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Working Paper

Nature-based solutions to development and climate change challenges: Understanding ecosystem-based adaptation approaches

DIIS Working Paper, No. 2021:09

Provided in Cooperation with:

Danish Institute for International Studies (DIIS), Copenhagen

Suggested Citation: Ladekjær Gravesen, Marie; Funder, Mikkel (2021) : Nature-based solutions to development and climate change challenges: Understanding ecosystem-based adaptation approaches, DIIS Working Paper, No. 2021:09, ISBN 978-87-7236-051-5, Danish Institute for International Studies (DIIS), Copenhagen

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Nature-based solutions to development and climate
change challenges:

UNDERSTANDING ECOSYSTEM- BASED ADAPTATION APPROACHES

Marie Ladekjær Gravesen and Mikkel Funder

Acknowledgements

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DIIS WORKING PAPER 2021: 09

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ISBN 978-87-7236-051-5 (pdf)

DIIS publications can be downloaded free of charge from www.diis.dk

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Marie Ladekjær Gravesen and Mikkel Funder

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LIST OF ABBREVIATIONS

| | |
|--------|---------------------------------------------------------------|
| CBD | Convention on Biological Diversity |
| EbA | Ecosystem-based Adaptation |
| EbM | Ecosystem-based Mitigation |
| FPIC | Free Prior and Informed Consent |
| GiZ | German Society for International Co-operation |
| IUCN | International Union for Conservation of Nature |
| MEA | Millennium Ecosystem Association |
| NbS | Nature-based Solutions |
| NbSA | Nature-based solutions for adaptation |
| NDC | Nationally Determined Contributions |
| Norad | Norwegian Agency for Development |
| ODA | Official Development Assistance |
| PES | Payment for environmental services |
| UNDP | United Nations Development Programme |
| UNDRIP | United Nations Declaration on the Rights of Indigenous People |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |

INTRODUCTION

Nature-based Solutions (NbS) to climate- and development-related challenges have recently gained attention in development cooperation. This Working Paper focuses on nature-based solutions to climate change adaptation, also known as Ecosystem-based Adaptation (EbA). It provides an overview of selected lessons learnt from EbA in the context of development cooperation, with a particular emphasis on the opportunities and risks regarding poverty alleviation and rights.

This Working Paper is based on a desk study of selected academic literature and policy- and project-related publications and reports. It has been prepared by DIIS as part of the project ‘Research and Evaluation of Development Cooperation’ with funding from the Danish Ministry of Foreign Affairs. The Working Paper seeks to generate learning for Danish development cooperation, including future programming under Denmark’s 2021 development strategy, in which NbS approaches are emphasised. However, the paper can also be read as a general discussion of experiences with EbA in the development context.

The Working Paper consists of seven main sections. It first provides a conceptual overview of EbA in relation to NbS and where the typology comes from, then outlines the potential in using EbA approaches before briefly describing the landscape of the institutions and agencies that fund, promote and implement EbA. The paper then provides a synthesis of lessons learned from PES and REDD+ schemes that are of relevance to EbA. It also outlines the overall challenges to EbA identified in the literature before going on to discuss the key success factors. Finally, it provides a list of recommendations and possible entry points for Danish Development Cooperation in the use of EbA. The working paper also presents five highlighted examples of EbA projects drawn from project publications and, where available, peer-reviewed papers selected to illustrate different types of EbA activities in practice. Our desk study has not been in a position to verify the reported outcomes, but it did find that few EbA project reviews or studies comment on rights issues.

EBA, WHAT IS IT?

According to International Union for Conservation of Nature (IUCN), the term ‘nature-based solutions’ (NbS) is to be understood as an umbrella term for approaches that *‘protect, sustainably manage and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits’* (IUCN 2016). Besides Ecosystem-based Adaptation (EbA), other approaches that fall under the NbS umbrella include, among several others, Ecosystem-based Mitigation (EbM) and

Ecosystem-based Disaster Risk Reduction (Eco-DRR) (see Cohen-Shacham et al. 2016: 32).¹

In 2009 the concept of ‘ecosystem-based adaptation’ (EbA) was defined by the Secretariat of the Convention on Biological Diversity (CBD) as the ‘*use of biodiversity and ecosystem services to help people adapt to the adverse impacts of climate change*’ (CBD 2009). The CBD later altered its definition to make it more holistic. In 2010, EbA was thus defined as the ‘*sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities*’ (CBD 2010: 3, cited in Doswald et al. 2014: 185). The three-legged adaptation approach, focusing on human well-being, ecosystem management/conservation/restoration, and climate change adaptation, has already been applied to a range of ecosystems, including the restoration of mangroves to shield them against storm and sea-level rises, the management of watersheds to protect against droughts and flooding, the management of rangelands to inhibit desertification and land degradation, and more sustainably managed fisheries and forestry in order to tackle food insecurity (Chong 2014). EbA thus not only addresses the restoration of already degraded ecosystems, but also the use, management and conservation of intact ecosystems. This holistic and comprehensive three-legged approach is also what distinguishes EbA from some forms of community-based adaptation that have a more specific goal of, for example, introducing improved crops for smallholders but take less account of the potential long-term impacts on the ecosystem.

Example 1. The EbA Programme for Mountain Ecosystems - Uganda

This programme was conducted in Nepal, Uganda and Peru, funded by Germany, and led by UNEP, UNDP and IUCN in collaboration with national and subnational authorities and communities. In Uganda, EbA activities included soil and water conservation, reforestation and green infrastructure (terracing, contours), agroforestry and reforestation (including a Payment for Environmental Services scheme), riverbank stabilisation rainwater harvesting and alternative forms of income-generation (e.g., making bricks, cooking stoves etc.). The Ugandan component reported a number of environmental, economic and social benefits. Species diversity increased, as did pollination and thereby crop productivity, floods were fewer and water flows were stabilised, farming became more resilient, crop diversity increased and food security improved.

Source: UNDP, 2017

¹ The NbS approaches can be categorised into five overall groups: 1. Restorative (Ecological restoration, Forest landscape restoration, Ecological engineering); 2. Issue-specific (Ecosystem-based adaptation; Ecosystem-based mitigation; Ecosystem-based disaster risk reduction; Climate adaptation services); 3. Infrastructure (Natural infrastructure; Green infrastructure); 4. Management (Integrated coastal zone management; Integrated water resources management); 5. Protection (Area-based conservation approaches, including protected area management and other effective area-based conservation measures) (Cohen-Shacham et al. 2019:22).

IUCN standards for NbS

Both the UNFCCC and the CBD recognise that EbA contributes to their objectives for sustainable transformation, and they have therefore recently encouraged parties to implement EbA approaches. IUCN proposes that NbS approaches can be implemented further by following their global standards of 8 criteria and 28 indicators (see Table 1). They have developed a guide that can already be used in the design phase to calculate how well a potential project adheres to the NbS criteria and indicators. The guide instructs users in how to perform a self-assessment to design new NbS projects, identify gaps and assess past projects and new proposals (IUCN, 2020 a, 2020 b). All the determined global standards are directly or indirectly relevant to a rights-based, pro-poor approach. However, the most critical of these are highlighted in blue below.

Table 1. The IUCN global standards

| Criteria | Indicators |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1: NbS effectively address societal challenges | 1.1 The most pressing societal challenge(s) for rights-holders and beneficiaries are prioritised |
| | 1.2 The societal challenge(s) addressed are clearly understood and documented |
| | 1.3 Human well-being outcomes arising from the NbS are identified, benchmarked and periodically assessed |
| 2: Design of NbS is informed by scale | 2.1 The design of the NbS recognises and responds to the interactions between the economy, society and ecosystems |
| | 2.2 The design of the NbS is integrated with other complementary interventions and seeks synergies across sectors |
| | 2.3 The design of the NbS incorporates risk identification and risk management beyond the intervention site |
| 3: NbS result in a net gain to biodiversity and ecosystem integrity | 3.1 The NbS actions directly respond to evidence-based assessments of the current state of the ecosystem and the prevailing drivers of degradation and loss |
| | 3.2 Clear and measurable biodiversity conservation outcomes are identified, benchmarked and periodically assessed |
| | 3.3 Monitoring includes periodic assessments of unintended adverse consequences on nature arising from the NbS |

| | |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 3.4 Opportunities to enhance ecosystem integrity and connectivity are identified and incorporated into the NbS strategy |
| 4: NbS are economically viable | 4.1 The direct and indirect benefits and costs associated with the NbS, who pays and who benefits, are identified and documented |
| | 4.2 A cost-effectiveness study is provided to support the choice of NbS, including the likely impact of any relevant regulations and subsidies |
| | 4.3 The effectiveness of the NbS design is justified against the available alternative solutions, taking into account any associated externalities |
| | 4.4 The NbS design considers a portfolio of resourcing options, such as market-based or public-sector options, voluntary commitments, and actions to support regulatory compliance |
| 5: NbS are based on inclusive, transparent and empowering | 5.1 A defined and fully agreed upon feedback and grievance resolution mechanism is available to all stakeholders before an NbS intervention is initiated |
| | 5.2 Participation is based on mutual respect and equality, regardless of gender, age or social status, and upholds the right of Indigenous Peoples to Free Prior and Informed Consent (FPIC) |
| | 5.3 Stakeholders who are directly and indirectly affected by the NbS have been identified and involved in all processes of the NbS intervention |
| | 5.4 Decision-making processes document and respond to the rights and interests of all participating and affected stakeholders |
| | 5.5 Where the scale of the NbS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision-making by the stakeholders in the affected jurisdictions |
| 6: NbS equitably balance trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits | 6.1 The potential costs and benefits of associated trade-offs of NbS interventions are explicitly acknowledged and inform safeguards and any appropriate corrective actions |
| | 6.2 The rights, usage of and access to land and resources, along with the responsibilities of |

| | |
|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | different stakeholders, are acknowledged and respected |
| | 6.3 The established safeguards are periodically reviewed to ensure that mutually agreed trade-off limits are respected and do not destabilise the entire NbS |
| 7: NbS are managed adaptively, based on evidence | 7.1 An NbS strategy is established and used as a basis for regular monitoring and evaluation of the intervention |
| | 7.2 A monitoring and evaluation plan is developed and implemented throughout the intervention life cycle |
| | C-7.3 A framework for iterative learning that enables adaptive management is applied throughout the intervention life cycle |
| 8: NbS are sustainable and mainstreamed within an appropriate jurisdictional context | 8.1 The NbS design, implementation and lessons learnt are shared to trigger transformative change |
| | 8.2 The NbS informs and enhances facilitating policy and regulation frameworks to support its uptake and mainstreaming |
| | 8.3 Where relevant, the NbS contributes to national and global targets for human well-being, climate change, biodiversity and human rights, including the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) |

