Integrating EbA and IWRM for climate-resilient water management

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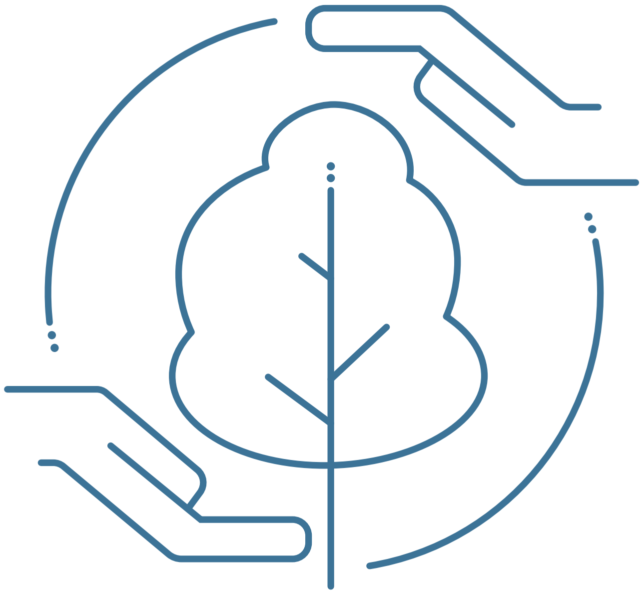

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→ List of acronyms

BMU	German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit)
BMZ	Federal Ministry for Economic Cooperation and Development, Germany (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung)
CBD	Convention on Biological Diversity
CC	climate change
CCA	climate change adaptation
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EbA	Ecosystem-based Adaptation
Eco-DRR	Ecosystem-based Disaster Risk Reduction
EFA	Environmental Flow Assessment
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GWP	Global Water Partnership
IWRM	Integrated Water Resource Management
MoU	Memorandum of Understanding
NAP	National Adaptation Plan
NbA	Nature-based Approaches
NbS	Nature-based Solutions
NC	National Communications
NDC	Nationally Determined Contributions
SAM	Strategic Adaptive Management
SCBD	Secretariat on the Convention of Biological Diversity
TEEB	The Economics of Ecosystems and Biodiversity
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-WWAP	United Nations – World Water Assessment Programme
VA	Vulnerability Assessments
WASH	Water, Sanitation and Hygiene
WRM	Water Resources Management
WWC	World Water Council
WWDR	World Water Development Report
WWF	World Water Forum

→ Executive summary

Water is a key resource for human well-being and ecosystem health, and vital for most economic sectors. The pressures on global water resources are constantly increasing along with growing global water demands. Climate change is further aggravating this situation. Factors here include changing precipitation patterns and hydrological flows and increases in the number and intensity of extreme events in many regions of the world. Healthy ecosystems can support adaptation to the negative impacts of climate change on water resources; they can increase natural water storage capacities and water availability, improve water quality and buffer the effects of extreme events. However, on account of global overuse of natural resources and the impacts of climate change itself, ecosystems are facing ongoing degradation. Ecosystem-based Adaptation (EbA) approaches support the protection, restoration and improvement of ecosystem services. These provide a mechanism to increase climate resilience, which in turn supports resilient water management in the face of climate change.

Water resources management is currently based on the globally accepted paradigm of Integrated Water Resources Management (IWRM). The concept of IWRM comprises a set of principles, mechanisms and tools for water resources management to support sustainable, social and economic development without compromising ecosystem health.[1] It acknowledges that water catchments are the appropriate planning units to address water-related challenges, rather than administrative boundaries. Furthermore, it supports reconciliation among water users with competing interests through participatory planning and management approaches. Climate change as a global challenge is endangering the key objectives of IWRM, compromising both sustainable social and economic development and ecosystem health. IWRM acknowledges the need for adaptation and risk management strategies for watersheds[2], but does not yet call for systematic climate proofing of water management approaches to safeguard water security.

Furthermore, IWRM should put more emphasis on promoting the ability and strengths of healthy ecosystems to reduce vulnerabilities to climate change in watersheds. Integrating the concepts and approaches of EbA and IWRM could support both the systematic mainstreaming of climate change adaptation (CCA) and risk management into IWRM, and the proactive development of healthy ecosystems as part of an overall adaptation strategy for climate-resilient watersheds.

This study explores how the two leading approaches in water resources management and ecosystem thinking for climate change adaptation – i.e. IWRM and EbA – can be merged to achieve greater climate resilience in watersheds. It entails a conceptual analysis of both approaches and showcases nine practical implementation examples of integrated EbA-IWRM projects around the world. The case studies reveal structural similarities, key lessons, and enabling and inhibiting factors for integrated EbA-IWRM approaches. From this, the study derives and promotes a set of guiding principles for integrated EbA-IWRM projects. These encompass features for designing new, coupled EbA-IWRM projects and also elements for inclusion and enhancement of ongoing water and/or conservation projects. The way forward outlines the need to further advance conceptual thinking on integrating IWRM and EbA for climate-resilient water management. It also advises increased practical experiences of coupled approaches around the world and the fostering of knowledge management and mutual learning on the strengths of integrated approaches.

1 See for example: www.gwp.org/en/learn/iwrm-toolbox/About_IWRM_ToolBox

2 According to Ven Te Chow et al. (1988), a watershed is "the area of land draining into a stream at a given location".

→ 1. Introduction

Growing water demands and ongoing water degradation are exerting pressure on the world's water resources. Increasing water needs are a consequence of ongoing population growth, economic development and changes in consumption patterns and will multiply during the coming two decades, especially in countries with developing or emerging economies. Further pressures on the world's water resources arise from reduced water availability due to water pollution. The contamination of water resources caused by industry, agriculture and households has considerably worsened over the last thirty years in almost all rivers in Asia, Africa and Latin America. This situation which is expected to escalate further over the coming decades. Both – increasing water demands as well as reduced water availability in adequate quality – pose threats to human well-being and ecosystem health, and overall to sustainable development (BMZ, 2017; WWAP/UN-Water, 2018a, 2018b).

Water and related ecosystem services are key factors in all economic sectors and local livelihoods (SCBD/WWF, 2019); pressures on the global water resources are projected to further increase due to climate change (CC). It is expected that CC will cause an intensification of the global water cycle. This means that even a small change in the global climate can have significant impacts on hydrological flows, reduced water availability and intensification of extreme events, such as floods and droughts (→ see Figure 3). Other effects of climate change on global and local water resources include an increasing number of extreme precipitation events and tropical storms, with greater difficulties of forecasting their frequency and intensity. To this one can add increased rainfall variability, the melting of glaciers and a sea level rise as well as slow-onset disasters. These affect hydrological regimes, and with this water availability and water quality for human well-being and ecosystem health (Quevauviller, 2011; WWAP/UN-Water, 2018b; GIZ, PIK and adelphi, 2020). Climate-resilient water management is of multi-sectoral importance, e.g. for agriculture, food security, energy and health (GIZ, 2019). Due to the vital importance of water for almost all economic sectors, coupled with a very high vulnerability of the water sector itself, water management has become a priority area in numerous national climate policies, such as National Adaptation Plans (NAP) and National Communications (NC), and also in the adaptation and mitigation sections of the Nationally Determined Contributions (NDC).

Water availability in adequate quality is highly dependent upon healthy ecosystems and their provisioning functions and services. As described above, the status of many ecosystems and water resources is highly degraded, which increases their vulnerability and the vulnerability of dependent communities to climate change. Further, the health of ecosystems themselves is endangered by climate change. Degraded natural or transformed landscapes can be rehabilitated through implementing Nature-based Solutions (NbS), which include 'green' measures to conserve, restore or re-develop ecosystem support functions. Nature-based Solutions, also called Nature-based Approaches (NbA), support or mimic natural processes to assure ecosystem service delivery. On an operational level, if NbS focus on human adaptation and if they are explicitly implemented as an element of an outlined climate adaptation strategy, they are termed 'Ecosystem-based Adaptation' approaches, abbreviated: EbA. EbA approaches in addition always assure livelihood benefits. EbA can enhance water availability, improve water quality and reduce water-related risks in watersheds, but do not necessarily require a focus on a water-related perspective. All in all, EbA – through multiplying the above benefits – can support overall water security and increases the resilience to climate change.


CO_2 → → O_2
ອານຸລັກປ່າໄມ້-ປ້ອງກັນສະພາບດິນຟ້າອາກາດ
Protect the Forest-Protect the climate

The Covid-19 pandemic

Through the current Covid-19 pandemic, the world is facing urgent and additional pressures on human well-being and sustainable development. The global health crisis demands immediate solutions as well as mechanisms for recovery. The ongoing pandemic may fundamentally shape global and national development agendas, now and in the future. Some key themes are currently emerging at high speed which work at the interface of EbA and IWRM, such as WASH (Water, Sanitation and Hygiene), and climate resilience ce as well as job creation through 'green recovery' (UN-Water, IWA, IUCN, and Worldbank). Further analyses are required to reveal how coupled EbA-IWRM approaches can support the protection of livelihoods during the ongoing pandemic and a green recovery in a climate-sensitive and sustainable way.

Box 1: the Covid-19 pandemic

Across the world, water resources are managed and governed within a huge variety of natural, cultural and technical settings. One overarching concept that has emerged as a guidance on how water management should be generally approached is called Integrated Water Resources Management (IWRM). Meanwhile, IWRM provides a globally accepted definition as well as principles and tools for water resources management.[3] These can address diverging interests at local catchment scales, and also affect transboundary large-scale processes. Climate change as a global challenge is endangering the key objective of IWRM, which includes both sustainable social and economic development and ecosystem health. IWRM generally supports the acknowledgement of climate change impacts on water resources and the development of adaptation options. This is one of the key strategic themes of IWRM, though it does not demand systematic climate proofing of water projects as a key requirement to assure water security under climate change.[4] Moreover, the IWRM concept does not emphasise the vital role of healthy ecosystems in aiming for climate resilience in watersheds.

Various EbA programmes and projects have already been implemented within the water sector all over the world, with schemes ranging from micro-watershed management approaches to large-scale transboundary water management practice. However, these projects are seldom conceptually anchored within participatory and catchments-based IWRM approaches. EbA could be improved by adding such an integrated perspective.

Coupling EbA and IWRM approaches could maximise opportunities to increase resilience in watersheds. Merging the approaches optimises both: systematic mainstreaming of CCA into IWRM towards climate-sensitive water resources management, as well as the proactive development of healthy ecosystems (natural, like forests and wetlands; or transformed, within agricultural or urban areas) as part of a defined adaptation strategy in a catchments-based, participatory and integrated manner.

The study thus aims to analyse how these two concepts can be merged in practice. After the introduction (chapter 1), the study continues with a conceptual assessment of IWRM and EbA (chapter 2), to provide the background for the case studies. Chapter 3 addresses the analysis of tools and mechanisms that can foster the linking of EbA and IWRM through two in-depth case studies in Peru and the Nile Basin (chapter 3.1.), followed by an analysis of the actual implementation of EbA approaches in water basins in Thailand and the Philippines (chapter 3.2). Chapter 4 presents five short case studies on implementing EbA within IWRM from the Democratic Republic of Congo, Burundi, Tajikistan, Mexico and Costa Rica / Panama. Chapter 5 summarises lessons learned, presents guiding principles for coupled approaches and outlines the way forward.

3 For details on the definition and approach, please refer to chapter 2.

4 With regard to the role that CC and CCA currently play within IWRM please check: www.gwp.org/en/we-act/themesprogrammes/Climate-Resilience and https://www.gwp.org/en/WashClimateResilience

Takeaways chapter 1: the ecological foundation

- → The world's water resources are under increasing pressure due to growing water demands as well as an ongoing degradation of the global water resources. Climate change is expected to worsen this situation in most regions of the world.
- → The water sector is vital for human well-being and sustainable development and crucial to other economic sectors, such as agriculture and industry. It is further highly vulnerable to climate change.
- → Thus, sustainable water management is a top priority in climate adaptation planning and implementation, as expressed through numerous global and national strategic key documents, i.e. National Adaptation Plans (NAP), National Communications (NC) and the adaptation sections of Nationally Determined Contributions (NDC).
- → The resilience in watersheds greatly depends on healthy ecosystems and their services. Healthy ecosystems support natural water storage and retention, reduce impacts of extreme events and contribute to water purification through bio-chemical and bio-physical processes. This increases water availability in adequate quality, and overall also contributes to water security, despite increasing pressures on global water resources through climate change.
- → Ecosystems and water resources continue to be degraded, which increases the vulnerability to climate change. The status of degraded ecosystems can be improved through Nature-based Solutions (NbS). NbS are 'green' measures that support or mimic natural processes to restore or develop ecosystem support functions. On an operational level, if NbS focus on adaptation, are human-centric and implemented in the context of wider climate adaptation strategies, they are termed 'Ecosystem-based Adaptation' approaches, in short: EbA. EbA enhances climate resilience in watersheds.
- → Water resources management is based on the internationally accepted principles of Integrated Water Resources Management (IWRM). IWRM supports stakeholder participation and reconciliation of diverging interests between water users in a catchment-based approach. IWRM caters for the development of climate adaptation strategies in watersheds, but neither systematically promotes climate proofing of water management approaches nor fosters the implementation of EbA in climate-resilient water management. Now, IWRM needs further enhancement, first through systematic mainstreaming of CCA into its main principles and approach, and secondly through supporting a structured integration of EbA as an ecological pathway towards resilient water management.

Box 2: takeaways: the ecological foundation

→ 2. A strong combination: merging EbA and IWRM

This chapter outlines the background and key features of state-of-the-art water resources management and ecosystem thinking that aim to enhance water security under climate change-related pressure. The outline includes an assessment of principles, mechanisms and tools of the globally established approaches of Integrated Water Resources Management (IWRM), Nature-based Solutions (NbS) and Ecosystem-based Adaptation (EbA). Due to the high vulnerability of the water sector to the impact of climate change, the analysis sets a special focus on policies and practices that support adaptation to climate change in watersheds. This analysis further reveals how integrating EbA and IWRM can improve current water management practice for and provide greater climate resilience. The chapter sets out the conceptual basis for the case studies following in chapter three.

2.1 Integrated Water Resources Management (IWRM)

The conceptual development of IWRM was initiated at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. Here the international community commonly agreed upon the 'Dublin Principles' as the shared, new global paradigm for water resources management. The declaration of the Dublin Principles for IWRM was a milestone for the global water management community. The four principles (→ see Box 3) set the foundation for new conceptual thinking in water management – away from techno-centric engineering solutions towards participatory management approaches – and provided the first guidelines for the implementation of IWRM on a global scale.

The Dublin Principles

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policy makers at all levels.
3. Women play a central part in the provision, management and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognised as an economic good.[5]

Box 3: the Dublin Principles (Source: UNCED, 1992)

Previously, water management was understood as developing technological solutions to operational water problems; these include water quality improvement through quality control and water treatment or flood control through dam construction. Water management used to be treated as the sole task of sectoral agencies and government departments, which planned and implemented water projects in techno-centric top-down processes. These 'mono-tasking' and top-down approaches embraced neither the complexities of socio-ecological systems, nor the multi-sectoral and ecological interconnectedness within watersheds. They also failed to acknowledge the wide range of stakeholders and water users with diverging interests. Water management before 1992 focused rather on 'fixing (single) symptoms' instead of treating the underlying causes. According to the UN, top-down processes were functional at the time, as there was sufficient water for human needs and the various ecosystems. With the fast-paced growth of the global economy, coupled with the growing risks and impacts of climate change, water demands and pressures on global water resources have increased drastically, necessitating a fundamental change in water management practice (WWC, 2015). The declaration of the Dublin Principles as a new global paradigm for IWRM led to a global reform of water management approaches that aimed at integrated multi-sectoral water management. Since then it has shaped water reforms, planning and management practice.

5 Whereas the first three principles gain broad acceptance, the fourth principle – assigning an economic value to water – is considered controversial by some stakeholders and is not always accepted as shared concept and guiding principle.


WATER IS LIFE
DONATO P. BINWAG
for
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DONATO P. BINWAG
for
COUNCILOR

This advance has supported the development of a new and globally accepted definition of IWRM in 2000 (→ see Box 4).

Since then, both academia and practitioners have agreed that managing water resources is a cross-cutting subject that requires integrated approaches (→ see Figure 1). By adhering to the three principles of social equity, economic benefits and environmental sustainability, the management of water resources must now encompass (diverging) social, economic and environmental objectives of multiple water users, including challenges and risks.

Definition of IWRM

Based on the Dublin Principles, the globally accepted definition of IWRM now states that *'IWRM is a process, which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.'*

Box 4: definition of IWRM (Source: GWP, 2000:22)

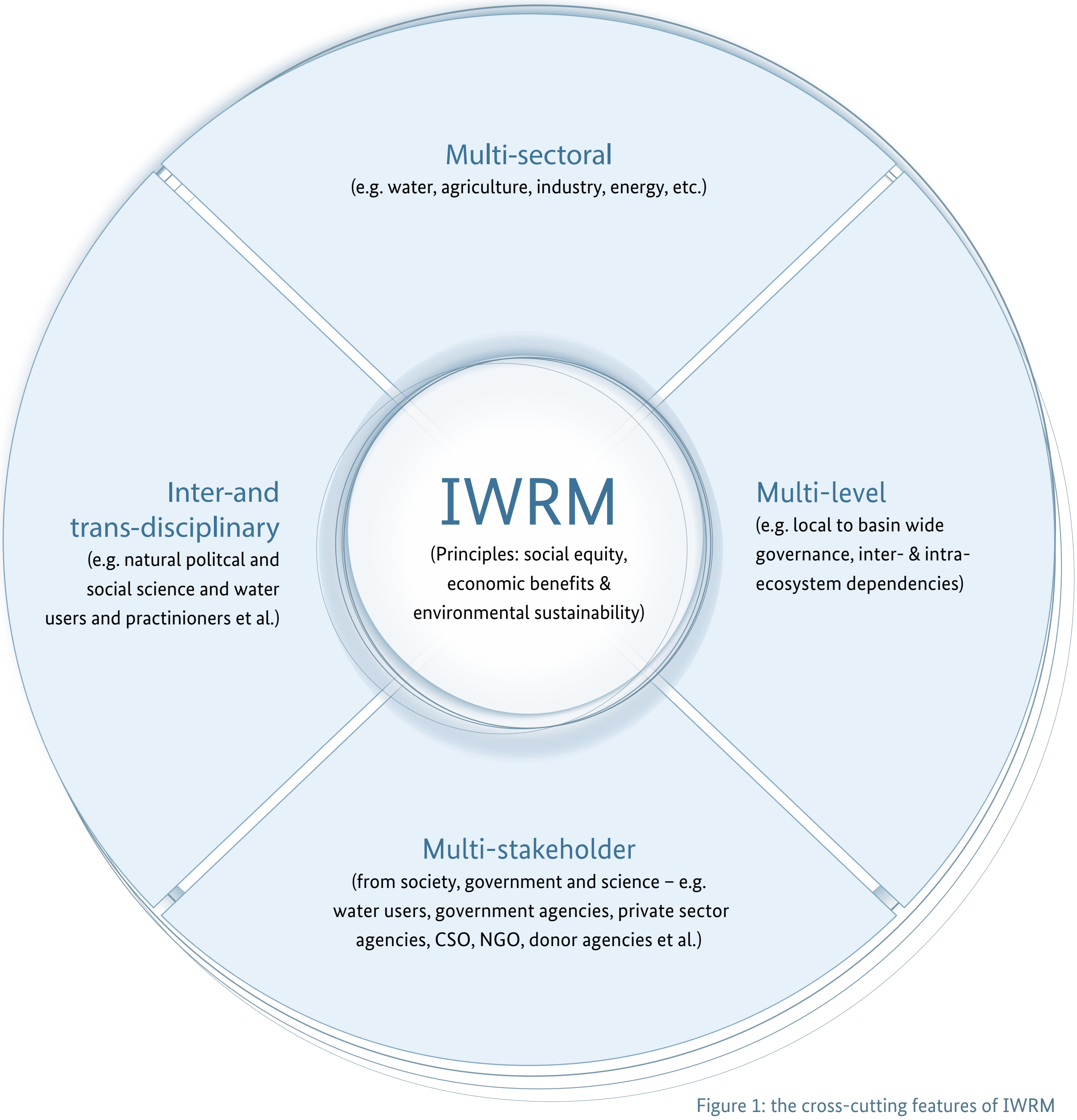


Figure 1: the cross-cutting features of IWRM

IWRM therefore strives to support sustainable social and economic development without compromising ecosystem health, and acknowledges that water catchments, rather than administrative boundaries, are the appropriate planning units to address water challenges. It supports reconciliation among water users with competing interests through participatory planning and management approaches. To foster implementation of IWRM, the Global Water Partnership (GWP) has developed a comprehensive toolbox, providing about sixty tools, organised into three themes. These include tools to develop (1) an enabling environment, (2) institutional frameworks and (3) management instruments.[6] The toolbox supports practitioners who formulate IWRM policies and plans (such as national water management policies and sectoral plans) and develop implementation approaches. Water experts and practitioners have suggested expanding the scope of the themes that require attention in IWRM. In 2009, a fourth area was added to the key themes by Lenton and Muller (2009) and in 2015 the World Water Council (WWC, 2015) augmented these with a fifth and sixth theme. Together, these six thematic fields function as a set of pre-conditions for the systematic planning and implementation of IWRM (→ see Box 5).

