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Ecosystem-based Approaches in G20 Countries: Current Status and Priority Actions for Scaling Up

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Ecosystem-based Approaches in G20 Countries: Current Status and Priority Actions for Scaling Up

S.V.R.K. Prabhakar, H. Scheyvens, and Y. Takahashi

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Institute for Global Environmental Strategies
Hayama, Japan

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Contents

Tables	ii
Figures.....	ii
Boxes.....	ii
Abstract.....	2
1. Introduction.....	2
2. Ecosystem-based Approaches.....	2
3. Ecosystem-based Approaches in G20 Countries	3
3.1 Context	3
3.2 Methodology	4
3.3 Findings on current level of integration	4
4. Challenges and Actions for Scaling up EB Approaches.....	8
4.1 Challenges	8
4.2 Actions for scaling up	9
4.2.1. Strategies for mainstreaming EB approaches into sectoral plans and strategies	9
4.2.2. Monitoring and evaluation of EB approaches	11
4.2.3. Financing strategies	12
4.2.4. Facilitative institutional and policy mechanisms.....	15
5. Conclusions.....	16
6. References.....	17

Tables

Table 1. Plans in Japan that recognise and encourage EB approaches	7
Table 2. Monitoring and evaluation of EbA and Eco-DRR projects in selected G20 countries	12

Figures

Figure 1. Multiple benefits of Eco-DRR and EbA	3
Figure 2. The status of EB approaches integration into national adaptation plans and strategies of selected G20 countries.....	5

Boxes

Box 1. Ecosystem-based adaptation and ecosystem-based disaster risk reduction	3
Box 2. Framework for assessing the level of integration of EB approaches in G20 countries .	6
Box 3. Six steps for the implementation of ecosystem-based projects.....	11

Abstract

Ecosystem-based (EB) approaches have been strongly promoted in various international environmental and development processes. As a result, they are gaining increasing attention among development practitioners, policy makers and researchers. A review of G20 national

adaptation plans and related strategies revealed that member countries have recognised EB approaches, which they expect can generate a wide range of benefits. Some G20 countries have identified indicators and targets, and developed guidelines for mainstreaming, as well as allocating modest funding for implementation of EB approaches. G20 countries still face significant challenges, however, to promote EB approaches associated with mainstreaming, financing, monitoring and evaluation, and institutional and policy bottlenecks. These bottlenecks are related to capacity and attitudinal factors, and insufficient research and evidence on the effectiveness of EB approaches.

To enhance mainstreaming and understand costs and benefits in the short to long term, it is important that research, and monitoring and evaluation efforts collect tangible evidence on the effectiveness of EB approaches. Engaging the private sector could help countries to bridge the gap between needs and available finances, while also building the capacities of governments. Tax benefits, concessional loans, and subsidies can provide the necessary incentives for implementing EB approaches through public-private partnerships. Countries can put in place facilitative institutional and policy mechanisms for EB approaches. These can include technical advisory bodies to guide ministries on mainstreaming, guidelines for policymakers and practitioners, and mandates for organisations to employ EB approaches. Project financing guidelines can be designed to provide impetus for project formulators and implementers to consider EB approaches. Governments can set an example by integrating EB approaches into their own operations. Mechanisms under the G20, such as the Climate Sustainability Working Group, can provide a means for countries to exchange experiences and technologies to facilitate the scaling up of EB approaches.

1. Introduction

Climate change adaptation initiatives have largely been directed at introducing new technologies and constructing ‘hard’ or ‘grey’ infrastructure.¹

These infrastructural works can be expensive, yet even when constructed at great cost, some are unlikely to withstand the impacts of climate change. Nature can potentially be harnessed to complement, or in some cases even provide a more effective and less costly substitute for, technological and infrastructural adaptation measures.²

The international disaster risk reduction community has long emphasised the importance of nature in mitigating disaster risks. For example, maintaining hillslopes under natural forest cover is a common strategy in watershed management to reduce the risk of landslides and flooding. The function that healthy mangroves play in protecting coastal communities against storm surges, tsunamis and winds is also well recognised. Reflecting the importance of functioning ecosystems to disaster risk reduction, the Sendai Framework for Disaster Risk Reduction 2015-2030 encourages “ecosystem-based approaches...to build resilience and reduce disaster risk”.³

Recognising the importance of addressing climate change adaptation and disaster risk reduction needs, G20 countries recently established the Climate Sustainability Working Group (CSWG) under the Germany Presidency in 2018. The ongoing discussions in the CSWG meetings and related documents indicate the relevance of and need for employing EB approaches in G20 countries. For G20 countries to effectively promote EB approaches in

their adaptation and disaster risk reduction plans and strategies, there is a need for better understanding of the current status of integration of EB approaches in each country, the bottlenecks facing EB approaches, and how these can be overcome. This paper aims to contribute to this understanding by reviewing national and sub-national level adaptation and disaster risk reduction plans and strategies to assess G20 countries' recognition of and support for EB approaches, and discussing ways to help G20 countries scale up EB approaches.