Origin if the EbA term

The term 'EbA', which springs from ecosystem services, was popularised in the 1970s, long before climate change impacts became widely acknowledged. Rather than being presented as an approach to adaptation, ecosystem services were promoted by conservation biologists to underline nature's role in contributing to human well-being and to criticise the overemphasis on economic growth in development and environmental policies (Chong 2014: 392). The Millennium Ecosystem Association (MEA) defines ecosystem services as '*the benefits people obtain from ecosystems*' such as water, food and pollination (WRI 2005). However, over the years, ecosystem services have in practice become increasingly commodified and treated as '*stocks and flows of economic value*' (Chong 2014: 393). This can be seen in the trend to expand schemes of payment for environmental services (PES), even though critics have argued that the impact of commodification approaches such as PES has been limited (Büscher and Fletcher 2020).

Despite the criticisms of this trend towards commodification, the idea that ecosystems can contribute to human well-being (e.g., poverty alleviation) and simultaneously be environmentally beneficial has reached policy agendas globally, as well as created awareness among local communities (Chong 2014). EbA can be seen as an improvement to the commodified framework of ecosystem services, due to the supposed shift away from the dominating nature-culture dichotomy towards an inclusive and holistic approach that supports the adaptive capacity of nature as well as of society (Khan and Amelie 2015; Munang et al. 2014; Scarano 2017).

Example 2. EbA in Samoa's development policy

Samoa's development strategies include efforts to strengthen community resilience through natural systems such as buffering the impacts of cyclones and flooding with mangroves. Forest landcover is used as an indicator, as this is relevant to slope stabilisation and coastal protection. The incorporation of customary law into natural resource management laws and policy has enhanced recognition of traditional knowledge and rights. For example, communities are permitted to develop their own fisheries by-laws and to oversee management plans. Reportedly, the acknowledgment of customary law by EbA planners and implementers provided an important motivation for community member to engage in EbA design and implementation.

Sources: Chong 2014, Lo 2016

EbA: a multi-purpose approach

EbA should be seen as a multi-purpose approach whereby eco-systems are restored not only for the sake of people's well-being. As an example of a linear single-purpose adaptation approach, clearing forest to produce biofuel contributes to societal adaptation, yet leads to biodiversity loss and is therefore *not* grounded in EbA. By contrast, forest conservation may preserve biodiversity *and* sustain water storage and filtration for the benefit of downstream adaptation by farming communities. It thus has both adaptive social benefits as well as benefits for the ecosystem and biodiversity in general.

A distinction is necessary between *pure EbA* approaches (where the direct and integrated societal and ecosystem/biodiversity benefits are targeted) and *EbA-relevant* interventions, where the focus is primarily on societal adaptation activities and the ecosystem and biodiversity benefits are not directly targeted or are being considered solely to avoid interventions that might lead to biodiversity loss (Chong 2014: 393). Doswald et al. define EbA-relevant interventions as: '*activities such as ecosystem restoration, dryland management and natural resource management, where activities were undertaken either to reduce vulnerability of humans or to help humans cope with climatic variability and extremes*' (Doswald et al. 2014: 187), rather than primarily to protect biodiversity. However, the opposite scenario would also be EbA-relevant, namely that an intervention primarily focuses on the regeneration of ecosystems or biodiversity, and in doing so no damage is done to community livelihoods. Such approaches thereby operate with a 'do no harm'

principle, as opposed to fully fledged EbA approaches in which both societies and ecosystems benefit from an intervention.

Due to the challenges of including multiple stakeholders, institutions and ministries in the implementation of pure EbA approaches, project implementers could be inclined to cut corners and effectively implement the EbA-relevant approaches because doing so would place fewer demands on stakeholders, institutions and sectors. There might be a concern that this would introduce a slope 'back' towards single-purpose adaptation approaches that are essentially far from the holistic multi-purpose, multi-sectoral and multi-scalar essence of EbA. Indeed, Vignola et al. (2015) argue that some EbA practices found today are labelled EbA despite having few if any direct livelihood benefits in their design. For example, some focus on technical solutions such as the use of organic fertilizers, the relocation of crops etc., while paying less attention to whether or not such initiatives have an impact on food security. This reduces the direct relevance of such EbA approaches to smallholders. Instead of distinguishing between pure EbA and EbA-relevant approaches, Vignola et al. suggest that an initiative should be defined as an EbA if it benefits societal adaptation, biodiversity and ecosystems, and as an 'EbA with smallholder benefits' if it *also* contains livelihood benefits that, for example, directly improve the food security of the farmer's family (see Table 2).

Table 2. EbA status criteria

| <p>Vignola et al. (2015) set out three dimensions with fundamental criteria that need to be satisfied by agricultural interventions for them to be regarded as EbA practices that are appropriate for smallholders. If an agricultural intervention that delivers on at least one criterion in the dimensions 'ecosystem-based' and 'adaptation-benefits', it can be deemed an EbA intervention. Interventions that also deliver on one or more criteria in the third dimension can be deemed EbA practices appropriate for smallholders.</p> | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimension 1. Ecosystem-based | Dimension 2. Adaptation benefits | Dimension 3. Livelihood security |
| Is based on the conservation, restoration and sustainable management of biodiversity (e.g. genetic, species and ecosystem diversity) | Maintains or improves crop, animal or farm productivity in the face of climate variability and climate change | Takes advantage of local or traditional knowledge of smallholder farmers |
| Is based on the conservation, restoration and sustainable management of ecological functions and processes, such as nutrient cycling, soil formation, water infiltration or carbon sequestration) | Reduces the biophysical impacts of extreme weather events and high temperatures on crops, animals and farming systems | Uses local, available and renewable inputs, e.g. using local materials from within the farm or landscape, rather than external inputs such as pesticides, inorganic fertilizers, etc. |
| | Reduces crop pest and disease hazards due to climate change | Increases or diversifies income generation of smallholder households |
| | | Increases the food security of smallholder households |
| | | Requires implementation costs and labour that smallholders can afford |

An intervention that addresses all these three dimensions would be a good starting point for pro-poor EbA interventions in rural settings - also being adaptable for urban contexts as well.

WHAT IS THE POTENTIAL OF EbA?

Potential benefits of EbA to poverty alleviation

EbA can potentially contribute to poverty alleviation by reducing climate risks for the poor and enhancing their livelihood opportunities. Seddon et al. identify three dimensions through which EbA can reduce climate risks (Seddon et al. 2020a):

- (i) Reducing exposure, e.g., through protection from erosion, drought, flooding and coastal hazards in both rural and urban areas.
- (ii) Reducing sensitivity, i.e., buffering communities from climate shocks by enhancing and diversifying ecosystem services.
- (iii) Supporting adaptive capacity through the strengthening of institutional frameworks that enhance resource access and empower communities in the governance of adaptation and natural resources.

There is evidence that EbA contributes to food- and livelihood security, helps diversify income structures and protects against market changes (Munang et al. 2014; Vignola et al. 2015, Reid et al. 2019). For instance, introducing agro-forestry into the production systems of cattle-, cocoa- or coffee-farmers offers the co-benefits of potential diversification of income by providing timber, fruit and fuelwood for the farmer, thus providing a safety net for years when the farmers' main revenue is low, while simultaneously contributing to biodiversity and the forest ecosystem.

Example 3. Making the case for biodiversity in South Africa

The 'Making the Case for Biodiversity' project was undertaken in South Africa by the South African National Biodiversity Institute and the national Department of Environmental Affairs with GEF funding and UNDP support from 2011-13. The project used communications experts to investigate the attitudes of national and subnational policymakers and other stakeholders towards biodiversity. It was found that biodiversity tended to be associated with the wealthy or privileged, rather than the poor, and that the biodiversity sector was thought to be out of touch with the everyday realities of a developmental state. On this basis the project worked to increase awareness among decision-makers of the advantages of EbA and associated approaches.

