to life, property and the environment that would occur if a hazard took place. Risk is estimated by combining the probability of events and the consequences that would arise if the events took place. It denotes the result of the interaction of physically defined hazards with the properties of the exposed systems i.e. their sensitivity or social vulnerability[150].

Climate-smart/resilient agriculture = An integrated approach to increase food production sustainably and optimize productivity with efforts to strengthen the resilience to climate change and variability and reduce agriculture's contribution to climate change[86].

Co-benefits = The positive effects that a policy or measure aimed at one objective might have on other objectives, irrespective of the net effect on overall social welfare. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits[77].

Cost-Benefit Analysis (CBA) = A decision tool which judges the desirability of projects by comparing their costs and benefits[150]. It assesses the impact of different options on social welfare, valuing all relevant costs and benefits in monetary terms, unless it is not proportionate or possible to do so[117].

Cost-Effectiveness Analysis (CEA) = A decision tool which compares alternative ways of producing the same or similar outputs[117].

Decentralisation = The transfer of authority and responsibility for public functions from the central government to the subordinate government and/or private sector. It includes political, administrative, fiscal and market dimensions[150].

Deforestation = Human-induced conversion of forested land to non-forested land. Deforestation can be permanent, when this change is definitive, or temporary when this change is part of a cycle that includes natural or assisted regeneration[147].

Do No Harm principle = To prevent and mitigate any negative impact of actions on affected populations[151].

Discount rate = The annual percentage rate at which the present value of future monetary values is estimated to decrease over time[117].

Displacement = Reduction of an impact in one place results in the impact starting or increasing in another location, counteracting the benefits of the initial reduction (project definition).

Ecological engineering / Ecoengineering / Bioengineering = The design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both[52].

Ecosystem resilience = Ecosystems suffer natural disturbances (strong winds, fires) that affect their structure and operation, to which they respond through the recolonization of vegetable species in the affected areas. The recovery time is directly dependent upon the intensity and extension of the disturbance. The ecosystems' capacity to approximately return to the state prevailing prior to the disturbance is called resilience[150].

Ecological restoration = The attempt to repair or otherwise enhance the structure and function of an ecosystem that has been impacted by disturbance or environmental change[57].

Ecosystem-based adaptation (EbA) = The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change[152].

Ecosystem-based disaster risk reduction (Eco-DRR) = The sustainable management, conservation and restoration of ecosystems to provide services that reduce disaster risk by mitigating hazards and by increasing livelihood resilience[154].

Ecosystem services = Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth[155].

Endemic = Native to, and restricted to, a particular geographical region. Highly endemic species, those with very restricted natural ranges, are especially vulnerable to extinction if their natural habitat is eliminated or significantly disturbed[150].

Enrichment planting = The planting of desired tree species in a modified natural forest or secondary forest or woodland with the objective of creating a high forest dominated by desirable (i.e., local and/or high-value) species[150].

First loss contribution = A subordinate capital layer which acts as a buffer for a portfolio[155], identifying the party, or the provider, which will bear the first losses. This can be in the form of equity, grants, guarantees, or debt[157].

Free, Prior and Informed Consent = Consent given before access to knowledge or genetic resources takes place, based on truthful information about the use that will be made of the resources, which is adequate for the stakeholders or rights holders giving consent to understand the implications[147]. It is a specific right that pertains to indigenous peoples, recognised in the United Nations Declaration on the Rights of Indigenous Peoples.

International Climate Finance (ICF) = Official Development Assistance from the UK to support developing countries to respond to climate change. Around half is spent on adaptation – helping countries and people to build resilience to the current and future effects of climate change. And half is spent on mitigation – reducing greenhouse gas emissions and supporting clean growth. This statistical release has been produced for the purpose of accountability to the UK public for ICF investments[158].

Indigenous and local knowledge systems = Indigenous and local knowledge systems are social and ecological knowledge practices and beliefs pertaining to the relationship of living beings, including people, with one another and with their environments. Such knowledge can provide information, methods, theory and practice for sustainable ecosystem management[147].

Integrated Coastal Zone Management (ICZM) = An integrated approach for sustainably managing coastal areas, taking into account all coastal habitats and uses[77].

Integrated Water Resource Management (IWRM) = A process that promotes the coordinated management of water, land and related resources to maximise economic and social welfare without compromising ecosystem sustainability[159].

Invasive species = species that are introduced, accidentally or intentionally, outside of their natural geographic range and that become problematic[150].

Landscape approach = Dealing with large-scale processes in an integrated and multidisciplinary manner, combining natural resources management with environmental and livelihood considerations[86].

Mainstreaming = Incorporating a specific concern, e.g. sustainable use of ecosystems, into policies and actions[155].

Mitigation (of climate change) = A human intervention to reduce the sources or enhance the sinks of greenhouse gases[77].

Monoculture = The agricultural practice of producing or growing a single crop, plant, or livestock species, variety, or breed in a field or farming system at a time[147].

Multi-criteria analysis = A decision tool that integrates and weights different types of monetary and non-monetary information, based on ecological, social and economic criteria: economic valuation of ecosystem goods and services can be incorporated as one of these criteria[150].

Natural capital = An economic metaphor for the limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services. Natural resources, like water, air and soil[150].

Natural or ecological infrastructure = A concept referring to both services by natural ecosystems (e.g. storm protection by mangroves and coral reefs or water purification by water and wetlands), and to nature within man-made ecosystems (e.g. microclimate regulation by urban parks)[150].

Nature-based Solution = Actions which enlist elements of nature or natural processes to address a particular problem, or suite of problems, faced by society and which deliver multiple benefits in the form of public goods (for further information, please see the **Methods Document**).

Official Development Assistance (ODA) = When support, expertise or finance is supplied by one government to help the people of another country. Commonly known as 'overseas aid'[160].

Opportunity cost = the value which reflects the best alternative use a good or service could be put to[117].

Payment for ecosystem services (PES) = Market-based approaches using payments or rewards to encourage or discourage specific practices in natural resources management[150].

Protected area = a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives[152].

Reforestation = Re-establishment of forest through planting and/or deliberate seeding on land classified as forest[153].

Restoration = Any intentional activities that initiate or accelerate the recovery of an ecosystem from a degraded state[147] (wider definition).

= Any activity with the goal of achieving substantial ecosystem recovery relative to an appropriate reference model[32] (definition used for the ecological restoration indicator guidance).

Resilience = The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation[77].

Safeguard (Environmental and Social) = procedures to prevent and mitigate undue harm to people and the environment in the development process. Safeguards help assess the possible environmental and social risks and impacts (positive or negative) associated with a development intervention, and define measures and processes to effectively manage risks and enhance positive impacts[161].

Seed zone = geographically delineated areas within which seed can be transferred with little risk of maladaptation. The use of seed zone maps helps ensure that plant materials are adapted to the local environment and improves restoration success[162].

Silvopastoral systems = Agroforestry arrangements that combine fodder plants with shrubs and trees to increase animal nutrition and yield through natural processes, whilst also improving resource use efficiency and providing environmental services[163].

Social cost of carbon = The cost of impacts associated with an additional unit of greenhouse gas emissions[68].

Sustainable Forest Management = A dynamic and evolving concept, that is intended to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations[153].

Sustainable Land Management = the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions[164].

Traditional knowledge = Knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity[165].

The 'triple win' = Actions which simultaneously contribute to biodiversity enhancement, climate change mitigation or adaptation, and poverty reduction policies. This is also referred to as the triple win for biodiversity, climate, and people (for further information, please see the **Methods Document**).

Value for Money (VfM) = How well a project optimises net social costs and benefits based on consideration of numerous factors including performance against SMART objectives, net value of social benefits, resource costs, and costs of mitigating or managing risks[117].

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Nature-based Solutions
Case Studies

The following 12 case studies were drawn from a review of 2,934 projects (see **Evidence Base** chapter) and were selected from the **Database of NbS Case Studies** through a shortlisting process (further information can be found in the **Methods Document**). These case studies provide a summary of 12 NbS projects in ODA-eligible countries that demonstrate how the projects provide a triple win for biodiversity enhancement, climate change mitigation and/or adaptation, and poverty reduction.

JNCC

Applying Ecosystem-based Disaster Risk Reduction for Sustainable and Resilient Development Planning in the Koh-e Baba, Afghanistan

© Alec Knuerr | UNEP

Achievements:

Biodiversity
235,380 saplings of indigenous and resilient species planted.

Climate
Flood risk-reduction and training has **strengthened community resilience** to climate change.

People
Training provided skills for **270** community members which enabled them to earn up to **six times** more income based on projections.

Executing entities:

UN environment programme | European Commission

with 12 project partners

Location: Afghanistan

Dates: 2013–2016

Ecosystem: Montane Rangelands

Nature-based Solution: Ecosystem-based disaster risk reduction (Eco-DRR)

Context

The Koh-e Baba, located in the west of Afghanistan's Central Highlands, range up to 5,000 m above sea level and hold several glaciers and areas of permanent snow and ice. The mountains support a diversity of flora and fauna, including several endemic plant species and breeding bird populations, as well as approximately 14,700 people across 22 mountain villages. The area is subject to multiple environmental hazards, including flooding, landslides and avalanches. Most villages become isolated during the winter months, and widespread poverty and a reliance on natural resources, such as land and irrigation water, make communities particularly vulnerable. Unsustainable land use has caused considerable environmental degradation, and climate change has led to unpredictable weather patterns, both of which increase the risk of environmental disasters. To reduce environmental risks and support community livelihoods in the area, this project implemented Eco-DRR through a landscape approach – promoting sustainable development and ecosystem restoration.

Project objectives:

- To demonstrate the effectiveness of Eco-DRR in reducing the risks of floods, harsh winters and avalanches, and providing multiple benefits for local livelihoods.
- To develop local and national capacities for implementing Eco-DRR through a landscape approach.
- To inform national and provincial policies and planning by mainstreaming Eco-DRR.

Funding:

- European Commission – $250,000 (USD).
- UNEP staff costs in kind.

Project approach

The project used a bottom-up approach to development planning, firstly facilitating environmental sustainability and disaster risk reduction in seven local villages, and then promoting Eco-DRR through landscape-scale national planning processes.

The sustainable use of natural resources and disaster risk reduction measures were promoted through the development of a Green and Resilient Development Planning template, and through influencing the Shah Foladi Protected Area Management Plan. Tree nurseries were established to provide natural infrastructure to mitigate flooding, as well as fruit for additional income, and a hydropower pump was developed as a sustainable irrigation method. Tree planting focussed on stabilising stream banks and reducing soil erosion in the upper valleys, to reduce flood risk to lower valley villages. Community resilience centres and disaster preparedness teams were established to provide shelter and aid in response to disasters. The project increased the capacity of national planners and actors in relation to Eco-DRR, through several workshops, trainings and partnerships focussed on strengthening collaboration, as well as through supporting national policy and planning processes that promote risk-informed sustainable development.

Project outcomes

The highlights of the interventions were as follows:

- A **local database** on ecosystem health and environmental hazards of Koh-e Baba was established.
- A **Green and Resilient Development plan** was developed and tested.
- **210 participants** from communities, government and universities were involved in a 'training of trainer' programme, with trainers delivering nursery management training to **270 community members**.
- **Six community tree nurseries** were established, with fruit trees projected to provide up to **$6,000 (USD)/2000m²/year**.
- **235,380 saplings of indigenous and resilient species** planted across **seven villages** to reforest and regenerate degraded slopes.
- **Three community resilience centres** were established.
- **Over 100 people trained** on disaster preparedness and early warning, and several local first aid teams established.
- **Two university partnerships** were established to mainstream Eco-DRR into academic curricula.
- **Increased government engagement** in the post-2015 national and global policy consultations on Eco-DRR.

Lessons learnt

- **Work with existing administrative structures and planning processes:** Supporting and strengthening current planning frameworks promoted greater ownership and sustainability.
- **Mainstream in national policy:** Promoting Eco-DRR as a key component of humanitarian and disaster management supported policy advocacy. However, changes in government staff resulted in long delays.

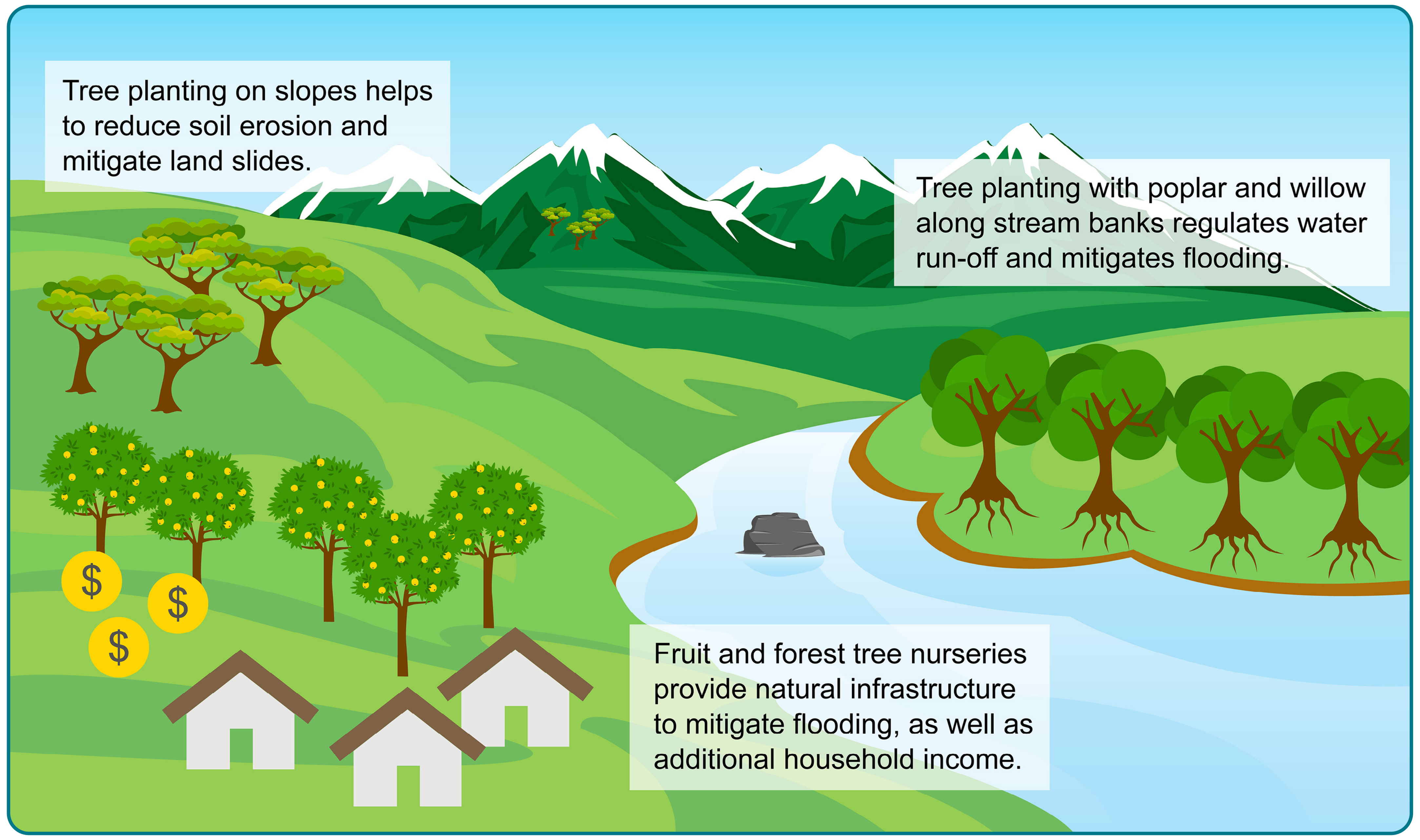


Diagram of the NbS interactions showing that ecosystem-based disaster risk reduction provides benefits for biodiversity, livelihoods and climate change adaptation.