6 See: www.gwp.org/en/learn/iwrm-toolbox/About_IWRM_ToolBox

What is needed for IWRM

1. A strong enabling environment – policies, laws and plans that put in place 'rules of the game' for water management that use IWRM;
2. A clear, robust and comprehensive institutional framework – for managing water using the basin as the basic unit for management while decentralising decision-making;
3. Effective use of available management and technical instruments – use of assessments, data and instruments for water allocation and pollution control to help decision makers make better choices;
   to which Lenton and Muller (2009) added:
4. Sound investments in water infrastructure with adequate financing available – to deliver progress in meeting water demand and needs for flood management, drought resilience, irrigation, energy security and ecosystem services;
   to which WWC (2015) added:
5. Effective strategies for dynamically catalysing and managing change at all levels – facilitation of processes for social learning, supported by data, communications and empowerment to take action to solve problems and learn-by-doing, which work with and reinforce reform processes and investments;
6. Operating mechanisms that bridge strategy setting and problem solving – platforms that enable sectors and stakeholders to come together to negotiate, coordinate, collaborate and jointly innovate.

Box 5: what is needed for IWRM (Source: WWC, 2015:9,20)

IWRM acknowledges complex local realities in watersheds and thus does not provide a one-size-fits-all approach or blue-print on how IWRM should be implemented. IWRM provides principles, mechanisms and tools, and leaves it to the stakeholders to jointly define their prevailing water problem(s) and to develop tailor-made solutions themselves. This approach is still criticised for not appropriately acknowledging local governance, politics and sector realities. Applying IWRM in the local context requires accepting that participation may not equally work in every political context: what is needed is a focus on political and economic analysis as a basis for effective participation and water governance (→ see Box 6).[7]

Political Economy Analysis

Political economy analysis (PEA) is a structured approach to assess sector politics to understand limits and limitations to change in the local context. PEA has been especially applied in the realm of development support. PEA can help understanding how political dynamics determine certain outcomes, whether competing interests exist, which approaches are feasible and which will not be successful. PEA includes tools and approaches to understand political motivation and dynamics.

Box 6: Political Economy Analysis (PEA) for climate-resilient water management (Source: van Tilburg and Minderhout, 2019:2)

2.2 NATURE-BASED SOLUTIONS (NBS) AND ECOSYSTEM-BASED ADAPTATION (EBA)

Nature-based Solutions (also known as Nature-based Approaches, NbA) are defined as 'actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.' (Cohen-Shacham et al., 2016:4; IUCN, 2016).

They aim for sustainable development by safeguarding human well-being in ways that reflect cultural and societal values and by enhancing the resilience of ecosystems, their capacity for renewal and the provision of ecosystem services (Cohen-Shacham et al., 2016). NbS are an umbrella concept for various ecosystem-related approaches, which can be structured within five main categories: a) ecosystem restoration approaches, b) issue-specific ecosystem-related approaches, c) infrastructure-related approaches, d) ecosystem-based management approaches and e) ecosystem protection approaches (Cohen-Shacham et al., 2016:10; FEBA/PEDRR, 2020).[8] (→ See also Figure 2)

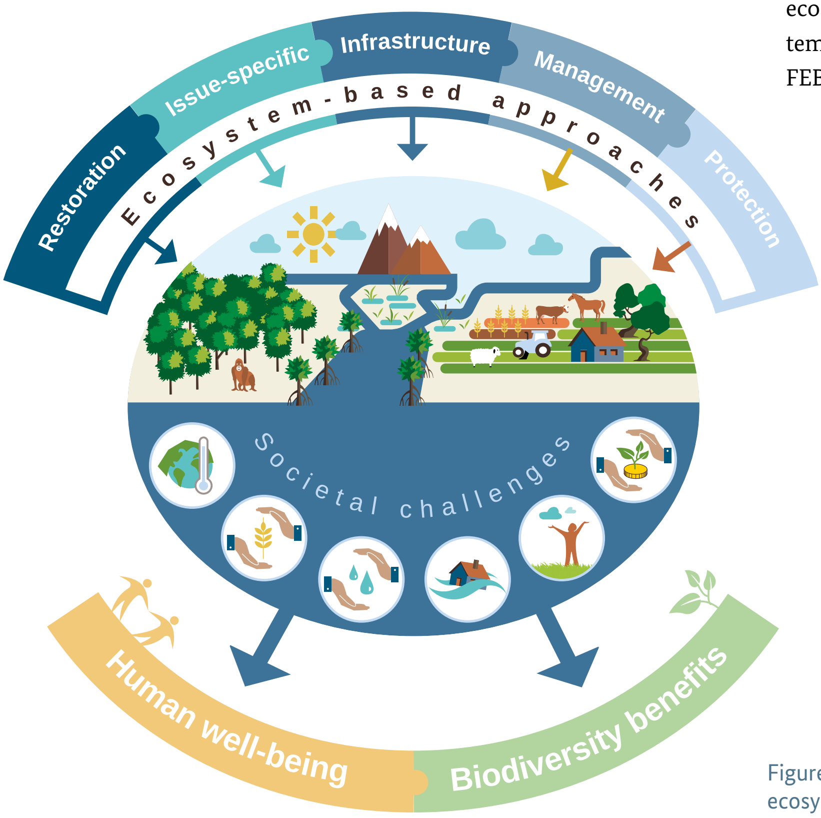


Figure 2: NbS as an umbrella concept for ecosystem-related approaches (IUCN, 2020:3)

7 For a comprehensive review on participatory approaches and the need to include a governance perspective into IWRM Dörendahl, 2015.

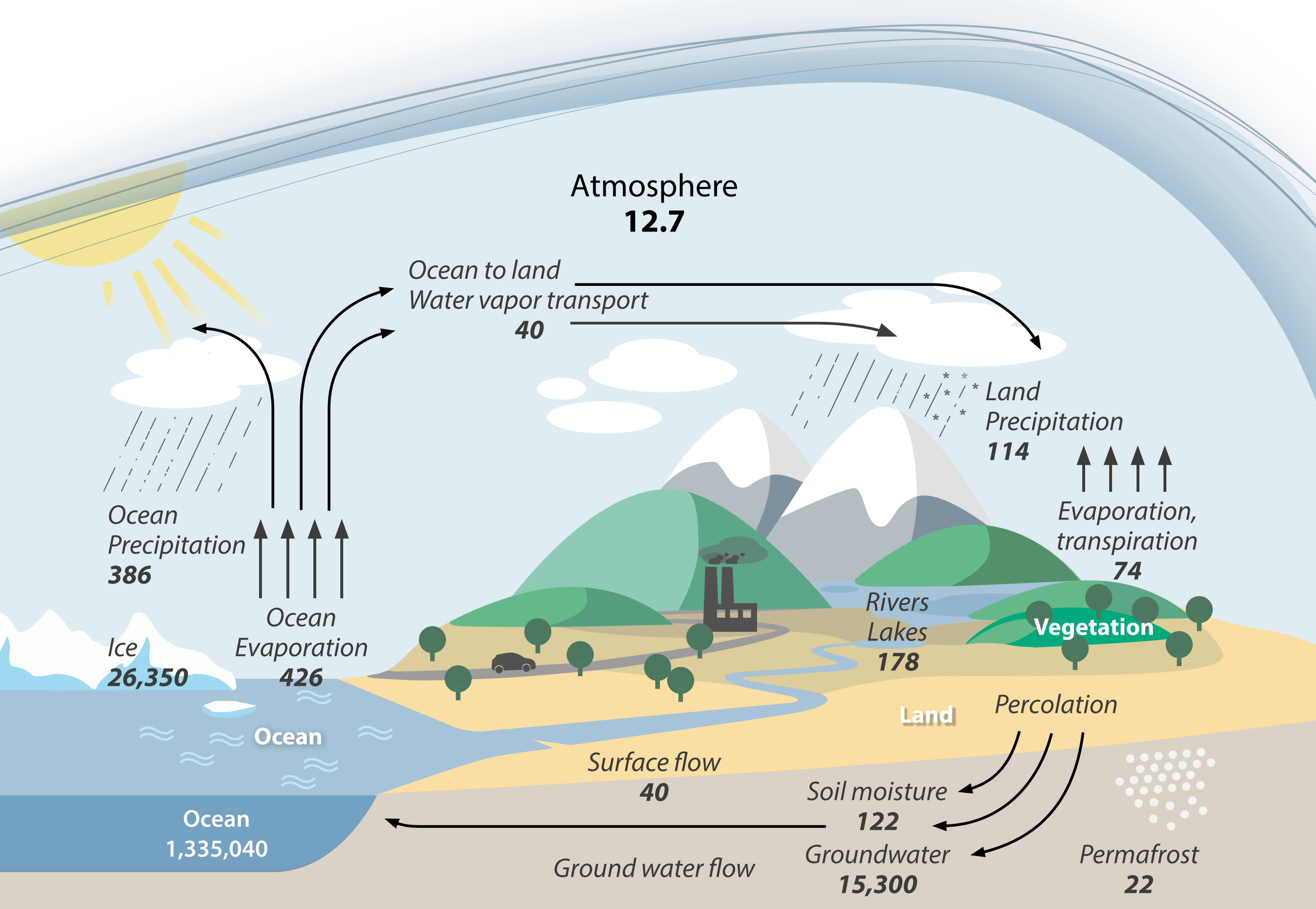
8 For a common understanding on NbS, a set of eight criteria and twenty-eight indicators has recently been published (IUCN, 2020). See: www.iucn.org/theme/nature-based-solutions/iucn-global-standard-nbs

Storage, movement and purification of water on, above and below Earth's surface are at the core of the global hydrological cycle, which is driven by factors such as biochemical and biophysical processes through ecosystems (→ see Figure 3). The processes are enabled by land-ecosystems like forests, grassland and wetlands, and by aquatic ecosystems such as oceans, seas, rivers, lakes and groundwater resources. Also transformed landscapes, such as agricultural lands, can provide ecosystem support functions if managed properly. In that these ecosystems define natural storage and retention capacities, they can reduce the impact of extreme events and work towards water purification. They play a key role in ensuring water security and reduce vulnerability to climate change (for details → see Annex 1) (WWAP/UN-Water, 2018a, 2018b).

Ecosystems strongly influence precipitation cycles at various scales (from local to continental) and impact on soil formation, erosion, sediment transport and deposition. Biodiversity determines ecosystem processes, as vegetation triggers 'water recycling'. on a global scale; up to 40% of terrestrial rainfall is based on plant transpiration and evaporation from land resources. The relation between land-use patterns and water availability is vital, even over long distances. For instance, 70% of the rainfall in the Río de la Plata Basin (South America) is based on evapotranspiration from the Amazon forests; water flows in the Nile Basin are influenced by evapotranspiration from the Gulf of Guinea, and moisture from Central Africa via transportation through the Ethiopian Highlands (WWAP/UN-Water, 2018b).

If ecosystems are degraded, the provisioning ecosystem services are impaired, which negatively impacts the water cycle and can endanger water security for people as well as very distant locations.

Figure 3: the global water cycle[9] (GIZ, PIK and adelphi, 2020:24)



9 The figure illustrates the global hydrological cycle, including estimations on the current global water budget and annual water flow, based on observations from 2002–2008 (units: 1000 km³ for storage and 1000 km³ per year for exchanges) (GIZ, PIK and adelphi, 2020 based on Trenberth et al., 2011)

NbS support protecting, managing and/or (re-)developing natural or semi-natural systems in watersheds, which can reverse degradation and contribute to the repair of the provision of water-related services. Nature-based Solutions can, for instance, reduce run-off and increase soil moisture retention, leading to groundwater recharge. Further, they can support water purification through those bio-chemical and bio-physical processes that are typical of natural or constructed wetlands and riparian buffer strips (Grizzetti et al., 2016; WWAP/UN-Water, 2018a, 2018b). NbS can work as stand-alone approaches or complement conventional engineering solutions. In some cases, NbS entail the only viable approaches to improving water provision, for instance in landscape restoration designed to combat desertification or land degradation; in other cases, however, conventional 'grey' infrastructure solutions are deemed more feasible (WWAP/UN-Water, 2018b). NbS can be applied on both a small and a large scale and can function both in natural and transformed agricultural, urban or rural settings. They can improve water availability and water quality and reduce water-related risks. Thus, they contribute to overall water security and resilience to climate change in multiple ways (WWAP/UN-Water, 2018a, 2018b; OECD, 2020) (→ see Box 7 and Annex 2 for details).

Sustaining or developing healthy ecosystems through NbS – both natural and transformed – are key features for climate resilience in watersheds. They have been progressively acknowledged and promoted by international organisations, and have correspondingly been mainstreamed into national climate policies such as Nationally Determined Contributions and National Adaptation Plans (WWAP/UN-Water, 2018b; SCBD, 2019; Seddon et al., 2019; GIZ, PIK and adelphi, 2020; Martin et al., 2020). On an operational level, they are referred to as 'Ecosystem-based Adaptation' (EbA), insofar as they focus on adaptation, are human-centric and implemented as part of a wider climate change adaptation strategy.

The concept of EbA stems from socio-ecological systems research that proposes the use of ecosystems for human adaptation to climate change (Scarano, 2017). The term EbA, coined in 2008, was officially defined in 2009 (→ see Box 8).

NbS for managing water security: improving water availability, water quality and reducing water related risks

NbS for water availability: *'NbS mainly address water supply through managing precipitation, humidity, and water storage, infiltration and transmission, so that improvements are made in the location, timing and quantity of water available for human needs.'*
NbS for water quality: *'Forests, wetlands and grasslands as well as soils and crops, when managed properly, play important roles in regulating water quality.'*
NbS for water related risks: *'Combining green and grey infrastructure approaches can lead to cost savings and greatly improve overall risk reduction'*
NbS for enhancing water security – Multiplying the benefits: *'NbS are able to enhance overall water security by improving water availability and water quality while simultaneously reducing water-related risks and generating additional social, economic and environmental co-benefits. They allow for the identification of win-win outcomes across sectors.'*

Box 7: NbS for managing water security (Source: WWAP/UN-Water, 2018a)

Definition of EbA

EbA is defined as 'the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. (…) It aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of the adverse effects of climate change'.

Box 8: definition of EbA (Source: SCBD, 2009:41)

Figure 4: EbA as part of a coherent CCA strategy (GIZ, 2019:9)

The CBD COP 10 in 2010 recognised the function of EbA as 'ecosystem-based approaches for adaptation that may include 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). Like its umbrella term NbS, EbA can entail 'green' stand-alone approaches, but can also complement conventional 'grey' as well as 'brown' measures (→ see Figure 4).

EbA is gaining growing attention within climate policies (e.g. UNFCCC Paris Agreement, Nationally Determined Contributions, National Adaptation Plans), as it often creates additional co-benefits for adaptation and mitigation.[10] Currently, a new set of recommendations is being developed that calls for the prioritisation of EbA approaches in national adaptation planning where possible and appropriate. The measures should be complemented by 'grey' infrastructure solutions when EbA reaches its limits in safeguarding human lives and ecosystem health (Terton and Greenwalt, 2020). EbA as a key concept in CCA is further anchored within Disaster Risk Reduction policies such as the SENDAI Framework for Disaster Risk Reduction 2015–2025, the Agenda 2030 and biodiversity conservation policies (e.g. Convention on Biological Diversity Strategic Plan 2011–2020, Aichi targets). For the latter, good examples are the adoption of the 'Voluntary guidelines for the effective design and implementation of Ecosystem-based Adaptation and Disaster Risk Reduction' through the CBD at COP 14 (SCBD, 2019). The distinctive feature of EbA is its people-centric concept, and its emphasis on the critical role that the integrity of ecosystems plays in human resilience. Based on its growing experiences with EbA, the Friends of EbA Network (FEBA) have developed three elements and five criteria to define what qualifies as EbA (→ see Figure 5). Linked to these five qualification criteria are twenty quality standards that jointly create an assessment framework for EbA approaches (FEBA, 2017).

EbA measures can enhance storage capacities and improve water quality, reduce the impact of extreme weather events and climate variability. They can also support ecosystem functions that provide cross-sectoral benefits for sustainable development as well as co-benefits for climate mitigation. EbA in watersheds offers a valuable opportunity to opt for water security in the face of climate change (→ see Annex 3). To maximise the potential of EbA, the approach should be mainstreamed into water policies and planning.