For example, the costs of climate hazards and disasters were calculated. A 3-year drought in one area cost R166.6 million in relief funding to help farmers feed their livestock, while flood damage in other regions cost R360 million. It was then documented how ecosystem restoration measures – such as restoring wetlands and grasslands and clearing invasive species - were relatively small investment with significant returns in local water yields, in contrast to costly and energy intensive engineering solutions such as desalinisation. The benefit of the improved water yields for local agriculture and job opportunities were also documented. The project further developed a framework of indicators that can be used by local governments to assess their actions vis-à-vis sustainable ecosystem management and socio-economic development. The project's activities are reported to have influenced national policy at the time, including adding an EbA perspective to South Africa's Green Economy Accord, which originally only covered aspects of climate change and waste disposal. In consequence, a number of large-scale infrastructure projects were subjected to EbA risk assessment activities.

Sources: Lo, 2016; Maze et al., 2016

EbA's co-benefits for mitigation and biodiversity

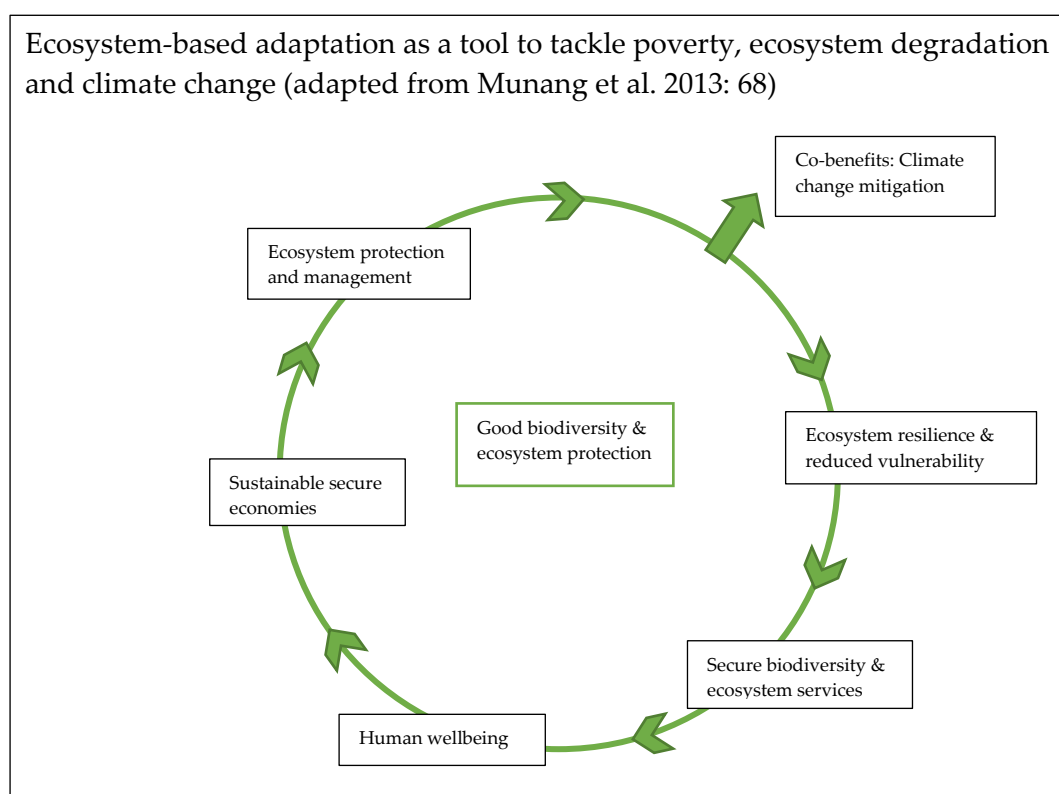
EbA potentially has significant environmental benefits. According to Vignola et al., *'the co-benefits of EbA practices in terms of climate regulation, water purification, habitat creation, biodiversity conservation and landscape amenities are often significantly greater than those of engineering alternatives (e.g., flood defences infrastructure, water treatment plants)'* (Vignola et al. 2015:129-30). According to Munang et al., there is evidence that EbA also provides climate change *mitigation* co-benefits (2013). Examples include forest carbon storage or the reduction of greenhouse gases from agricultural systems when, for example, the use of inorganic fertilisers, machinery and agrochemicals is reduced.

In principle, EbA can also provide major co-benefits for *biodiversity*. Sustainable management, conservation or restoration of, for example, wetland areas, mangroves, coral reefs and forests as part of EbA projects can provide an important means of protecting, regenerating and expanding biodiversity habitats. EbA could potentially form part of a broader effort to overcome the long-term tendency in conservation to segregate protected areas from human presence or

involvement (in the people vs. parks debates). EbA could also help facilitate a shift towards more recent 'co-existence' and landscape-based approaches in which the boundaries between human resource use and biodiversity habitats are more fluid, to the benefit of both (Hinchliffe 2007; Western et al. 2020). Critical to achieving this, however, is paying due regard to locally driven processes, resource rights and the actual socio-economic benefits of EbA.

Munang et al. (2013) see the co-benefits as EbA's biggest advantage compared to other adaptation approaches (see Figure 1).

Figure 1. Ecosystem-based adaptation



However, it should be noted that few studies have so far been conducted thoroughly documenting the effects of EbA on mitigation and especially biodiversity, given that most EbA schemes are relatively new. Such studies could help enhance the evidence base for EbA. In any case, these co-benefits cannot be assumed to take place automatically or within the lifespan of a particular intervention. Indicators should therefore be developed to track the assumed co-benefits alongside other expected or planned benefits.

EbA: a policy mix with costs and benefits

If undertaken optimally, EbA becomes *'a policy-mix that has the potential to, while adapting to climate change, drive sustainability transitions. It combines policies that can be sectoral or integrated, and demands socio-ecological research, while having the potential to bridge this with socio-technical research'* (Scarano 2017: 71). Based on the literature, the cost-benefit analyses of EbA interventions mostly have a net positive benefit (Munang et al. 2013). In addition to the targeted benefits and the co-benefits,

Munang et al. even argue that EbA offers a ‘third win’ in creating a basis for new economic growth: *‘The Economics of Ecosystems and Biodiversity studies show that an annual global investment of \$45 billion in protecting ecosystems could deliver an estimated \$5 trillion a year in benefits, a cost–benefit ratio of over 100:1’* (Munang et al. 2013: 68-9). These estimations refer to discussions of the ‘cost of no action’ in the sense that optimal interventions, i.e. EbA, is more cost-effective than half-baked interventions or inaction.

The 2020 UNEP Adaptation Gap report estimated the current annual costs of adaptation in developing countries to be USD 70 billion, expected to reach USD 280-500 billion by 2050. The cost of biodiversity loss and ecosystem collapse to local livelihoods and national economies are even greater, especially in low-income Sub-Saharan countries where reliance on wild-crop pollination and forest products is particularly high, and where the options for economic diversification are often fewer (Johnson et al. 2021). Successful EbA can help address these costs and losses.

It should also be noted that ecosystems not only represent economic values, but also often have important social and cultural values for communities and societies. These benefits are often not accounted for in economic valuations of ecosystem services but can be an important co-benefit of EbA.

Even so, it is indisputable that EbA not only delivers benefits but also requires investments, trade-offs and other costs, as summarised in Table 3.²

² The environmental costs mentioned in the table would ideally not be an issue in a successful EbA. Clearly all human agency comes with the risk of unintended consequences, and community-led measures to ensure that EbA principles are maintained must be developed in implementing EbA. Even so, in some situations EbA does involve certain overall environmental ‘costs’ when compared to ‘Total Protection’ situations. For example, restoration of an environmentally degraded farming zone through EbA would still need to allow for sustainable farming practices taking place, which in a conventional view of conservation would be a trade-off compared to Total Protection. However, the long-term benefits of EbA in securing ecosystem sustainability and biodiversity conservation may be better than a locally contested and poorly funded Total Protection zone.

Table 3. Reported costs and benefits from the literature

Based on a review of the peer-reviewed and grey literature, Doswald et al. compiled reports of the social, environmental, and economic costs and benefits of ecosystem-based approaches relevant for climate change adaptation (Doswald et al. 2014: 195).

| | Social | Environmental | Economic |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Benefits | Improved and secure livelihoods; new or preserved recreation areas; social cohesion and community; empowerment; better quality land for food and cattle; better water security; protection from damage and loss | Biodiversity conservation; carbon sequestration and mitigation benefits; land erosion and degradation prevention; habitat creation and restoration; mitigation of microclimatic variability | Damage costs prevented; new or improved incomes; profits; savings compared to alternative adaptation approaches; income from subsidies |
| Costs | Loss of land that could be used for other pursuits; effort required for the initiation and maintenance of EbA; knowledge-intensive | Loss of habitat for certain species; invasive species; increasing pressure on natural resources | Costs for setting up and maintenance; opportunity costs |

Source: Doswald et al. 2014:195

This raises the question of how the costs and benefits are distributed across different types of stakeholders. Estimates of EbA benefits and costs often assume that these are shared broadly, thereby overlooking key factors such as a lack of willingness to invest in EbA, or conflicts that arise from unequal distributions of costs and benefits and thus derail the process. Costs and benefits must also be considered in the light of developmental goals such as poverty alleviation and rights-based principles. UNFCCC notes: *‘Besides financial and economic assessments, social appraisal is crucial in any assessment of costs and benefits of adaptation options, because the impacts of climate change often disproportionately affect the most vulnerable communities and groups’* (UNFCCC 2010: 5, cited in Doswald et al. 2014: 186). Ensuring a pro-poor rights-based perspective thus becomes critical in providing support to EbA including not least material rights, such as land and water rights.