2. Ecosystem-based Approaches

Ecosystem-based (EB) approaches to climate change adaptation and disaster risk reduction highlight the importance of ecosystems and their services to human wellbeing in the face of climate change. Through the conservation, sustainable management and restoration of ecosystems, EB measures aim to reduce vulnerability by supporting the protective functions of ecosystems and facilitate long-term adaptation by securing the continuity of ecosystem services. An advantage of EB measures is their potentially wide range of co-benefits, which include climate change mitigation, biodiversity conservation, disaster risk reduction, soil protection, livelihood enhancement and preservation of traditional cultures. EB measures not only help people adapt, they also help nature survive, as healthy ecosystems have greater potential to withstand shocks and adapt to climate change. A brief overview of the concepts involved in EB approaches is provided in Box 1.

The biodiversity and climate communities have recognised the importance of nature-based solutions. In 2000, the Convention on Biological Diversity (CBD) adopted the ecosystem approach, which recognises interdependencies between social and ecological ecosystems. This was followed by a number of technical reports on biodiversity and climate change adaptation.⁴ The CBD defined ecosystem-based adaptation in 2009 as the use of biodiversity and ecosystem services as part of an overall adaptation strategy to reduce vulnerability and build resilience to climate change.⁵ In 2018, the CBD developed a set of voluntary guidelines for ecosystem-based approaches to climate change adaptation and disaster risk reduction.⁶ In its 5th Assessment Report, the Intergovernmental Panel on Climate Change noted growing recognition of the value of ecosystem-based adaptation. It identified various types of ecosystem-based adaptation initiatives from around the globe in both urban and rural areas, including green roofing, adaptive management and establishment of protected areas, management and replanting of mangroves, conservation agreements and community-based natural resource management.¹ Many of these initiatives are closely linked with community-based adaptation, as local communities can act as stewards of ecosystems and as they depend heavily on ecosystem services.

Box 1. Ecosystem-based adaptation and ecosystem-based disaster risk reduction

Ecosystem-based adaptation (EbA) and ecosystem-based disaster risk reduction (Eco-DRR) are the ecosystem-based approaches discussed in this paper. EbA aims to address a wide range of climate change impacts, including disasters associated with short-term perturbations and long-term changes, and impacts of climate change on socio-economic and environmental systems.^{7,8} EbA focuses on livelihoods and human vulnerabilities and ecosystem impacts, while Eco-DRR focuses on hazards, exposure and vulnerabilities, including those not attributed to climate change.⁹ As outlined in Figure 1, EbA and Eco-DRR aim to ensure climate change adaptation and disaster risk reduction interventions achieve their goals and generate co-benefits. The co-benefits can include carbon storage and sequestration, disaster prevention and recovery, hazard mitigation, sustainable livelihoods, soil and water protection, regional climate stabilisation, and biodiversity conservation.

In both EbA and Eco-DRR, the conservation and sustainable management of ecosystems is a strategy for supporting community adaptation to climate change and mitigating disaster risks. The enhancement of ecosystem services contributes to the resilience of communities and reduces their vulnerability to climate change and disaster impacts.

3. Ecosystem-based Approaches in G20 Countries

3.1 Context

The G20 was created to promote international financial stability. G20 countries have increasingly realised that climate change is an important underlying factor affecting this stability and their development. G20 countries have important roles to play in addressing climate change. They generate over 85% of global gross domestic product (GDP) and are responsible for over 80% of global greenhouse gas (GHG) emissions, despite only holding 51% of the global population.¹⁰

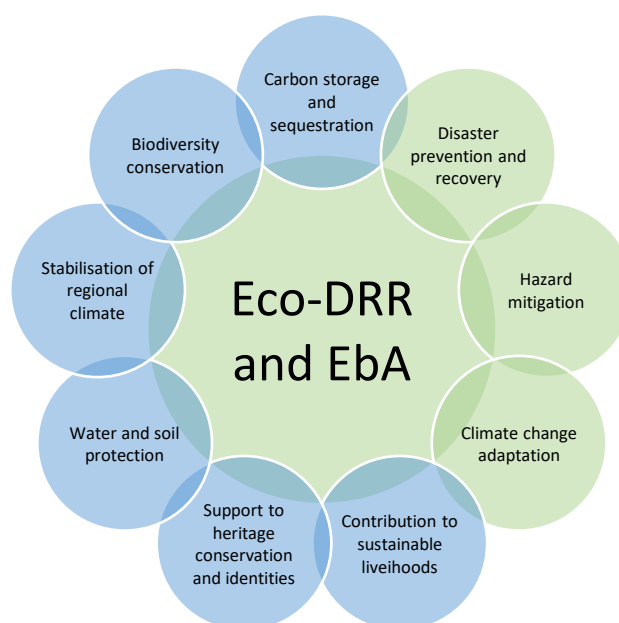


Figure 1. Multiple benefits of Eco-DRR and EbA¹¹

G20 countries can learn from each other and stand to benefit by working together to promote climate change adaptation. Their vulnerability to climate change varies, as does their preparedness to address climate change impacts. The Global Adaptation Index indicates that India, South Africa, Brazil, Mexico and Saudi Arabia are less prepared (with a Gain preparedness value of around 0.4), while the US, Australia, Canada, Japan and South Korea are more prepared for climate change (with a Gain preparedness value of around 0.7).¹² This indicates significant potential for G20 countries to exchange experiences and expertise to increase the preparedness of countries that are lagging.