- **Ensure project sustainability:** Community engagement promoted local interest in continuing initiatives, whilst mainstreaming Eco-DRR into policy and education ensured awareness and capacity could be maintained.
- **Consider gender norms:** Despite efforts to involve women in field activities, 70% of participants were men due to cultural and religious norms. To address this, awareness training was promoted on the importance of women to natural resource management.

Sustainability and legacy of project

The project demonstrated the potential of Eco-DRR, and developed community and government capacity to facilitate further action. The Green and Resilient Development Planning approach provided a framework for future sustainable development, and environmental community centres and Standard Operating Procedures will ensure long-lasting community resilience to disasters. By mainstreaming Eco-DRR within national policies, there is now greater collaboration between entities, and more financial resources. The project has also helped to inform the Sendai Framework for Disaster Risk Reduction (2015-2030), and is now being replicated in four other provinces. Additionally, a regional network of experts has been established, promoting further capacity building and strengthening Eco-DRR in the region.

Further information:

https://pedrr.org/casestudy/mountain-partners-afghanistan/

Return to Principles

Community-led Adaptation to Climate Change through Coastal Afforestation in Bangladesh

© UNDP Bangladesh

Achievements:

Biodiversity
Restore, improve and protect coastal biodiversity through the plantation of **9,870 ha** of mangroves and **444 ha** of native fruit tree species.

Climate
Increased carbon sequestration capacity equating to approximately **$2,895,000 (USD).**

People
$1,454,656 (USD) net benefit for additional income of households. **5876** households with increased food and income security.

Executing entities:

Ministry of Environment and Forest, Government of Bangladesh | UNDP

with five implementing partners

Location: Bangladesh

Dates: 2009–2015

Ecosystem: Coastal

Nature-based Solution: Coastal afforestation

Context

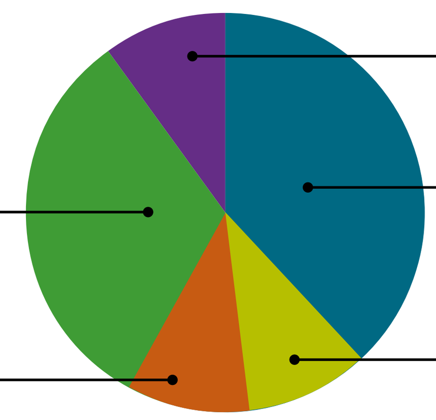
Many communities in Bangladesh are situated close to the shoreline and are reliant on agriculture and fishing for their livelihoods. Impacts of climate change, including sea level rise and increased cyclone storm surges increase the severity of flooding, coastal erosion and threaten the safety and well-being of the local communities. To reduce the vulnerability of coastal communities to the impacts of climate change, this project focussed on enhancing coastal resilience in four coastal communities through community-led adaptation interventions, focussing on coastal afforestation and livelihood diversification. Furthermore, to identify and address risks in changing weather patterns and other climate-related issues, this project also focussed on increasing local government and community resilience capacity.

Project objectives:

- To reduce vulnerability and enhance resilience of coastal communities to the impact of climate change-induced risks in four Coastal Forest Districts.
- To enhance national, sub-national, and local capacities of government authorities and planners to understand climate risk dynamics in coastal areas.
- To develop a functional system for the collection, distribution, and internalisation of climate-related knowledge.

Funding:

- Total project budget: **$8,550,398 (USD)**



Project approach

- The project implemented **community-led adaptation** interventions, focusing on coastal afforestation and livelihood diversification;
  - The **'Forest, Fish, and Fruit'** (FFF) model was the main intervention developed and involved planting protective and productive vegetation, with an elevated mound and ditch structure interspersed with fish nursery ponds.
  - Mechanisms such as rainwater harvesting, micro-surface and ground water treatment facilities were developed to **secure sources of potable water.**
- To support identifying and addressing climate change risks, national and community capacity was increased through **targeted training.**
- To increase community resilience to climate change impacts in coastal areas, **methods of adaptation** to climate risks were integrated into legislation related to coastal zone regulations.
- A system for the collection, distribution, and internalisation of climate-related knowledge was developed to **promote the sharing of project knowledge,** both within Bangladesh and with other countries.

Project outcomes

- Successful afforestation of: **9,650 ha** of mangroves, **112 ha** of FFF model (non-mangrove dyke plantations), **332 ha** of native fruit tree species (*Psidium guajava, Ziziphus mauritiana* and *Cocos nucifera*) on mounds, **680 km** strip plantation along embankment roads and **220 ha** of demonstration afforestation with mangrove species.
- **5,876** households benefitted from increased food security and income.
- **950** government officials at sub-district and Union level were trained. Adaptation plans adopted for the four sub-districts.
- **Livelihood support measures** were supported and co-financed by local government (e.g. road or educational infrastructure).
- **17** training manuals and technical papers disseminated at national and international workshops and on the project webpage.
- The post-project evaluation estimated the value of **carbon sequestration** to amount to **$2,895,000 (USD)**, for the total of 9,650 ha of mangroves planted.
- Total net benefits were valued at **$1,454,656 (USD)**, or a benefit-cost ratio in excess of three for the additional income of household beneficiaries from the FFF model.

Lessons learnt

- The **cooperation** and **participation** of government agencies was essential for timely and efficient implementation of the project.

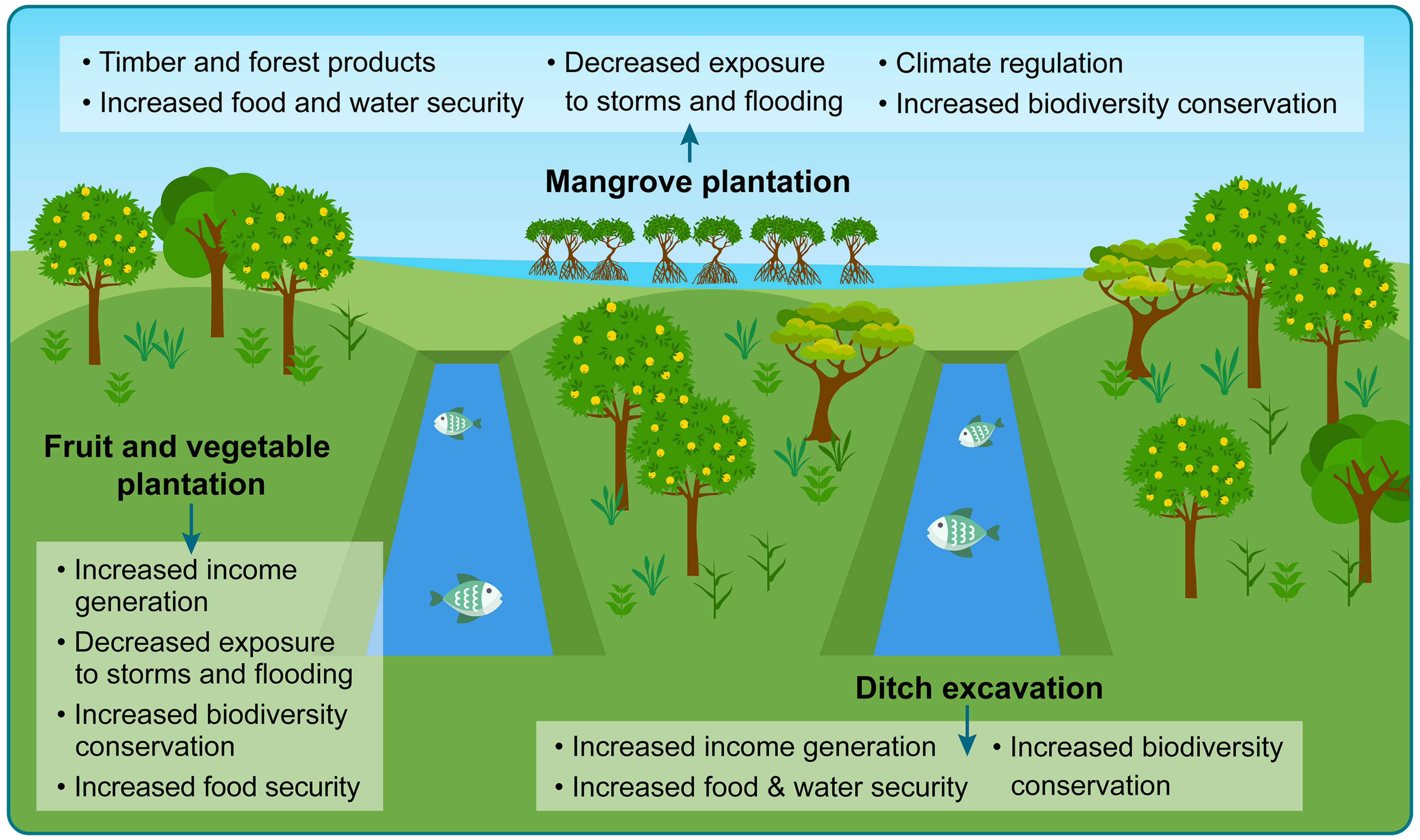


Diagram of the NbS interactions showing that the FFF model can contribute towards multiple benefits.

- Understanding **local environmental conditions** such as, the frequency and height of tidal inundation, is important, as these had the potential to threaten the FFF livelihoods initiatives and therefore **adaptive management measures** should be applied, ensuring to take climate projections into account.
- Social inequality often hinders the level of community participation. Addressing these **social barriers** (e.g. **gender inequality**) can **support proactive involvement** of local communities.

Sustainability and legacy of project

The project has prompted funding by GEF to replicate the FFF model in a further four districts. The ongoing income and resource generation from diversification will increase the adaptive capacity of coastal communities in Bangladesh and can help to sustain the FFF model in any anticipated conditions induced by climate change. The project will further generate adaptation benefits by facilitating the integration of climate risk into existing poverty reduction and rural development strategies. National and international dialogue forums will continue to provide opportunities for identifying similarly vulnerable areas within and outside of Bangladesh where a similar approach may be suitable for use.

Further information:

https://www.weadapt.org/placemarks/maps/view/138

Return to Principles

Community-led Mangrove Restoration and Management to Protect Coastal Ecosystems and Livelihoods in Madagascar and Indonesia

© Blue Ventures | Garth Cripps

Achievements as of 2019 in Madagascar:

Biodiversity
6,229 ha of native mangrove forest protected or under sustainable local management.

Climate
149,974 tonnes of CO_2 emissions prevented by decreased rate of mangrove deforestation.

People
20.2% of people profiting from established alternative sustainable livelihoods; **$116,930 (USD)** total income generated.

Executing entities:

blue ventures beyond conservation

with three project partners

Location: Madagascar and Indonesia

Dates: 2016–2024

Ecosystem: Mangroves

Nature-based Solution: Mangrove Restoration and Management

Context

Mangroves are incredibly productive ecosystems that provide a number of ecosystem services, such as coastal protection, nursery habitats and the capture and storage of carbon from the atmosphere. These services support marine biodiversity, climate change mitigation and traditional livelihoods of vulnerable coastal communities in Madagascar and Indonesia. However, the mangroves in Madagascar and Indonesia face a number of pressures associated with unregulated harvesting, as well as the increasing demand for seafood from a rapidly growing population. Consequently, these habitats and their provision of ecosystem goods and services are being lost through deforestation at an alarming rate. Restoration and effective local management of mangroves can reduce the rate of deforestation, improve local livelihoods, prevent carbon emissions, and aid the recovery of these important habitats.

Project objectives:

- **To reduce mangrove deforestation**, generating livelihood and environmental benefits worth many times the project investment.
- **To increase climate resilience** in coastal communities through blue carbon, forestry management and fisheries management.
- To work with local communities, the private sector and government to **create new sustainable livelihoods** for local communities.
- **To support community health and women's empowerment** through the replication of Blue Ventures' Population Health-Environment model.

Funding:

- UK Government, Department for Environment, Food and Rural Affairs – £10.1 million (GBP).

Project approach

The project comprised of the following four parallel areas of work:

- **Blue carbon and forestry management:** The project focused on conservation agreements for sustainable use of mangroves, establishing robust monitoring and enforcement, and monetising the carbon storage value of mangroves.
- **Fisheries management and improvement projects:** Frameworks for sustainable small-scale fisheries management were established. These frameworks included gear restrictions or periodic closures, with trade-offs mitigated through alternative livelihoods.
- **Mangrove livelihood diversification:** Livelihood interventions, such as aquaculture or apiculture, were identified, piloted and implemented.
- **Community health and women's empowerment:** Community health services were integrated with mangrove management efforts through the replication of Blue Ventures' Population-Health-Environment model.

The project **engaged local communities, government, and key stakeholders** across the 'blue growth' sector. The project follows **UNEP standard monitoring and evaluation processes** and procedures, and carbon sequestration estimates validated by **Plan Vivo carbon standards**.

Project outcomes

The expected outcomes of the full-term duration of the programme (eight years) are as follows:

- **181,678 ha** of mangrove forest protected under sustainable local management.
- Through conservation and restoration, **1,194 ha** of mangrove forests saved from deforestation.
- Ecosystem service benefits including regulating services (erosion control and storm protection), providing services (e.g. timber and charcoal) and cultural services (recreation and aesthetic) from mangrove restoration and management worth **$524,259 (USD) per year**.
- Reducing the rate of the deforestation of mangroves and preventing **c.1.7 Mt of CO_2 emissions** through sustainable forestry and fisheries management.
- **98,589 carbon credits** produced with a minimum of **50% revenue shared** with communities.
- **61,000 people** with income or livelihood benefits worth **$1.3 million (USD)**, achieved through established mangrove livelihood diversification.