Example 4. Reforestation and degraded ecosystems in Peru

This project, funded by the Swiss Agency for Development and Cooperation, works in and around three conservation areas in Peru. The areas are of high biodiversity value and protect the headwaters of the micro-basins that supply water to the city of Moyobamba. Unsustainable land-use practices exacerbated by climate change have resulted in increased risks of water stress for this urban area. Within the project, a private water-service provision company is collaborating with local and regional government to introduce a scheme in which an additional conservation tariff is added to the regular water tariff. The extra fee is used for conservation and related resource management, such as reforestation, management of coffee production, agroforestry, tree nurseries, financial compensation and income-generating activities.

The scheme was made possible through existing legislation that allows Payments for Ecosystem Services and is thereby sanctioned by the national regulatory framework. The project is governed by a steering committee which includes representatives of regional and local government institutions, civil society, including NGOs, a small agricultural association of people living in the micro-basins, academics, journalists and special interest groups in the city of Moyobamba and the Catholic Church (León and Renner 2010, MINAM 2010b).

Sources: Stern and Echavarria, 2013; Vázquez Vela, 2018

WHAT'S HAPPENING? EBA FUNDING AND ACTORS

In recent years, EbA has gained some traction in global and national frameworks on climate change, biodiversity and disaster risk reduction, either through specific mention as 'EbA', or as 'NbS for adaptation'. Table 4 provides an overview of selected global frameworks that either directly mention EbA or NbS for adaptation, or specifically link adaptation, ecosystems and livelihoods.

Table 4. Links to EbA in selected international frameworks and forums

| Framework/organisation | Link to EbA |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UN CBD Convention on Biological Diversity | Various documents endorse EbA, including 2018 voluntary guidelines on EbA approaches to climate change adaptation and disaster risk reduction |
| UNFCCC Paris Agreement on climate change | NbS measures for adaptation reflected in 62% of all NDCs under the agreement. The main agreement does not specifically mention EbA, though it recognises the links between adaptation, livelihoods and ecosystems (e.g., Article 7) |

| | |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sendai Framework for Disaster Risk Reduction | Aims to promote transboundary cooperation on EbA to enable its application in DRR policy and planning |
| Sustainable Development Goals | The only direct mention of EbA is in Goal 14 on oceans, which includes the indicator: <i>Number of countries using marine EbA</i> . There are also a number of implicit links, e.g., in goal 2: End Hunger, where target 2.4 links adaptation, ecosystems and food production |
| IPBES Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services | 2019 report emphasises how NbS can support the SDGs, including climate change. Some members provide technical support to EbA projects |
| IPCC | The 5 th Assessment Report recognises EbA. The 2019 Climate Change & Land Report states: <i>'EbA can, in some contexts, promote nature conservation while alleviating poverty and can even provide co-benefits by removing GHGs and protecting livelihoods (e.g., mangroves) (medium confidence)'</i> |
| Global Commission on Adaptation | Has a dedicated NbS Action Track aimed at raising political awareness of NbS and of its adaptation and incorporation in adaptation planning |
| UNFCCC Nairobi Work Programme for Adaptation and Resilience | EbA is part of the mandate |
| IUCN | 2020 NbS standards incorporate human well-being outcomes |
| UN Climate Action Summit 2019 | Included NbS among nine key action areas |
| EBAFOSA – Ecosystem Based Adaptation for Food Security Assembly (18 African Governments + variety of non-Govt actors, UNEP-supported) | Promotes EbA through national action plans and stakeholder collaboration |
| FEB - Friends of EBA (global network supported by Germany and IUCN) | Promotes integration of EbA in international climate change adaptation negotiations and policies |

In the first round of 168 Nationally Determined Contributions (NDC's) under the Paris Agreement, 63% included some form of NbS in their adaptation actions, though this is not necessarily stated as such (Seddon et al. 2020b). NbS actions are particularly prevalent in developing-country NDCs. One study found that all NDCs from low-income countries included NbS actions in their adaptation plans, compared to 27% of NDCs in high-income countries (op. cit.). EbA is also reflected in a number of the National Adaptation Plans submitted to the UNFCCC (Terton and Greenwalt 2020; WWF 2021a). However, the prominence of EbA/NbS for adaptation in the NDCs is not translated into clear targets: only 17% of NDCs with EbA-related actions were assessed as setting robust and quantifiable targets (Seddon et al. 2020b).

Overall EbA funding situation

Overall, adaptation finance constituted 12% of global public climate finance in 2018, amounting to USD 30 billion. A further USD 12 billion was provided for activities with dual adaptation and mitigation benefits. Most adaptation-specific funding – namely 79% or approx. 23 billion annually – was provided by development finance institutions (Buchner et al. 2019; Magnan and Dale 2020).

Funding to EbA specifically has increased recently but remains limited. A WRI analysis using the most recent OECD data (Swann et al. 2021) found that ODA support to Nature Based Solutions for Adaptation³ rose from an estimated USD 2.1–4.1 billion in 2012 (lower and upper ranges of estimate) to USD 3.8–8.7 billion in 2018. Overall, however, this only accounted for 9% of global public adaptation financing, 1.5% of all public climate finance flows and 0.6% of all climate flows (Swann et al., 2021). It should be noted that this does not include funding from most of the MDBs, as their reporting could not be linked to EbA. The UNEP Adaptation Gap 2020 report found that 13% of all the funding provided by four climate funds – the GCF, GEF, AF and Germany's IKI – had been allocated to activities with a focus on, or containing elements related to, adaptation-related NbS (Magnan and Dale 2020).

A number of sources agree that EbA has struggled to attract investment compared to other adaptation activities, especially compared to engineering-based infrastructure projects for adaptation (Cooper and Matthews 2020; GCA 2019; Reid et al. 2019). The reasons include:

- *A lack of clarity about what EbA entails in practice.* Despite the recent IUCN standards, the concept remains somewhat niche and is not widely known among decision-makers.
- *Uncertainty about the costs, benefits and effectiveness of EbA.* The evidence base for EbA has traditionally been limited. This is now improving, and recent studies have documented that EbA can provide cheaper solutions than conventional approaches (Chausson et al. 2020; Reid et al. 2019). However,

³ WRI prefers this term but equates it with EbA.

there are few tangible metrics with which planners and citizens can compare the costs and benefits of EbA against other types of intervention.

- *The funding landscape is not diversified.* Most support to EbA has so far been provided in the form of conventional ODA grants and relatively short-term projects (Swann et al. 2021). Longer term funding options are poorly developed. Private-sector investments have been limited, as the resources to be managed (water, land, forests etc.) and the benefits generated (adaptation, livelihoods, economic development) tend to be public and communal and are often not commercially viable in a traditional sense.
- *Constraints in climate finance programming.* EbA is multi-purpose and requires cross-sectoral interventions at several levels, ideally through longer-term interventions. Transaction costs can be high, as multiple stakeholders need to be involved. Such factors can act as disincentives in financing mechanisms where focused, short-term projects are often favoured.
- *Limited real demand from implementing organisations* in recipient countries. While a number of countries have adopted EbA in NDCs, the actual organisational landscapes tend to be dominated by strongly sectoral approaches. Cross-sectoral approaches such as EbA potentially challenge established sectoral arrangements and identities and may upset organisational reliance on revenue streams from other types of projects (Sarabi et al., 2020).

These constraints do not mean that EbA should not be funded, but they highlight the need for attention to be paid to (i) identifying more diverse funding sources, including consideration of whether private-sector financing for EbA is realistic and how it might be sourced, or whether alternative public finance solutions must be found; (ii) allowing long time frames in EbA planning and implementation; and (iii) supporting institutional arrangements that minimise sectoral competition, such as devolved EbA governance and implementation.

Actors in the EbA financing landscape

The emphasis placed on EbA in multilateral climate funds varies according to the thematic scope of each fund. For example, analysis of the GCF lifetime portfolio showed that 9% of its funding could be classified as EbA (a total of USD 2.02 billion in 2015-2018), while the Adaptation Fund equivalent was 68% of the portfolio (though only amounting to USD 0.5 billion in 2010-2018).

GEF-related funding for EBA has primarily been funded through the GEF-administered LCDF and SSCF funds. Since 2014 a suite of EBA projects drawn from the LCDF or SSCF have been implemented through UNEP in a variety of countries. (total grants for these 12 projects specifically labelled EbA amount to approximately USD 70 million from LCDF and USD 8 million from SSCF, according to the GEF database). According to UNDP data, by October 2020 a UNDP-GEF partnership for EbA had amounted to USD 143 million of project grants from the LCDF and USD 16 million from the SSCF. A number of other GEF-funded adaptation projects include EbA more indirectly or as one component

among other adaptation activities. figure 5 shows the main bilateral ODA funders of EbA in 2012-2018 and selected multilateral organisations. Of the bilateral donors, *Germany* has been particularly active in supporting EbA, including through its IKI funding instrument, which supports climate change and biodiversity under the German Ministry of Environment and Nature Conservation (GiZ, 2018; Vázquez Vela, 2018).