10 This is currently been articulated through the new NDC of Jamaica. See: www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Jamaica%20First/Updated%20NDC%20Jamaica%20-%20ICTU%20Guidance.pdf

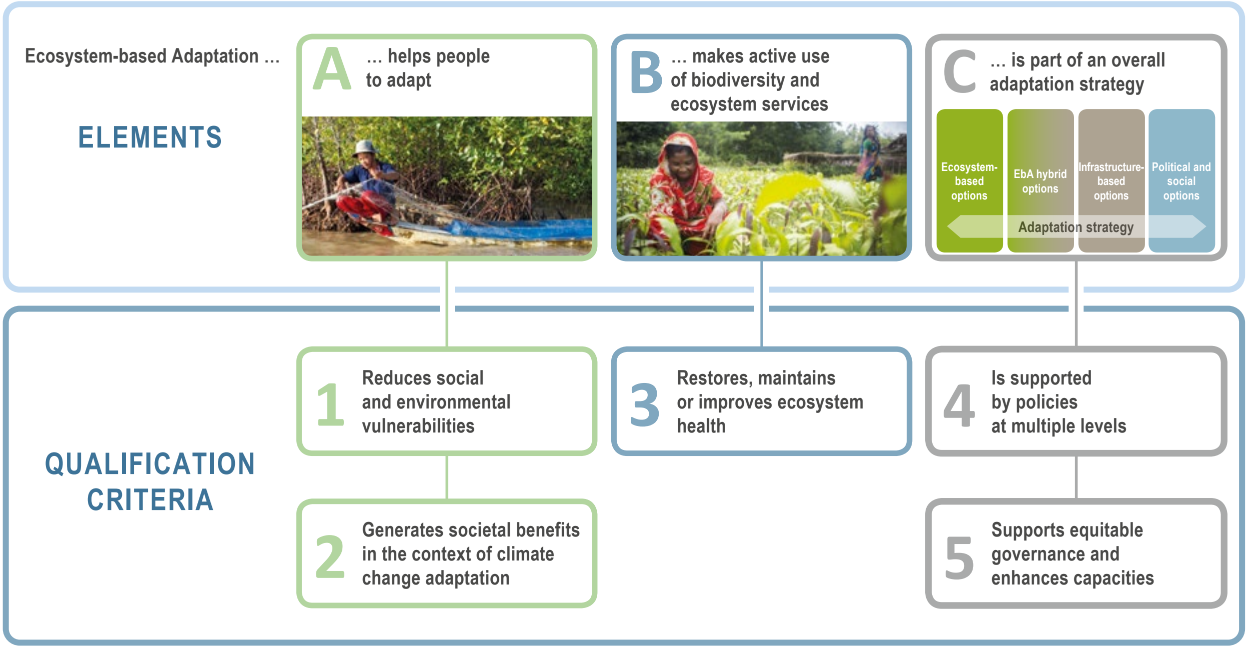


Figure 5: making EbA effective: a framework for defining qualification criteria and quality standards (adapted version) (FEBA, 2017)

2.3 THE STRENGTHS OF INTEGRATING EBA AND IWRM

IWRM as a global paradigm for water resources management is a holistic, integrative and participatory water management approach that aims for social, economic and ecological sustainability in watersheds. IWRM further addresses strategic global challenges and policies; the concept supports sustainable development by explicitly fostering SDG (Sustainable Development Goals) implementation.[11] It acknowledges climate change as a key global challenge for sustainable development, but does not systematically include climate proofing of water management approaches; under current climate change projections, however, this is a must if water security is to be ensured for a growing population. IWRM creates the space for water users to define their prevailing water problem(s) and develop solutions, but does not yet acknowledge the strengths of healthy ecosystems to increase resilience in watersheds. Hence shared management decisions often overlook EbA as an approach towards water security; this deficiency is partially based on limited knowledge and experience of the effectiveness, strength and long-term sustainability of EbA. As a result, decision makers are neglecting opportunities to improve climate resilience. This tendency is amplified by external factors such as (large scale) funding mechanisms bound to, or supporting, conventional water infrastructure solutions.

Yet, IWRM as a shared paradigm for water resources management can play a vital role in building climate resilience in watersheds by fostering the structural integration of climate proofing mechanisms into water management and by promoting and supporting the integration of Ecosystem-based Adaptation approaches. Merging EbA and IWRM would anchor a systematic inclusion of a CCA approach into IWRM and provide ecological solutions to assure ecosystem health. This would increase the long-term resilience of watersheds to climate change.

The practical implementation of coupled EbA-IWRM approaches, including enabling and hindering factors, as well as lessons learned, is illustrated in the forthcoming chapters.

11 See: www.gwp.org/en/sdg6support

2.4 Takeaways chapter 2: maximising the benefits by merging the approaches

- IWRM has evolved as a global paradigm for water resources management. Moving away from techno-centric solutions to water problems, IWRM addresses water resources management in a holistic, multi-sectoral and participatory approach, aiming for sustainable social, ecological and economic development in watersheds.
- IWRM encompasses key themes, strategies and tools for practical implementation, but leaves it to the stakeholders to identify and address their prevailing water problems in a participatory manner. It acknowledges global key challenges for sustainable development such as climate change, and supports CCA if deemed necessary by the water users. It does not require systematic climate proofing of water management approaches.
- Considering the vital importance of water security for human well-being – currently and in the future – the degree of global water resources degradation and the projected impacts of climate change on the global water cycle, IWRM is at present not going far enough to safeguard human well-being and ecosystem health. Further, IWRM does not acknowledge the considerable ability of healthy ecosystems to support water security in the face of climate change.
- Ecosystem-based Adaptation (EbA) caters for the sustainable provision of key ecosystem services that drive the water cycle. This is achieved by the protection, restoration, planning and management approaches that (re)develop support functions in degraded watersheds. These measures increase climate resilience and work for water security in adequate quantity and quality.
- The strengths of EbA to improve water availability, water quality and to minimize the impact of extreme events are gaining growing attention in global key policies in the fields of climate change, Disaster Risk Reduction, sustainable development and biodiversity conservation. New recommendations include applying EbA as a prioritised approach in national adaptation planning; wherever possible, these are to be complemented by 'grey measures' to protect human lives, ecosystems and infrastructure when EbA as a stand-alone approach reaches its limits.
- The noted lack of anchoring systematic climate proofing within IWRM-principles and mechanisms, and the need to focus on healthy ecosystems to achieve water security in the face of climate change both argue for an integration of the approaches.
- To aim for water security as a basis for human well-being, sustainable economic development and ecosystem health, coupled EbA-IWRM approaches need to (a) assure systematic climate proofing of water projects and (b) mainstream and prioritise EbA approaches to support climate resilience and water security in watersheds as means to adapt to climate change.

Box 9: takeaways: maximising the benefits by merging the approaches

→ 3. In-depth solutions

The following four cases show how EbA can be successfully embedded within an IWRM approach. The analysis supports the development of key lessons as well as enabling and inhibiting factors for each case. The first two case studies from Peru, Tanzania and Kenya (chapter 3.1: developing EbA entry points) reveal tools and mechanisms that can help practitioners and decision makers to introduce and mainstream EbA into IWRM (on the concept of Entry Points, → see Box 10).

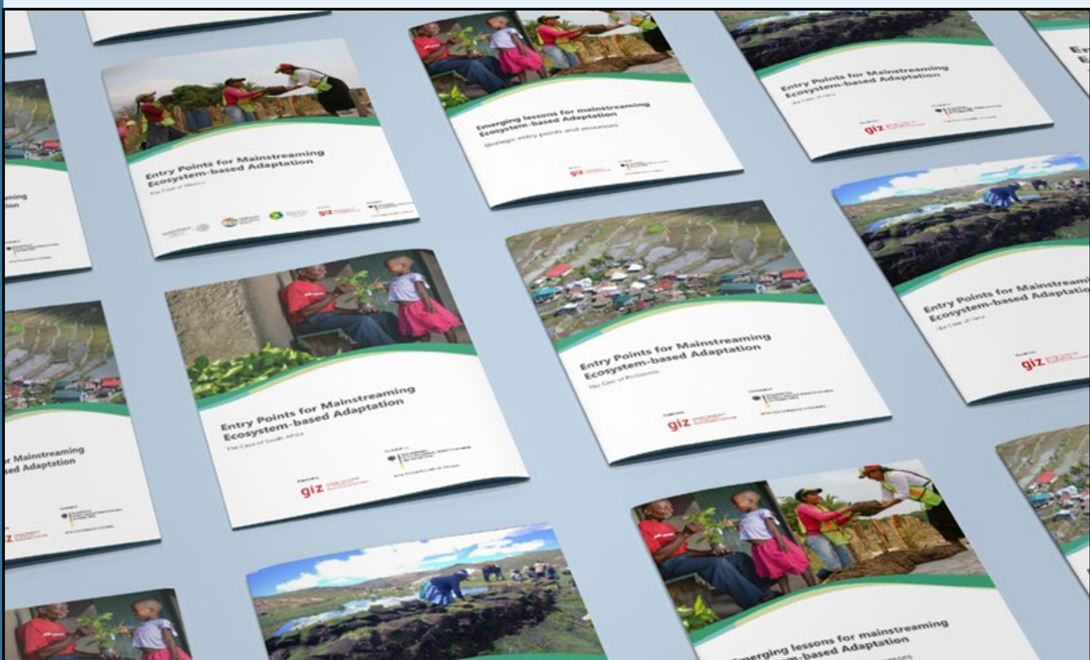
EbA Entry Points

Entry points are windows of opportunity to embed EbA in national and local policies and projects. The analysis of entry points is not a focus of this study, but entry points are implicitly used in each case study. This is achieved through a context analysis of the political and institutional setting for EbA, with a special focus on the role that EbA plays within national climate and water policies and institutional set-ups.

'Entry points' for EbA arise when three variable streams align:

a) the problem stream (stakeholders are aware of an existing problem or risk),
b) the proposal stream (availability of solutions, proposals, tools and knowledge) and
c) the political stream (the presence of political will to tackle the existing problem)

See:
https://www.adaptationcommunity.net/wp-content/uploads/2019/04/giz2019-en-study_Emerging-lessons-for-EbA-mainstreaming_web.pdf



Box 10: EbA Entry Points (Source: GIZ, 2018a, 2018b, 2018c, 2018d, 2019:13)

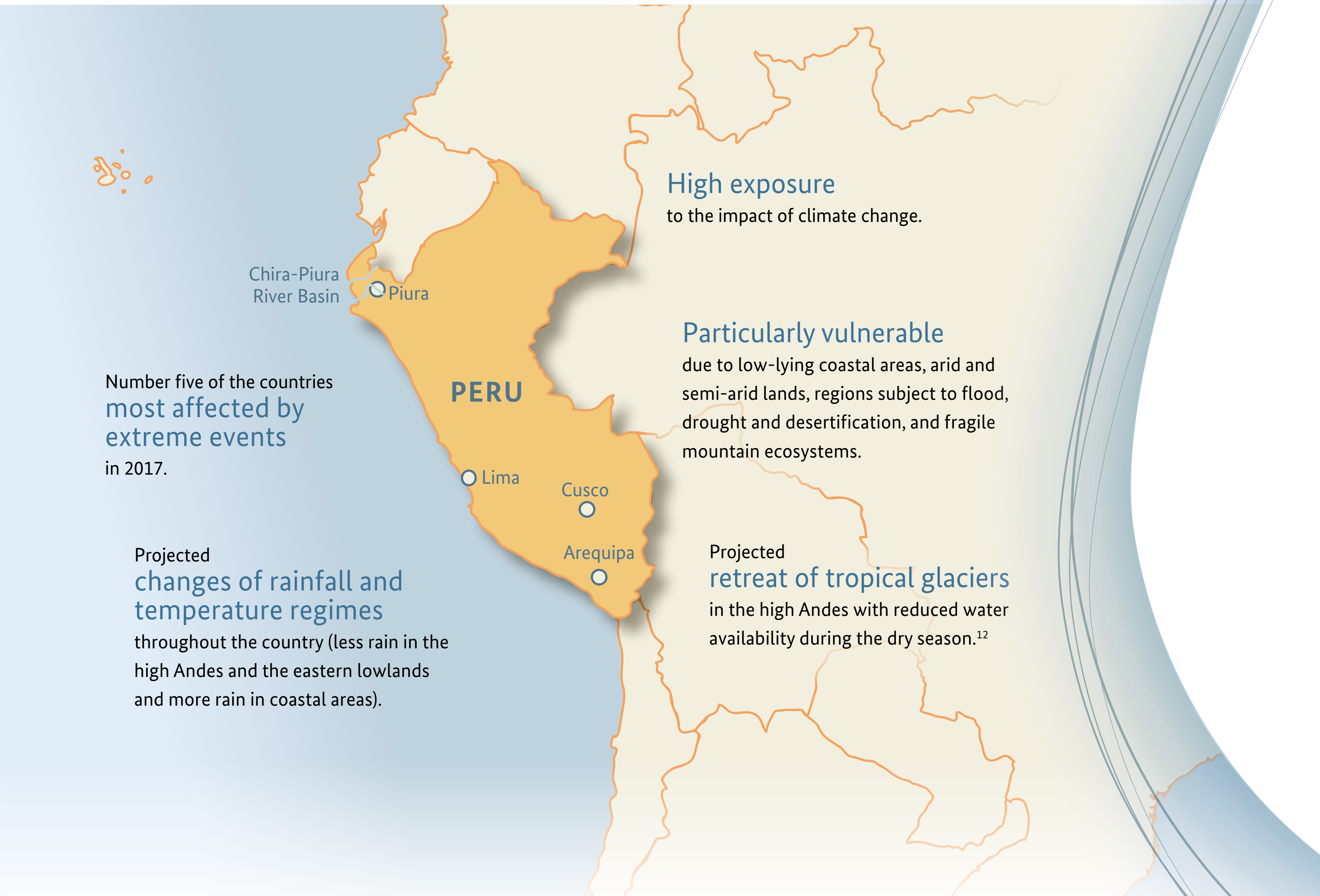
The following two in-depth-case studies from Thailand and the Philippines (chapter 3.2 – Getting into action) address the implementation of EbA approaches, including lessons learned, and enabling and inhibiting factors within IWRM through participatory multi-level approaches at different basin-scales. Table 1 summarises the key features of the case studies, highlighting the geographical diversity, the implementation level, the challenges addressed, the EbA approach, and the main objective and enabling factors.

No	Region › Country	Project	Imple-mentation level	Water Management Challenge(s)	Approach	Main objective of EbA approach	Enabling factors
1	Latin America › Peru	Water funds in the Chira-Piura River Basin	Watershed level	Impacts of El Nino and water-related climate change effects, endangered livelihoods in the arid landscape of the Chira-Piura River Basin.	Water Funds as an option to mainstream and finance EbA measures.	Water security	→ Supportive policies and regulations → River Basin Councils as established multi-stakeholder forums → Independent and transparent fund management → Transparency, communication and dissemination
2	Africa › Nile Basin › Kenya & Tanzania	E-Flows Assessment in the Mara River Basin	Trans-boundary (sub-basin) level	Transboundary cooperation to address IWRM challenges in the Mara River Basin – a large sub-basin contributing to water flows in the River Nile.	Environmental Flow Assessment as a basis for introducing and mainstreaming EbA in a transboundary setting.	Water quality and availability	→ A supportive institutional set-up at transboundary, national and sub-basin scale → The Nile Basin Initiative as facilitator → A guiding framework – the NBI's E-flows Strategy (2016) → An existing Memorandum of Understanding (MoU) between Kenya and Tanzania
3	Southeast Asia › Thailand	EbA in water sector policy and planning processes	National and watershed level	Overall increase in the frequency and intensity of floods and droughts, social, economic and environmental impacts at the watershed level.	Mainstreaming EbA into national climate and water sector policies and subnational key planning and implementation processes in the River Basins.	Water security	→ Building on local knowledge in line with national policies → Assuring participation by civil society → Working with established River Basin Committees → Willingness of local stakeholders to experiment → Building up on previous work → High level of awareness of the need for CCA in IWRM
4	Southeast Asia › Philippines	Anchoring EbA in the water sector of the Philippines	Watershed level (large-scale and smaller scale)	Degraded watersheds, challenging water security on a large scale (Manila Bay) and smaller scales (region Visayas and Mindanao).	Implementing EbA approaches in large scale and smaller scale basins	Water security	→ Supportive policies → Established structures to facilitate multi-stakeholder processes → Building up on previous work → Working with key actors

Table 1: overview of in-depth case studies

3.1 DEVELOPING EBA ENTRY POINTS

Case study 1 (Peru – the Chira-Piura River Basin): water funds to mainstream EbA into IWRM



> Political and institutional context

Peru responded to climate-related challenges at an early stage and is meanwhile one of the leading countries with regard to climate policies and strategies. As early as 1993, the National climate change Commission was created as a consultative body to supply relevant information for climate change initiatives. In 2003, the first National Strategy on climate change was enforced, and further developed in 2013. The strategy supports an integrated approach to increase awareness and adaptive capacity in Peru, to address climate risks, to protect carbon reserves and to contribute to the reduction of greenhouse gas emissions. The updated National Strategy on climate change explicitly acknowledges the crucial role of ecosystems, natural protected areas and biodiversity for climate change adaptation and mitigation, and paves the way for EbA (GIZ, 2018a).

In 2015, the first Nationally Determined Contributions (NDC) were published as a new national key strategy for climate change (Republic of Peru, 2015), building on previous measures. Due to the high vulnerability and cross-sectoral importance of water resources, the water sector was prioritised as one of five key sectors to be addressed for climate change adaptation. In 2018, the Peruvian climate policy was further enhanced by the enacting of the Law on climate change, which gives special importance to climate change adaptation and also considers EbA as one out of seven adjustment priorities. Currently, a roadmap for the development of the National Adaptation Plan (NAP) is under development by the Ministry of Environment (MINAM), the leading agency on climate policy. National climate policy and planning are being complemented by strategic action at the regional and local levels, where regional governments are legally bound to develop Regional climate change Strategies.

12 Further background information can e.g. be found here: MINAM, 2010, 2015; Germanwatch, 2018:6.

These strategies aim to identify the most vulnerable sectors and areas at the regional level and prioritise localised adaptation and mitigation measures. Meanwhile, 18 out of 25 regional plans have been finalised.

Climate change impacts are expected to endanger water-intensive key sectors such as hydropower generation, mining, irrigated agriculture and industry, and also imperil the small scale agricultural activities that are the main source of employment for a high percentage of the low-income population.

Peru's framework conditions for well-founded IWRM were finally shaped in 2008 with the adoption of the amended National Law on Water Resources, based on the previous water law of 1969. The law explicitly applies IWRM policies; these include integration of sectoral policies, stakeholder participation, decentralised water resources management, management of water resources at River Basin levels and the recognition of water as a crucial socio-economic asset. The enactment of the Law was complemented by the foundation of the National Water Authority (ANA) as the key regulating agency for Peru's water resources management, mandated to enforce and monitor the implementation of the new law. ANA's responsibilities cover water resource planning at basin and national levels, increasing water efficiency and ensuring water quality and environmental flows in coordination with the Ministry of Environment; they also promote stakeholder participation in IWRM, manage water conflicts, and adapt Peru's water resources management to climate change and water-related risks.