With the formation of the Climate Sustainability Working Group (CSWG) under the Germany G20 presidency, 2018 was a landmark year for promoting EB approaches in G20 countries. The CSWG meetings reiterated the importance of promoting EB approaches including for adaptation and resilient infrastructure. The meetings provided an opportunity for G20 countries to discuss the current state of EB approaches and understand their importance.¹³ Previous G20 summits also recognised the importance of ecosystems to G20 countries efforts to address climate change risks. For example, the G20 summit in Germany discussed the importance of efficient management and use of water-related ecosystems to address the impacts of climate change.¹⁴

3.2 Methodology

The national adaptation plans (NAP) and strategies of G20 countries were reviewed to identify the extent to which EB approaches were integrated into them. The review assessed whether the plans and strategies recognised EB approaches and whether they identified specific approaches, priority sectors, mainstreaming strategies, timeframes for implementation, and funding. Box 2 describes the six items used to assess the integration of EB approaches into the plans and strategies.

3.3 Findings on current level of integration

The results of the analysis are summarised in Figure 2. Most G20 countries recognised the importance of EB approaches in their plans and strategies, and EB approaches formed a guiding principle of adaptation for several countries (e.g. Brazil, Italy, Mexico and US). Wherever the strength of EB approaches was recognised or not, the plans and strategies spelled out the importance of enhanced ecosystem services to human wellbeing and resilience to climatic stresses. Almost all countries promote EB approaches associated with ecosystem protection and conservation. Most countries identified urban areas, coastal areas, mountainous areas, and marine areas as priority areas for EB approaches. China and Japan stressed the importance of EB approaches for resilient infrastructure. Japan, Indonesia, Germany and South Africa identified land-use planning and other related spatial approaches as essential entry points for the integration of EB approaches into natural resource management.

Brazil ¹⁵	Black	Black	Black	Grey	White	
China ¹⁶	Black	Black	Black	White	White	
France ¹⁷	Black	Black	Black	White	Black	
Japan ¹⁸	Black	Black	Black	Grey	White	
Australia ¹⁹	Grey	Black	Black	White	White	
Germany ²⁰	Black	Black	Black	White	Black	
S. Korea ²¹	Black	Black	Black	White	White	
India ²²	Grey	Black	Black	Grey	White	
Mexico ²³	Black	Black	Black	Black	White	
Indonesia ²⁴	Black	Black	Black	White	White	
US ²⁵	Black	Black	Black	White	White	
Italy ²⁶	Black	Black	Black	White	White	
S. Africa ²⁷	Black	Black	Black	Black	White	
	Recognition	Approaches	Sectors	Mainstreaming	Timeframe	Funding

Figure 2. The status of EB approaches integration into national adaptation plans and strategies of selected G20 countries

Note: Black: Clear indication of integration, Grey: Either vague indication of integration in NAP or mentioned in strategies and plans other than NAP. White: No indication of integration.

Source: Compiled from the national adaptation plans and strategies of G20 countries. Some countries are not included due to unavailability of relevant documentation or language issues.

All countries have gone beyond merely recognising EB approaches in their national plans and strategies by specifying mechanisms for integrating EB approaches into their developmental sectors. For example, in their NAPs Brazil and South Africa specified actions to integrate the concept of EB approaches into sectoral adaptation strategies by developing appropriate methodologies for integration, by putting in place a working group that guides the strategy, and by laying out a timeframe and specific indicators for assessing the progress.

South Africa emphasised the need for collaboration among multiple agencies to promote EB approaches in its adaptation strategy. It also emphasised the importance of EB approaches in other national strategies, as did Japan and Brazil. South Africa developed the *Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation (EbA Strategy 2016-2021)*, which has four areas of work to promote EbA.²⁸ These are (1) Effective coordination, learning and communication to mobilise capacity and resources for EB, (2) Research, monitoring and evaluation to provide evidence for the contribution of EB approaches to a climate-resilient economy and society, (3) Integration of EB approaches into policies, plans and decision-making to support an overall climate change adaptation strategy, and (4) Implementation of projects to demonstrate the ability of EB approaches to deliver a wide range of co-benefits. To implement EbA Strategy, 2016-2021, South Africa developed guidelines, established a coordination mechanism, and is implementing a pilot project funded by the Adaptation Fund.

Box 2. Framework for assessing the level of integration of EB approaches in G20 countries

The level of integration of EB approaches into climate change adaptation (CCA) and disaster risk reduction (DRR) policies and plans was assessed using the following six-point framework:

Recognition: A plan or policy is understood to have recognised EB approaches if it includes the key phrase “ecosystem-based approaches”, states the importance of EB approaches for climate change adaptation and disaster risk reduction, and spells out the need to implement EB approaches.

Approaches: As CCA and DRR issues are often location-specific, identifying specific approaches indicates that planning may have taken the diverse needs of a country into account and that efforts have been made to identify what works best for a country. Approaches refer to whether or not a policy or plan identifies specific EB approaches to be promoted for achieving the stated CCA and DRR objectives.

Sectors: Identifying and/or prioritising specific sectors for EB approaches enables countries to make concerted efforts to mainstream EB approaches into these sectors on a priority basis. Sectors differ in their potential to employ EB approaches for various reasons, including their level of familiarity with similar approaches, institutional capacity, the relevance of EB approaches to their sector, and the strategies they have identified to address climate change.