Table 5. ODA funders for NbSA and distribution by regions

The main bilateral ODA funders for NbSA (i.e., EbA) and funding received by region and country (USD, millions) from 2012-2018

| | DONOR | 2012 | 2015 | 2018 |
|----------------------------------|-------------------------------------------------|--------------------|--------------------|--------------------|
| BILATERAL | Germany | 420–550 | 730–1,050 | 920–1,510 |
| | United Kingdom | 0–70 | 210–400 | 850–890 |
| | Sweden | 90–160 | 100–130 | 260–360 |
| | Japan | 330–590 | 20–470 | 230–450 |
| | United States | 290–430 | 180–350 | 110–220 |
| MULTILATERAL | Asian Development Bank | - | - | 0–1,580 |
| | European Union institutions | 380–750 | 340–1,000 | 790–1,560 |
| | Green Climate Fund | - | 0–40 | 0–460 |
| | International Fund for Agricultural Development | - | 0–460 | 0–250 |
| | Global Environment Facility | - | 0–110 | 0–180 |
| | Adaptation Fund | 0–40 | 0–50 | 0–55 |
| | <i>Total of all ODA funding for NbSA</i> | <i>2,130–4,170</i> | <i>2,690–6,230</i> | <i>3,750–8,700</i> |
| REGIONS | | 2012 | 2015 | 2018 |
| Sub-Saharan Africa | | 370–900 | 1,110–2,020 | 1,670–2,880 |
| Latin America and the Caribbean | | 490–630 | 650–1,000 | 510–930 |
| South and Central Asia | | 260–590 | 230–920 | 370–1,740 |
| East Asia and the Pacific | | 480–900 | 230–750 | 300–1,140 |
| Europe | | 25–150 | 45–390 | 80–320 |
| Middle East and North Africa | | 120–210 | 170–280 | 30–270 |
| Unspecified developing countries | | 380–790 | 240–870 | 790–1,420 |

Source: Swann et al., 2021. Based on raw data from the OECD Stat database. Note: except for the ADB, data on EbA support through the development banks are not included in these figures, as they are reported differently. NbSA = nature-based solutions for adaptation; ODA = official development assistance. Note also that the latest data provided here are for 2018, and thus do not incorporate the recent growing attention to NbS.

Of the multilateral organisations, *UNEP* and *UNDP* have been prominent in promoting EbA as a key approach in adaptation (much of which has been funded through GEF and IKI support and is therefore included in the table). Flagship programmes include the ‘EbA South’ programme promoting South-South collaboration on EbA (Mills et al., 2020) and the Global Mountain EbA programme in Nepal, Peru and Uganda with IUCN (UNDP, 2017; UNEP/UNDP, 2015). In October 2020, UNDP identified 39 of their current projects as EbA with financing amounting to USD 504 million in grants drawn from various sources (especially

GCF and LCDF), plus USD 1.4 billion in co-financing.⁴ Recently, UNDP and FAO have developed toolkits for mainstreaming NbS in National Adaptation Plans and NDCs (FAO, 2020; UNDP, 2019). In 2021 UNEP, IUCN and Germany initiated the Global Fund for EbA which provides smaller project grants (<USD 250,000) to enhance technical assistance for EbA.

Data on EbA support through the development banks apart from the Asian Development Bank are not included in these figures, as they are reported differently. The *World Bank* 2019 strategy on adaptation includes NbS as a priority for action (WB, 2019: p15), and the Bank's 2020 'Principles for Adaptation' emphasise the need to 'systematically consider NbS' (WB, 2020: 86). Since 2017, the bank has operated an 'NbS program' which provides technical support in the integration of NbS to its own teams and partners, with a particular focus on water and DRR. In early 2021, the *AfDB and Global Center on Adaptation* initiated the 'Africa Adaptation Acceleration Program', which aims to mobilise USD 25 billion for scaling up adaptation across Africa. NbS has been mentioned as a thematic area under this programme, but it remains to be seen whether this will develop.

Among the global NGOs, WWF has recently sought to foster policy dialogue on NbS, including on the links between NbS and employment (WWF, 2021b; WWF/ILO, 2020). WWF is also a member of the Nature Based Solutions Initiative, along with various other conservation INGOs and research institutions, including Oxford University and IIED.

Thematic and regional focus of EbA projects

A global study found that the most frequently addressed climate hazards in EbA projects were intense precipitation (i.e., heavy rainfall leading to flooding, erosion and landslides) and drought (Magnan and Dale 2020). The EbA projects in that study were mainly undertaken in forest ecosystems, wetlands, agricultural ecosystems, coastal zones and urban areas (see Annex II, Figure 2).

The emphasis on EbA projects showed regional differences, e.g., EbA projects that addressed coastal hazards were more prominent in the Asia-Pacific region (23% of projects in that region), while drought was a particular emphasis in African EbA projects (34%). EbA projects in Africa, Asia, and Latin America were less focused on urban settings than in the North, with the majority of projects in Africa (73%) being focused on rural areas (Magnan and Dale 2020).

According to a WRI analysis of OECD data (see Annex 2, Figure 3), the main sectors of ODA associated with EbA in 2018 was agriculture, biodiversity and general environmental protection (Swann et al., 2021). Again, this only includes the ADB but no other MDBs, and we would expect that support to some sectors,

⁴ Data from <https://www.adaptation-undp.org/ecosystem-based-adaptation> accessed 9 July 2021. See also UNDP (2015).

especially water, would feature more prominently if the latter's funding was included.

WHAT CAN WE LEARN FROM PES AND REDD+?

EbA interventions often draw on past and other ongoing efforts to link ecosystem conservation and socioeconomic benefits. This includes the broad array of local and global efforts that apply Payment for Environmental Services (PES) principles. Lessons from these are important to consider in respect of the development of EbA. The following provides a brief summary of selected lessons from local PES schemes and the REDD+ agenda.

Lessons from local PES schemes

A large number of local PES schemes have been implemented worldwide in which farmers and other resource users are compensated for taking actions to manage land, water and other natural resources that provide ecological services to society. While such schemes can be relevant to apply to EbA, they also present challenges for a pro-poor approach (Benra and Nahuelhual 2019; Ravnborg 2007). PES is typically based on the principle of compensating formal right holders, but the poor often do not have access rights, or lack the means to document them. Moreover, the many stakeholders and associated transaction costs in such schemes can mean that small-scale landowners and resource users are marginalised from PES benefits, either through market dynamics (buyers may prefer large-scale providers) or power dynamics (Adekola et al., 2015; Corbera et al., 2020). Lastly, because the poor are often critically dependent on local natural resources, financial compensation may not be sufficient to compensate for the actual costs of PES-related restrictions on their livelihoods (Ravnborg 2007).

These risks point to the problems of developing conventional market-based incentive structures in pro-poor EbA. Where PES-related mechanisms are employed, support must therefore emphasise institutional mechanisms that avoids elite capture and marginalisation of the poor (Corbera et al. 2020; Ravnborg 2007). This can include:

- Basing PES schemes on communities as collective service providers rather than on individuals, and distributing benefits and responsibilities equally. This may entail supporting legal recognition of communities as ecosystem service providers and employing well-established approaches to ensure transparency and minimise elite capture within communities.
- Providing secure ownership and access rights to natural resources for communities as a key element in PES, rather than monetary compensation alone. Most importantly, such rights must provide added value to communities, especially the poor, rather than taking the rights they already have as a 'ransom' for ecosystem protection.

Lessons from REDD+

The REDD+ agenda is effectively envisaged as a global PES scheme aimed at providing economic benefits to governments and communities in return for forest conservation. Although aimed mainly at mitigation, it also offers important lessons for a pro-poor approach to EbA. As is well known, REDD+ has created significant concerns among many forest-using communities, and the literature has pointed to a number of risks for the poor. These include the loss of local land and use rights, as forests are subjected to stricter conservation measures and global market dynamics under REDD+, and the potential undermining of customary resource governance institutions (Chomba et al. 2016; Funder 2009; Satyal et al. 2020). It is also not inevitable that REDD+ automatically addresses all aspects of biodiversity conservation (Krause and Nielsen 2019). Although far more attention is now being paid to these risks in REDD+ schemes, these concerns remain valid.

REDD+ also offers broader lessons for EbA. Many REDD+ measures and financing mechanisms have consisted of project islands that were not anchored in national or more particularly subnational planning and governance mechanisms. As a result, the conservation activities and socioeconomic benefits were often not effectively integrated or scaled up beyond small project sites (Wunder et al. 2020). The expectations of a large-scale global market for financing REDD+ have also not materialised so far, being driven instead by a small number of donors (Duchelle et al. 2019). The financing available in REDD+ has therefore been insignificant compared to the (short-term) economic value of deforestation. While the future of REDD+ remains uncertain, its challenges have also stimulated important debates and efforts to devise principles that are relevant to EbA, including:

- Development of global networks that support the rights of local communities and indigenous peoples in forest governance. One example is the global ‘Governors’ Climate and Forests Task Force’ (supported by Norad), which includes subnational representatives who have formulated guiding principles for rights-based approaches to REDD+ related schemes (Duchelle et al. 2019). Aligning with such networks can help build broader global action for pro-poor and rights-based EbA.
- A gradual shift towards so-called ‘jurisdictional approaches’, whereby REDD+ schemes follow the subnational jurisdictional boundaries of, for example, local governments, rather than project-based approaches. While these approaches are still evolving, they indicate situations whereby EbA can be linked to subnational (and national) planning and governance processes (Wunder et al. 2020).
- Greater attention to leveraging domestic finance for purposes of forest conservation under REDD+. This includes enhancing and disseminating evidence of the true economic benefits of forest conservation to decision-makers and building economic incentives for rights-based conservation into local government budgets (Duchelle et al. 2019).