The institutional framework for water resources management has been complemented by the National Policy and Strategy on Water Resources (ANA, 2012) and the National Water Resources Plan (ANA, 2013). The Water Strategy highlights the importance of protected areas and ecosystem conservation to assure water security, though remained vague with regard to action. In 2014, this changed through the introduction of the Mechanism for Compensation for Ecosystem Services (MERESE). Whereas MERESE is voluntary for most sectors, it became a mandatory mechanism in the Housing Sector, enforced through the Law on the Modernisation of Sanitation Services and the Law on the Management and Provision of Sanitation Services and related regulations. This new regulatory framework requires drinking water companies to include a fee for environmental compensation mechanisms, with the aim of promoting efficiency in water use and water treatment and developing climate change adaptation plans. With the help of this framework, drinking water companies throughout the country are required to include a 1% fee, to be invested in the protection of freshwater sources. While the water supply companies are meanwhile obliged to finance the protection of freshwater sources, other water consumers, like agriculture and mining, are currently not forced to contribute to the financing mechanism for water source protection. Although EbA as an approach has not yet explicitly been anchored in national water policies, the institutional framework and local practice constitute an enabling environment for promoting and mainstreaming EbA into IWRM.

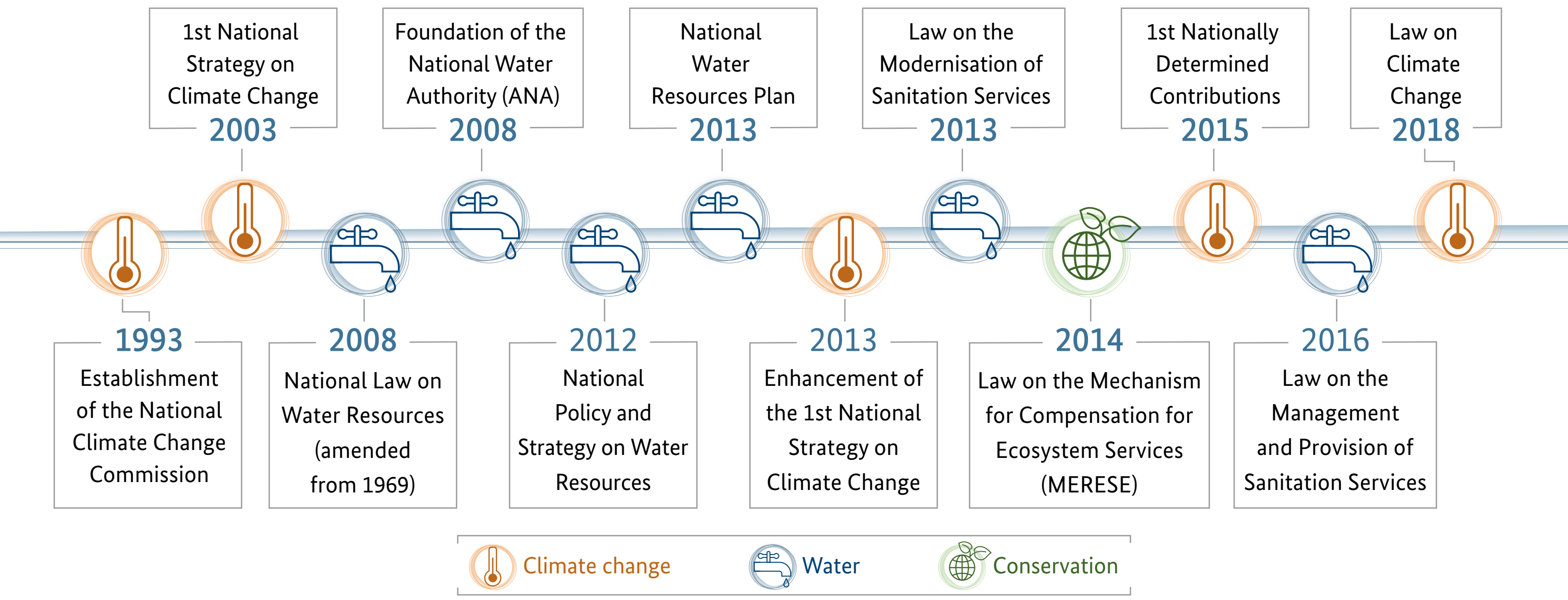


Figure 6: timeline with selected political and institutional milestones (Peru)

> Tools and mechanisms: The Chira-Piura Water Fund (FORASAN)

To improve water security and increase the resilience to the impacts of climate change, the 'Partnering for Adaptation and Resilience – Agua (PARA-Agua)' Project was established, focussing on three vulnerable watersheds in Peru and two in Colombia.[13] While the national climate and water policy framework in Peru acknowledges the value of ecosystems to reduce climate-related water risks, the lack of funding constitutes an obstacle for the implementation of EbA measures. Thus, a key feature of PARA-Agua to facilitate local investments for climate-sensitive water resources management in Peru was the consolidation of FORASAN, a regional water fund in Chira-Piura. Water funds are transparent and long-term financial mechanisms that gather a variety of stakeholders to jointly develop solutions to water-related problems. They can support water conservation measures and apply the principles of IWRM. Water funds can be used as 'Mechanisms for Retribution of Ecosystem Services', where measures can, but do not necessarily have to, apply EbA approaches. In Chira-Piura, the project was a co-operation with the River Basin Council. The aim was to establish a water fund that would cater for the implementation of the Water Management Plan and for financing ecosystem conservation measures. These contribute to adapting to climate variability by maintaining base water flows during the dry season and protecting soils against erosion during the rainy season or as a result of extreme rainfall events. Consolidating the water fund was a participatory process that required a phased approach.

1. Feasibility phase: assessment of context and viability of the fund.
2. Assessment phase: a) mapping of stakeholders and potential contributors, b) developing an approach and implementation strategy, c) defining the mechanism for financial contributions, as well as d) defining fund objectives and the scope and structure of the fund.
3. Negotiation phase: facilitation of discussions and engagement between potential contributors from the private and public sectors as well as international partners, recipients (communities) and decision makers (government) to specify voluntary contributions and to achieve agreements on the final formation of the fund.
4. Foundation phase: legal establishment of the fund.
5. Consolidation phase: implementation of measures and consolidation of fund operation.
6. Implementation of a communication and dissemination strategy.

The success of the fund was highly reliant on facilitating communication during all phases of the project; this included working with the River Basin Councils, non-governmental and governmental stakeholders and private sector organisations. Such collaboration was required to strengthen the political will to create a multi-stakeholder-led water fund; the lack of political support had been a hindrance to fund development in the first place. The importance of organisations like the River Basin Councils lay in establishing neutral spaces for dialogue among stakeholders and actors, and assuring transparency and efficiency in fund management. This policy promoted long-lasting trust among the different stakeholders.

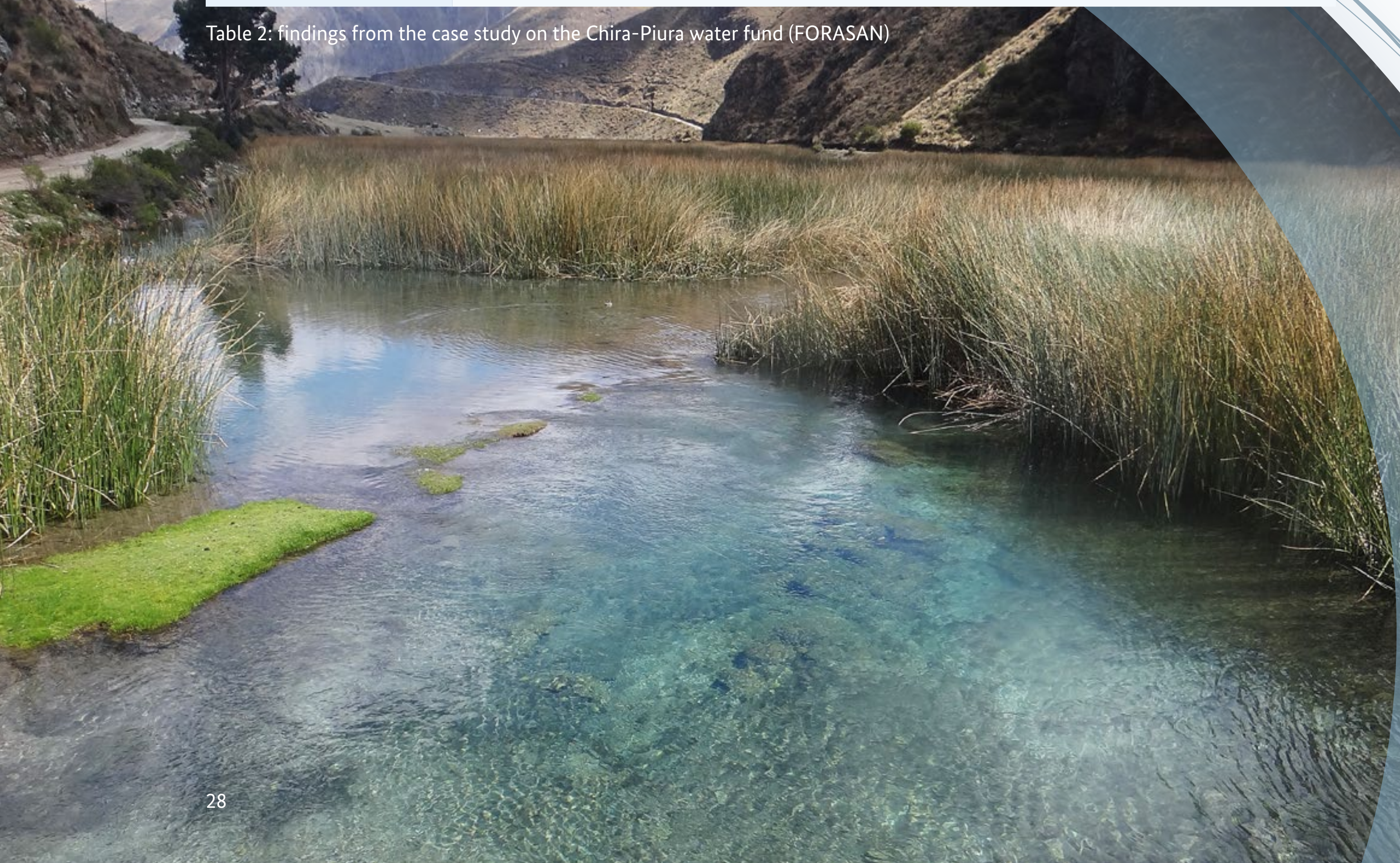
The procedure to establish the Chira-Piura water fund (FORASAN) took more than eight years of stakeholder engagement and negotiations; in the last three years, PARA-Agua supported the final phases of the planning. During the negotiation phase, water fund members jointly agreed which activities should be financed through the funding scheme. In the case of Chira-Piura, it was decided that investments should focus on priority actions for water conservation, pollution control, risk management and protection of natural areas. The fund directory includes interested public and private actors, parties financially contributing to the fund and actors responsible for the follow-up of implementation on the ground. This scheme assures that objectives, norms and scope are clear to all stakeholders. The institution administering FORASAN is a private entity that can grant certificates to allow for tax reduction for companies investing in the fund. Ensuring fund management through an independent actor has supported transparency and trust in the funding scheme, a crucial factor for its sustainability.

FORASAN became operational in 2018, with mixed regular financing from private sector investors and the National Water Authority, as well as projects funded by international donors and by the Piura Regional Government. Since December 2018, private users like farmers in the lower part of the River Basin and one private company contribute almost twenty thousand USD annually. From the collected money, 80% is invested in resource protection measures and 20% in FORASAN assets. Though FORASAN meanwhile constitutes a functioning public-private partnership, more funding would be required to assure ecological effectiveness of measures as well as long-term sustainability to adapt local water resources management to the impacts of climate change. FORASAN now allows to sustainably finance EbA measures within the wider context of IWRM for improved climate resilience.

13 The project was developed by the United States Agency for International Development and implemented by AECOM International Development, The Mountain Institute (TMI), the Stockholm Environmental Institute (SEI) and the National Center for Atmospheric Research (NCAR). For further information see: USAID, n.d.; USAID, 2017; FORASAN Piura, 2018.

Key lessons	**Catering for broad stakeholder participation:** a vital role is played by the River Basin Councils, including non-governmental and governmental stakeholders and private sector organisations. The importance of these organisations lies in establishing neutral spaces for dialogue among stakeholders and actors and assuring transparency and efficiency in fund management. This fosters a long-lasting trust among the different stakeholders.
Enabling factors	**Supportive policies and regulations:** national policies and regulations support measures that can foster EbA at the sub-regional levels. Here, IWRM processes are inscribed in basin management plans in Peru, which allow for the implementation of comprehensive participatory processes. These are required for the establishment of a water fund. **River Basin Councils – established multi-stakeholder forums:** the multi-stakeholder set-up of the River Basin Council in Chira-Piura facilitated the participatory approach which was required for fund development and the development of alliances between public and private sectors to achieve financial commitments. **Independent and transparent fund management:** trust in the effectiveness and honesty of public institutions is rather low; fund management is therefore the responsibility of an independent and non-governmental management institution. **Transparency, communication and dissemination:** these elements play a crucial role in informing the water users about the fund, objectives and achievements; in turn this creates trust, the key feature for the long-term success of the fund.
Inhibiting factors	**Lack of political will** to create a multi-stakeholder-led water fund: political will is needed to assure the establishment of the fund. **Low skills and limited knowledge** negatively affect the newly formed regulatory frameworks. Difficulties in managing this kind of financing mechanism hamper fund implementation at sub-national levels. **Long-term processes and objectives of climate-sensitive IWRM measures** normally exceed usual project live-spans. Ensuring the resources to operate the fund took eight years, and monitoring actions to prove the effectiveness of the scheme need funding that even further exceeds this time-span. Ensuring resources in the long-term constitutes a challenge for upscaling the scheme.

Table 2: findings from the case study on the Chira-Piura water fund (FORASAN)



Case study 2 (Tanzania / Kenya – the Mara River Basin): environmental Flow Assessment for transboundary and climate-resilient IWRM

The River Nile is
Highly vulnerable
to the impact of climate change.

One of the
most conflict prone water basins
in the world.

Eleven riparian states with
high and growing water demands
and limited coping mechanisms.

Expected
increase of frequency and severity of extreme events
like floods, droughts and heat waves.

Expected severe effects on economic key sectors,
such as agriculture, fisheries and livestock, endangering food and nutrition security and future economic growth.

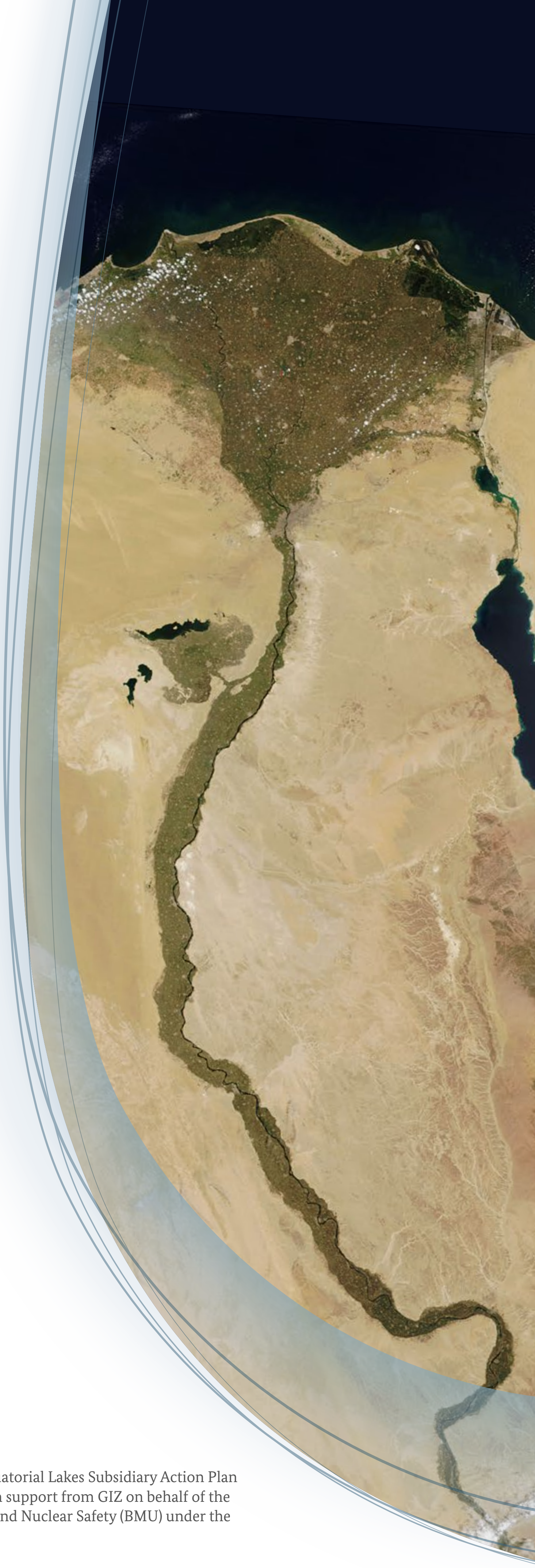
To address the above challenges and to foster collaboration among riparian states, the Nile Basin Initiative (NBI) was established in 1999.[14] Water governance through the NBI is based on a Cooperative Framework Agreement (CFA), which outlines principles, rights and obligations for the riparian states and is designed to support regional integration and consensus building. As water allocation is one of the most disputed challenges of the NBI, the Treaty promotes an 'integrated management, sustainable development, and harmonious utilisation of the water resources of the Basin, as well as their conservation and protection for the benefit of present and future generations' (NBI, n.d.). Because of pending ratifications, the CFA has not yet entered into force. Whereas a joint legal foundation remains a challenge, the NBI fosters collaboration by facilitating structured stakeholder dialogues among riparian states and by supporting knowledge generation and information sharing at basin and sub-basin levels. As part of the ongoing collaboration efforts, the NBI has introduced the concept of Environmental Flows or E-Flows. E-Flows are 'the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems' (Brisbane Declaration, 2007:1). Mainstreaming E-Flows into IWRM was defined as one of the strategic entry points to address integration at all basin scales. Based on a holistic and risk-based model, the NBI has developed a strategic framework towards mainstreaming E-Flows into transboundary and local IWRM, which was formalised under the NBI's Environmental Flows Strategy in 2016 (NBI, 2016).

14 See: https://nilebasin.org

The E-flows framework establishes linkages between river water flows and human and ecosystem needs and provides a knowledge base to foster stakeholder dialogues on water allocations. Besides measurements and projections of surface water flows and the classification of ecosystems, it promotes the balance of social and economic development needs with ecological requirements. A holistic assessment of E-Flows (Environmental Flow Assessment – EFA) also integrates climate information, climate projections and climate change risk parameters. EFA is conceptually understood as a tool that could cater for the introduction and mainstreaming of EbA within IWRM. It provides a knowledge base of hydrology, climate change impacts and basic human and ecosystem needs (now and in the future) within a given water basin. It also supports capacity development, stakeholder negotiations on water needs, allocations, and limitations to water provision under CC.