Mainstreaming: Mainstreaming occurs when a plan or policy identifies specific institutional mechanisms to promote or implement EB approaches. For example, a plan or policy is said to have mainstreamed EB approaches if it establishes an institutional mechanism, such as a committee or advisory body, to advise the policy implementing body on EB approaches to achieve its CCA and DRR objectives. Mainstreaming here mainly refers to institutional arrangements.

Timeframe: Having a specific timeframe helps with the implementation of EB approaches. By specifying a timeframe for the implementation of EB approaches, governments are also providing incentives for stakeholders to contribute to achieving the stated CCA and DRR objectives.

Funding: Additional funding may be necessary to initiate research and development efforts, to develop and deploy new technologies, and to strengthen institutional and human resource capacities for EB approaches. Just as with a timeframe, funding provides incentives for strengthening interventions at various levels and enables departments to implement EB approaches. National level funding can help ministries promote EB approaches and gain necessary technical capacities including engaging a specialised work force or putting in place a monitoring and evaluation framework. Funding also indicates significant commitment by the national government to EB approaches.

Table 1. Plans in Japan that recognise and encourage EB approaches

Title	EB approaches specified	Mechanism identified for mainstreaming EB approaches
Japan National Biodiversity Strategy and Action Plan ²⁹	<ul style="list-style-type: none"> • Spatial planning to reduce exposure to natural hazards • Establishing, maintaining and protecting coastal protection forests • Establishing urban green infrastructure network 	<ul style="list-style-type: none"> • Promoting DRR education • Encouraging vacating high-risk areas • Establishing urban green infrastructure network • Promoting participatory decision making
National Resilience Basic Act and Basic Plan ³⁰	Establishing, maintaining and protecting coastal protection forests and wetlands	<ul style="list-style-type: none"> • Assessment of ecosystem functions for DRR and other services • Development of local resilience plans by local governments
National Land Development Plan ³¹	Utilising ecosystem functions to reduce disaster risks, and recognising other ecosystem services in non-disaster times	<ul style="list-style-type: none"> • Assessment of ecosystem functions for DRR and other services • Development of local resilience plans by local governments
National Land Use Plan	Promoting green infrastructure with multiple ecosystem functions, promoting beautiful landscapes	<ul style="list-style-type: none"> • Promoting green infrastructure
Priority Plan for Social Infrastructure Development	Use of multiple ecosystem functions aligned with the ‘green infrastructure’ concept	<ul style="list-style-type: none"> • Promoting green infrastructure
Japan National Adaptation Plan ³²	Establishing coastal forest conservation measures	<i>Did not state</i>

Source: Compiled by authors from sources provided in the table.

Japan recognises EB approaches in policies and guidelines in addition to its national adaptation plan. Table 1 lists some of these policies and plans. Of these, Japan’s National Biodiversity Strategy and Action Plan recognises that spatial approaches such as spatial planning, coastal protection forests and urban green infrastructure can reduce exposure to disasters. The Action Plan prioritises mountain areas, coastal areas and cities for EB approaches. Its premise is that EB approaches support ecosystem services that have potential to mitigate disasters. In addition to the plans listed in Table 1, EB approaches have also been promoted through guidelines for practitioners. For example, *Ecosystem-based Disaster Risk Reduction in Japan-A Handbook for Practitioners* encourages conservation, restoration, management and creation of new ecosystems to reduce disaster risk.³³

With respect to timeframes, Mexico laid out clear goals for 10, 20 and 40 years in its adaptation strategy. It recognises that current EB approaches suffer from limitations in terms

of identification, quantification and evaluation of ecosystem services that contribute to human resilience, vulnerability reduction and climate change adaptation. Australia does not mention EB approaches explicitly in its adaptation strategy, but considers ecosystems to be major impact points of climate change and identified them as a focus area, with emphasis on ecosystem conservation.

In terms of resourcing, very few countries have earmarked funding for EB approaches, though Germany has earmarked EUR15 million per year to implement its national strategy on biological diversity, which has synergies with EB approaches. The reasons for minimal allocation of funding to EB approaches could include lack of means to secure funding, limited incentives for dedicated financing, limited conviction on the efficacy of EB approaches, and lack of technical means to implement EB approaches. Lack of clear roadmaps for mainstreaming EB approaches may also explain the limited financial commitment by many countries.

4. Challenges and Actions for Scaling up EB Approaches

4.1 Challenges

From our analysis, it is clear that most G20 countries recognise the importance of EB approaches to adaptation and other national goals, including those related to biodiversity. Implementation requires commitment in the form of roadmaps for mainstreaming, guidelines for specific stakeholders, and earmarking of funds to promote EB approaches, which are lacking. These actions must be backed up by policies that go beyond merely recognising EB approaches to specifying targets for mainstreaming and implementation. For this to happen, countries need to recognise issues confronting EB approaches and initiate remedial actions. Some of the necessary actions can be taken under the G20.