There is a need to apply a broad ecosystems perspective that takes the conservation of full systems into account, rather than singling out one particular aspect (e.g., forestry). This is particularly important in EbA a key aspect of which is the interaction of different elements to produce ecosystem benefits to society. It is also worth remembering that forests are not the only relevant ecosystems in EbA. The ecosystem benefits of wetlands and peatlands are also considerable (Adekola et al. 2015), as are other less well-known ecosystems such as grasslands (Bengtsson et al. 2019).

WHAT ARE THE CHALLENGES?

Across the academic literature, seven overall challenges can be identified as impeding factors that potentially hamper the usefulness of EbA practices. These are synthesised below:

Finance distribution challenges

Some scholars point to a **disproportionate distribution in the way the funds for EbA activities are allocated**. In some instances, a large part of budgeted funding is spent on securing rights to the resource, e.g., by purchasing land, leaving less funding for actual implementation of the EbA project. Additionally, some governments have prioritised spending EbA funds on conventional biodiversity conservation, paying little attention to improving ecosystems for the benefit of livelihoods. In some instances, a lack of funding for technical and human resources has also been shown to complicate the assessment of appropriate methods of EbA implementation, whereas in other cases inadequate funds were prioritised for the upkeep and management of activities on the long run (Nalau et al. 2018).

Governance and institutional challenges

Several scholars present **issues related to governance and cross-sectoral collaboration as major constraints to the implementation of EbA** (Nalau et al. 2018; Chong 2014). This is problematic, since EbA necessitates the involvement of sectors that manage as well as benefit from ecosystem services (Vignola et al. 2015; Munang et al. 2014). However, if cross-sectoral collaboration is not ensured, environmental and adaptation interventions can come to counteract each other (Scarano 2017). The evidence suggests that the impacts were very limited in the situations where mainstreaming was lacking between the governing bodies involved in the Eba activity.

Additionally, access and rights to the targeted EbA resource can be a challenge. As EbA necessitates land that is already in use being set aside for restoration, clear agreements about the rights to that land is essential. Without a clear understanding of existing user rights and the active engagement of such users, the implementation, scale and overall impact of the project is at risk. Shortcomings

can lead to the inability to include a whole ecosystem (e.g., both sides of a riverbed), or to the most vulnerable user groups (e.g., farmers without security of tenure) losing access to the targeted resource and not being adequately compensated, which means that the EbA activity cannot be considered pro-poor. Another governance-related challenge is posed by existing legislative incentive structures that encourage practices that run counter to the intended EbA activity (e.g., for farmers to use chemical fertilizers), thus making participating in and maintaining the EbA alternative less attractive than existing measures (Vignola 2015).

Participatory challenges

A number of scholars have suggested that **many EbA projects do not contain the required level of participation**, even though community involvement in adaptation projects has been widely stressed for many years (Nalau et al. 2018; Chong 2014; Ojea 2015; Munang et al. 2014). Here again, much opposition from involved communities can arise when land is taken away for EbA activities without their full consent or support, when compensatory structures are not sufficiently in place, where interventions are not considered participatory and where community knowledge and wishes are not taken into account. In other instances, the opposition is caused by institutional and disciplinary silo approaches where inadequate collaboration and a lack of mainstreaming become the norm. This may, for instance, be the case when EbA implementations are targeted at a watershed where multiple jurisdictions need to be involved, in addition to the participation of different sectoral institutions and disciplinary experts (Nalau et al. 2018).

Social and communicative challenges

Some authors have stressed **misconceptions and misunderstandings in the way EbA is communicated** to stakeholders as an issue. Private landholders in particular can have misconceptions about how EbA practices are administered, perceptions that may be related to experiences with other conservation programmes that were either top-down driven or that largely favoured the protection of biodiversity and wildlife over people's livelihood practices. In restoring watersheds or dryland ecosystems, such experiences may cause farmers to be reluctant to support EbA practices (Nalau et al. 2018). Once again, adequate inclusion of local participation and compensatory schemes has been stressed for avoiding such pitfalls (Munang et al. 2014).

Additionally, it is important to understand the contexts in which communities access information, implement changes and make adaptive decisions (Nalau et al. 2018; Vignola 2015). For EbA to be successful, appropriate information must be available to user groups. Yet, in marginal rural areas, the availability of technical expertise may be limited. Without clearly and appropriately communicated information, a farmer may be forced to choose the short-term over long-term benefits if put under stress by, for example, existing climate change-induced variation in weather events (Vignola 2015).

Methodological confusion and interdisciplinary challenges

Many of the scholars consulted for this paper point to **methodological and disciplinary challenges** as one significant reason why the evidence base for EbA effectiveness tends to rely on anecdotal case studies rather than comprehensive reviews (Doswald et al. 2014: 186). Several authors mention that confusion over the definition and terminology of EbA impacts on implementation, as multiple methodologies and assumptions can clash (Munang et al. 2014; Nalau et al. 2018; Khan and Amelie 2015; Doswald et al. 2014). Another point of confusion is related to the methodology used to assess the impacts of climate change on ecosystems, where such assessments solely consider current variabilities and not future climate projections as well (Doswald et al. 2014). These points of disagreement and confusion can restrict the development of a consistent approach to the monitoring and evaluation of EbA activities (Munang et al. 2014). Some of the methodological confusion comes from the multi-sectoral architecture of EbA where social, political, economic, biological and climatic data need to be integrated (Munang et al. 2014; Nalau et al. 2018; Khan and Amelie 2015). The complexity, diversity and scale of the various stakeholders, institutions and disciplinary approaches are challenging to coordinate (Nalau et al. 2018; Khan and Amelie 2015). Thus, narrow institutional and disciplinary approaches tend to take priority - approaches where the natural sciences continue to dominate - and the social factors that are meant to ensure livelihood benefits tend to be mis- or underrepresented, leading to social impacts being inadequately assessed (Nalau et al. 2018).

Biological tipping points

Scholars point to the issue that EbA projects tend not to consider **an activity's limitations in relation to certain climate change scenarios**, such as the tipping point for the targeted resource. A variation or change within even pristine ecosystems can reach a point where the potential costs of relying on it outweigh the benefits, and an entire restructuring is needed. Without reliable benefits or services, EbA practices become inadequate or even obsolete. For instance, regenerated mangrove ecosystems can only mitigate flooding from sea-level rises and extreme weather events to a certain degree, and the latter may reach a point where communities have no other alternative than to migrate (Chong 2014). Such considerations should already be clarified in the planning phase, integrating localised future climate scenarios with assessments of current underlying stressors and vulnerabilities that are relevant to the targeted ecosystem (Nalau et al. 2018; Khan and Amelie 2015).

Knowledge-based challenges

Scholars point to **several knowledge gaps** within which more research is needed to improve the effectiveness of EbA approaches (Scarano 2017). Firstly, despite the praise given to EbA as a key to achieving sustainable transformations, we lack evidence about EbA's transformational aspects, especially how EbA may be linked with, for example, mitigation efforts (Scarano 2017; Khan and Amelie 2015). Secondly, comparative studies that evaluate EbA's effectiveness against alternative adaptation approaches, such as PES and community-based adaptation,

are generally lacking (Vignola 2015; Munang et al. 2014; Khan and Amelie 2015; Doswald et al. 2014). Thirdly, little is known about the potential negative byproducts of EbA activities (Nalau et al. 2018). Fourthly, more consistent and quantifiable evidence is needed with regard to adaptation in certain ecosystems (particularly for grasslands, mountain regions and marine ecosystems) if we move past a two-degree increase in global temperatures (see section on ‘biological tipping points’ above) (Munang et al. 2014; Nalau et al. 2018; Doswald et al. 2014; Vignola 2015).

WHAT ARE THE KEY SUCCESS FACTORS?

The following success factors were derived from a review of the literature on the lessons learnt from EbA so far, with a focus on ‘what works’.

Sustained financing for EbA

- Pilot projects can serve as good demonstration schemes, but *attention is needed from the outset as to how sustained financing for EbA can be achieved and incorporated into local and national institutional mechanisms* (GiZ 2018). Reid et al. (2020) present four models for doing so, namely (i) the incorporation of EbA into public works or social protection programmes; (ii) the devolution of EbA funding to local governments; (iii) a national trust-fund model; and (iv) PES. When considering these modalities, attention to pro-poor approaches is important. For example, option (i) provides good scope for particular attention to supporting the poor, while past research on PES suggests that option (iv), while relevant, must take a number of risks for the poor into account (see section on ‘what we can learn from PES and REDD+’).

Cross-sectoral government buy-in

- Ensuring government buy-in and support for EbA across sector agencies is a challenging but critical aspect of institutionalising EbA. In Peru, the GiZ *used existing national climate plans and agreements as the main entry point*, including the NDC, national climate change strategies and adaptation plans (Vasquez Vela 2018). The UNDP and FAO have developed tools to assist in this (FAO 2020, UNDP 2019). In this way, EbA can be linked to the existing commitments, coordination mechanisms and workflows of government agencies, rather than devising new frameworks and tasks. A CBD review of 20 EbA-related projects recommended a similar approach, pointing to the opportunities for linking EbA to national biodiversity strategies and action plans (Lo 2016).
- A number of studies emphasise the importance of ‘making the case’ for EbA (and NbS more broadly) to government agencies *by documenting and communicating the benefits* of these approaches. In South Africa, a UNDP-

supported project documented the costs of local droughts and floods and showed how EbA investments in biodiversity and water conservation were a more cost-effective and socioeconomically beneficial means of addressing these climate hazards than engineering approaches such as desalination (Maze et al. 2016). Significantly, it is equally critical to demonstrate to environmental protection agencies that community use and managed access rights are effective means of ensuring long-term environmental sustainability and in fact help fulfil the conservation mandates of such agencies.