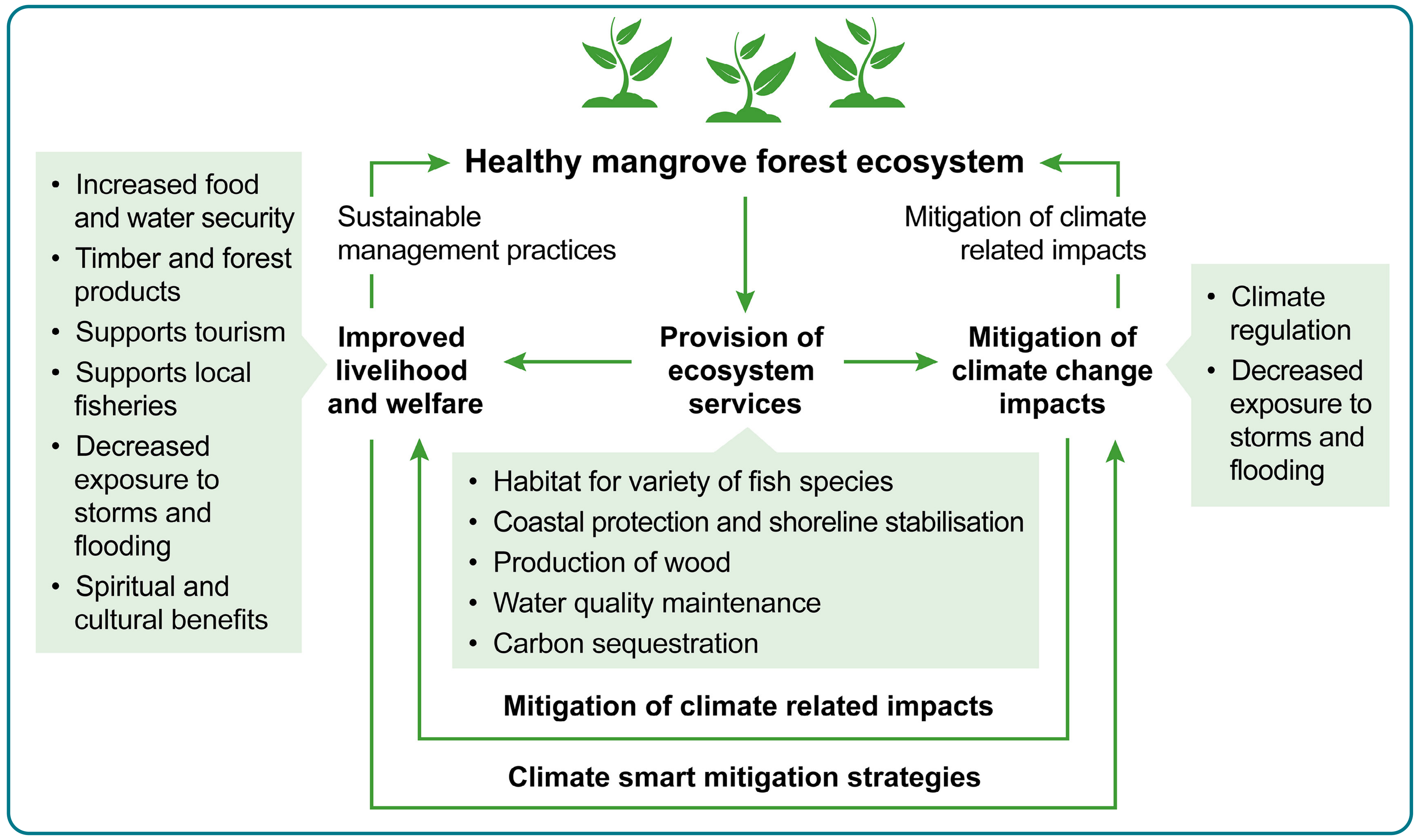


Diagram of NbS interactions showing that mangrove restoration can contribute towards multiple benefits.

Lessons learnt

- Initial buffer period critical to account for potentially unforeseen challenges and delays due to differences in social and political climates.
- Account for potential legal obstacles, and associated resource implications, when developing work plans.
- Important to balance trade-offs and requirements of coastal communities, national and regional government authorities against the specifications of the carbon standard.
- Developing partnerships has ensured that the project is able to reach a scale quickly and is also aware of ongoing changes in policy and legislation so it can, where possible, adapt accordingly.

Sustainability and legacy of project

As this project is still ongoing it is not possible to fully conclude the sustainability and future potential of the project. In terms of effectiveness as of 2019, the project had met the target for eight output indicators, overachieved on five indicators and underperformed on three indicators. Spending power remains high for the programme which will continue to be monitored. There is additional scope to extend the lifetime of the project, as well as expand its geographical scope to other mangrove-rich tropical countries, if it is successful during the initial eight-year period.

Further information:

https://blueventures.org/conservation/blue-forests/

Return to Principles

Implementing Wildlife-friendly Agroforestry and Sustainable Forest Management in Bolivian Indigenous Territories

© WCS | Robert Wallace

Project achievements as of 2020:

Biodiversity

22% increase in avian diversity; increased native tree diversity in agroforestry plots.

Climate

On track to sequester or avoid **199,046 tCO_2e** by project completion.

People

271 indigenous producers have yield and income benefits, including **102%** increased income for cacao producers.

Executing entities:

WCS – Wildlife Conservation Society, 125 years | tekokavi – facilitando el aprendizaje para vivir bien

Location: Bolivia

Dates: 2017–2021

Ecosystem: Tropical and subtropical forests

Nature-based Solution: Agroforestry

Context

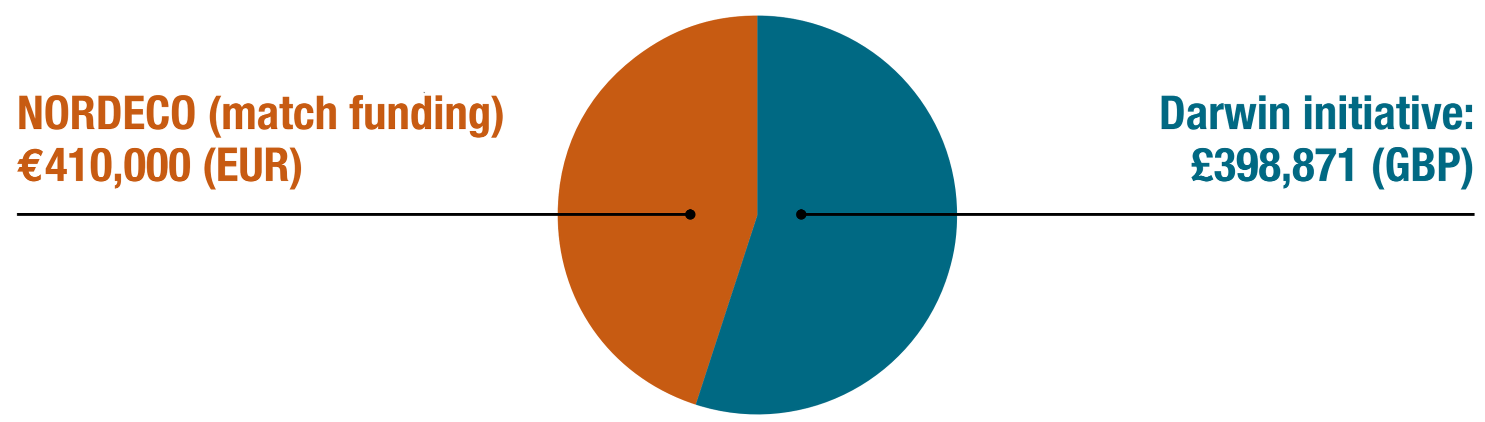
The T'simane Mosetene, Leco and Tacana indigenous territories in Bolivia cover over 1,000,000 ha bordering and overlapping the Madidi and Pilón Lajas protected areas. This region contains globally important avian diversity and populations of vulnerable wide-ranging species, such as jaguar and spectacled bear. This region's high biodiversity value is threatened by deforestation from illegal agricultural clearing and settlements, timber extraction and gold mining. This deforestation and degradation negatively impacts forest-dependent community livelihoods, perpetuating a cycle of poverty. Indigenous communities in the region benefit from access to collective lands. By supporting indigenous community efforts to maintain control over these lands, coupled with investments to support sustainable agroforestry, this project aims to address the abovementioned threats. This, in turn, delivers benefits for biodiversity, local livelihoods, and safeguards the capture and storage of carbon from the atmosphere.

Project objectives:

- To **conserve** over 1,000,000 ha of highly biodiverse forests by addressing threats in the region.
- To **increase the capacity of indigenous communities** to control and protect their forests.
- To **strengthen livelihoods** by improving coffee and cacao **agroforestry management**.
- To **increase avian diversity** in and around agroforestry plots.

Funding:

- Total project budget: approx. **£751,347 (GBP)**



Project approach

Cacao and coffee-based agroforestry are important livelihood alternatives for indigenous communities in the region. By building technical capacity in agroforestry through training workshops, communities have improved agricultural productivity and greater access to markets, supporting and diversifying local livelihoods. Well-managed agroforestry plots with diverse shade tree canopy also provide habitat for birds and other wildlife, and increase carbon storage. The project supports a decentralised and cost-efficient system for control and vigilance of indigenous territories. By strengthening the capacity of widely distributed agroforestry producers through communication protocols, threat mapping and rapid collective response, communities are able to exert territorial control over large areas.

Project outcomes

Highlights of the project interventions by March 2020:

- Through agroforestry, **271 indigenous producers** have **increased productivity** of cacao by 85%, or of coffee by 203%.
- Average annual household income **increased by 102%** for cacao producers.
- **Avian diversity increased by 22%** inside agroforestry plots and is 69% higher compared to monoculture crops.
- 13 coffee producers are **certified under the Smithsonian standards as "bird friendly".**
- System developed for **reporting illegal encroachment**s on 636,466 ha of indigenous territories.
- **Restoration of 336 ha** of agroforestry plots and native groves using agroforestry approaches (pruning, soil management and diversifying canopy shade trees).
- Established **127 ha of new agroforestry systems** as an alternative to slash-and-burn agriculture.
- **591 indigenous producers** (including 154 women) **trained** in pre-harvest management of agroforestry plots and native cacao forest groves, surpassing targets.
- **Post-harvest management** improved through 12 workshops on quality control and development of six community processing infrastructure 'modules'.

Further expected outcomes by project completion (2021):

- Engage further producers to expand activities.
- As income from coffee has stabilised, the **marketing strategy** will be adapted to access higher paying markets.
- An estimated **152,672 tCO_2e** absorbed in new agroforestry plots, as well as **46,374 tCO_2e** prevented through 80 ha of avoided deforestation.

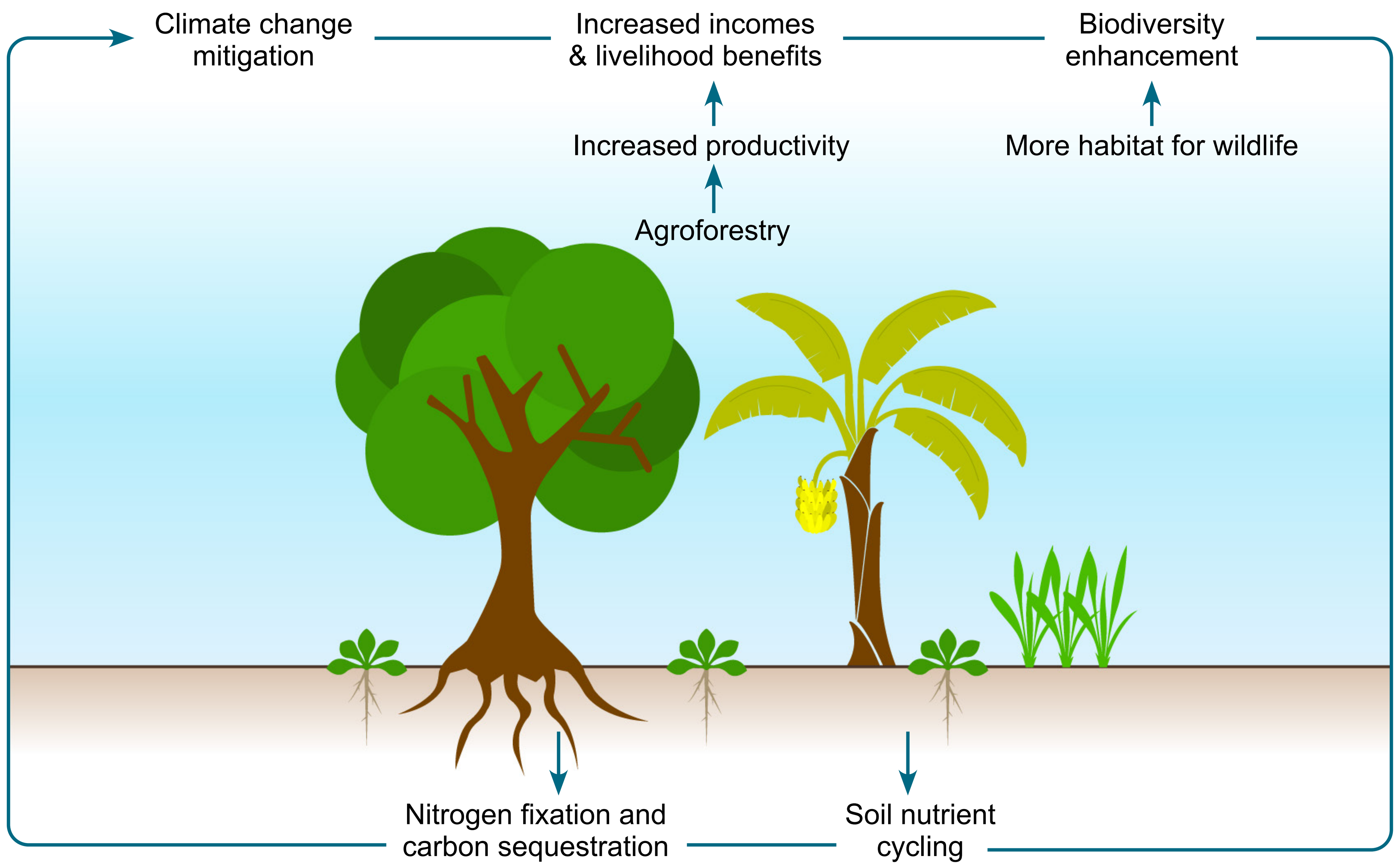


Diagram of the NbS interactions showing that agroforestry provides benefits for climate change mitigation, poverty reduction and biodiversity.

Lessons learnt

- **Adapt to the context:** The socioeconomic impacts arising from gold mining in the region represents an obstacle for promoting sustainable agroforestry. Promoting the high-quality and increased value of products from agroforestry has been recognised as an effective mechanism to continue gradually increasing the number of producers.
- **Utilise adaptive management:** Climate change is a significant challenge to farmers, threatening production in years of extreme drought and rain. The project responded by transplanting wild cacao relatives to agroforestry plots and diversifying the crops planted. This increased genetic variability and promoted varieties more resilient to extreme weathers.
- **Engage local communities:** One indigenous culture was more interested in other forest products. The project **adapted the engagement approach** by focussing on activities which required less time commitment, such as agroforestry management.

Sustainability and legacy of project

By working with established producer organisations in the region operating under approved and legitimate indigenous management plans and natural resource use regulations, longevity of activities beyond the project duration is promoted. Sustainability and legacy are also supported by the transference of technical knowledge to producer organisations and empowering indigenous communities to govern and control their land. Economic sustainability was enhanced through increased household incomes and market linkages.

Further information:

https://www.darwininitiative.org.uk/project/DAR24011/

Return to Principles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Community Reforestation to Enhance a Buffer Zone Around a Landfill Site in a South African City

Project achievements as of 2020:

Biodiversity
786,894 trees and other plants of over **141 species planted** in **712 ha** of land. Bird species increased from **91 to 197.**

Climate
On track to **sequester 42,214 tCO_2e** over a 20-year period.

People
635 jobs created.