Despite the progress described above, countries are facing several challenges to the promotion of EB approaches. One challenge is a lack of clearly tested and proven guidelines on EB approaches for a given country's context, as EB approaches are relatively new and still evolving. This partly explains why the current level of commitment of countries to EB approaches in NAPs and adaptation strategy documents is largely limited to recognising EB approaches, while leaving out details on implementation strategies. Brazil is an exception; its National Adaptation Plan has spelled out broad implementation modalities including establishing a monitoring and evaluation (M&E) framework, identifying M&E indicators, and establishing a working group that guides the development of a detailed EbA strategy (Figure 2).

A second challenge is a lack of means of measuring the impact of EB approaches on resilience, adaptation, disaster risk reduction and sustainable development. Consequently, there is a lack of information that can be used for stakeholder communications and decisions. While countries like Brazil and Japan have identified indicators for measuring the progress of implementation, measuring the actual outcome of actions is largely absent from most strategies.

A third challenge is the lack of incentives for EB approaches to gain momentum. It is unclear what kind of incentives would encourage national and subnational actors to mainstream EB approaches into their adaptation, disaster risk reduction and development strategies. Studies to identify appropriate incentives for promoting EB approaches are required.

Other challenges, as Table 1 indicates, are the failure of G20 countries to provide a clear timeframe for achieving the full mainstreaming of EB approaches into national and sectoral plans and strategies, and to clarify the means for financing EB approaches.

4.2 Actions for scaling up

The following four actions emerge from the foregone discussion as important to scale up EB approaches in G20 countries:

- a) Identify and promote strategies to effectively mainstream EB approaches into national and sectoral adaptation plans and strategies,
- b) Develop a monitoring and evaluation mechanism to identify the contribution of EB approaches to resilience, adaptation, disaster risk reduction, and sustainable development, and to ensure that such knowledge can aid decision-making and risk communications,
- c) Identify and ensure effective financing strategies for promoting EB approaches, and
- d) Establish a facilitative institutional mechanism within the G20 and in individual G20 member countries for promoting ecosystem-based solutions that have synergies with other global frameworks.

Points a) and b) are directed at the G20, and points c) and d) are relevant to both the G20 and individual member countries.

These four actions are closely interrelated, mutually reinforcing and dependent. For example, a) mainstreaming could help reduce costs compared to standalone interventions, which is relevant to c) financing. Similarly, b) M&E of a) mainstreaming can contribute to more effective mainstreaming, while also being applied to standalone EB interventions. Hence, depending on how M&E is designed, it can act as a stimulant and incentivising agent to integrate EB approaches into sectoral plans and strategies.

4.2.1. *Strategies for mainstreaming EB approaches into sectoral plans and strategies*

As is evident from the review of the national adaptation plans and strategies, EB approaches can be mainstreamed into a range of interventions in a variety of sectors and contexts. Important sectors for mainstreaming include infrastructure, food and agriculture, water, energy, transportation, and forestry, and important areas for mainstreaming include coastal areas, hilly areas, and urban areas. This broad scope for EB approaches supports their scaling up, but for this to occur, bottlenecks to mainstreaming must be overcome. One bottleneck is associated with the way ecosystem services are understood and recognised in many of the sectors and contexts in which EB approaches can be applied. Stakeholders in some development sectors such as food and agriculture, water, and forestry, and locations such as coastal areas and hilly areas are relatively well aware of the relevance of ecosystem services and their applications to their work, while common stakeholders in infrastructure, energy, and urban planning are not. Approaches such as organic agriculture and other non-chemical

farming methods with a long tradition already incorporate ecosystem services concepts; hence, sectors such as food and agriculture can readily provide avenues to mainstream EB approaches. Mainstreaming in other sectors, however, may not be as easy, as many of their decision-making mechanisms and tools suffer from institutional and technological ‘lock in effect.’ So while mainstreaming EB approaches in infrastructure, energy, and urban planning sectors could generate a range of positive outcomes, it is also likely to be challenging.

Several off-the-shelf approaches can help overcome the lock-in effects associated with the current institutional, technological and policy mechanisms. These include investments into research and development, investments in pilot projects that open up avenues for entry and expansion, and establishing targets and recognition schemes.³⁴ Financial incentives have already been widely employed to break away from lock-in effects of traditional systems, as is evident from the emerging examples from the low-carbon work.³⁵ The emphasis for research and development should be to a) identify costs and benefits of mainstreaming EB approaches, both in the short-term and long-term, to convince stakeholders of the net benefits of mainstreaming,¹ b) identify niche areas where mainstreaming can be taken up on a pilot basis, and c) identify bottlenecks and solutions to scale up EB approaches.

Developing pilot projects is an effective means of gathering evidence, identifying bottlenecks and tailoring solutions at the local level. Pilot projects often deal with new areas that are not within the ‘comfort zone’ of governments as they go beyond known solutions. Pilot projects can provide a means of engaging other stakeholders such as private sector actors, and this can bring in perspectives and experiences that do not exist within governments. It is especially important that pilot projects are informed by the contexts in which scaling up may take place in the future and cognisant of the institutional and technological bottlenecks that need to be overcome. Successful pilot projects can provide a wealth of information on factors for successful mainstreaming and can inform broader policy approaches.