DIIS research on adaptation interventions has found *that cross-sectoral coordination is often smoothest at the subnational 'district' level, where deconcentrated line agencies, local governments and civil-society organisations interact on an everyday basis, thus being forced to find common solutions in order to respond to local pressures and 'show results' to their parent ministries* (Funder and Dupuy, in review).

Balancing ecosystem- and socioeconomic benefits

- Successful EbA projects have typically provided *equal attention to the ecological and social dimensions*. EbA approaches that focus mainly on one dimension and apply a 'no harm' approach to the other can be risky because ecosystems and livelihoods are closely related, and the longer-term effects are difficult to predict. For example, the long-term carrying capacity of ecosystems may be over-estimated if the focus is mainly on livelihoods. Likewise, a focus mainly on ecosystems may overlook the indirect constraints on people's livelihoods and transformative change.
- *Risk assessments* during programming can help reduce the negative effects of EbA on the poor and on ecosystems. EbA will almost inevitably involve short-term trade-offs for the parties involved, and it is important to make these clear to provide transparency and allow for informed negotiation. This is particularly important in the context of climate change, which places extra stress and unpredictability on both ecological and socioeconomic dynamics. While this may require some expert knowledge, a participatory approach to risk assessment is key, including an emphasis on highlighting the risks to the poor, which tend to be overlooked.

Ensuring community rights and resource access

- *Ensuring community rights to ecosystem resources in EbA is critical for a pro-poor result*, but it is often overlooked. It is notable that few EbA projects to date appear to address rights issues explicitly, focusing instead on participation and alternative forms of income generation as the main 'social' dimension. If evaluated against the recent IUCN NbS standards, this is insufficient. Clarity on tenure and access rights is therefore critical. EbA project design should pay attention to both the cost side of community rights (i.e., what is the cost to communities of a given EbA arrangement in terms of their resource-ownership and use) and the benefit

side (e.g., ensuring that communities have a right to access the improved water flows from an EbA project). Leaving these issues unarticulated can mean that communities effectively lose access rights to critical resources such as water, forests and pasture as a result of EbA, without harvesting the benefits of improved ecosystem services. Overall, experience suggests as a sound principle that EbA should not reduce existing community *ownership* rights of particular resources. When EbA involves the regulation of existing community *use* rights to a given resource (i.e., setting quotas for resource extraction), this should always be the result of a negotiated agreement with and within communities, and should be implemented by communities themselves.

- When communities agree to regulate their resource in the form of use rights (e.g., harvesting less timber or setting aside pasture for natural regeneration), *there should be clear and lasting socioeconomic benefits in return*. Examples include providing communities with mutually agreed use- and management rights in otherwise protected areas in return for the community-led conservation of ecosystems on adjoining community land, or ensuring that climate-vulnerable communities obtain use rights to the benefits of EbA. For example, an EbA project in El Salvador supported the community-driven regulation of aquatic resource use and the restoration of mangrove ecosystems. This reportedly reduced flooding hazards and improved fisheries and other socioeconomic benefits, including for the poorest, as well as strengthening community use rights over sugarcane production.
- There seem to be more examples of successful interventions in sectors that circle around resources with shared user- and ownership structures, such as coastal and mangrove areas. *Clarity on resource tenure and access largely determines the scale of what can be implemented*. Compared to resources that tend to have private user- and ownership structures, such as drylands, resources with shared access and ownership structures tend to use simpler processes of stakeholder negotiation more locally. This may be the reason why many EbA projects have been focused on protecting existing biodiversity in drylands (areas that already have conservation status, such as forests or national parks) or areas that tend to have collective use structures (such as wetlands and coastal zones), rather than restoring private land that has been degraded or overused by, for example, intensive farming: implementation may simply be easier in such areas.
- A rights-based approach to EbA can thus help to build and sustain longer term rights for vulnerable communities. This includes *helping communities obtain recognition of customary rights* that are not necessarily recognised in formal legislation. Chong (2014) reports how, in Samoa, the acknowledgment of customary law by EbA planners and implementers made communities feel represented, and they accordingly took a more active role in the EbA intervention's design and implementation (see example 2).

Multi-stakeholder governance arrangements

- Governance arrangements are key to ensuring successful EbA. A key principle here is that *national government agencies should coordinate and facilitate, but that the actual enactment of EbA should be anchored locally*. Support from formal as well as informal institutions is critical if interventions are to be successful and effective. Positive examples of the thorough involvement of stakeholders and government bodies do exist, particularly from EbA in coastal zones such as in the Seychelles, where policy network mappings are carried out, and the Department of Environment takes on a coordinating and liaison role with other units of management and expertise, including ad hoc committees and the Department for Community Development, to ensure the involvement of stakeholders as well as municipal leaders. In the Seychelles, such efforts have enabled EbA interventions to be integrated into comprehensive frameworks for marine spatial planning (Khan and Amelie 2015).
- A number of sources point to the importance of *engaging local government bodies* in successful EbA, as this is where context-specific planning can be undertaken. As an extension of this principle, communities and local CSOs should have a key role in the governance of EbA (Vignola et al. 2015; Chong 2014; Khan and Amelie 2015). This includes the initial development of EbA activities and the weighing of the costs and benefits, as well as the actual management and regulation of ecosystem use and the monitoring of EbA outcomes. Experiences from PES and REDD+ also emphasise the importance of anchoring work in subnational jurisdictions, and there are signs that the much-contested REDD+ mechanism is now moving in this direction (see section on ‘what we can learn from PES and REDD+’).
- *Local knowledge is key to successful EbA*, and if the incentive structures are right, communities can become highly efficient resource managers. Farmer-to-farmer development of successful EbA farming techniques has been a successful feature of several EbA projects and can be linked with university research collaboration. Participatory methods for capturing local knowledge and solutions exist (Roth and Rist 2012). Various methods and indicator frameworks for tracking EbA impacts on adaptation and ecosystem also exist and can be applied by stakeholders (Danielsen et al. 2021; Donatti et al. 2020).
- EbA involves multiple stakeholders with varying interests, and conflicts will almost inevitably arise. Several sources recommend *conflict resolution forums* as a means to address grievances and avoid conflicts becoming too entrenched. This is also emphasised in the IUCN NbS Standards (Indicator 5.1). However, few such mechanisms have been implemented so far. A related means of addressing grievances is *complaints mechanisms* such as Kenya’s National Environmental Complaints Committee. Again, however, such mechanisms are rare, and this is one area where EbA could support the development of new institutional mechanisms.

Example 5. Ecosystems Protecting Infrastructure and Communities (EPIC) in Burkina Faso and Senegal

The Ecosystems Protecting Infrastructure and Communities (EPIC) was a global 2012-17 programme that aimed to promote Ecosystem-based Disaster Risk Reduction (Eco-DRR) with an emphasis on adaptation. It was funded by Germany and coordinated by the IUCN. The programme conducted pilot projects in Burkina Faso, Senegal, Chile, China, Nepal and Thailand.

In Burkina Faso and Senegal, the project used the participatory Climate Resilience Evaluation for Adaptation through Empowerment (CREATE) tool to assess the climate vulnerabilities of communities. It then used the Promoting Local Innovation (PLI) toolbox to identify and prioritise local innovation measures to enhance adaptation. This included soil restoration through three different endogenous, low-cost techniques that are known to improve water infiltration and storage, reduce erosion and increase soil fertility. Reforestation with locally adapted trees and Assisted Natural Regeneration, that is, the retention of naturally regenerating seedlings that enhance soil productivity and provide shade and protection to crops. Joint stakeholder workplans were then developed involving both community committees and government decision-makers in order to link up with local and national policy. National and international exchange visits were conducted by stakeholders for purposes of peer-to-peer learning. These activities were accompanied by scientific studies to document long-term effectiveness, although logistical problems constrained this. The positive impacts on farming yields are therefore mainly anecdotal. This stakeholder-driven process was reported to be effective. In Senegal the project led to EbA approaches and DRR being incorporated into the country's National Wetlands Policy.

Sources: Buyck, 2017; Roth & Rist, 2012

RECOMMENDATIONS AND POSSIBLE ENTRY POINTS FOR DANISH DEVELOPMENT COOPERATION

Overall recommendations

- Denmark's development cooperation should support EbA as a component of its broader emphasis on NbS. Overall, NbS approaches have the potential to provide socially and environmentally sustainable ways to address climate change adaptation and mitigation challenges, with important co-benefits for human development and ecosystem protection.
- The support must have a strong focus on ensuring that EbA is pro-poor (i.e., supports poverty alleviation) and rights-based (i.e., support the rights of local resource users). Experience of EbA efforts to date, and of related

approaches in PES and REDD+, show that EbA is not automatically pro-poor or supportive of local rights to natural resources and ecosystem services. In particular, there is insufficient attention to and knowledge of rights issues in EbA. Danish development cooperation should help lead the way in ensuring that EbA takes a rights-based approach and supports poverty alleviation. This will also support and ensure compliance with the IUCN standards for NbS, to which Denmark subscribes.