Executing entities:

ETHEKWINI MUNICIPALITY | WILDLANDS

with in-country partners

Location: South Africa

Dates: 2008–2025

Ecosystem: Towns and Cities

Nature-based Solution: Reforestation

Context

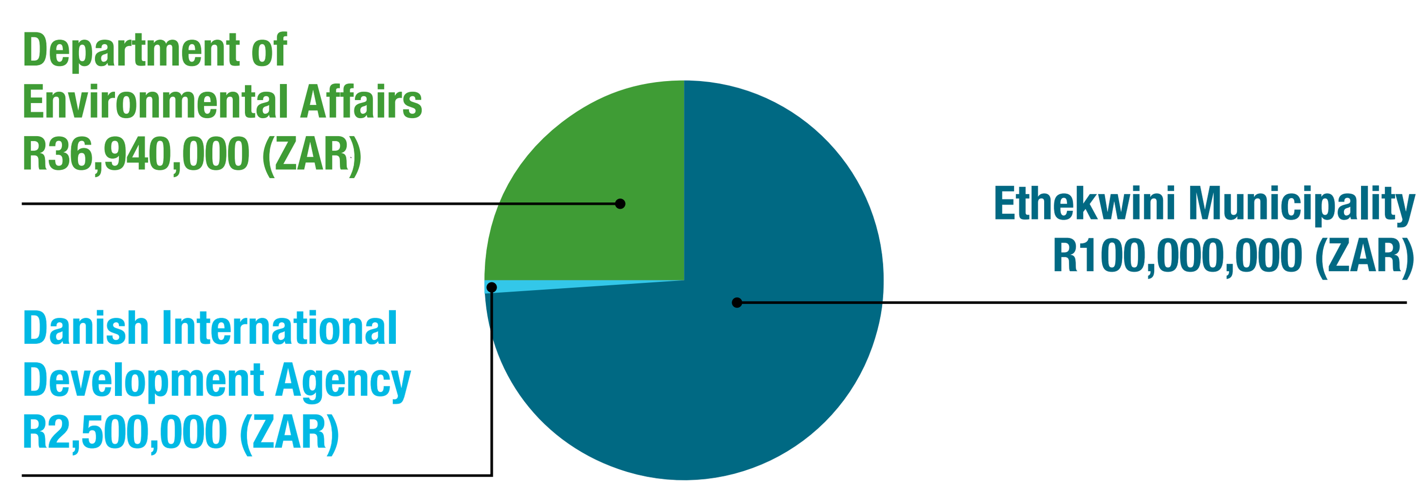
The Buffelsdraai Landfill Site is the largest regional waste landfill site owned and managed by eThekwini Municipality's Durban Solid Waste Department. All landfill sites by law are required to have a buffer zone to screen nearby communities from views and odours. The 787 ha Buffelsdraai buffer zone was under sugarcane production for around 100 years, which resulted in a severe loss of biodiversity on the site and, in many areas, wetlands were drained and forest pushed back for additional sugarcane to be grown. The sugarcane farms did create employment, but mainly for workers from neighbouring Lesotho and few benefits were generated for local communities. The initial aim of the Buffelsdraai Reforestation Project was to offset a portion of the CO_2 emissions associated with Durban hosting part of the 2010 FIFA World Cup™. However, the project quickly demonstrated how restoring forest can increase the capacity of people and biodiversity to adapt to, and support the mitigation of, climate change impacts.

Project objectives:

- Improve the biodiversity of the site, through forest restoration using locally indigenous species.
- Ensure job creation and skills development for local community members.
- Offset a portion of CO_2 emissions associated with Durban's hosting of several 2010 FIFA World Cup™ football matches.

Funding:

- Total project budget: R139,440,000 (ZAR) (approx. £7,027,706 GBP).



Project approach

The Reforestation Project was implemented through the Wildlands Conservation Trust's (WCT) Indigenous Trees for Life Programme. This Programme assists unemployed people who are subsequently known as 'Tree-preneurs' to set up small-scale indigenous tree nurseries at their homes until they are ready to be traded. On collection of the trees, tree-preneurs are paid with credit notes that can be used at 'tree stores' organised by WCT to purchase goods. Tree-preneurs are drawn from local communities from the peri-urban areas directly adjacent to the Buffelsdraai Landfill Site. Collected trees are kept in a holding nursery at the project site and are sorted according to size and species, ready to be hardened off prior to planting. A separate team maintains the site after planting is complete. This includes cutting grass and controlling non-native plants. Fire management is also undertaken to minimise the destruction of newly planted trees.

Project outcomes

Highlights of the interventions as of 2020 were as follows:

- A comparison of food security levels before and during the initiation of the project showed that people who **reported that they "sometimes go hungry the whole day" were reduced from 80% to less than 50%.**
- Approximately **R13,000,000 ZAR (approx. £655,194 GBP) in social benefits** were provided to the local community between 2009-2015.
- **786,894 trees and other plants of over 141 species** planted in 712 ha of land. The planted trees included over 46 locally indigenous species.
- **Bird species seen increased from 91 to 197.**
- **A total of 99 full-time, 24 part-time and 512 temporary jobs were created.**
- Projected to **sequester 42,214 tonnes of CO_2 equivalent** over a 20-year period, offsetting a proportion of Durban's hosting of FIFA matches (declared as 307,208 tCO_2e).
- A total of **32,000 training days** delivered to employees to develop skills related tree nurseries, tree planting and site management.

Lessons learnt

- **Engage communities in a participatory approach:** Community engagement from the onset of the project was essential to help community members understand the value of the project, as well as to ensure project ownership and project sustainability.
- **Consider the co-benefits:** The project has demonstrated that forest restoration can provide direct socio-economic benefits to surrounding communities through enhanced ecosystem functioning. By communicating these co-benefits, community buy-in is increased.

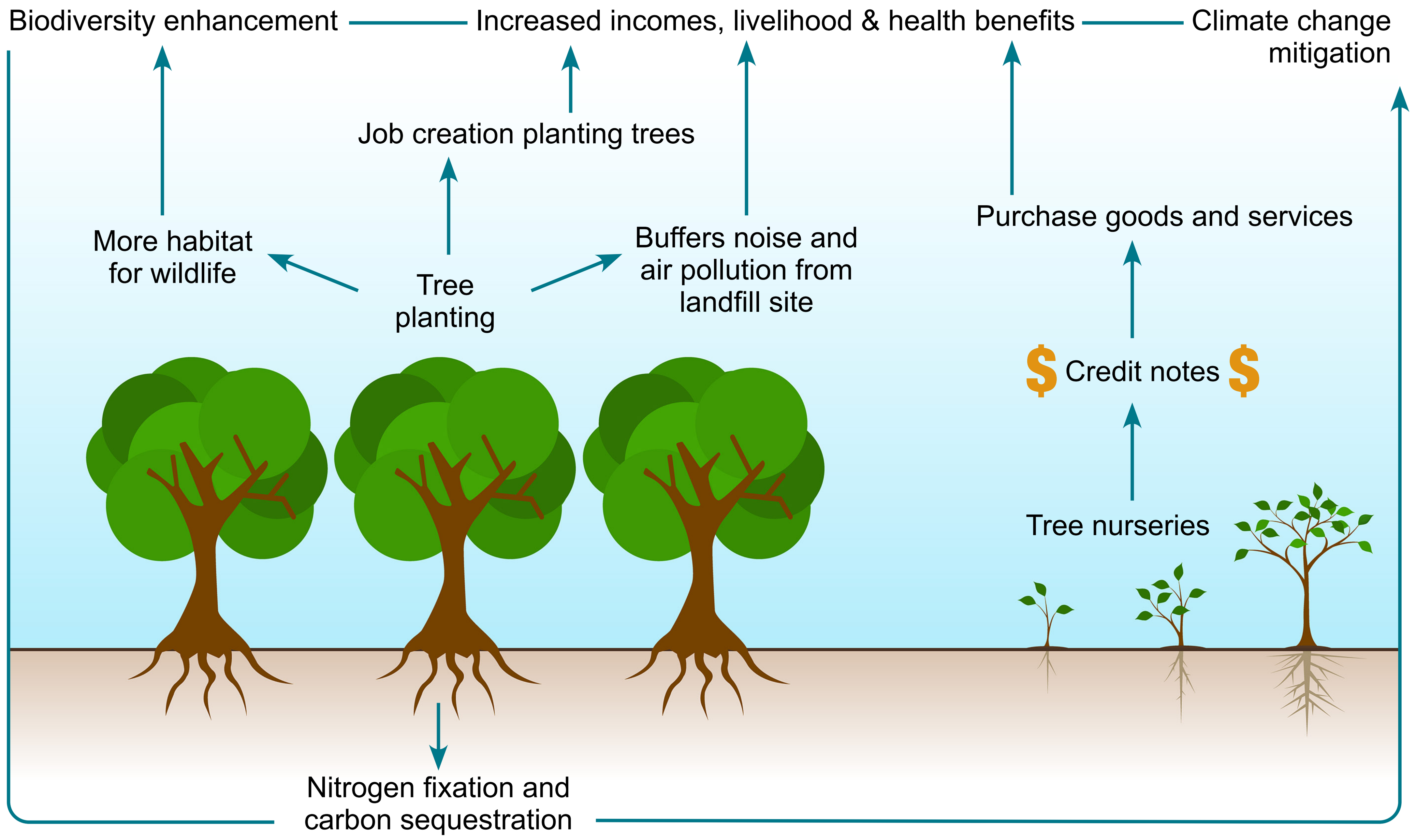


Diagram of the NbS interactions showing how urban reforestation can provide benefits for climate change mitigation, poverty reduction and biodiversity.

Sustainability and legacy of project

Through the success of the Buffelsdraai project, two other projects have subsequently been initiated in the eThekwini Municipality, one at iNanda Mountain and one at Paradise Valley Nature Reserve.

The Reforestation Centre of Excellence was established at the Buffelsdraai Reforestation project site. This centre will showcase the innovative reforestation techniques, on-site research by local students, and use of sustainable technologies in the building itself. Periodic monitoring of biodiversity on the site will be done between 2011 and 2050, and a plot-based study is underway to investigate the success of different planting approaches. EThekwini Municipality, through its Environmental Planning and Climate Protection Department, will undertake post-implementation maintenance and monitoring.

Further information: https://panorama.solutions/en/solution/urban-eba-and-drr-ethekwini-municipality-durban-buffelsdraai-community-reforestation

Return to Principles

Implementing Drought-resilient Ibis Rice in Cambodia

Project achievements as of 2020:

Biodiversity
7% increase in critically endangered bird's nests protected.

Climate
Adaptation to climate change through **579** households using drought-resilient seeds.

People
Basic Necessity Survey scores increased by **0.34**; increased food security.

Executing entities:

Sansom Mlup Grey

with project partners

Location: Cambodia

Dates: 2017–2021

Ecosystem: Terrestrial production landscape

Nature-based Solution: Climate-resilient agriculture

Context

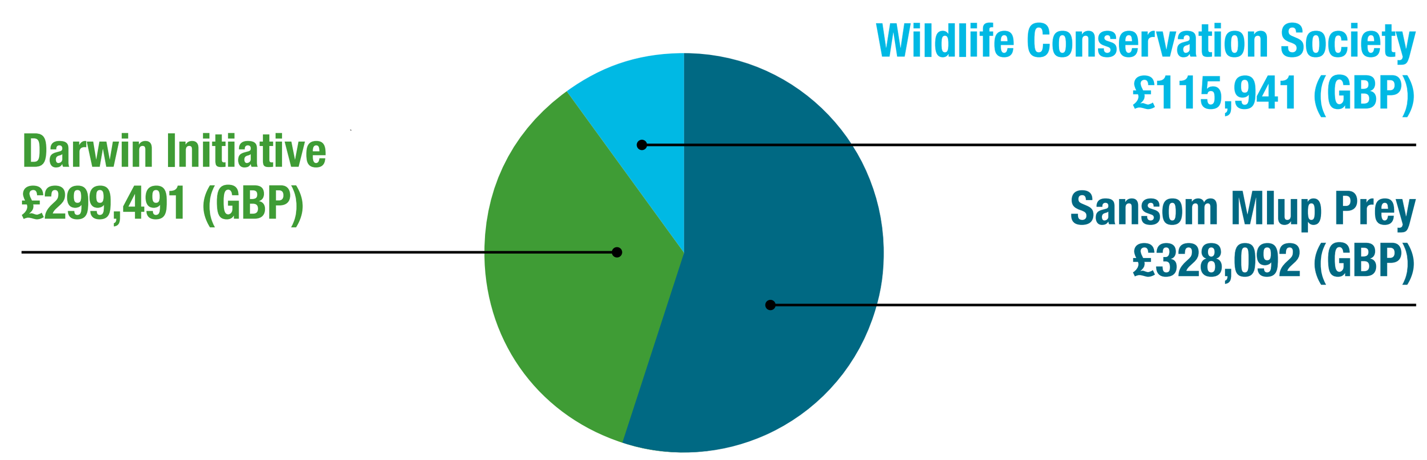
Northern Cambodia supports over 50 species of global conservation concern, including the Giant and White-shouldered Ibises. Three protected areas together cover more than 400,000 ha of forest and wetland which support more than 20,000 people. Local communities of this region are amongst the poorest in Cambodia and are dependent on the forest and land resources within the protected areas for their livelihoods. Sansom Mlup Prey (SMP) successfully established the Ibis Rice concept, which provides local communities with an incentive to engage in conservation by offering farmers a premium price if they abide by conservation agreements. These agreements are designed to protect the rare waterbirds and other species that use the protected areas. The rules and regulations are developed by local communities and are approved by government. Despite previous project success, climate change-induced droughts – for which the area is considered extremely vulnerable – threaten the wildlife-friendly farming that forms the link between improved incomes and biodiversity conservation. As a result, this project promotes climate-resilient agriculture to overcome the trend of decreasing productivity resulting from climate change, whilst expanding the Ibis Rice scheme to provide further conservation and livelihood benefits.

Project objectives:

- To **expand** implementation of the Ibis Rice concept.
- To work with wildlife-friendly Ibis Rice farmers to adopt a **drought-resilient rice strain** and new **soil conservation techniques**.
- To **increase income** and improve **food security** of > 2,500 households.
- To **reduce habitat loss** across 400,000 ha forest and **protect threatened species**.

Funding:

- Total project budget: **£743,524 (GBP)**



Project approach

By implementing drought-tolerant organic-certified seed, complementary soil conservation techniques, and crop diversification this project promotes soil fertility, sustainable production, secure livelihoods and improves farmer resilience to climate change. From previous Ibis Rice projects and research, it is estimated that farmers who follow wildlife-friendly compliance, and can thus sell their rice into the scheme, improve their incomes by at least 20%. This premium incentivises farmers to join the Ibis Rice scheme and abide by conservation agreements. Additionally, switching to a drought-resilient rice strain and implementing new soil conservation techniques will improve food security in protected areas where here are no legal alternative food or income sources during drought years. Ibis Rice devolves decision-making process surrounding natural resource use to local communities, building capacity and establishing Village Marketing Networks. These Networks are responsible for ensuring that the community follows an agreed land-use plan and financially incentivising compliance. Compliance, in turn, benefits the protected habitats and globally threatened species.

Project outcomes

The expected outcomes of the full-term duration of the project (four years) are as follows:

- Ibis Rice project expanded to directly benefit a further **1,270 families**.
- The capacity of Village Marketing Network to manage Ibis Rice compliance is increased by at least 50%.
- **> 1,250 families** of Ibis Rice farmers have tested and adopted **drought-resilient agricultural practices** and complementary **soil conservation techniques.**
- **Deforestation rates decrease** around target villages compared to deforestation rates in the wider landscape. This outcome assumes that premiums paid for Ibis Rice are sufficient to change behaviours, which has been shown through previous Darwin projects.
- Increase of 20% in the number of **critically endangered nests protected**.
- **Poverty status improved by 20%** for people in Ibis Rice villages (measured through surveys on Basic Necessity Scores, rice harvest and food security).
- Impacts of Ibis Rice program on threatened bird populations, habitat trends and human livelihoods are monitored and disseminated to a wide audience, including relevant national and regional Payments for Ecosystem Services (PES) policymakers.