> Tools and mechanisms: E-Flows assessments for EbA in transboundary IWRM – the case of the Mara River Basin under the NBI (Kenya / Tanzania)

- → The Mara River Basin: covering more than 13,000 km^2 and home to 1.28 million people.
- → One of the most important River Basins of East Africa, shared between Kenya and Tanzania.
- → An important drainage area for the Nile basin.
- → Includes the world-famous Maasai Mara-Serengeti ecosystem, declared as one of the seven natural wonders of the world.
- → Endangered by climate change: projections include extreme weather events, increasing temperatures and acute seasonal variabilities.[15]



15 Further background information can be found here: USAID, 2019.

16 The project was implemented in collaboration with NBI's Nile Equatorial Lakes Subsidiary Action Plan (NELSAP) Coordination Unit and the Tanzanian Government, with support from GIZ on behalf of the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) under the International Climate Initiative (IKI).

> Political and institutional context

Kenya and Tanzania both provide institutional regimes that formally support IWRM at transboundary as well as local scales. In Kenya, the Water Act, which caters for management, conservation, use and control of the water resources, came into force in 2002. In that it applies IWRM principles, it recognises the importance of stakeholder engagement towards effective water resource management and fosters the establishment of the Water Resources Users Associations within the six drainage areas of Kenya. Community participation for natural resources management – at least formally – was reinforced through the enactment of the constitution in 2010 and the 2016 Water Act.

In Tanzania, the Ministry of Water and Irrigation was established in 2005 to support sustainable water resources management and foster stakeholder engagement. The Tanzanian Water Resources Management Act was enacted in 2008 as basis for a legal and institutional framework for sustainable water resources management; it outlines the principles for WRM, and encourages both stakeholder participation and the implementation of the National Water Policy (LVBC and WWF-ESARPO, 2010:9).

Both legal acts – the Kenya Water Act (2002) as well as the Tanzania Water Resources Management Act (2008) – define reserve flows as the quantity and quality of water required to meet basic human needs and to preserve aquatic ecosystems. Kenya and Tanzania belong to the few countries in the world that have included specific references and norms for E-Flows in their legal frameworks. In both countries, the water authorities are legally obliged to assure these reserve flows as a top priority within water allocation; included here are transboundary rivers like the Mara river (LVBC and WWF-ESARPO, 2010).

Between 2006 and 2015, under the umbrella of the NBI, the Mara River Basin Project was implemented; one of its aims was the facilitation of transboundary cooperation by the development of a comprehensive Cooperative Framework for transboundary water resources management (Dickens, 2011:61; NBI, 2015). In 2010, the first Environmental Flow Assessment (EFA) was conducted by the water authorities of Kenya and Tanzania for the upper Mara River Basin with external financial support and under the auspices of the Lake Victoria Basin Commission of the East African Community (LVBC and WWF-ESARPO, 2010). In order to address bilateral environmental and development challenges, a Memorandum of Understanding was signed in 2015 by the Republic of Kenya and the United Republic of Tanzania for Joint Water Resources Management of the transboundary Mara River Basin. It stipulated the responsibilities of both countries with respect to the dual management of the Mara River Basin, but did not formally refer to the outcomes of the EFA as a potential basis for bilateral water allocation agreements. Nevertheless, it constitutes an institutional cornerstone of IWRM and transboundary water cooperation in the Mara Basin.

In 2019, an EFA was also implemented for the lower Mara River Basin.[16] The assessment was carried out by representatives from different ministries from both countries, applying the NBI's framework for E-Flow assessments (NBI, 2020). The first full implementation of the NBI Environmental Flows Framework determined the E-flow requirements for the Lower Mara. The EFA resulted in the specification of water-resource quality objectives (RQOs) and recommended flow values for sustaining basic human needs and environmental flows. The recommendations reflect the stakeholders' goal to strike a balance between protection of the ecosystem and using it for their daily needs.

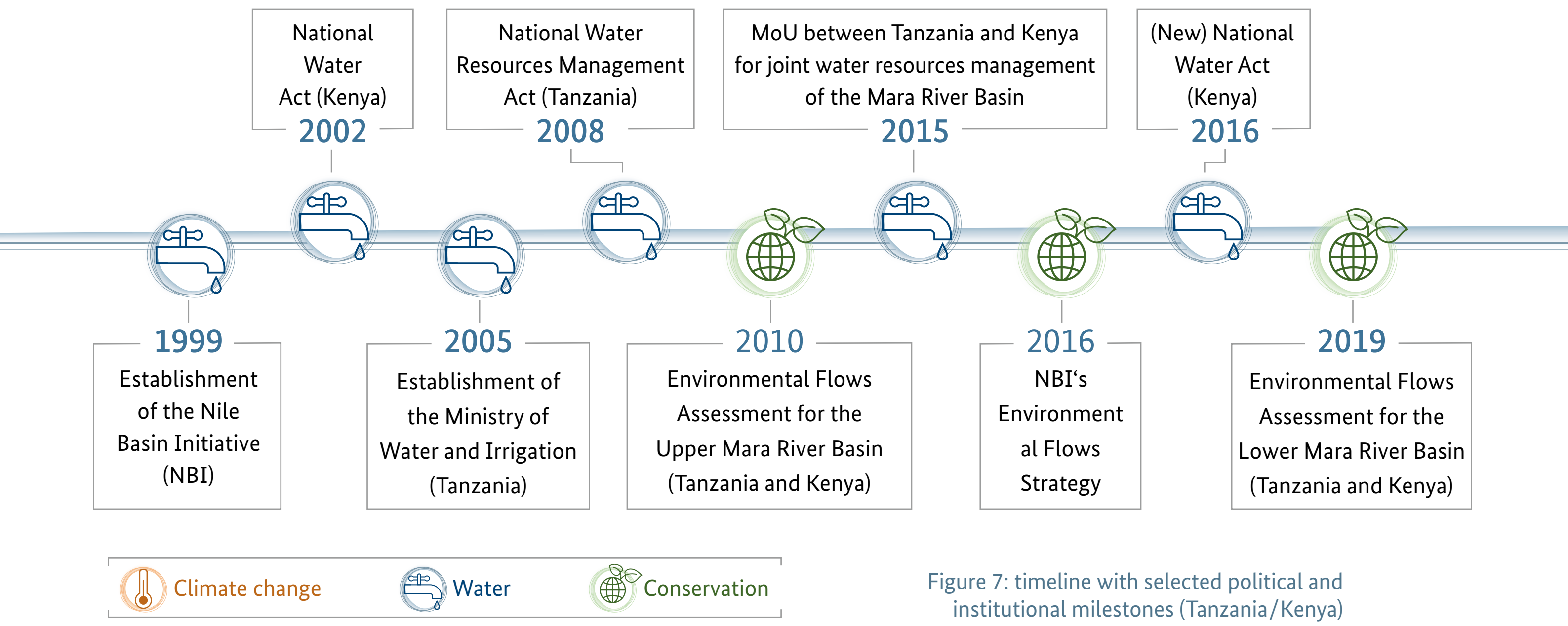


Figure 7: timeline with selected political and institutional milestones (Tanzania/Kenya)

Capacity building measures at all levels were at the core of major activities during the E-flow assessment. During fieldwork and campaigns, local participants were encouraged to work with different experts of the assessment team to learn about their specific fields of expertise and gain hands-on experience in applying fieldwork methodologies. Further, knowledge exchange between the water authorities of Kenya and Tanzania was considered a high priority. Community members contributed by providing information on the customary state of ecosystem conditions as well as registering recent changes.

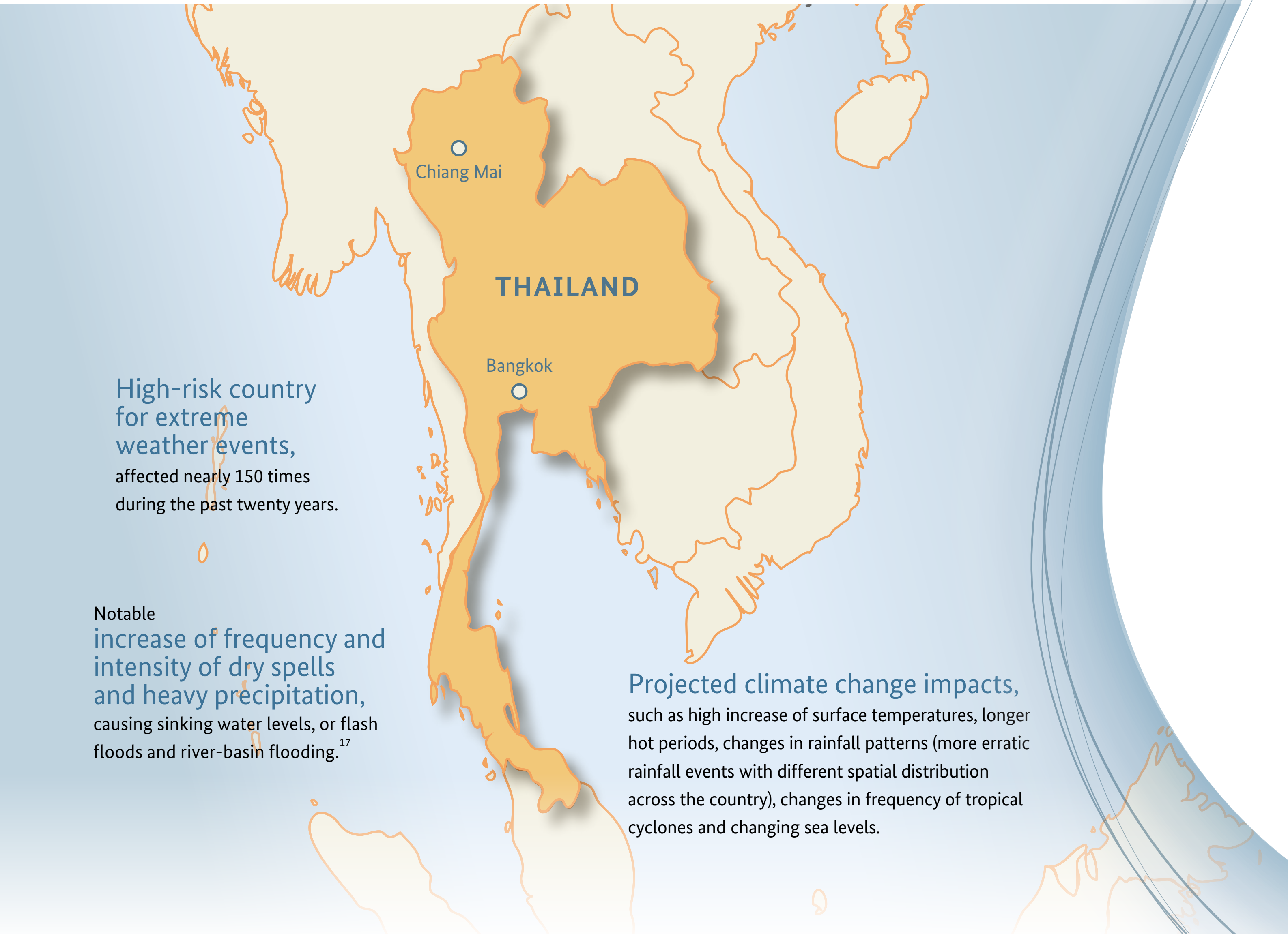
Under the umbrella of the NBI and with extensive external support over more than two decades, the development of EFA was implemented for both the upper and lower Mara River Basin as part of a basin-wide and transboundary IWRM approach. This took place within an institutional setup that supported IWRM and fostered EFA through a combination of binding and non-binding elements. The assessment, visualisation and negotiation of water needs and the legal assurance of minimum flows for basic human needs and ecosystems preservation can be interpreted as a model for introducing and integrating EbA into IWRM as means to cater for stable water provisioning under CC.

Key lessons	**Environmental Flow Assessment (EFA) is a tool that can foster and mainstream EbA within IWRM at multiple scales, including transboundary:** transboundary water resources management is highly political in nature and faces considerable challenges in the implementation of cooperative, basin and sub-basin agreements. EFAs provide a knowledge base of hydrology, climate change impacts and basic human and ecosystem needs within a water basin, as well as an approach for facilitation of stakeholder and regional dialogues. In view of climate change impacts, these are vital factors in the engagement of countries in future water allocation schemes and management negotiations at multiple scales.
Enabling factor	**A supportive institutional set-up:** the institutional set-up (transboundary, national and sub-basin scale) supported the joint development of EFA within the Mara River Basin. It includes binding elements such as the national Water Acts in Kenya and Tanzania (both requiring reserve flows), and non-binding elements, such as the EFA framework of the NBI. **The NBI as facilitator:** at the transboundary scale, the NBI has been acting as a basin-wide/country cooperation mechanism for more than twenty years, supporting collaboration between its member states. **An existing Memorandum of Understanding (MoU) between Kenya and Tanzania**: at the bilateral level, Kenya and Tanzania have agreed on shared modes of transboundary water governance, enacted through a MoU. **A guiding framework – the NBI E-flows Strategy (2016):** the introduction of the NBI's E-Flows strategy, as a guiding document for EFA, has proved itself viable for application in the Mara River Basin.
Inhibiting factor	**Need for capacity building on E-Flows and EbA:** training measures are required in the field of capacity building on E-Flow assessments and EbA; these would improve the chances of catering for more stable water provisions under CC.

Table 3: findings from the Mara River Basin case study

3.2 GETTING INTO ACTION

Case study 3 (Thailand): anchoring EbA in water sector policies and River Basin planning



> Political and institutional context

The Government of Thailand has been responding to the above challenges by developing and adapting key national policies, like the first NDC under the Paris Agreement (GoT, 2016) and Thailand's National Adaptation Plan (NAP) (GoT, 2018). The water sector was defined as one of six priority sectors for climate change adaptation in the NAP, with a specific focus on enhanced Integrated Water Resources Management (IWRM). Also EbA has been anchored in the NAP – first as one of the nine guiding principles of the NAP, and second as concept and approach under the priority sector of 'Natural Resources Management'. Nevertheless, EbA is a very new concept in Thailand, which still requires intensive capacity building and advocacy, as well as conceptual and operational guidance.

Parallel to the development of Thailand's climate policies, major changes restructured the country's water sector. First, the Office of National Water Resources (ONWR) was newly established to become the central regulatory agency in charge of Thailand's water resources management and responsible for bundling competencies in Thailand's (still) highly fragmented water sector. It became the central water management authority under Thailand's National Water Resources Committee and is now in charge of developing, regulating and managing national policies to progress towards IWRM. In this new organisational context, IWRM became both the paradigm and core management principle of ONWR at national level. Climate change impacts are experienced and perceived as increasing (e.g. catalysed by recent extreme events such as a severe drought in 2019 and 2020), which has led to more awareness and readiness of

17 Further background information can e.g. be found here: GoT, 2018a; Germanwatch, 2018:9.

ONWR and other water sector stakeholders to foster strategies to adapt to climate change, improve the management of climate and disaster risks and develop water security measures.

Second, the Water Resources Act came into force in 2019 (GoT, 2019a). It not only provides a (new) legal basis for Thailand's water resources management, but also caters for a stronger role of River Basin Committees (RBCs) and emphasises participatory approaches. This can be seen as an opportunity to promote and systematically integrate EbA options into the assessment and development of solutions for water resources management at a local or basin level.

Third – and parallel to the development of the NAP – Thailand's 20-Year Water Resources Management Plan, 2018–2037 (WRMP) (GoT, 2019b) came into effect. The WRMP is now the key policy document for the water sector. However, the opportunity to also establish a structural link to national climate strategies, i.e. the First NDC and the NAP, was missed. Thus, the WRMP neither addresses climate change adaptation as a key sectoral challenge nor EbA as a practical approach to CCA. Nevertheless, implicitly, EbA solutions are inherent in the six key strategies of the WRMP. Hence the WRMP provides suitable entry points for adaptation to climate change and can support the water-related goals of the NAP.

To date, water management projects in Thailand's water sector are dominated by large-scale (grey) structural solutions. The systematic use of NbS/EbA approaches, even as complementary measures to grey solutions, is limited. This is in part due to the lack of knowledge and awareness on NbS and EbA, (measurable) effects of grey infrastructure approaches versus uncertainties about the effectiveness of EbA measures (e,g, hydrological and environmental effects, cost-benefit ratio, socio-economic impacts). Even though a range of small-scale examples of NbS-approaches in the water sector exists on the ground, these measures are seldom anchored in a broader CCA approach and thus do not (yet) qualify as EbA. Although EbA has been reflected in the NAP, it still lacks systematic anchoring in the water sector. This underscores the need to enhance capacity building for EbA as an approach to complement climate-sensitive IWRM and to strengthen climate resilience in Thailand's water resources management.

The below timeline shows that in the mid- to long-term, there is a window of opportunity to promote EbA approaches in the political momentum for enhanced IWRM and CCA (→ see Figure 8). Increased efforts are now being undertaken to overcome barriers that exist in a water sector with many players and overlapping competences, limited access to local climate risk information, awareness of NbS and EbA and a historical prevalence of grey (large-scale) infrastructural solutions to solve water challenges.

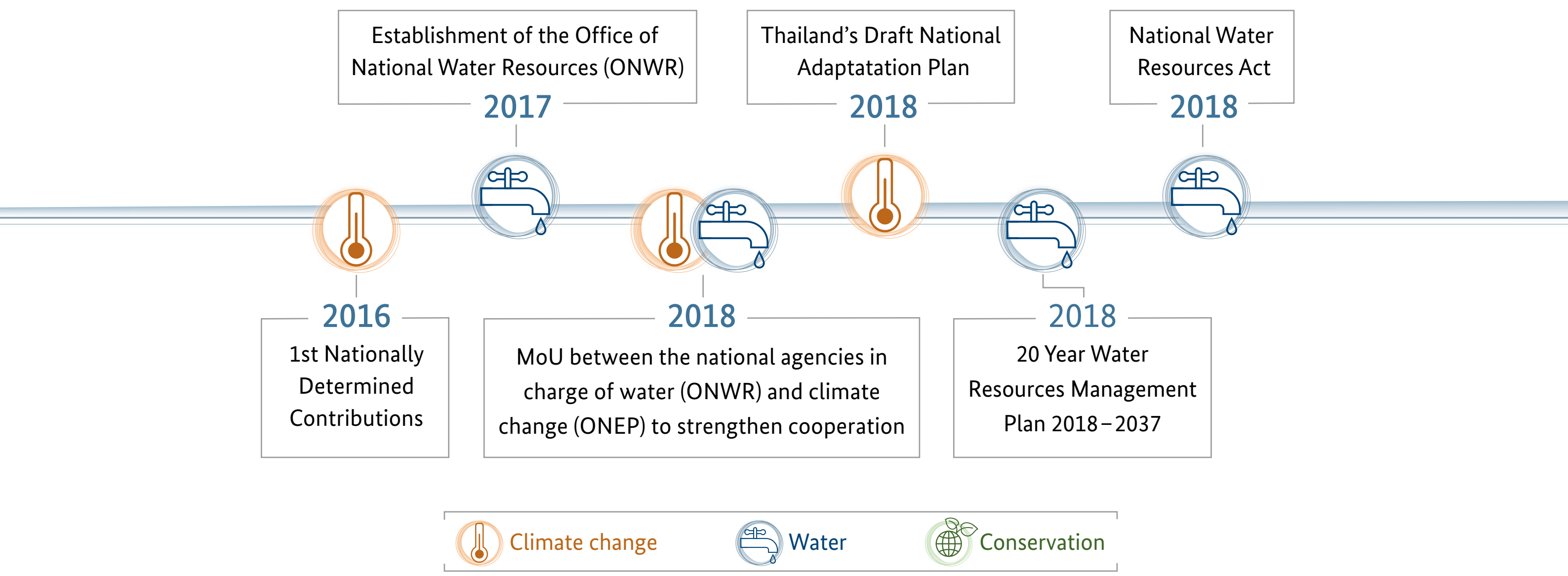


Figure 8: timeline with selected political and institutional milestones (Thailand)

> Implementation Approach 1: improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds (ECOSWat) (2013 – 2017)

ECOSWat aimed at implementing Ecosystem-based adaptation measures to better cope with extreme weather events (floods and droughts) in three pilot watersheds.[18] Activities focused on capacity building in EbA, implementing a participatory and inclusive approach through working with sub-River Basin stakeholders, and supporting the implementation of pilot- and demonstration measures. It also advocated for the inclusion of EbA as key concepts in the development of Thailand's National Adaptation Plan (NAP).