- When supporting EbA, Denmark should opt for a fully integrated approach, where both the ecosystem and social development dimensions are addressed in any given context. This is the best way to ensure that ecosystem services are not over-exploited as a result of misguided EbA, and that socioeconomic development is not side-lined. For funding to be called 'EbA', it should address both dimensions.
- Reflection is needed on whether EbA should be one of several ways in which Denmark supports adaptation, or whether it should be the major strategic approach. EbA requires a concerted effort, so it makes sense to scale the learning across the portfolio. On the other hand, in some settings EbA may not be a feasible approach to adaptation, including for the poor. For example, current Danish multilateral and bilateral adaptation support includes a variety of non-EbA interventions such as drought-resilient crops, hydrological infrastructure, road construction and job creation or the development of alternative livelihoods. In some cases, such activities may be sound adaptation solutions, and should as a minimum apply a 'no harm' principle to ecosystems but they are not EbA.

Possible entry points

- Experience to date stresses that EbA requires a concerted effort and that financing does not flow easily, despite narrative support for the concept. Denmark could team up with key multilateral and bilateral donors and actors in the field, such as GiZ, UK, UNEP/UNDP and (already supported) IUCN and WWF, as well as African countries, to jointly leverage financial support and commit to an NbS approach to adaptation (and mitigation). The World Bank's significant general adaptation support and expertise could also be engaged.
- A key thematic focus in such a collaborative effort on EbA could emerge around promoting and implementing the IUCN standards for NbS. Here, the MFA could play a particular role in further supporting the pro-poor aspects (see criteria 1 and 4), and especially the issues on rights and governance (see criteria 5 and 6), for which Denmark is well positioned historically.
- In the climate funds, a stronger focus on EbA in GCF could also be pursued, and the upcoming eighth replenishment of the GEF in 2022 provides an opportunity to increase support to EbA further through this facility.

- In respect of bilateral support, one entry point to consider is to strengthen EbA in the context of existing agreements and frameworks, such as the NDCs and national adaptation / biodiversity action plans, in accordance with the GiZ approach discussed above.
- This could be accompanied by support to much needed documentation, and especially communication of the national economic and environmental benefits of EbA – and NbS more broadly – to governments and sector agencies. Studies of EbA impacts on poverty alleviation, and the effects on mitigation and biodiversity conservation, would also strengthen the evidence base for EbA.
- Denmark could further promote the grounding of EbA in local governments through area-based and locally driven approaches. This would be in line with lessons learnt from REDD+, as well as the existing experience with EbA and broader adaptation support through, for example, the Climate Investment Funds, and the tendency for cross-sectoral coordination to be more effective at subnational levels. In leveraging funds, Denmark could play a role in ensuring that the developing blended/private-sector investments around EbA have a strong focus on local poverty alleviation and land and water rights. This includes the IUCN Nature+ Accelerator Funds, which begin in 2021 and seek to leverage public and private investments in nature-based solutions. A recent World Bank report identified a number of options for scaling up private investments for ecosystem services and biodiversity (WB 2020). The effectiveness of such investments on EbA and the effects on poverty alleviation and local resource rights are as yet unknown. Possible risks include a tendency for the poorest to lose out (as experience with PES shows) or the strengthening of overly protectionist agendas, thereby increasing conservation and resource management conflicts rather than overcoming them. This requires close attention to pro-poor approaches and local rights, which Denmark could (co-) lead on.
- As an extension to this, support to leveraging domestic investments in EbA would be a further entry point. Research suggests that mobilising international climate finance for adaptation in developing countries has so far been more difficult than leveraging domestic finance (Pauw et al., 2016). Support to domestic investments could help make EbA less vulnerable to global market dynamics and may provide better opportunities for pro-poor development.

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ANNEX I. EXAMPLES OF EBA POLICIES

Model for financing EbA in the longer term

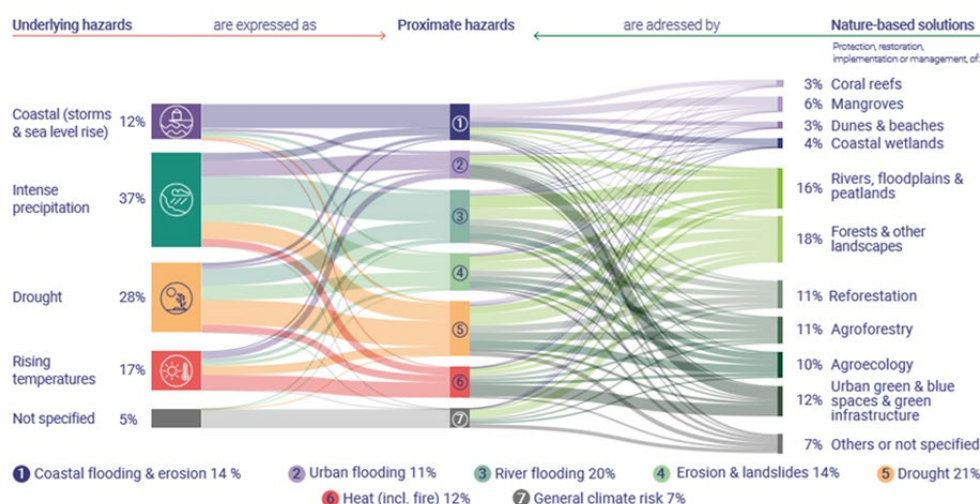
| Model | Example from EbA case studies |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Incorporation into public works/social protection programmes | South Africa has several expanded public works programmes – such as 'Working for Water' – into which EbA can be integrated. These address critical political priorities such as job creation, poverty reduction and water scarcity and are funded with tax allocations. These programmes have started to integrate EbA metrics so they can also measure success in terms of adaptive capacity gains. |
| County-level climate change planning and management | In Kenya, county climate change fund management legislation commits counties to committing a percentage of their development budget to climate change finance. The institutions for managing the Isiolo County Climate Change Fund are in place and integration into county-level planning and management systems means they can channel funding to local EbA investments. Project donor funding ended in 2016, but the county is seeking further funding from global climate funds or county-level climate change funds. |
| Conservation/trust fund | Several studies have proposed a national hilsa conservation fund in Bangladesh to cover the costs of incentives provided under the incentive-based hilsa conservation programme (Islam 2016; Dewhurst-Richman et al. 2016; Bladon et al. 2014; Bladon et al. 2016a). |
| Payments for ecosystem services | In Uganda, the EbA project bundled watershed and carbon services into credits that could be sold to buyers such as the National Water and Sewerage Corporation of Uganda. |

Source: Reid et al. 2019

ANNEX II. SUPPLEMENTARY TABLES AND FIGURES

Figure 2. Underlying hazards and their impacts

Sankey diagram connecting underlying hazards to their impacts on the ground (proximate hazards) and showing how different types of NbS are being used to address them.



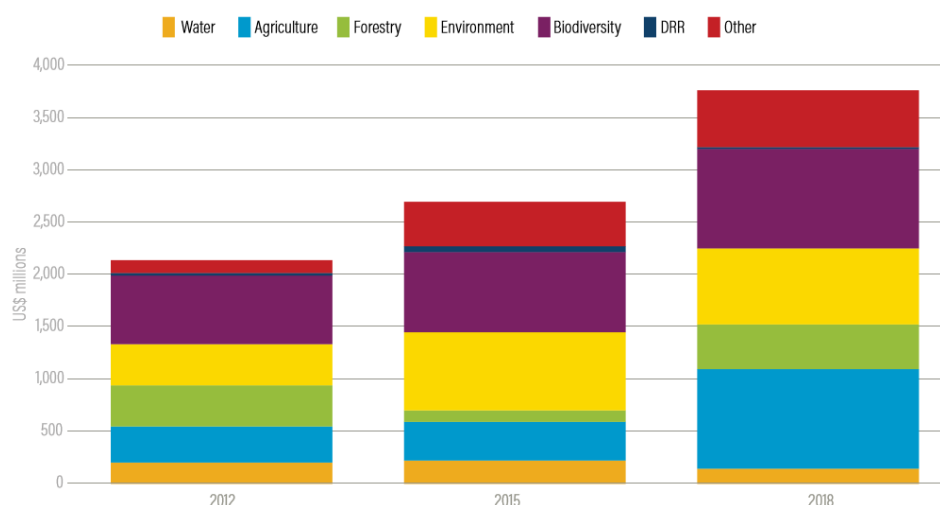
Note: The thickness of the ribbons is determined by the number of projects referring to each of the categories. Projects often mention multiple underlying and proximate hazards and can refer to several NbS to address them. (Example how to read the figure: temperature rise can lead to increased heat in urban areas that is effectively ameliorated with green and blue spaces as well as green infrastructure. Many other NbS are sometimes also used in the context of heat-related hazards). Percentage values presented in the figure are rounded to the nearest integer.

Source: Authors' analysis based on data sourced from the AF, GCF, ClimateADAPT, CDP, IKI and NH-NbS databases

Source: Magnan and Dale 2020

Figure 3. Sector distribution

ODA NbSA funding flows into selected sectors (lower-bound only)



Notes: DRR = disaster risk reduction; LAC = Latin America and the Caribbean; NbSA = nature-based solutions for adaptation; ODA = official development assistance.

Source: Based on raw data from OECD.Stat database, Creditor Reporting System, modified by the authors.

Source: Swann et al. 2021