Lessons learnt

- **Incentives** to promote compliance may need to look beyond economic drivers and **adapt approaches towards the local context**. This project found groups continuing to engage in illegal activities were incentivised to engage when approached directly, increasing community buy-in.
- Approaches towards **local community engagement** should be inclusive of all smaller groups, such as smaller networks of farmers, which may not be reached effectively.

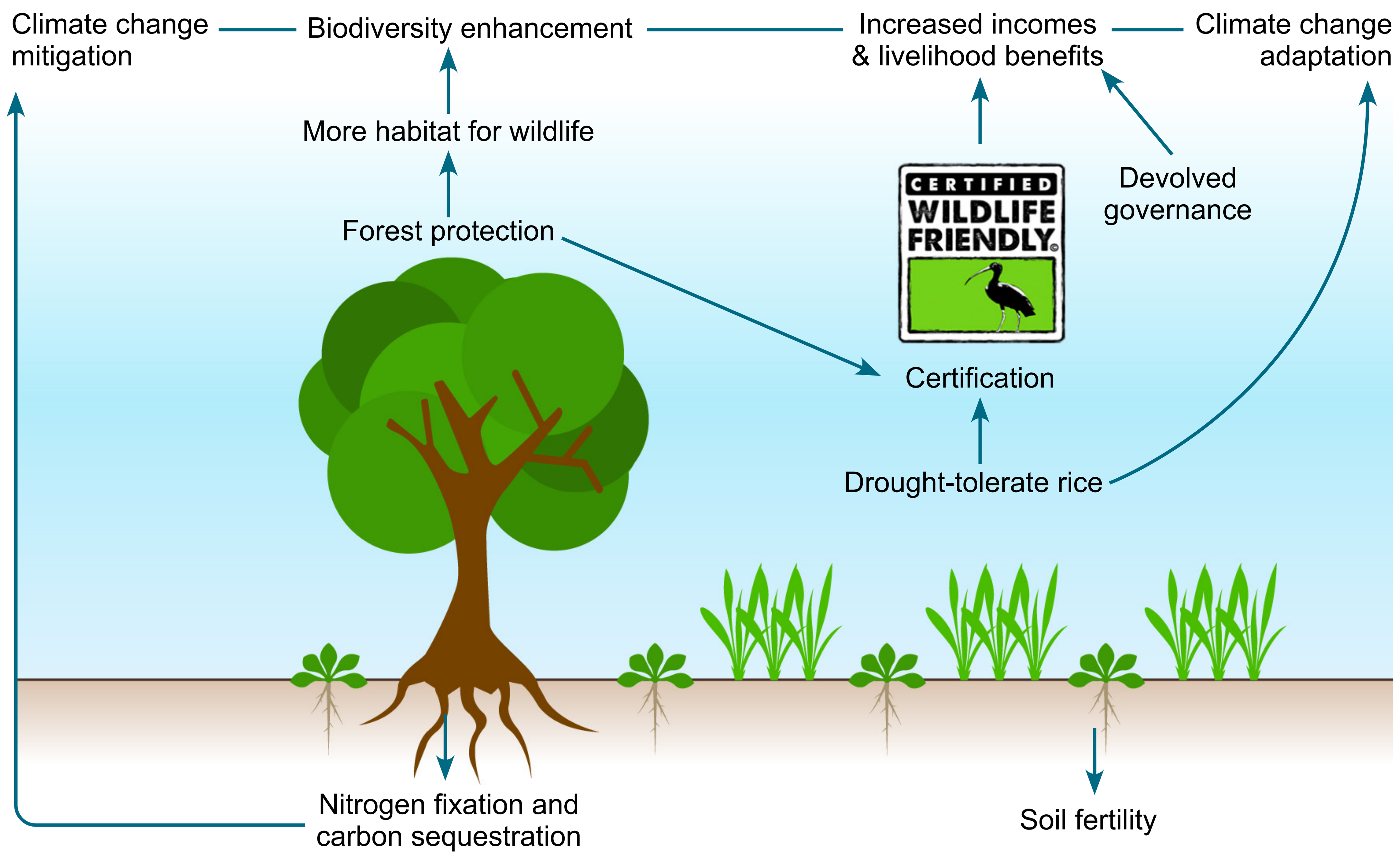


Diagram of the NbS interactions showing that climate-resilient agriculture, coupled with PES schemes, can provide multiple benefits.

Sustainability and legacy of project

This project is designed to expand the Ibis Rice concept as a locally managed, climate-change resilient initiative that can be sustained without future inputs.

The project delivers an alternative development pathway with clear short-term financial benefits and structures that support the long-term socioeconomic development of local communities. Village Marketing Networks facilitate planned, sustainable resource use. Land-use plans that form the basis for the conservation agreements and the delineation of community-use zones within protected areas guarantee access to forest resources by participants. By registering these plans with government, the project ensures that land cannot be appropriated for development by agro-industrial plantations.

Ibis Rice has proven to be a relatively low cost mechanism for incentivising conservation, which at current scale and input can be sustained through market sales alone. Potential for further expansion of the concept is high, owing to the number of suitable villages and community buy-in. This potential becomes accessible when international certification is achieved to open stable, high-volume, high-value international markets, thus securing funding of on-going activities.

Further information: https://www.darwininitiative.org.uk/project/DAR24028/

Return to Principles

Implementing Mangrove Restoration to Improve the Resilience of Vulnerable Coastal Communities to Climate Change Related Impacts in Viet Nam

Project achievements as of 2019:

Biodiversity
1,442 ha of mangroves planted or regenerated.

Climate
34,414 tCO_2 sequestered.

People
2,402 storm resilient houses built; **906 people** protected by the mangrove buffer, **39% women.**

Executing entities:

Ministry of Agriculture and Rural Development (Viet Nam) and other in country ministries

Location: Viet Nam

Dates: 2016–2022

Ecosystem: Mangroves

Nature-based Solution: Mangrove Restoration and Natural Regeneration

Context

Viet Nam is one of 30 'extreme risk' countries on the Climate Change Vulnerability Index, with 60,000 coastal homes damaged in storms and floods each year. In the Mekong and Red River deltas, lives and local community livelihoods are at risk from saltwater intrusion, extreme weather events, and sea level rise.

Viet Nam's natural buffer, mangrove forests, are in steep decline from increasing population pressure and poorly designed aquaculture. Government reports estimate that mangrove cover decreased from 408,500 ha to 59,760 ha between 1943 and 2008.

Mangrove restoration will support local fisheries, buffer against sea level rise and saltwater intrusion, and protect communities from sea surges and storms. The project aims to provide resilient building plans for coastal communities, to improve mangrove replanting and natural regeneration, and to provide enhanced climate risk information to public and private sectors.

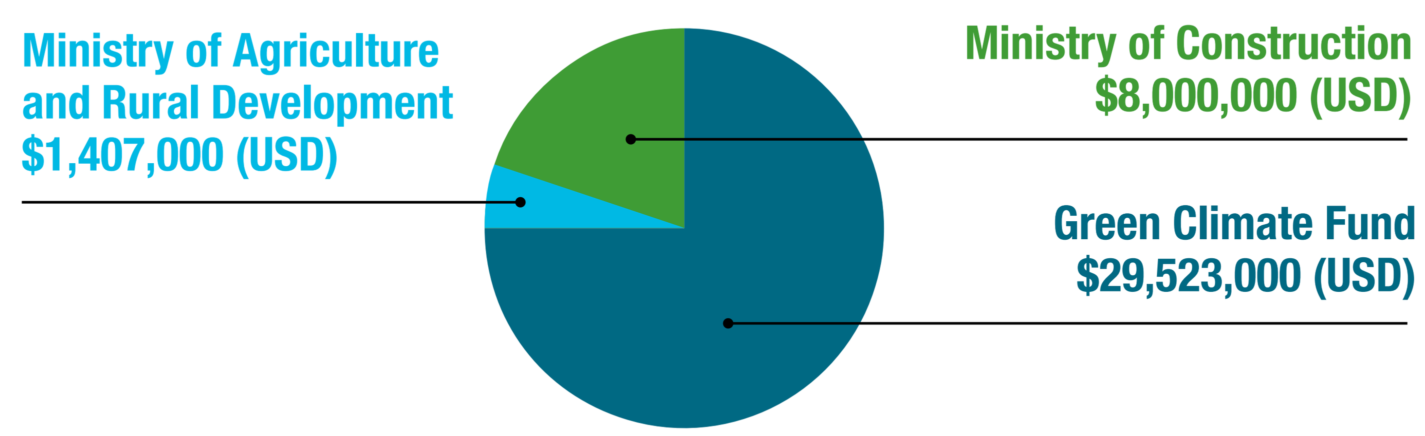
Project objectives:

Through scaling up previous restoration interventions, this project aims to improve coastal resilience through:

- **Increase mangrove coverage:** to provide a natural buffer between coastal communities and the sea.
- **Enhance climate risk information:** to guide climate-resilient and risk-informed planning.
- **Safe housing:** to protect vulnerable coastal communities from increased flooding and storms.

Funding:

- Total project budget: **$41,984,578 (USD)**



Project approach

- **Create storm surge buffer zones:** The project scales up previous successful mangrove restoration projects in Viet Nam. To avoid monoculture plantations, the project will plant a diversity of mangrove and other coastal tree species identified by local communities. Working with landowners and community groups, mangrove regeneration and replanting is planned for integration with aquaculture farming and in surrounding vulnerable communities. Alternative livelihood models (e.g., integrated aquaculture, livestock and crop production) have also been proposed and trialled to mitigate potential impacts of restoration on farmers.
- **Enhance climate risk information:** Aligning with existing community groups and structure, the project will train participants in community-based disaster risk assessment and management (CBDRA/M). This follows a participatory, decentralised approach, improving data collection and access while strengthening ownership.
- **Safe housing:** The project worked with architects to design and build storm and flood resilient housing for coastal communities. New storm and flood resilient housing reported no damages during Typhoon Matmo in 2019.

Project outcomes

Expected project outcomes and milestones include:

- **Restoration of native mangroves and coastal species** expected to provide 4,000 ha of storm surge buffer over the project life cycle, and sequester approximately **565,180 tCO_2e.**
- **Mainstreaming of project objectives and approach** has led to the consideration of adjustments in cost norms for mangrove plantings at the national level.
- Improved risk planning from CBDRM/A training and activities will contribute to tailored **products for the finance and insurance sectors**. Training will also ensure ongoing monitoring and adaptive management of replanting activity.
- As of 2019, **152 communes established CBDRM/A Technical Assistance Committees,** comprising 16,723 participants including those from the Women's Union, Youth Union, and the Red Cross in 2019.

Lessons learnt

- **Disaggregate data:** The project engaged women's and youth groups, uplifting vulnerable groups and increasing community participation.
- **Elevate local knowledge:** Recommendations by local community members improved project siting, and increased the diversity of species used in buffer zones.
- **Encourage natural regeneration:** Research supported by the project found that natural regeneration can increase mangrove seedling survival from 50% to 80%.
- **Evaluate cost effectiveness:** The project found that replanting mangroves was more costly than the given national standard of $800-1,000/ha. Raising cost norms to $1,500-$4,000/ha can ensure more effective restoration activities are undertaken.

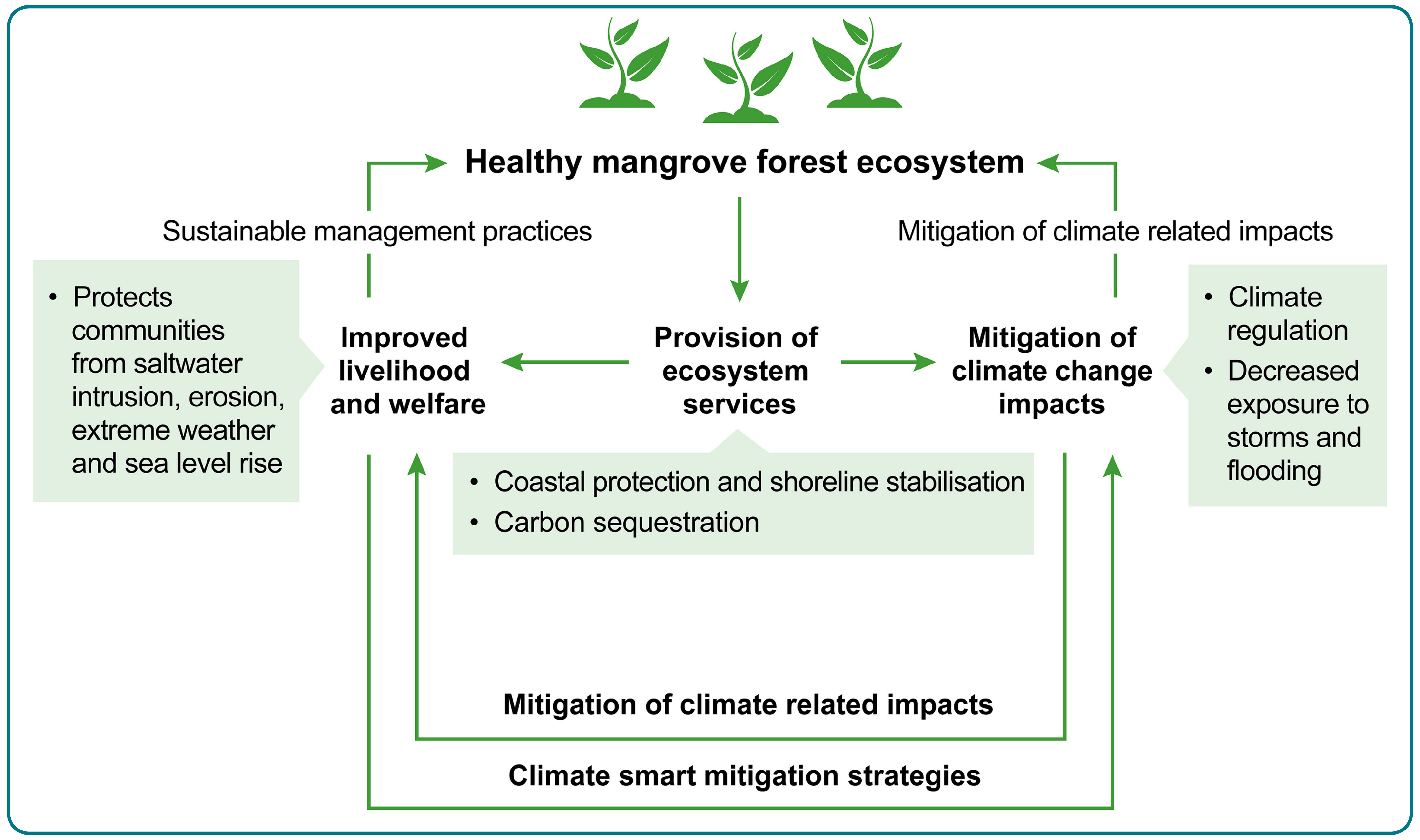


Diagram of NbS interactions showing that natural regeneration of mangroves can contribute towards multiple benefits.