That setting targets and goals aids in delivering results is well-recognised. At the international level, the Millennium Development Goals, Sustainable Development Goals, and indicators in the Sendai Framework help countries to monitor their progress in various development areas. Goals and targets for development are also widely institutionalised at national levels, as can be seen in country poverty reduction strategies, and national development plans and strategies. A well-organised target and goal setting exercise, starting from the national level and proceeding to the local level, could provide incentives for stakeholders to mainstream EB approaches. Appropriately set targets and goals can encourage stakeholders to collaborate to achieve the objectives of policies and plans. Targets and goals may also promote a competitive environment and in doing so speed up implementation. For EB approaches, targets could consist of mainstreaming targets at the sectoral level and project level.

Financial incentives have also been advocated to promote EB approaches. For example, the draft *Guidelines for Ecosystem-based Approaches to Climate Change Adaptation and Disaster Risk Reduction* being developed under the Convention on Biological Diversity (CBD) advocates tax benefits to the private sector to encourage innovation while addressing existing perverse incentives that may be hindering the scaling up of EB approaches. Although

¹ The CBD voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction provides detailed discussion on methods to evaluate EB approaches.

financial incentives can work in a variety of contexts, there is also a risk of overemphasising them.

4.2.2. Monitoring and evaluation of EB approaches

This section discusses monitoring and evaluation (M&E) from a broad perspective, keeping in mind the need for embedding M&E into all ecosystem-based projects, as well as into consensus building among stakeholders. The voluntary guidelines for EB approaches recently endorsed by the CBD (Box 3) recognises M&E as the sixth step in the six steps of an EB project cycle.

Box 3. Six steps for the implementation of ecosystem-based projects

- Step A. Understanding the social-ecological system
- Step B. Assessing vulnerabilities and risks
- Step C. Identifying EbA and Eco-DRR options
- Step D. Prioritising, appraising and selecting EbA and Eco-DRR options
- Step E. Project design and implementation
- Step F. Monitoring and evaluation of EbA and Eco-DRR

Source: CBD (2018)⁵

Project appraisal starts from baseline assessment as outlined in the Steps A and B in Box 3, particularly the assessment of vulnerabilities and risks. Here the intended outcomes of the proposed interventions centring on the reduction of vulnerabilities and risks should be assessed, including those provided by ecosystems and their combination with manufactured infrastructures. Simultaneously their multiple co-benefits need to be understood, for which Lo (2016)¹¹ provides a useful framework (Figure 1). Next, a list of available and priority options to address the vulnerabilities and risks are developed (Steps C and D). Among these, the option that best harnesses the synergies between these central outcomes and multiple co-benefits is selected, designed and implemented (Step E). For effective M&E (Step F), quantitative indicators to capture the intended outcomes, their synergies and trade-offs should be developed.

Emerton (2017)³⁶ is a sourcebook of methods for valuing the benefits, costs and impacts of EbA measures for decision-making. It clarifies methods to value EbA benefits with respect to their biophysical effects, risk exposure and vulnerability, economic costs and benefits, as well as livelihood and wellbeing impacts. The Natural Capital Project led by Stanford University provides a suite of open-source biogeographical models known as *InVEST, or Integrated Valuation of Ecosystem Services and Trade-offs*.³⁷ It currently equips 15 models: *carbon storage and sequestration; coastal blue carbon; coastal vulnerability; crop pollination; fisheries; habitat quality; habitat risk assessment; marine fish aquaculture; offshore wind energy; recreation; reservoir hydropower production; scenic quality; sediment retention; water purification and wave energy*. These tools can be used for Step F (M&E) and support its contribution to mainstreaming. Several examples of M&E as part of projects employing EB approaches from eight of the G20 countries are presented in Table 2.

Table 2. Monitoring and evaluation of EbA and Eco-DRR projects in selected G20 countries

Country	Cases
Germany	The effectiveness of proposed flood risk management measures on the Mulde River was assessed from three perspectives – physical effectiveness, cost-effectiveness and economic efficiency – which highlighted the importance of non-structural measures. ^a
India	An economic valuation study revealed that USD 294 million initial capital investment for building coastal embankments and USD 6 million annual cost for their maintenance would be required to provide the same level of protection from coastal hazards as that offered by the Sundarbans mangroves. ^b
Indonesia	The effectiveness and impact of hybrid ‘building with nature’ (BwN) coastal adaptation measures were evaluated. The project assessed biophysical and socioeconomic impacts through stakeholder engagement, which contributed to local acceptance and upscaling of the proposed BwN approaches. ^a
Mexico	Economic valuation of three protected areas was conducted to communicate their values for local, national and sectoral development. The process built capacity among protected area managers. ^a
South Africa	<p>The impacts of adaptation measures on non-monetary economic indicators, particularly on employment, were assessed. The project assessed climate change impacts on employment, and identified the contribution of proposed adaptation measures to job-related outcomes.^a</p> <p>The potential for an EB approach in Eden district municipality was studied. Climate change impacts and vulnerabilities, including the cost of a 3-year drought, were assessed. The study estimated that ZAR 166.6 million would be required to cover livestock feed loss and ZAR 360 million to deal with flood damages. An EB alternative to engineering solutions was found to be less expensive and to provide larger returns in terms of water storage and co-benefits.^b</p>
United Kingdom	The ‘Slowing the Flow’ project in North Yorkshire assessed a proposed flood defence measures package and identified co-benefits offered by natural measures. It also identified the conditions in which an EB approach is beneficial through sensitivity analysis. ^b

Sources: ^a Emerton (2017); ^b Lo (2016)

4.2.3. Financing strategies

Financing EB approaches can be challenging, due to both technocratic and non-technocratic limitations. The technocratic limitations are associated with effectiveness and applicability, both of which are highly interrelated. Non-technocratic limitations are related to factors such as limited awareness among stakeholders about EB approaches and attitudinal factors.