Key lessons	**Be practical:** capacity building measures as a key to EbA must cater for action learning and include implementation of pilot measures on the ground. **Building on local knowledge in line with national policies:** integrating local knowledge into the planning process was an important factor for the suitability of the measures in a local context. In this case, living weirs as environmentally-friendly weir constructions that act as a flood buffer were a local solution. Further, they were in line with the King of Thailand's Sufficiency Economy Philosophy of applying technologies based on local resources and know-how, thus supporting sustainable implementation. **Assuring participation of civil society:** the participatory approach and early involvement of civil society, as well as the acceptance of EbA by the latter, was crucial for successful project implementation.
Enabling factors	**Working with sub-basin committees:** working in sub-basins through committees that were composed of representatives from different interest groups (civil society, academia, government) enabled the introduction of EbA to the water sector and in addition, supported acceptance of the approach. **Willingness to experiment:** local communities with innovative leaders were open and willing to experiment with different approaches to prevent floods and droughts.
Inhibiting factors	**Lack of experienced implementing agencies for EbA measures:** there is a lack of market solutions and also of capable agencies and construction companies experienced in implementing EbA measures. Most construction companies only had experience in conventional construction approaches.

Table 4: findings from the ECOSWat case study

18 The project was implemented by GIZ

> Implementation approach 2: the Thai-German Climate Programme – Water (TGCP – Water) (2018 – 2021)

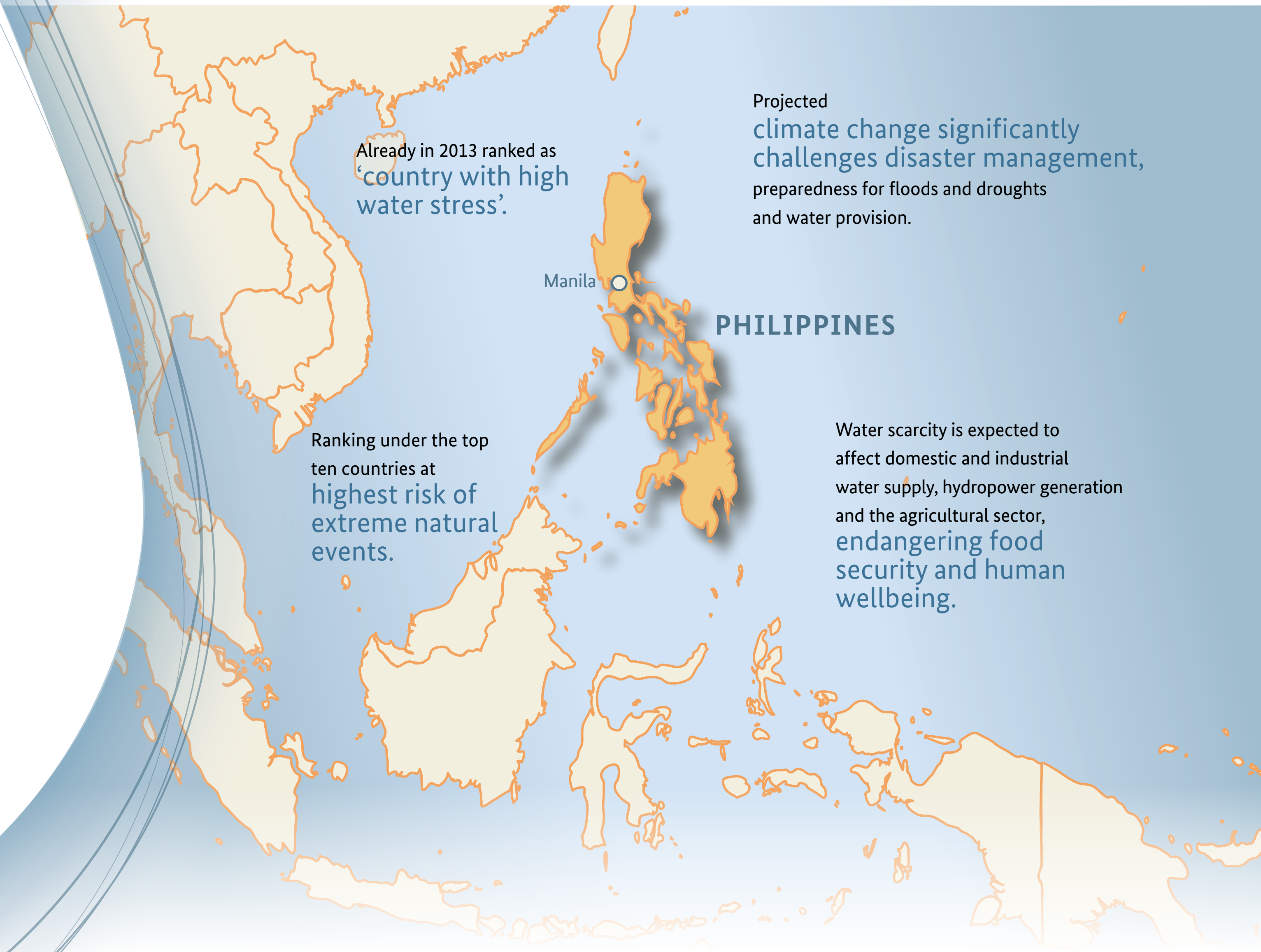
Project and Policy Context: the Thai German Climate Programme (TGCP) works across five sectors – climate policy, agriculture, energy, waste, and water – to support a low-carbon and climate-resilient development path in Thailand.[19] TGCP-Water aims at increasing the resilience of the Thai water sector by enhancing the framework conditions for climate-sensitive IWRM and by introducing EbA approaches at national and at river-basin scale. It works across five fields of action: 1) national policy development: integration of CCA, incl. ecosystem-based solutions, into national water management strategies and plans; 2) sub-national Implementation: support of institutional and technical capacity building to develop risk-informed and climate-sensitive River Basin Master Plans that follow the IWRM principles and include EbA as a guiding strategy for adaptation to climate change at a River Basin scale; 3) Monitoring and Evaluation (M&E): development of a framework for the monitoring and reporting of adaptation action in the water sector in alignment with national M&E processes of NAP implementation and international reporting according to the Paris Agreement; in addition, a joint research partnership with five Thai universities was established to develop an M&E methodology for EbA measures (i.e. on natural retention areas or traditional measures like 'living weirs') to provide further evidence of the effectiveness of EbA and to foster mutual learning; 4) financing: identification of public and private financing options to enhance climate financing in the water sector; 5) international cooperation: knowledge exchange and sharing of Thailand's experiences on the systematic integration of climate change adaptation into the water sector.

19 TGCP-Water is part of the Thai-German Climate Programme (TGCP), implemented through German bilateral cooperation.

Key lessons	**A new governance context in the water sector constitutes a 'window of opportunity':** the new political and policy context in the water sector through a) the establishment of ONWR as a national lead agency for coordinated IWRM in 2017; b) enactment of the Water Resources Act in 2019 and c) the launch of the 20-Year Water Resources Management Plan (2018–2037) allows the scene to be set for climate-sensitive EbA and IWRM. **Need to demonstrate benefits:** it needs to be proven to decision makers and IWRM practitioners that Ecosystem-based Adaptation solutions are cost-effective and sustainable options for climate-resilient water management and bring socio-economic benefits to local communities.
Enabling factors	**Intensified cross-sectoral/inter-agency cooperation and alignment of policies:** recognising that climate change impact is already influencing Thailand's water sector, the country has seen intensified cooperation between the agencies in charge of water (ONWR) and climate change (ONEP). The two agencies committed to strengthen cooperation activities in a MoU signed in 2018, and have since pursued the harmonisation of relevant policy frameworks. **Strong entry points in Thailand's climate and water policy framework:** the water sector is defined as one of the six key sectors for climate change adaptation, while enhanced IWRM was also inscribed as one of the top priorities in the Thai NDC. The National Adaptation Plan that lays out the framework and targets for sectoral implementation of the NDC emphasises EbA as a 'guiding principle'. At the same time, the six strategies of the 20-Year Water Resources Management Plan allow leeway for Nature-based Solutions for different water sector objectives. **The Water Resources Act** allows ONWR to lead the water sector as the main regulatory agency. Also based on its role as the climate change focal point for the sector, it shows strong commitment to promote climate change adaptation and EbA. It further emphasises the need for clear mandates and integrated planning processes, strengthening the role of the River Basin Committees and the importance of River Basin Master Plans. **Building upon previous work:** the promotion of the systematic use of the concepts of climate-sensitive EbA and IWRM in Thai water resources management (as pursued under TGCP-Water) has benefited from the work of the ECOSWat project. This was implemented together with the Department of Water Resources (DWR) between 2013 – 2017, which initiated the piloting of EbA for water management.
Inhibiting factors	**Need for capacity development at technical and institutional levels:** the level of knowledge on climate-sensitive EbA and IWRM is still inadequate, both at national and River Basin scale. This requires extensive training on concepts, guidance in the development of risk-informed and climate-sensitive River Basin Master Plans as well as tools, good practices and skills to identify, select, design and implement the most suitable EbA measures in River Basins. **Lack of evidence on the effectiveness of EbA:** technical guidance and M&E frameworks need to be developed to define costs, hydrological effects and co-benefits of EbA more clearly.

Table 5: findings from the TGCP-Water case study

Case study 4 (Philippines): integrating EbA in water sector planning and implementation in watersheds



> Political and institutional context[20]

In response to the high-risk exposure of the country and the projected impacts of climate change, the Government of the Philippines actively engaged in climate policy and organisational development at an early stage. In 2009, the climate change Act came into force, leading to the establishment of the climate change Commission (CCC). The CCC is the key policy-making body in the field of climate change and is responsible for coordinating, monitoring and evaluating climate change programs and action plans. In 2010, the National Framework Strategy on climate change was adopted, followed by the National climate change Action Plan (NCCAP) for 2011– 2028. The NCCAP is the overarching plan to steer adaptation and mitigation action, focussing strongly on adaptation but also catering for mitigation and NDC development. Water sufficiency, ecosystem and environmental stability and food security have been set as three out of seven priority areas to increase the country's resilience.

Based on an analysis of the strengths and weaknesses of the Philippines' water sector to combat climate change, a 'comprehensive review and subsequent restructuring of the entire water sector governance' was recommended (CCC, 2019:7). Meanwhile, the recommended restructuring of the complicated water governance landscape has been pending since 2013; it is considered an urgent requirement of effective climate change adaptation. The water sector allegedly lacks sufficient authority to develop, steer and monitor climate-sensitive water sector governance. Despite this criticism, the existing institutional and policy context has nonetheless catered for mainstreaming climate change

20 Further background information can be found here: Gassert et al., 2013; CCC, 2019; World Risk Report 2019.

adaptation into IWRM to a limited extent. In 2012, eighteen Major River Basins were declared as priority areas for climate-sensitive water resources management. The Department of Environment and Natural Resources – River Basin Control Office (DENR-RBCO) acted as lead agency to initiate and coordinate climate proofing of water management plans for the eighteen catchments (so called Integrated River Basin Management and Development Plans – IRBMDP). These documents are eventually to be connected to the development of Local Climate Action Plans (DENR-RBCO, 2018). The initiative involves screening and prioritisation of adaptation strategies and programs for each River Basin. It also bundles climate change adaptation and Disaster Risk Reduction within the context of IWRM (Rola et al., 2018). As of 2016, fifteen of the eighteen River Basins had updated their plans (NWRB, 2018). Additionally, as of 2018, six of them have been reported as climate-responsive (DENR-RBCO, 2018), among others the Pampanga River Basin, draining into Manila Bay and covering Metro Manila. Enhancement of the remaining master plans is an ongoing process.

Whereas Integrated Water Resources Management (IWRM) has meanwhile been internalised in key sector policies, the term 'Ecosystem-based adaptation' (EbA), as a fairly new concept, is largely unknown, especially to actors outside natural resources management and nature conservation. In the Philippines, EbA as a concept and approach is therefore anchored neither in climate and water policies nor in sector strategies. However, implicit links between EbA and IWRM exist at the interface of other planning procedures like land-use planning processes, implementation of the Sustainable Integrated Area Development Strategy, and the climate change Cluster on Adaptation and Mitigation-Disaster Risk Reduction agenda, as well as processes for protected area management related to the National Adaptation Plan (NAP) (GIZ, 2018b).[21] Mainstreaming EbA into key strategies for climate-sensitive IWRM in the Philippines, as well as implementing and showcasing practical examples still requires major efforts and investments.

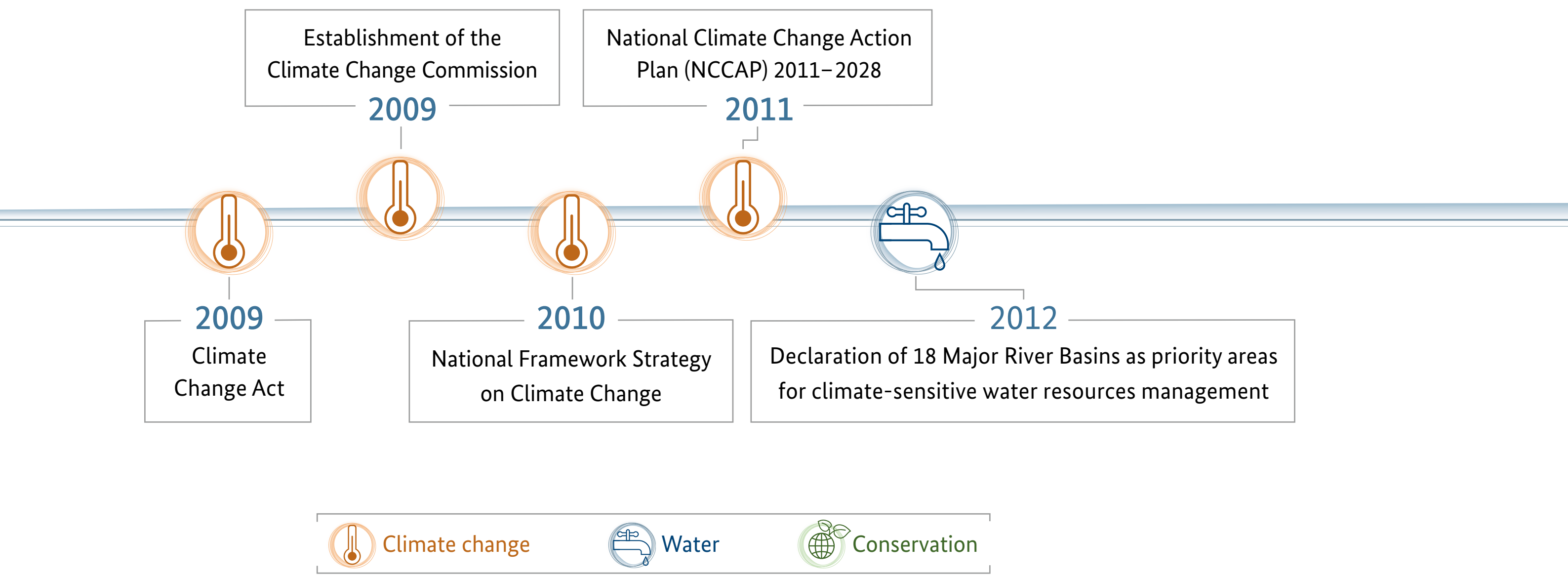


Figure 9: timeline with selected political and institutional milestones (Philippines)

21 Establishing EbA as a key concept for climate change adaptation was initiated through the GIZ-implemented Global Project on Mainstreaming EbA in partnership with the Environmental Management Bureau of the Department of Environment and Natural Resources between 2016 and 2018 and is further systematically supported by GIZ-Philippines through its project on EbA in River Basins, which started in 2019.

> Implementation Approach 1: the Manila Bay Case (Luzon)

Manila Bay merges the drainage areas of different River Basins, among others the Pampanga River Basin. Covering an area of more than one million hectares, this basin faces a multitude of severe ecological and water-related problems and contributes to the ecological challenges of Manila Bay. These include: very high levels of water pollution; expanding built-up areas at the cost of agricultural lands; notable arsenic concentration in soils and consequently in rice grains; and excess groundwater extraction, resulting in land subsidence and saline water intrusion. Climate change is projected to exacerbate this situation. The area is highly susceptible to sea-level rise, storm-water surge and flooding, and one of the most pressing social issues is probably the limited access to safe water and sanitation.

To address these challenges and to reduce vulnerability to climate change, the Climate Responsive Integrated Master Plan for the Pampanga River Basin 2016–2030 was developed under DENR-RBCO and launched in 2019. It serves as an entry point for EbA. The formulation of the objectives, strategies and measures of the Master Plan was enabled by a comprehensive multi-stakeholder process led by DENR. The master plan articulates the vision of Pampanga as the most economically advanced and resilient River Basin in the country[22] and identifies key challenges based on the analysis of current vulnerabilities. It further caters for the inclusion of EbA measures to reach its objectives (→ see Table 6). Though not explicitly labelled as EbA, the proposed measures qualify as EbA, as they are embedded in an overall adaptation strategy.