Sustainability and legacy of project

The project builds on previous mangrove restoration efforts, improving best practice and replicating success. Long-term support of the project's objectives is evidenced in the mainstreaming of NbS in policy and decisions as well as co-financing from cross-sectoral ministries. This allows for longer-term planning and commitment to NbS approaches. The project provides strengthened evidence base for decision-makers in the cost-effectiveness of restoration techniques and seedling survival rates. Improved knowledge from monitoring by local commune CBDRM/A committees allows for feedback and adaptive management responsive to new information and changing ecosystems due to climate change. Finally, the recognition of the importance of site-specificity (considering species, soil chemistry, and other environmental parameters) has ensured the success of restoration projects, protecting communities and creating a lasting impact.

Further information: https://www.greenclimate.fund/project/fp013

Return to Principles

Silvopastoral Systems for Climate Change Mitigation and Poverty Alleviation in Colombia's Livestock Sector

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Achievements as of 2019:

Biodiversity
Intervention areas had a **32%** increase in birds and a **47%** increase in beetles.

Climate
Mitigated over **1.5 million tonnes** of carbon dioxide equivalent.

People
Enhanced livelihoods on **4,100** farms, increasing incomes by as much as **$523 (USD)/ha/year.**

Executing entities:

Federación Colombiana de Ganaderos

with four project partners

Location: Colombia

Dates: 2012–2020

Ecosystem: Terrestrial production landscape

Nature-based Solution: Silvopastoral agroforestry systems

Context

Colombia is a biodiversity hotspot, with forests and natural ecosystems covering over half the country. However, unsustainable land use is driving ecosystem degradation and biodiversity loss, with the agricultural sector alone producing 38% of Colombia's greenhouse gas (GHG) emissions. Whilst cattle ranching employs 28% of the rural population, it provides poor livelihoods for small farms and is highly vulnerable to the effects of climate change. Prevailing livestock techniques also leave land degraded and unproductive, forcing farmers onto new land and contributing towards more deforestation and biodiversity loss. Silvopastoral systems (SPS) integrate agroforestry with livestock farming and can increase the efficiency of cattle production, whilst providing substantial environmental benefits. However, there is limited uptake of SPS across Colombia due to a lack of knowledge, high initial costs and technical complexity. This project aimed to demonstrate how SPS can reduce GHG emissions, reduce poverty and provide environmental benefits, to promote wider uptake of SPS across Colombia.

Project objectives:

- To convert approximately 28,000 ha of open pasture into SPS in seven regions of Colombia.
- To determine if SPS can reduce GHG emissions and deforestation caused by cattle ranching.
- To make SPS accessible for small and medium scale farmers to reduce poverty across society.
- To promote wider adoption of SPS in Colombia.

Funding:

- Co-funded by the UK's ICF Fund: £15.3 million (GBP).
- Built on previous work initiated through funding from the Global Environment Facility: $7 million (USD).

Project approach

The project facilitated the implementation of SPS across Colombian farms and tested whether SPS could contribute towards more sustainable agriculture, building on previous SPS pilot projects led by the World Bank.

SPS approaches involve planting trees, shrubs and fodder crops on grazing land in ways that increase and preserve tree cover, enhance carbon dioxide sequestration, improve biodiversity and soil quality, and increase livestock productivity. UK funding was used to establish a new payment for ecosystem services (PES) scheme that paid farmers for carbon capture resulting from the implementation of SPS. This complimented an already established PES scheme that paid for measurable increases in biodiversity. UK funding was used to provide technical assistance to farmers, through an extended network of demonstration farms, and to subsidise the cost of seedlings, trees and organic fertilisers, to facilitate the conversion of land to SPS. Impacts of the project were continuously monitored and evaluated to improve the evidence base for SPS, and results were disseminated to different stakeholder groups. Programme data was used by the Government of Colombia when establishing an enhanced national sustainable cattle-ranching target.

Project outcomes

The highlights of the interventions were as follows:

- Enabled the conversion of over **38,000** ha of degraded cattle pasture to SPS.
- Enhanced livelihoods on **4,100** farms through technical assistance, PES or the establishment of seed nurseries.
- Mitigated over **1.5 million tonnes** of carbon dioxide equivalent within the project's lifespan.
- Milk productivity per ha increased by 17% on average across participant farms, and livestock carrying capacity increased by 23% on average.
- Farm incomes increased by up to **$523 (USD)/ha/year**, exceeding estimates by up to **$70 (USD) /ha/year**.
- As SPS adoption increased, biodiversity also increased, as measured though the **Environmental Services Index**.
- A landscape evaluation of biodiversity identified a **32%** increase in bird populations and a **47%** increase in beetle populations in the intervention areas.
- Enhanced landscape connectivity generated by SPS provided critical mobility for **65%** of monitored species.
- The project influenced the doubling of the sustainable livestock target in the **2018-2022 Colombian National Development Plan.**

Lessons learnt

- **SPS techniques are effective:** Intervention areas demonstrated improvements in carbon storage and biodiversity, but implementation may be hindered by a lack of labour, seeds, or severe weather.

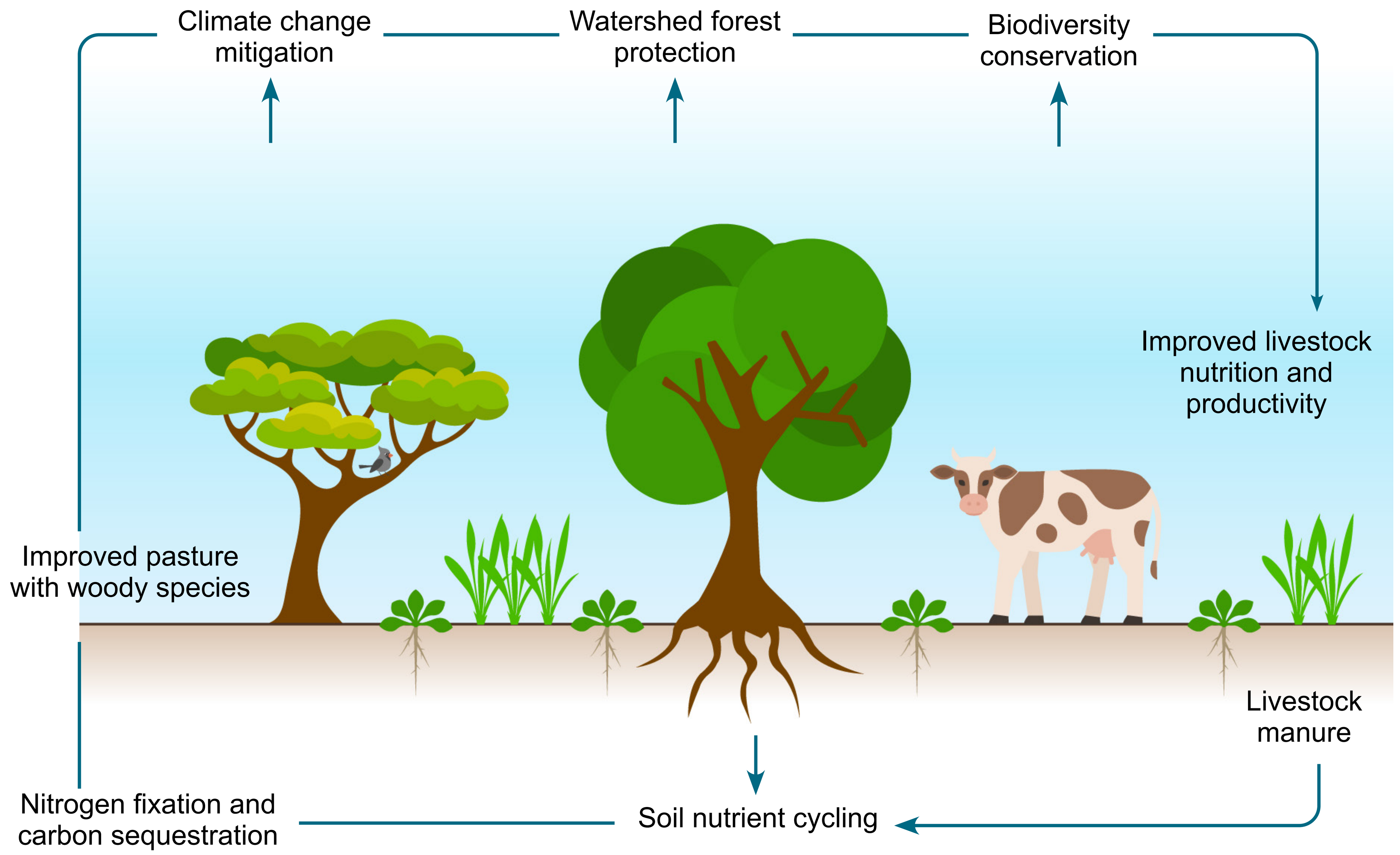

Diagram of the NbS interactions showing that silvopastoral systems provide benefits for biodiversity, livelihoods and climate change mitigation.

- **Unforeseen trade-offs:** Whilst SPS can deliver wins for climate, biodiversity and poverty reduction simultaneously, there is a partial trade-off between these objectives. This project found that maximising the spatial extent of SPS conversion can conflict with maximising poverty reduction objectives, when funding is limited.
- **Financial incentives may not outweigh upfront costs:** Whilst PES schemes incentivised environmental stewardship on many farms, prohibitive upfront costs hindered large-scale change.
- **Multi-partner challenges:** Unaligned decision-making and administrative processes delayed crucial aspects of the project, such as early payments to farmers.

Sustainability and legacy of project

The project has enhanced the evidence base for SPS and contributed to the establishment of several publicly accessible knowledge products and SPS training platforms that have since been mainstreamed into the agricultural sector. Survey data indicates that farmers included in the project are expanding SPS conversion on their farms, and neighbours are replicating their efforts. The project has contributed to transformational change in the livestock sector by inspiring the Colombian Government to adopt more ambitious sustainable cattle ranching targets and providing potential to scale-up SPS across Colombia.

Further information:

https://devtracker.fcdo.gov.uk/projects/GB-GOV-13-ICF-0020-SPS

Return to Principles

Large-scale Ecosystem-based Adaptation in The Gambia River Basin: Developing a Climate Resilient, Natural Resource-based Economy


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Achievements as of 2019:

Biodiversity
10 million mangrove propagules planted; **846 ha** of land rehabilitated.

Climate
375,000 trees protected from wildfires to improve climate resilience.

People
Increased the resilience and enhanced livelihoods of **5,133 people, 50% being women.**

Executing entities:

Government of The Gambia: Ministry of Environment, Climate Change & Natural Resources.

Accredited entity: UNEP

Location: The Gambia

Dates: 2017–2023

Ecosystem: Tropical forest, savanna, woodland and mangroves

Nature-based Solution: Ecosystem-based Adaptation (EbA)

Context

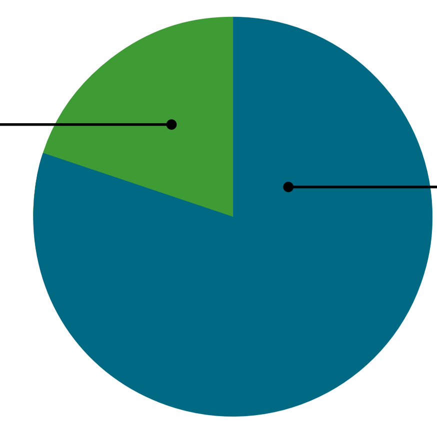
The Gambia is the smallest country in mainland Africa, extending over 400 km along the Gambia River in West Africa. One-third of the country lies below 10 m above sea level, and 10–20% of land is subject to seasonal or diurnal flooding, making the population of 2.1 million people highly vulnerable to climate change and rising sea levels. Climate projections suggest an increase in rainfall variability, and intense floods and droughts already cause crop failure in many areas. The agricultural sector provides two-thirds of household incomes, and many rural communities face a 'hunger season' from July to September. To provide alternative livelihoods and food sources, resources are unsustainably extracted from forest ecosystems, resulting in the degradation of ecosystem services, and further exacerbating crop failure. This project aimed to develop a sustainable natural resource-based economy in The Gambia, utilising nature and healthy ecosystems to reduce the impacts of climate change, through EbA.

Project objectives:

- To restore degraded forests, savannas and farmland, and create healthy ecosystems.
- To establish ecologically sustainable businesses.
- To develop 'home gardens' to diversify food and income sources, and thus build climate resilience.
- To mainstream adaptation actions into policy to support large-scale implementation of EbA.

Funding:

- Total project budget: **$25.5 million (USD)**



Project approach

The project is implementing EbA through large-scale reforestation, the development of natural resource-based businesses and capacity building.

Degraded farmland and woodland are being reforested using multi-purpose native plant species, selected by local communities for their climate resilience and provisioning value as either wood, fuel, food or medicine. Enrichment planting – planting valuable species to assist natural regeneration – will reduce soil erosion and increase groundwater supplies, thus strengthening climate adaptation. Mangrove plantations will act as buffer zones, protecting villages from storms and floods, and firebreaks – constructed through forest clearing and planting fire resistant vegetation – will reduce wildfire risk. Conservation and biodiversity management is being enhanced across 10,000 ha of land, and over 150 natural resource-based businesses will be set up to provide sustainable livelihoods and ecosystem services. Demonstrations on how to create diverse 'home gardens' with annual productivity will be used to ensure a continual food supply. Additionally, four sectoral policies (transhumance, migration, agriculture and energy) will integrate adaptation actions into their annual plans, thus helping to mainstream EbA across The Gambia.

Project outcomes

Highlights of the interventions by 2019:

- Multi-purpose native plant species used to **rehabilitate 846 ha** of degraded forests, woodlands, savannas and mangroves, and **plant 1,231 ha** of agricultural lands.
- **375,000 trees protected** from fires and animal trampling.
- **40 km by 10 m firebreak** constructed to protect trees.
- **300 beehives** under construction for 30 beekeeping enterprises to be established.
- **10 million native mangrove propagules** planted to protect coastal villages from flooding and provide fish habitat.
- **45 protocols** developed for EbA planning and implementation to respond to climate change.

Further outcomes expected by project completion (2023):

- **166 natural resource-based businesses** generating $4.5 million (USD) in cash returns to be developed.
- **$11.3 million (USD)** will be raised for the **National Forest Fund** over the next 20 years using taxes and licencing fees, strengthening future natural resource management.
- The project aims to enhance livelihoods for over **8,000 vulnerable people**, and to ensure at least 50% of beneficiaries are women.

Lessons learnt

- **Tree species preference and numbers to be planted should be determined in advance:** Tree seedling availability remains a challenge for the project, but tree nurseries are expected to alleviate this problem.
- **Providing capital is not enough to develop successful natural resource-based enterprises:** A more holistic, capacity development approach is required.