Regarding the technocratic limitations that EB approaches face, lack of evidence of effectiveness is paramount. There is little evidence to support the postulated benefits of EB approaches, due largely to the timeframe within which benefits are accrued. For example, building a concrete seawall or dyke could provide immediate mitigation of tsunami or storm

surge risks. In contrast, a biological wall consisting of mangroves could serve the same functions but could take many years to establish.

The second factor constraining EB approaches is related to their applicability. While EB approaches can be identified for a variety of fields and sectors, their applicability can be limited due to unfavourable location-specific conditions. These could include unfavourable soil and climate conditions, making identification of suitable species and biological approaches difficult.

Another issue related to application is that EB approaches can be complex compared to conventional approaches. EB approaches can have additional data and analytical needs, require cross-sectoral collaboration, additional stakeholder involvement, and additional technical capacities. As new types of interventions, they also require close monitoring and assessment. This greater complexity may require employment of additional staff.

Any financing strategy to promote EB approaches should start with collecting evidence on their effectiveness and how they compare with conventional approaches in terms of short- and long-term costs and benefits. Financing strategies to promote EB approaches should aim to improve the efficiency of investments and improve the flow of investments to EB approaches. Financing strategies for scaling up EB approaches could include employing EB approaches where they improve risk/return ratio, result-based financing, coupling the payment of ecosystem services (PES) and insurance approaches, introducing financial management guidelines for promoting EB approaches, support through credit and related measures, and public-private partnerships.

When selecting between competing approaches, governments use a variety of metrics. Infrastructure investments are long-term investments, so attention is given to risks and returns.³⁸ EB approaches will thus be attractive to stakeholders when they help improve the risk/return ratio of interventions. Efforts must be made to both inform governments of EB approaches and build capacities for assessing their risks and returns relative to those of conventional approaches. EB approaches can help by quantifying risks, prioritising EB projects and programmes that focus on the most vulnerable regions, developing scenarios, and by incentivising stakeholders. Risk identification should be an integral part of interventions and only those EB projects and programmes that provide robust risk mitigation strategies should be promoted. Emphasis should be given to cost-effective approaches that mitigate risks under future scenarios under which the interventions may have to perform.

Result-based financing (RBF) is finance that is conditional on the achievement of prior identified results. RBF approaches have worked well in payment for ecosystem services (PES) schemes, suggesting potential to apply RBF to other EB approaches.³⁹ RBF can also ensure institutional service delivery as well as accountability and transparency.⁴⁰ RBF can be effectively employed at the service delivery end in sectors such as education, health, water and sanitation, and rural livelihood generation. However, because payments are made after results are verified, RBF may not be suitable for all situations where EB approaches are employed. For example, in projects where there are significant upfront costs, there would be a need to combine RBF with advanced payment options. Also, since payments can only be made upon 'verifiable' measurement of results, intangible results, which may constitute a significant proportion of the outcome of EB approaches, may not be well recognised and rewarded. Efforts to capture these intangible results will be necessary. Another concern is

that RBF could result in additional costs, as it has large data needs for monitoring, evaluation and verification purposes.

Many innovations can now be observed in the insurance sector. This interest in innovation provides development practitioners with an opportunity to design insurance programmes to promote EB approaches. One innovative financing arrangement would be a combination of PES with insurance. Biodiversity protected under PES can act as a natural insurance as it provides a buffer against natural hazards by enhancing the effectiveness of ecosystem services. In the absence of biodiversity and ecosystem services, the cost of formal insurance will be higher. Insurance policies may act against biodiversity as they usually do not incentivise the conservation of biodiversity and they may mitigate the risks of development projects that harm biodiversity. This suggests a possible synergy in combining PES and insurance into a single product that would protect and enhance natural capital, while reducing the financial costs of insurance and improving economic resilience. Various combinations of ecosystem conservation and insurance can be considered for optimal allocation of investments for optimal risk reduction benefits.

Countries are in the process of developing financial management guidelines to assist national ministries and local governments with prioritising investments, improving sustainability of interventions, tracking expenditure, and linking financing with the end-result as a part of their financial governance reforms.⁴¹ These guidelines can act as the first entry points for scaling up investments in EB approaches by encouraging public expenditure to consider EB approaches in areas such as infrastructure and energy.