IWRM issues	IWRM Objectives	EbA relevant climate proofing instruments
1. Water shortage for irrigation	1. To develop water sources and water-supply infrastructure for irrigation 2. To decrease water shortages arising from irrigation, owing to their impact on cropping systems.	Improvement of land use and land-use practices Forest landscape restoration Climate-smart cropping systems
2. Water shortage in municipal water supply	To develop water sources and water-supply infrastructure for the municipal water supply	Development of new water sources through rehabilitation of natural infrastructure such as catchment areas of rivers, lakes and forests
3. Conservation, protection and restoration of water-related ecosystems (including soil, forests etc.)	To realise the benefits of healthy water-related ecosystems that support the development outcomes of both the River Basin masterplan and the coastal strategy plan	Forest landscape restoration Soil conservation Ecosystem services valuation
4. Water-related Disaster Risk Reduction (DRR)	To reduce flood risks in the Bay area	Forest landscape restoration Soil conservation
5. Multi-stakeholder participation in the governance of IWRM including the private sector	To strengthen the river basin governance structure	Enhancement of multi-stakeholder participation in the planning and implementation processes of River Basin management

Table 6: EbA-IWRM climate proofing measures in the Pampanga River Basin Master Plan

22 The vision statement for the Pampanga River Basin (NEDA, 2017) foresees its future as the most economically advanced and resilient river basin in the country with the lowest poverty incidence, fully restored watershed and ecosystems, properly utilised and managed water resources, adequately provided modern infrastructure facilities, and an empowered citizenship in partnership with transparent, accountable, and development-oriented leaders.

Key lessons	**Fragmented water governance sector:** the high number of (partially inconsistent) development plans and strategies can hamper the implementation of planned EbA measures. Sector harmonisation efforts are required to ascertain implementation action. **EbA happens in disguise:** although not explicitly classified as EbA, Nature-based Solutions to adapt to climate change are merged into River Basin policies and plans with the aim of a more sustainable IWRM approach in the Manila Bay, and can thus be interpreted as EbA. **Need for systematic integration of EbA and actual implementation:** a more systematic integration of EbA into the Integrated River Basin Management Plan as well as ensuring implementation action would be required to improve actual climate resilience. **Need to introduce EbA Valuation:** measures that focus on benefits for the poor should be increased. The methods of EbA-Valuation[23] should be introduced in the Manila Bay area to guide policy makers and local decision makers in water-demand management, water-financing instruments and risk-transfer mechanisms. Additional options are required to address impending government plans for reclamation of large areas within Manila Bay and to assess their impact on thousands of vulnerable coastal communities in the area.
Enabling factor	**Supportive policies:** the current policies support the consideration of Nature-based Solutions to adapt to climate change in River Basin management and planning; these cater for mainstreaming EbA and IWRM, although the term NbS is not explicitly mentioned in the policies. **Established structures to facilitate multi-stakeholder processes:** multi-stakeholder engagement processes were implemented by DENR-RBCO, facilitating integration of EbA through climate-proofing of the Master Plan.
Inhibiting factor	**Lack of inclusivity:** there is limited representation in the steering structure by actors outside of government, and external participation is limited to a few NGOs and academic institutions. Furthermore, engagement is lacking among local community representatives, local governments and the private sector. **Limited Action:** so far, the implementation of the Master Plan is still pending. An evaluation of the actual implementation of EbA measures and their effectiveness needs to be conducted at a later stage.

Table 7: findings from the Manila Bay case study

23 https://www.adaptationcommunity.net/wp-content/uploads/2017/12/EbA-Valuations-Sb_en_online.pdf

> Implementation Approach 2: Ecosystem-based Adaptation in two River Basins (Visayas and Mindanao) (2019 – 2023)

The project 'Ecosystem-based management and application of ecosystem values in two River Basins in the Philippines (E2RB)' aims at implementing Ecosystem-based management and integrated land-use and development planning in two River Basins in the regions of Visayas and Mindanao.[24] The project works on the basis of a participatory multi-level approach, involving key stakeholders from local through regional to national level. It supports biodiversity protection and ecosystem service provision through policy development and improved sector coordination in a highly fragmented water-governance landscape. The values of ecosystem services provide a basis to engage with the private sector, to jointly develop sustainable financing mechanisms of conservation and protection measures. Key outputs will be the reduction of hazard prone households, improved water availability and quality and biodiversity conservation in the two River Basins.

Key lessons	**EbA as new approach:** EbA is not yet a well-established concept and approach in the Philippines. Introducing a fairly new concept in a multi-level approach requires capacity-building measures for different stakeholders, from local through regional to national level.
Enabling factors	**Working with key actors:** the project supports the Department of Environment and Natural Resources in its task to coordinate ecosystem-based management of River Basins within the framework of national guidelines and policies such as the National climate change Action Plan; it also contributes to the knowledge management of Philippine partners. **Raising stakeholder awareness on the importance of participation and collaboration during decision making:** the project included a role-playing game with River Basin stakeholders.[25] Furthermore, additional game events and issue cards were developed, representing local experiences from River Basin management in the country, to make the game more relevant for the Philippines. This improved both the understanding of the multiple factors that influence a basin's overall health, and the recognition of the importance of participation and collaboration during decision-making. **Building up on previous work:** E2RB builds on the achievements and partnerships created as part of previous and ongoing projects implemented by GIZ, USAID and Earth Security Partnerships in the Philippines, as well as projects in neighbouring countries and GIZ global projects. This fosters the introduction and mainstreaming of the new approach.
Inhibiting factors	**Complex water governance landscape:** working in a multi-level approach requires collaboration within a complex water governance landscape. Building up trustful relationships with a high number of key actors and in a political context of great complexity needs time.

Table 8: findings from the E2RB case study

24 The project is implemented through GIZ in collaboration with the Department of Environment and Natural Resources – River Basin Control Office (DENR-RBCO)

25 See: www.worldwildlife.org/pages/get-the-grade-a-game-about-natural-resource-and-water-management

3.3 Takeaways chapter 3: experiences from in-depth case studies

- Setting the scene – developing entry points for EbA: EbA mainstreaming requires enabling settings. These can be developed, for instance, by supporting national and sectoral policy development or establishing practical tools and mechanisms that can cater for EbA implementation, such as water funds or Environmental Flow Assessments.
- Need for embedding EbA in national climate and water policies: national climate and water policies meanwhile often apply and cater for IWRM, but still lack the explicit embedding of EbA as an approach towards increased resilience of the water sector.
- Taking Action – actual implementation of EbA within IWRM: mainstreaming EbA can be fostered by merging EbA planning processes with an IWRM approach and implementing pilot and demonstration measures that visualise effects and effectiveness of EbA.
- Need for merging top-down with bottom-up approaches: successful merging of EbA and IWRM ideally occurs simultaneously at different policy and planning levels, so that organisations include EbA in their mandates and also at project implementation level, to facilitate practical experiences and showcase the effectiveness of EbA measures.
- Acknowledge the politics: IWRM is a highly political approach, aiming for a balance between stakeholders' interests and human and ecosystem needs. EbA adds to this complexity by introducing additional concepts, stakeholders and their perceptions and interests. So far, compared to conventional water infrastructure solutions, EbA is a relatively cheap approach, with sustainable long-term effects. Implementing EbA may not suit political agendas, which tend to focus on the duration of election cycles and prefer to aim for quickly visible infrastructure solutions and short gains. Flanking 'grey' infrastructure measures with 'green' EbA solutions to introduce and showcase the strength of EbA acknowledges current, conventional practices and realities, and can use these as a vehicle for mainstreaming new state-of-the-art sustainability thinking.
- Upscaling requires independent and long-term funding mechanisms: EbA offers practical long-term solutions, but is introduced through projects with relatively short life-spans (a few years). Funding is also limited to financing pilot and demonstration measures. Enabling upscaling of successful approaches requires the establishment of independent, long-term funding mechanisms.

Box 11: takeaways: experiences from in-depth case studies

→ 4. Solutions at a glance

The following case studies on linking EbA with IWRM come from the platform 'PANORAMA – Solutions for a Healthy Planet'. The PANORAMA platform presents cases via a 'solutioning approach', demonstrating how projects develop a practical and replicable response to complex socio-ecological real-life problems. The platform structures the solutions across different types of ecosystems, geographical settings and thematic areas, one of which focuses on examples for EbA. Solutions can cover entire projects or selected aspects of a project, and incorporate several steps or modules which have been structured into 'building blocks' and allow for replication. They further reflect on enabling factors and lessons learned for EbA. More than 90 EbA examples on the platform address water as the central natural resource affected by climate change. Some of these cases not only address EbA to maintain local water resources, but holistically embed EbA within a comprehensive IWRM approach. Five of these examples are presented in this chapter. The selected case studies cover solutions for merging EbA with IWRM across different regions and themes. Though context-specific, they are to be understood as a practical and replicable inspiration for other contexts and are designed to foster mutual learning and exchange.

No	Country › Region	Project and Approach	Main objective of EbA approach
1	Africa › Democratic Republic of Congo	**EbA for Disaster Risk Reduction in IWRM in the Lukaya Basin** capacitated local and national stakeholders to adapt to climate change by setting a stronger focus on disaster prevention and by strengthening coping capacities at the local and national level in a holistic, EbA-IWRM approach.	Water related risks
2	Africa › Burundi	**Resilient management of water and soil resources (Burundi)** aimed at reducing the impacts of climate change on the availability of water and land resources and ensuring food security in one of the poorest and least-prepared countries to adapt to CC in the world. It merged EbA into IWRM through capacity building measures, facilitating joint stakeholder negotiations and decision-making processes based on the most appropriate EbA measures. The project applied a holistic, catchment-based approach and implemented pilot and demonstration activities.	Water availability
3	Central Asia › Tajikistan	**Integrated Disaster Risk Reduction in flood-affected areas** addressed adaptation to climate change by introducing EbA measures in a catchment-based approach and by facilitating a participatory engagement process among stakeholders with conflicting interests. It enabled the development of solutions between forestry enterprises involved in livestock grazing in the upper catchments, which had caused land degradation, flash floods and debris flows in the lower catchment.	Water related risks
4	Latin America › Mexico	**The 'dynamic tool for integrated land use and water management', called PAMIC,** facilitates sustainable land use and water resources management at catchment scale, transcending policy and administrative changes of election cycles. It emphasises planning for sustainable land use and management of water as a key natural resource, and works with a top-down and bottom-up approach, ensuring both institutional support from the national level as well as active civil society engagement from the local level. The project fosters the implementation of EbA measures within a holistic IWRM approach.	Water security
5	Latin America › Costa Rica / Panama	**Governance for adaptation in the shared Sixaola River Basin** was supported through an approach that fostered bilateral, multidimensional and flexible governance through improved participation. It was based on ecosystem and catchments-based thinking and supported EbA measures that also worked towards ensuring local livelihoods. EbA measures focused on the agricultural sector as a key to the sustainable livelihoods of the marginalised population.	Water security

Table 9: overview of PANORAMA case studies

4.1 DEMOCRATIC REPUBLIC OF CONGO: ECO-DISASTER RISK REDUCTION THROUGH IWRM

The project, implemented between 2013 and 2016, addressed disaster and climate risk reduction in the Lukaya River Basin, which is one of the main watersheds supplying the DRC's expanding capital of Kinshasa with drinking water.[26] Land and water resources in the watershed are highly degraded, due to overuse by a rapidly growing urban population. Unsustainable land-use practices, such as deforestation, quarrying, and slash-and-burn agriculture, cause excessive erosion and deep gullies and lead to increased flood risks, landslides and deterioration of water quality downstream.

To increase the resilience in the watershed, the project was based on five building blocks:

Figure 10: overview – Eco-Disaster Risk Reduction through IWRM (Democratic Republic of Congo)

building block 1 (Mainstreaming Eco-DRR into IWRM) constituted the overarching project goal, to which the other building blocks contributed. It addressed mainstreaming Ecosystem-based Disaster Risk Reduction (Eco-DRR) and EbA in terms of the development of an IWRM Action Plan in cooperation with the Association of the Users of the Lukaya River Basin (AUBR/L). The project provided the first demonstration of an IWRM approach in the country, linking upstream and downstream communities while promoting disaster and climate risk reduction. This first building block involves capacity building as well as institutional and organisational development of the AUBR/L as a key actor for IWRM in a post-conflict situation; the presence of technical administration and resources at the local level was still weak. The IWRM action plan, which was jointly developed over almost one year, now caters for the implementation of specific Eco-DRR and EbA measures and provides a roadmap for climate-sensitive water resource management and Disaster Risk Reduction in the Lukaya River Basin. One of the project's key achievements is the AUBR/L's successful mediation role in stopping local pollution and reducing the sediment loads that affect the operation of the Lukaya water treatment plant; this supplies 400,000 Kinshasa residents. **Building block 2 (Agroforestry and reforestation)** and **building block 3 (Gully and soil erosion control)** covered the implementation of pilot and demonstration measures to showcase benefits for livelihood security and Disaster Risk Reduction in the catchment. Activities at the source of the river addressed revegetation through community agroforestry, as well as reforestation and forest protection measures. Further downstream, in the Mafumba sub-catchment

26 The project was implemented with funding from the European Commission and UN Development Account.

near Kinshasa, which is characterised by informal sprawl and rapid, unstructured suburban development, land degradation and soil erosion constitute major problems. Activities therefore focused on implementing erosion control through bio-engineering measures as well as establishing a soil erosion monitoring system. A hydro-meteorological and river flow measurement network was also set up within the basin to map flood risk zones and develop a water-resource allocation model. The project introduced both Eco-DRR, as well as IWRM approaches, with the help of intensive **capacity building (building block 4)**, as a key requirement for the success of the project. This covered the implementation of more than seventy training sessions and workshops at local and national levels, as well as general awareness-raising measures, hands-on learning activities at the demonstration sites, and field visits and study tours in the country and region. **Building block 5 (advocacy)** leveraged the Lukaya case as a model to advocate for ecosystem-based measures at the national and regional level, including their mainstreaming into policies and projects.

- → The holistic and intertwined EbA-IWRM approach capacitated local and national stakeholders to focus more intensively on disaster prevention in the basin and also strengthened coping capacities at the local and national level.
- → The project catalysed the institutionalisation of catchment management departments with the Environment Ministry and the public water utility.
- → It further resulted in greater national commitment to mainstream Eco-DRR into national development policies, including the development of a National Water Policy roadmap.

> Further Reading:
www.panorama.solutions/en/solution/applying-ecosystem-based-disaster-risk-reduction-eco-drr-integrated-water-resource

4.2 BURUNDI: RESILIENT MANAGEMENT OF WATER AND SOIL RESOURCES

Burundi is one of the poorest countries in the world and heavily dependent on its agriculture and land resources; these provide livelihoods for about 90% of the population, and are affected by recurrent food shortages and famines. The pressure on land, soil and water resources is extreme, causing overexploitation of natural resources and a very high level of degradation of Burundi's ecosystems. The country is highly vulnerable to climate change, yet because of its limited adaptive capacity, is hardly able to adapt to it. Climate change is projected to aggravate the situation in the country through a potential extension of the dry season, a high probability of an average annual temperature increase, especially during the dry season, increasing rainfall in selected regions and a greater risk of extreme events such as floods and landslides.

The project ACCES (Adaptation to climate change for the protection of water and soil resources) aimed at reducing the impacts of climate change on the availability of water and land resources and assuring food security in regions which are prone to natural disasters; it was implemented in close cooperation with the Burundian Office for Environmental Protection.[27] The project applied a holistic and comprehensive CCA approach by implementing 'no-regret' EbA measures; these were derived from both, 'top-down' and 'bottom-down' decision-making in vulnerable watersheds. The project comprised four building blocks: **building block 1 (Integrated vulnerability analysis at national and local level)** depicted a comprehensive vulnerability assessment as a basis for decision-making at the national level. It also supported knowledge transfer and prioritisation of future action through a participatory process. As an outcome, three pilot watersheds were prioritised for further action at the local level, followed by the implementation of in-depth vulnerability assessments (VA) for each watershed. The local VAs then guided decision-making for climate change adaptation at river-basin scale. For reasons of feasibility and sustainability, it was decided to focus future action in the catchments on capacity building and practical implementation of EbA-pilot- and demonstration measures. **Building block 2 (Holistic and participatory approach to CC adaptation)** addressed the further prioritisation of specific EbA measures within the pilot watersheds. The approach led to three key lessons to assure acceptability and sustainability of the EbA measures: 1) ensure public support through participatory planning, 2) foster understanding and mutual learning through training, awareness-raising and capacity building and 3) safeguard the accountability of measures through institutionalisation, in this case through a 'Technical Committee', composed of local key actors from administration, farming and local associations and mandated to monitor and sustain the implemented measures. **Building block 3 (Adaptation, gender and the empowerment of women)** addressed gender

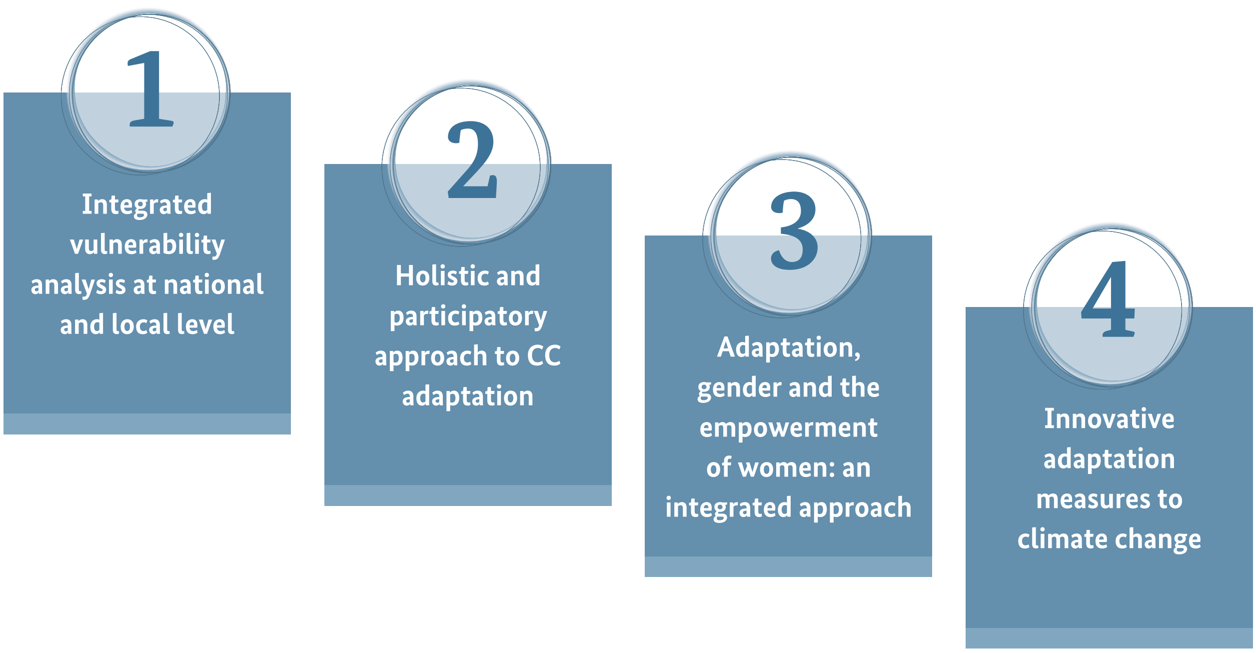


Figure 11: overview – Resilient management of water and soil resources (Burundi)

27 The project was implemented by GIZ.

inequalities, aiming for an inclusive approach in decision-making, resources management and access to benefits. **Building block 4 (Innovative measures for climate change adaptation)** aimed at the practical implementation of EbA pilot- and demonstration measures such as agroforestry, community reforestation, rainwater storage, soil conservation measures and the introduction of an ecological sanitation approach. ACCES provides insights into a holistic EbA-IWRM approach in a highly challenging, poverty-stricken environment. The holistic approach can be visualised as follows (→ see Figure 12):

- → The project applied IWRM by addressing vulnerabilities and needs in a holistic, participatory catchment-based approach.
- → It supported institutionalising cooperation across actors and sectors through the (new) establishment of a 'Technical Committee' for selected catchments.
- → It merged EbA into IWRM by facilitating joint stakeholder negotiations and decision-making on the most appropriate EbA measures in the local context.
- → Meanwhile, based on the project's interventions, relations between the effects of climate change, environmental degradation, vulnerabilities and disaster prevention are becoming increasingly well-known and are starting to influence planning, decision-making processes and action at both the national and the local level.