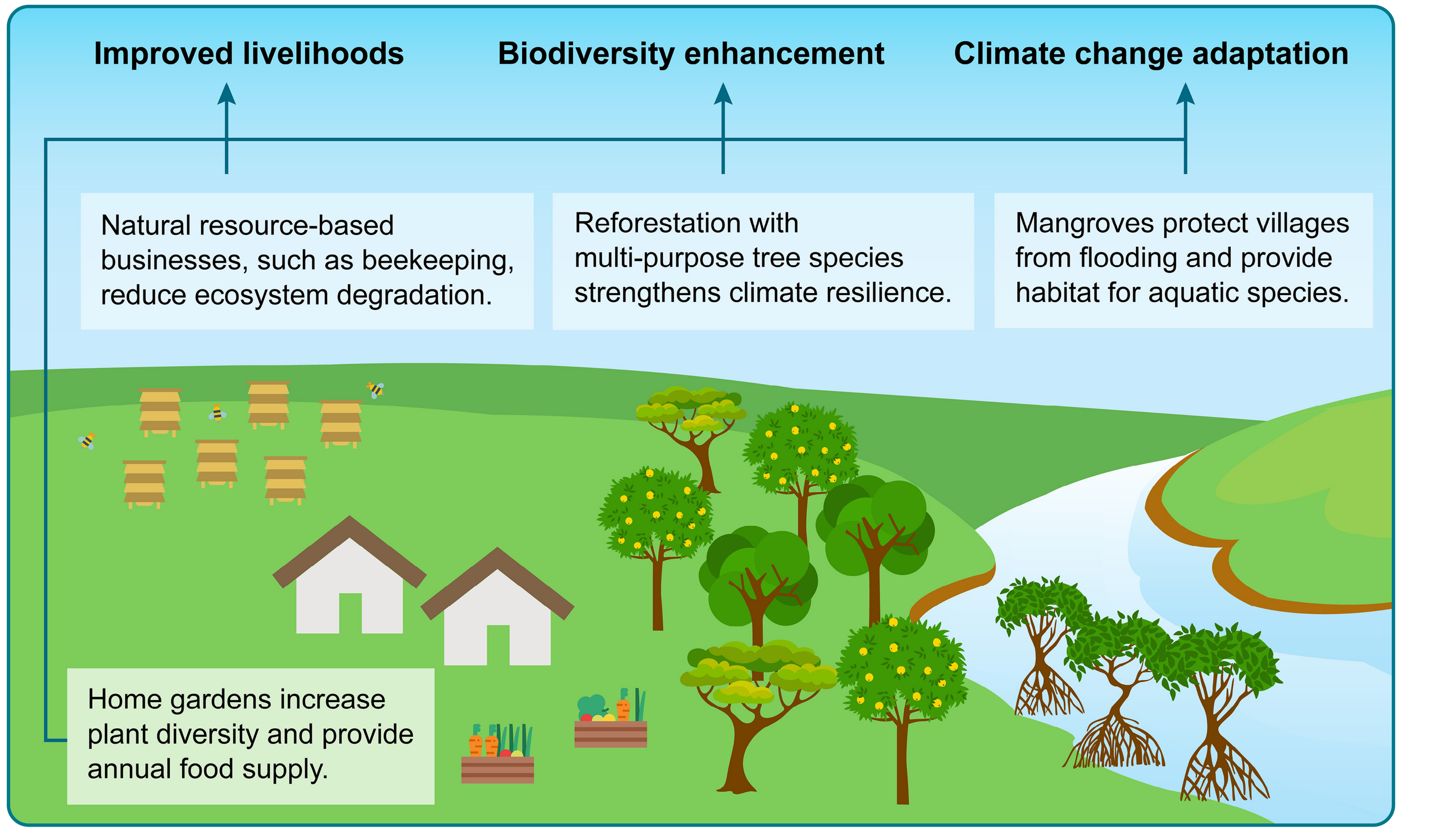


Diagram of the NbS interactions showing that ecosystem-based adaptation provides benefits for livelihoods, biodiversity and climate change adaptation.

- **Keep regular communication with regional coordinators to get timely information:** Coordination of different stakeholder groups and communities takes time and resources, but has proved critical to ownership over the project strategy.
- **Accommodate gender in project design:** Conducting a gender analysis and adopting gender-equitable targets in line with national policies and priorities ensures both men and women benefit from project activities.

Sustainability and legacy of project

The project is utilising an upscaling strategy to integrate EbA and natural resource-based businesses into existing government plans and activities. Through capacity building and incorporating EbA into decentralised land use planning, successful EbA activities will be integrated into government services and replicated in the future. Furthermore, an evidence base on the effectiveness of EbA and the commercial viability of natural resource-based businesses will be established, promoting future investment from decision-makers in both the government and private sector. This aims to facilitate a paradigm shift across Gambian society, addressing the challenges of climate change, rural poverty and ecosystem degradation.

Further information: https://www.greenclimate.fund/project/fp011

Return to Principles

Implementing Ecosystem-based Integrated Water Resource Management to Mitigate Disaster Risk in the Lukaya River Basin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Achievements:

Biodiversity
115 ha community agroforestry; **7 ha** reforestation on slopes.

Climate
Through flood risk-reduction, local resilience to climate change is strengthened.

People
71 training sessions & workshops; Increased incomes; Improved water quality.

Executing entities:

UN environment programme | European Commission

with in-country partners

Location: Democratic Republic of the Congo

Dates: 2013–2016

Ecosystem: River basin

Nature-based Solution: Integrated Water Resource Management

Context

The Lukaya River Basin is located southwest of Democratic Republic of the Congo's capital, Kinshasa, and is a vital source of drinking water for approximately 400,000 of its inhabitants. In the Basin, rapid urbanisation, unsustainable agricultural practices, quarrying and charcoal production have resulted in deforestation, excessive sedimentation in the river, and high incidence of flooding. Heavy sedimentation in the Lukaya River reduces water quality, blocks river flow, affects local fisheries and increases water treatment costs. Flooding has taken lives and damaged houses, infrastructure and agriculture.

If managed sustainably, ecosystems can deliver multiple services, including disaster risk reduction and reducing local vulnerabilities to climate change. This project promoted ecosystem-based measures to mitigate hazards, namely gully erosion and floods and addressed ecosystem degradation, which is a driver of disaster risk in the Lukaya River Basin.

Project objectives:

- To demonstrate the effectiveness of ecosystem-based measures in reducing the risks of floods and gully erosion, improving water quality and providing multiple benefits for local livelihoods.
- To develop local and national capacities for implementing a river basin management approach.
- To inform national policies and planning on mainstreaming Ecosystem-based Disaster Risk Reduction (Eco-DRR) through Integrated Water Resource Management (IWRM).

Funding:

- European Commission – $310,000 (USD).
- UN Development Account – $390,000 (USD).
- UNEP staff costs contributed in kind.

Project approach

The project targeted disaster and climate risk reduction objectives by implementing IWRM – a process which promotes the coordinated development and management of water, land and related resources, maximising economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. One component of this was the promotion of ecosystem-based measures, including reforestation, agroforestry, and gully erosion control through vetiver bioengineering. Strong community uptake of these interventions resulted in soil stabilisation, flood and soil erosion risk reduction, as well as boosting agricultural yields and household incomes.

A key aspect of project success was the sustained participation of local river users, through a formally sanctioned community-based river user association. Women, as community leaders, farmers and income earners demonstrated high interest and showed strong engagement throughout the project. A number of the interventions, such as agroforestry, have been replicated independently in the Basin.

Project outcomes

The highlights of the interventions were as follows:

- **Four tree nurseries were established** producing 42,000 seedlings (forestry and fruit trees) per year.
- **Community agroforestry system was established** on over 15 ha, supporting 20 households with 40% of framers involved being women. The system was designed to be expanded through a benefit sharing and revolving fund system.
- **Vetiver bioengineering was pioneered** in the Lukaya River Basin to reduce gully and river bank erosion. Four vetiver nurseries were established, producing 32,000 vetiver plants per year.
- **A green buffer zone was established** to reduce river bank erosion and sedimentation.
- **Reforestation on slopes** (7 ha), as well as green walls around houses.
- **Improved water** quality, substantially improving the operation of the water treatment plant.
- **71 trainings and workshops on mainstreaming Eco-DRR through IWRM were delivered**, each of which targeted between 10 and 240 local, national and regional actors.
- **Local risk monitoring systems were established.**
- **Eco-DRR has been mainstreamed** in the IWRM Action Plan for the Lukaya River basin.

Lessons learnt

- **Engage communities in a participatory approach:** Working through, and developing the capacity of, a local institution, ensured successful engagement with key stakeholders.
- **Communicate the co-benefits:** Emphasising the multiple benefits, beyond disaster risk-reduction, was key to obtaining local buy-in.
- **Consider landscape-scale interactions:** By openly recognising the conflicting priorities for shared resources between upstream and downstream communities, the project strengthened collaboration to work towards a shared development vision.

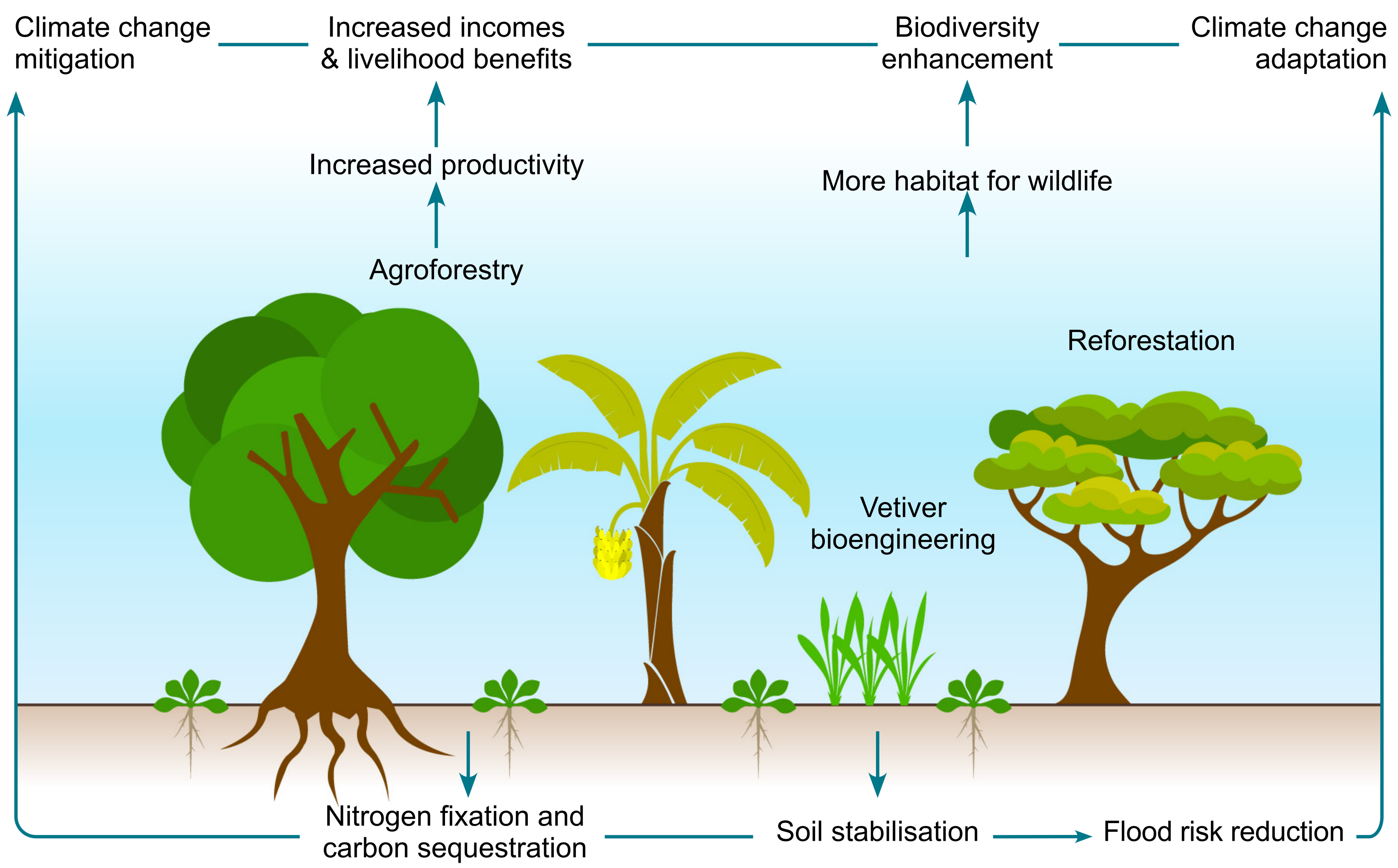

Diagram of the NbS interactions showing that agroforestry, reforestation and vetiver bioengineering can contribute towards multiple benefits.

Sustainability and legacy of project

The project developed local capacities to undertake and manage agroforestry, reforestation, vetiver bioengineering systems allowing interventions to continue to deliver long-term benefits to households. Secondly, the IWRM Action Plan provides a roadmap for the in-country partners to initiate new partnerships and mobilise additional resources. Finally, through mainstreaming, there is now greater national awareness and commitment from the National Government to promote the interventions.

The project demonstrated that ecosystem-based disaster risk reduction can be achieved through an IWRM framework which has been tailored to local needs. A 2016 national water law now mandates that water resources are managed at the river basin scale, helping to promote replication of similar initiatives in the country's watersheds. However, as the project was only three years and UNEP have since closed their country office, there is a gap of knowledge in terms of post-project impacts.

Further information:

https://pedrr.org/casestudy/river-partners-democratic-republic-of-the-congo/

Return to Principles

Implementing a Ridge to Reef Approach to Mitigate Disaster Risks and Reduce Vulnerabilities in Haiti

Harvesting vetiver, Haiti © UNEP | Marc Lee Steed

Achievements:

Biodiversity

54,065 native fruit and forestry trees and **36,300** native mangrove and sea grape trees planted.

Climate

141 ha of reforestation to mitigate the impacts of flooding and storm surges.

People

6.5 ha of sustainable vetiver farms established; Increased income and food security; **150** people received training on improved coastal zone management.

Executing entities:

UN environment programme | European Commission

with 10 partners

Location: Haiti

Dates: 2013–2016

Ecosystem: Multiple

Nature-based Solution: Ecosystem-based Disaster Risk Reduction

Context

Haiti is one of many countries in the Caribbean that face frequent storms and hurricanes. These devasting natural events threatens the safety and wellbeing of many local communities, through impacts such as coastal flooding, sedimentation, and upstream erosion. In addition, environmental degradation from unsustainable practices, as well as unsustainable fishing efforts, increases the pressure on both terrestrial and marine ecosystems and contributes towards erosion and landslides. This project applied Ecosystem-based Disaster Risk Reduction (Eco-DRR) through a ridge-to-reef approach, by targeting hazards (flooding, storm surges and erosion), vulnerability (due to unsustainable management) and increasing disaster preparedness (e.g. early warning) to reduce disaster risk for local communities in Port Salut, Haiti.

Project objectives:

- To demonstrate the effectiveness of Eco-DRR through a ridge-to-reef approach to coastal zone management, in **reducing the risks of floods**, **storms/hurricanes**, and **soil erosion** and providing multiple benefits for local livelihoods.
- To **develop local and national capacities** for implementing Eco-DRR through a ridge-to-reef approach.
- To **inform national policies and planning** on Eco-DRR for improved coastal governance.

Funding:

- European Commission: $300,000 (USD).
- UNEP staff costs contributed in kind.

Project approach

The project has three main components, which were closely interlinked and implemented in parallel:

1. Field interventions. This included soil erosion reduction in the uplands, coastal revegetation, stabilisation of riverbanks and establishing sustainable and resilient fisheries practice.
2. Local and national capacity building on Eco-DRR for improved coastal zone management. This involved awareness raising, training and workshops, hands-on learning activities within demonstration sites, supporting improved municipal coordination, field visits and study tours with government and other partners.
3. National awareness-raising on Eco-DRR in marine protected area establishment. This was achieved by making baseline data available on the diversity and status of coastal and marine ecosystems in the area, and emphasising the multiple benefits of protecting these ecosystems, particularly for disaster risk reduction.