National governments could promote credit-enhancements or soft credit for interventions initiated by local governments, private sector entities, and institutions that integrate EB approaches into programmes and projects. Mainstreaming could bring overall higher benefits with even higher net returns on investment. Cost-sharing mechanisms, including sharing costs among different departments and ministries and with private sector entities and other stakeholders would reduce the overall burden on the government, and increase the ownership and sustainability of interventions. Local governments are engaged in the implementation of infrastructure programmes and hence financing regulations that provide sufficient stimulus and flexibility at the local level are necessary. A variety of financial instruments have been advocated to promote EB approaches in urban infrastructure. These include congestion charges, tolls and property taxes.⁴⁴

As public finances alone are not sufficient to promote EB approaches, there is a need to engage the private sector. Initiatives such as public-private-partnerships (PPP) could address many issues that may arise with the mainstreaming of climate fragility issues into development and can contribute to sustainability through wider ownership.⁴² The advantage of engaging private sector actors is that they can bring efficiency and effectiveness into development programmes.⁴³ Private sector engagement also brings new skills and technologies and can contribute to skill development for communities (ibid). Tapping financial resources from the private sector to mainstream EB approaches may be possible by emphasising the benefits such investments can bring to the private sector. Governments can stimulate private sector engagement in EB approaches through targeted subsidies, concessional loans, low interest credit, tax incentives, and compensation for the base costs.⁴⁴

4.2.4. Facilitative institutional and policy mechanisms

There is a need to establish facilitative institutional mechanisms both at the country level and at the G20 level. At the country level, the current institutional structures and policies suffer from 'lock-in' effects and it may be challenging for countries to adopt EB approaches. Sectors and institutions that have been traditionally reliant upon engineering-based solutions may be less receptive to EB approaches. Agricultural research and extension institutions faced this situation several decades ago when new technologies were developed based on research plots in experimental stations. It took several decades for these institutions to break from conventional research approaches and to engage with farmers using participatory research and development methods. Such a shift was possible with the realisation that the issues facing farmers were poorly addressed by plot-based research and that research products were only sustainable when the end-users were considered as equal partners in the process of technology development.⁴⁵ In the agricultural sector the fact that farmers and researchers are now working together on solutions means that they are not fixated on engineering solutions, and this makes them more receptive to EB approaches. Such progress in thinking and approaches is yet to happen across all the fields of development where EB approaches could be effective. This is especially the case in urban areas, which for the most part still rely heavily on conventional engineering solutions. Nevertheless, even in urban areas attempts to employ EB approaches can be observed.^{46,47,48}

Solutions to the institutional issues hindering scaling up of EB approaches include training and capacity building of organisations and policymakers on the benefits of EB approaches and tools to scale up EB integration into sectoral and national development planning processes. Capacity building in combination with facilitative institutional systems such as cross-sectoral advisory bodies at national and sub-national level could initiate the process of integrating EB elements into sectoral strategies and plans. Even though such bodies sometimes lack effective power, they can help in bringing together different departments and set a platform for discussion and exchange of ideas that could initiate change.⁴⁹ They can be more effective when legally empowered. Examples include the Steering Committee on Climate Change (SCCC) in India and the National Disaster Risk Reduction and Management Council (NDRRMC) in the Philippines.^{50,51} In India, the SCCC was established for the implementation of the National Action Plan on Climate Change (NAPCC), which required inter-ministerial coordination to be effective. Similarly, the NDRRMC was formed in the Philippines as a working group of various government, non-government, civil sector and private sector organisations for effective disaster risk reduction. Both of these bodies are led by the head of the state or a senior minister, and possess powers to approve projects or to convene meetings and guide ministries and departments to take measures.

The G20 can provide opportunities for cooperation and the exchange of experiences and technologies to mainstream EB approaches. Some countries are at advanced stages of integrating EB approaches and others that are less advanced can learn from them. The G20 can facilitate this learning; its Climate Sustainability Working Group (CSWG) could be engaged for this purpose. Collaboration activities at G20 level for promoting EB approaches could include a) technical assistance programmes for the developing member countries, b) identifying and strengthening regional resource institutions for promoting EB approaches throughout the region, and c) developing regional financial resources in the form of grants

and loans for promoting EB approaches through public private partnerships, and pools of funding for EB approaches contributed to by member countries.

5. Conclusions

The potential of EB approaches to contribute to human wellbeing and human security through CCA and DRR and their multiple benefits may, in some cases, make them a better alternative to conventional engineering approaches. In other cases, a hybrid approach comprising some engineering works and EB approaches might be optimal.

It is evident from the review of country adaptation plans and strategies that several G20 countries have recognised the importance of integrating EB approaches into their national strategies to achieve CCA and DRR. Most countries, however, are yet to put in place operational modalities for integrating EB approaches into CCA and DRR projects, relevant sectors, and national actions. A few countries have made significant progress on putting in place advisory committees for integrating EB approaches, monitoring and evaluation indicators, funding frameworks, and guidelines for sectoral stakeholders. These initiatives can be emulated by other G20 countries.

For scaling up EB approaches in G20 countries in terms of sectoral integration and geographical spread, the following four strategies are recommended, and should be taken together and in parallel:

- a) Generate evidence-based knowledge that can encourage stakeholders integrate EB approaches into national and sectoral strategies;
- b) Set up a monitoring and evaluation framework to evaluate the effectiveness of EB approaches and generate experiences that can inform decision-making, including scaling up;
- c) Design financing strategies to incentivise multi-stakeholder engagement;
- d) The G20 to provide a framework for countries to share experiences and expertise with emphasis on capacity building, and to explore ways to mobilise financial resources for EB approaches (carried out by G20).

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For more details, contact:

Natural Resources and Ecosystem Services Area

Institute for Global Environmental Strategies

Hayama, Japan

Email: nre-info@iges.or.jp