Project outcomes

The highlights of the interventions were as follows:

- Tree nurseries were established producing **137,000 seedlings** (native coastal, riparian and fruit species), directly benefiting 200 households through increased food and income security.
- Coastal species nursery management training delivered to **150 people** from local communities and government.
- **141 ha of reforestation** undertaken as a natural defence barrier in areas exposed to coastal hazards and flooding.
- **6.5 ha** of sustainable vetiver farms established, directly **benefitting 25 households** on hillsides.
- Provided **boat repairs** and **fleet improvements** to enable local fishermen to head further out to sea and reduce fishing pressure on near shore ecosystems.
- **Disaster preparedness plan** established which included an early warning system and emergency equipment.
- Training delivered to **30 fishermen on disaster preparedness and management.**
- Participatory action plan developed to agree on priorities and solutions for sustainable and resilient fisheries.
- Community-led collection of solid waste along the coast to **reduce marine litter and obstruction of waterways.**
- Municipal coordination round-table established and civil **society participation** in decision-making on coastal zone management increased.

Lessons learnt

- **Promote and mainstream Eco-DRR:** This was critical for upscaling approaches to larger, more ecologically-significant scales.
- **Strengthen local community-based organisations:** Capacity building was a key mechanism for delivering project activities and strengthening governance at the local level.

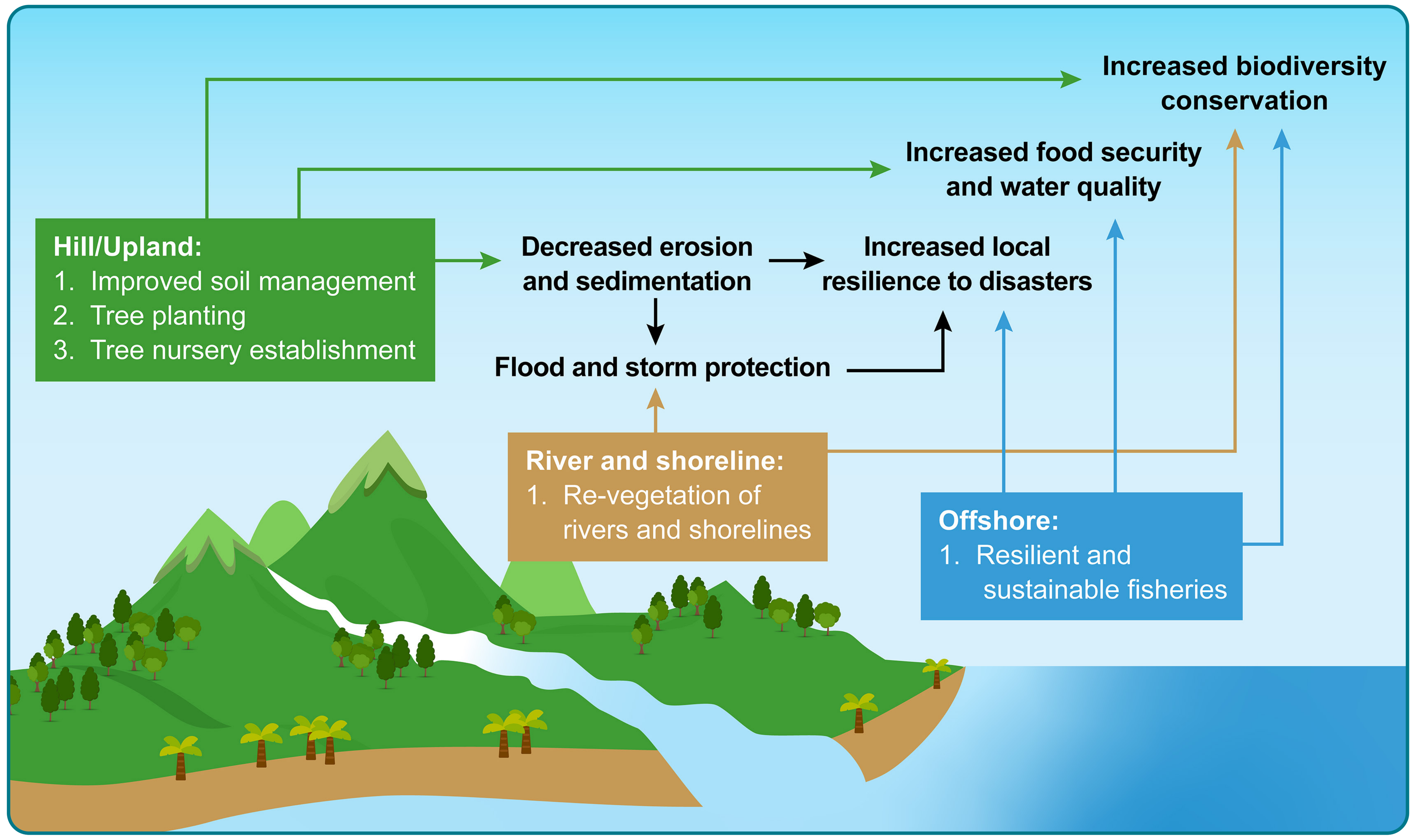

Diagram of NbS interactions showing how a ridge to reef approach can contribute towards multiple benefits.

- **Consider the co-benefits:** Demonstrating multiple benefits beyond disaster risk reduction, such as economic benefits, was key to obtaining local buy-in.
- **Ensure project sustainability:** Legacy can be supported by promoting ownership among local residents, capacity building and awareness raising.

Sustainability and legacy of project

The project received a high level ownership among local residents, as well as local and national government authorities. The approach carried out will be integrated into a $15 million (USD) investment by the Ministry of Agriculture and InterAmerican Development Bank in the fisheries sector in Southern Haiti. The field interventions of the Eco-DRR project will also be expanded by UNEP through secured funding from the Government of Norway and GEF, within their Marine Protected Area establishment framework. The project has successfully served as a stepping-stone for potentially larger-scale activities.

However, in 2016, Haiti was struck by Hurricane Matthew, destroying a number of the project interventions. It is therefore important to recognise that the long-term outcomes may be threatened by factors outside of the project's control and therefore adaptive management measures should be applied, ensuring to take climate projections into account.

Further information: https://pedrr.org/casestudy/coastal-partners-haiti/

Return to Principles

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Building Resilient Communities, Wetland Ecosystems and Associated Catchments in Uganda

Project achievements as of 2019:

Biodiversity
4,000 ha of wetlands restored; **148.2 km** of wetland boundaries demarcated to support monitoring and protection.

Climate
106 technicians and change agents trained in disaster preparedness.

People
444 women-led households engaged in alternative livelihoods.

Executing entities:

Government of Uganda, Ministry of Water and Environment

with other in-country ministries

Location: Uganda

Dates: 2016–2025

Ecosystem: Wetlands; Terrestrial production landscape

Nature-based Solution: Wetland restoration; Climate-smart agriculture

Context

The wetlands in Eastern and South Western Uganda sustain the livelihoods of 800,000 people through market benefits – including livestock watering, irrigation, or domestic use – as well as ecosystem services – including water filtration and storage, micro-climate control, and storm protection.

The wetlands are at risk from shifting rainfall patterns, more extreme weather events, droughts, and floods. Shifting rainfall patterns negatively impacts the availability of water for irrigation or livestock, driving encroachment on wetlands. In one district alone, Kabale, 58% of the wetlands have been drained for agriculture, fisheries, or timber. Poaching, reed extraction, overexploitation, and invasions of non-native species are all driven by encroachment. The reforestation and restoration of these critical wetlands will restore important ecosystem services. Climate-resilient agriculture techniques and alternative livelihoods will diversify income sources, enhancing the human resilience to changing climate.

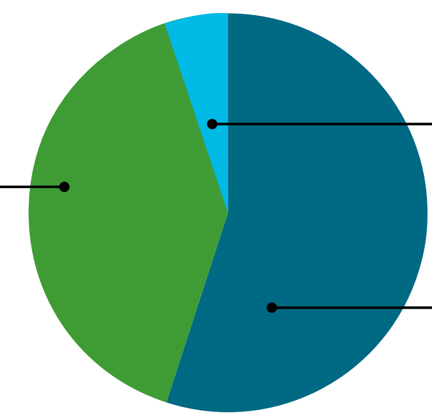
Project objectives:

The project aims to restore critical wetlands for improved ecosystem services and to empower communities through alternative livelihoods and disaster risk reduction and preparedness. Key objectives are:

- To restore and manage wetland hydrology and associated forests.
- To improve agricultural practices and alternative livelihood options in the wetland catchment.
- To strengthen access to climate and early warning information for farmers and other target communities.

Funding:

- Total project budget: **$44,262,000 (USD)**



Project approach

The project expands the Community Based Wetland and Biodiversity (COBWEB) model for restoration by establishing Community Conservation Areas (CCA) in a participatory, multi-stakeholder approach. CCAs are conservation areas, managed and monitored by local communities. The project will conduct habitat restoration activities in the wetland and grasslands in the catchment area, and improve small scale water infrastructure – including aquifers, small earth dams and inlets – to further strengthen the provision of water and ecosystem services. A key objective is to address identified gaps in the COBWEB model, including financial barriers and connections to the private sector. While the COBWEB model depends on ecotourism, this project introduces alternative livelihood models (e.g., beekeeping and raising goats or chickens) to improve value chains and local incomes. The project will provide training and demonstrations in climate-resilient agricultural practices, increasing access to markets. The project will create sustainable livelihoods and a reduction in food and water insecurity. The final aspect is strengthening access to climate data products and warning systems through training, community networks, and improved data sharing. This supports adaptive management responsive to climate change, and the decentralisation of warning systems.

Project outcomes

Expected project outcomes and milestones include:

- **64,370 ha of wetland restored by 2025**. In 2019, farmers near restoration sites reported improvements to microclimate and reduction of prolonged flooding.
- **800 farmers (330 women) trained** in crop diversification, climate-smart agriculture and livestock management, sustainable land management, and agroforestry practices.
- **Alternative livelihoods adopted by 1,095 households**, including fish farming, apiary, heifers and **300 community members** producing high value vegetables and fruits with improved irrigation.
- **Increased household incomes for 63% of beneficiaries** who had been provided agricultural training or alternative livelihoods.
- **Two Environment and Social Management Plans** developed at project level to mitigate or prevent any unintended negative impacts to the environment or human well-being.

Lessons learnt

- **Mainstream objectives into national and international frameworks:** Support from national policies and budgets allows for responsiveness to change or delays to disbursements. Linkage to global agreements provides an additional driver for government to invest in NbS.
- **Engage with multiple stakeholders in a participatory approach:** Scaling up the COBWEB model of Community Conservation Areas allows for local level planning and community ownership of the project.
- **Acknowledge synergies and uncertainties:** Cross-sectoral alignment and multi-scale approaches ensured completion of activities, harnessing the resources of multiple stakeholders. Identification of uncertainty allows for barriers to previous iterations to be addressed.

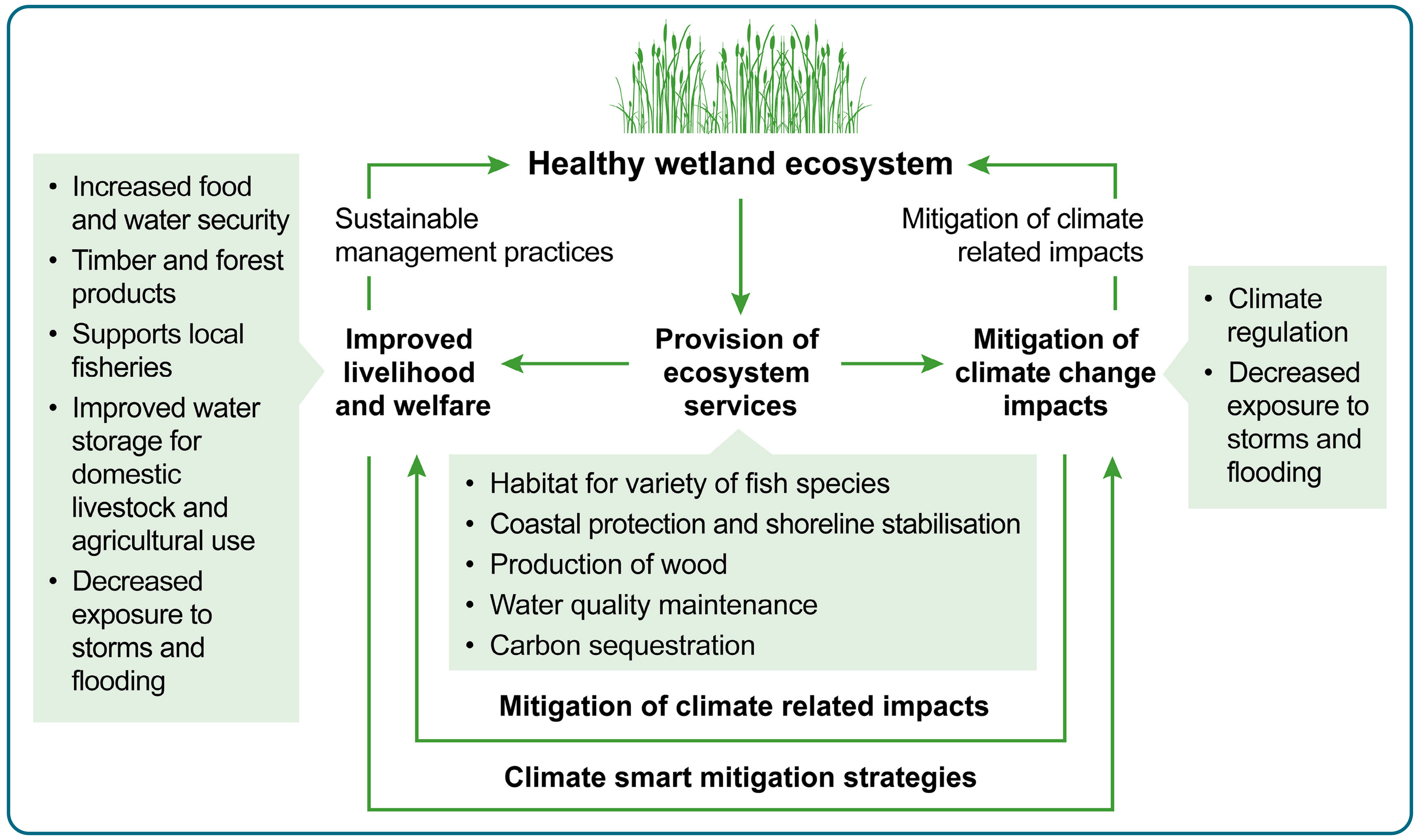


Diagram of NbS interactions showing that wetland restoration can contribute towards multiple benefits.

Sustainability and legacy of project

The project builds on lessons learned from COBWEB, addressing barriers to success and expanding into new territories. Barriers included a lack of connections to sustainable financial models and establishing microbusinesses. Sustainable markets and improved value chains create the necessary conditions for the financial benefits of alternative livelihoods to persist beyond the term of the project. The participatory approach to designing Community Conservation Areas and upskilling local communities ensures community buy-in and builds capacity on the ground for the maintenance of climate warning systems, data collection and interpretation. Connecting activities to decentralized decision-making community platforms increases the likelihood that the project will be embedded in community culture and continued.

Further information: https://www.greenclimate.fund/project/fp034

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