> **Further Reading:**
> www.panorama.solutions/en/solution/resilient-management-water-and-soil-resources-burundi

Figure 12: the holistic planning and management approach (Burundi)

4.3 TAJIKISTAN: INTEGRATED DISASTER RISK REDUCTION IN FLOOD-AFFECTED AREAS

In the lower parts of the Turkestan mountain range, villages and productive lands are mostly located in the valleys of rivers and streams. They are highly prone to seasonal and extreme flood events. Heavy rainfall and flooding after snowmelt further cause the transportation of large amounts of debris, which can cause more destruction than casual high-water events.

A noted increase of flash floods and debris flows has been attributed to land degradation in upper catchment areas, in combination with the impact of climate change. The project supported CCA in the flood prone areas through merging EbA with an IWRM approach.[28] After bringing together a diverse group of actors, including the Committee of Emergency Situations, locally affected communities and the forestry enterprise, a catchment-based approach was employed to analyse the causes of the high flood risks and plan integrated interventions. Flood protection measures to adapt to extreme events consisted of a balanced mix of 'green' EbA measures and 'grey' infrastructure solutions and were jointly implemented in a catchment-based IWRM approach.

Building block 1 (Community participation in planning, construction and maintenance of Disaster Risk Reduction measures) assured that local knowledge was integrated into the development of the solutions and that the design of measures addressed the needs and concerns of the local populace. This inclusive approach facilitated the involvement of the population and supported the sustainability of the measures. **Building block 2 (Combination of grey and green technologies)** addressed the implementation of activities, which included 'grey measures' such as massive, protective constructions and the installation of gabions, as well as 'green' EbA measures such as protective vegetation; these were accompanied by the reshaping of riverbeds and rehabilitation and protection measures further upstream. **Building block 3 (Collaboration with forestry enterprise)**, was a crucial factor for success, as a commercial forestry enterprise manages most of the areas in the upper catchment in which flash-floods and debris flows originate. A high percentage of the income of the enterprise is generated by issuing grazing permits for livestock owners, causing land degradation through overgrazing. By engaging with the forestry enterprise, measures for resource protection could be agreed upon, despite conflicts of interest. They now cover regulation of grazing activities, prevention of deforestation, and implementation of reforestation. Further, the forestry enterprise allows interested community members to lease land for rehabilitation, reforestation and fodder production for their livestock while preventing overgrazing and land degradation. Nevertheless, resource protection in the upper catchment to prevent disaster risks remains a challenge, also due to the transboundary nature of the catchment area.

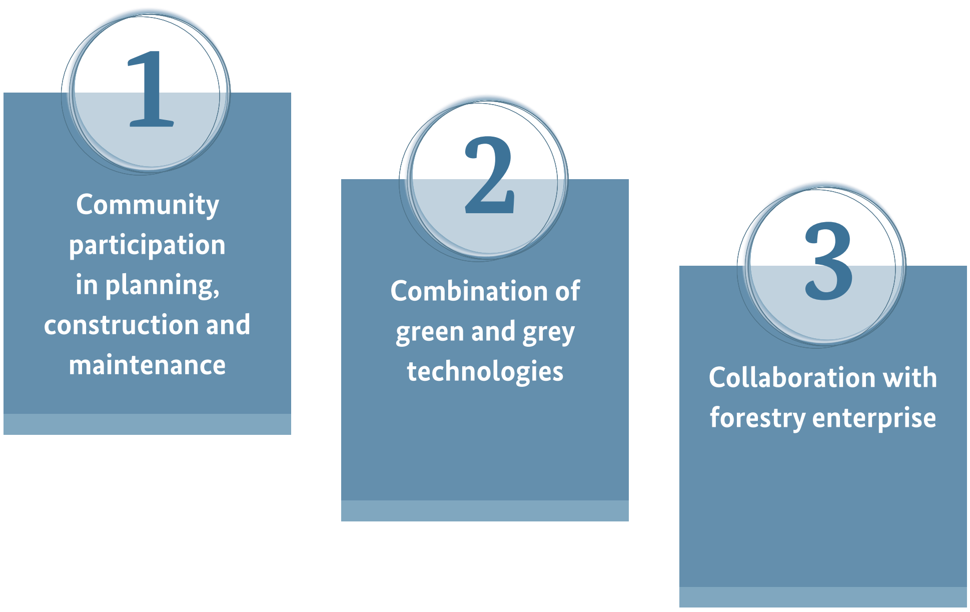


Figure 13: overview – Integrated Disaster Risk Reduction in flood-affected areas (Tajikistan)

28 The project was implemented by GIZ.

- Disaster Risk Reduction to adapt to climate change was addressed by introducing EbA measures in a catchment-based approach and by facilitation of a participatory engagement process among stakeholders with conflicting interests.
- It enabled the development of solutions between forestry enterprises involved in livestock grazing in the upper catchments, which had previously caused land degradation, flash floods and debris flows in the lower catchment.
- As the communities downstream as well as the Committee for Emergency Situations had neither the technical nor the financial resources to implement CCA measures in the catchment, the project provided expertise, machinery and construction material, while the communities contributed through voluntary work.
- It is expected that the measures can be replicated in similar local contexts.

> Further Reading:
www.panorama.solutions/en/solution/integrated-disaster-risk-reduction-flood-affected-areas

4.4 MEXICO: A DYNAMIC TOOL FOR INTEGRATED LAND USE AND WATER MANAGEMENT

In line with Mexico's six-year presidential election cycle, regular changes also occur in policy and administration; these challenge the sustainability of land use and water management projects. The Project C6 (Conservation of Coastal Basins in the Context of climate change) supported the development of an integrated, dynamic and effective planning tool that allows for joint development and implementation of 'Integrated River Basin Management Action Plans' (called PAMIC for its acronym in Spanish).[29] PAMIC was developed by the National Institution of Ecology and Climate Change (INECC) with the objective to include climate change impacts in territorial planning.

Project C6 enabled the implementation of EbA measures within a holistic land-use and IWRM approach. It highlighted planning for sustainable land use and management around water as a central natural resource, and facilitated participatory planning and management at basin scale among actors with different concepts and interests. It worked in a top-down as well as bottom-up approach, ensuring both institutional support from the national level and active civil society engagement. The PAMIC plans enable the continuation of sustainable land use and water management planning and practice at basin scale, regardless of election cycles. The project comprised five building-blocks: **building block 1 (Inter-institutional governance at different levels)** strengthened inter-institutional coordination between key governmental environment sector entities and national and international NGOs and CSOs. This scheme of governance is backed by formal agreements between institutions that establish the rules for all the other organisations and stakeholders involved. It has also allowed for the creation of two further funds to stimulate activities and impacts, enabling local solutions to function in the long-term. **Building block 2 (Creating a shared vision of land management through water)** put the local water resources and hydrological modelling at the centre of shared land use planning – which was a new concept. Modelling of surface water supply as well as sediment retention in different supply and demand zones allowed different users (e.g. population zones or tourist zones) to gain a better understanding and demonstration of ecological connections between water-production zones (i.e. mountainous zones with forest cover) and water-demand zones. Based on the outcomes of the modelling exercise using climate change scenarios, different stakeholders were brought together for the purpose of mutual learning, exchange and joint decision-making on required action; the aim was to ensure sustainable water provision for all water-demand zones. **Building block 3 (Key elements for the conservation of ecosystems are also anthropic)** acknowledges an intrinsic socio-ecological value of transformed and cultivated landscapes compared to pristine ecosystems. It also supports conservation efforts by introducing sustainable land use practices for transformed areas. This includes e.g. shade-grown coffee production or agro-silvo-pastoral and community forest management, as these support both livelihoods and ecosystems. It is based on the concept that sustainable ecosystems need human communities that live from and care for them in a sustainable fashion. **Building block 4 (Support from local institutions and grassroots organisations)** ensures cooperation with local Non-Governmental Organisations (NGOs) and Civil Society Organisations (CSOs) to facilitate long-term mentoring of local communities. Through an alliance with local

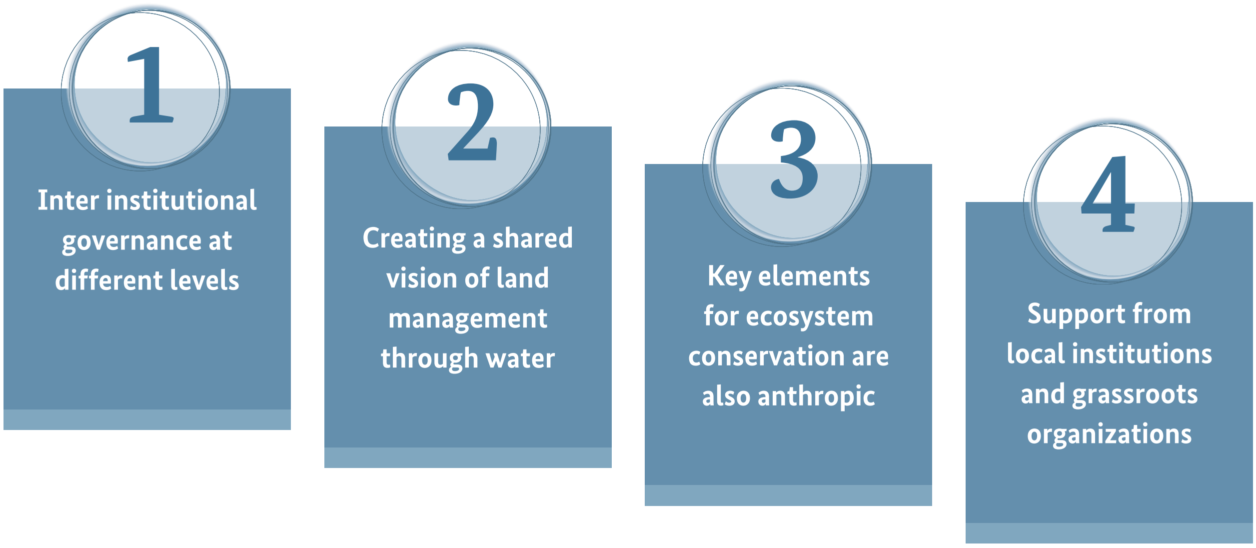


Figure 14: overview of the dynamic tool for integrated land use and water management (Mexico)

29 The project is presented by CONANP Mexico (Comisión Nacional de Áreas Naturales Protegidas, https://panorama.solutions/en/organisation/comision-nacional-de-areas-naturales-protegidas-conanp) on PANORAMA, and implemented in collaboration with various organisations on different governance levels.

governments, research centres and grassroots organisations with specific presence in each of the project basins, effective communication with producers and other actors in the territory could be ensured. Thanks to the network of local NGOs, both information and results workshops achieved high levels of impact and thereby allowed for a more efficient translation of stakeholder insights into practicable solutions. Examples of this support on the ground include: i) the management of different interests and potential conflicts between actors; ii) the integration of federal and / or local governmental social assistance programs, subsidies, etc., into River Basin zones suited to the project, which in turn created useful synergies; iii) the establishment of coordinated lines of work from government level to protected natural areas and CSOs; iv) the coalition among CSOs, which has had an impact on the River Basin and in reducing costs by co-ordinating the various capacities of the actors involved.

- The project enabled the implementation of EbA measures within a holistic land use and IWRM approach by developing the planning tool PAMIC.
- PAMIC centres planning for sustainable land use and management under climate change around water as a central natural resource and facilitates participatory planning and management at basin scale among stakeholders with different concepts and interests.
- The project worked in a top-down as well as bottom-up approach, ensuring both institutional support from the national level as well as active civil engagement.

> **Further Reading:**
> www.panorama.solutions/en/solution/dynamic-tool-integrated-land-use-and-water-management

Figure 15: the watershed approach

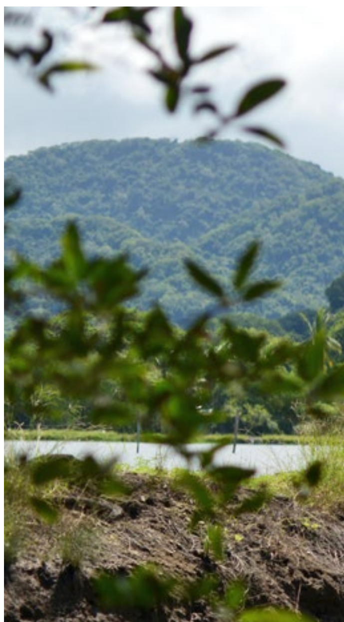
4.5 COSTA RICA / PANAMA: GOVERNANCE FOR ADAPTATION IN THE TRANSBOUNDARY SIXAOLA RIVER BASIN

The transboundary Sixaola River Basin, shared by Costa Rica and Panama and draining into the Caribbean Sea, is challenged by severe socio-environmental problems, unsustainable agricultural practices, degraded riparian ecosystems and reduced coping capacities of a highly marginalised and poor population. Climate change is projected to change rainfall patterns and seasons, affecting the agricultural sector by causing crop losses, increased occurrence of pests, diseases and flood risks, all factors that harm local livelihoods.

One of the main governance challenges is the low degree of binational, multi-level and multi-sectoral coordination. Although a 'Binational Commission for the Sixaola River Basin (CBCRS)' is in place and is designed to foster cooperation across nations in a multi-level and cross-sectoral approach, the lack of a binational territorial planning tool has weakened transboundary cooperation. The project aimed to strengthen transboundary governance and support the development of institutional adaptation capacities.[30] The main governance challenge of the CBCRS lies in the required binational multi-level and multi-sectoral coordination that aims for a shared vision and clear priorities. The project was based on a governance model that fostered a multidimensional, participatory and flexible approach; this was founded on ecosystem thinking and supporting adaptation actions that enhance ecosystem health and improve local livelihoods. The project comprised three building blocks: **building Block 1 (Putting an ecosystem approach into practice)** addressed the implementation of EbA measures with farmers and included the diversification of agricultural production and watershed restoration actions. This aimed at the improvement of livelihoods and increased resilience in a 'learning by doing' situation, and involved an adaptive management approach. Adaptive management supports learning and evaluation of short-term strategies under high socio-ecological uncertainties and the adjustment of the course of action if new knowledge is gained. **Building Block 2 (Achieving multidimensional governance for adaptation)** strengthened binational cooperation by implementing binational governance activities on water resources management and EbA. The binational cooperation supported joint action and learning through, for instance, binational reforestation days and binational efforts to promote agrobiodiversity and risk management. **Building Block 3 (Achieving participatory governance for adaptation)** supported stakeholder engagement at various levels (local/community, municipal and national) and specifically supported the inclusion of groups traditionally excluded from watershed management.

→ The project strengthened the acceptance of the CBCRS by supporting an increased integration of actors (communities, farmers, public institutions and civil society organisations and municipalities).

Figure 16: overview of governance for adaptation in the transboundary Sixaola River basin (Costa Rica / Panama)



30 The project was implemented by IUCN, in collaboration with various other organisations.

- → Capacity building led to the improved management, advocacy and coordination skills of CBCRS through activities that fostered binational learning and cooperation, such as an Agrobiodiversity Fair and binational reforestation events.
- → Scaling up and mobilising funds for EbA was enabled by the promotion of EbA measures. These included the 'resilient farmers' network', in close collaboration with the Ministries of Agriculture and agricultural agencies of both countries, and learning formats on EbA and its integration into public policies.
- → Commitments to EbA and 'Nature-based Solutions' were ensured by the signing of the Declaration of Local Governments on climate change by municipalities of both countries and the 'Bribri Indigenous Peoples' Development Association'.
- → The key multidimensional governance achievement was the adoption of the Strategic Plan for Transboundary Territorial Development (2017–2021).

> **Further Reading:**
> www.panorama.solutions/en/solution/governance-adaptation-shared-sixaola-river-basin

4.6 Takeaways chapter 4: experiences from PANORAMA-solutions

- → EbA as a new approach: implementing coupled EbA-IWRM projects often provides a new approach to climate resilience, compared to conventional, well-known and accepted grey infrastructure solutions. Introducing EbA requires intensive capacity building measures at all levels.
- → Experiencing the effects of CC on water resources paves the way for EbA: the direct experience of climate change impacts on local water resources increases the willingness of stakeholders to try EbA as a new approach, if introduced and facilitated by an external source.
- → Merging top-down with bottom-up approaches: merging EbA with IWRM is a process-oriented, holistic path towards climate resilience. Good examples merge top-down with bottom-up approaches, ensuring national / regional support as well as ownership at the local level, actively and practically implementing EbA measures on the ground.
- → Need for institutional strengthening of River Basin Organisations: combining EbA with IWRM as a highly participatory approach works better if local structures like basin organisations are already in place. However, established structures are often weak, have lost the full representation of stakeholders and often lack acceptance and trust by communities. Institutional strengthening of existing basin organisations is hence required in the first place, ensuring the broad participation of key stakeholders, who can then build up trust in the organisation to assure long-term involvement in the EbA approach.
- → Also informal structures can be supportive: if no (formal) basin committee is in place and the local situation does not allow the establishment of a (new) basin committee due to resources or time constraints, informal gatherings of groups from upstream and downstream can also facilitate collaboration across stakeholders and sectors within a basin.
- → Demonstrate the benefits of a practical approach: the implementation of pilot and demonstration measures is crucial to demonstrate and showcase the effects of EbA. It further fosters a general understanding of the effects of upstream degradation on downstream communities and ecosystems.
- → Work with what you have: examples show that even in settings of limited financial and time-related resources, EbA can be merged with IWRM and can facilitate joint action.

Box 12: takeaways: experiences from PANORAMA-solutions

→ 5. How to proceed

Integrating EbA and IWRM is a relatively new conceptual approach that faces manifold challenges: the level of knowledge about EbA is often still low, the financial and human resources to implement and test (new) EbA approaches for climate-resilient IWRM are limited, and the political will and institutional settings to foster 'green' adaptation approaches versus conventional 'grey' measures differ from place to place. Meanwhile, national climate and water policies broadly acknowledge IWRM as a paradigm for water resources management. However, structural integration of EbA as a means towards climate-sensitive IWRM is still fairly unknown among practitioners and not (yet) acknowledged to the same extent in national policies, planning and practice.

Although the nine cases analysed in this study are very context-specific, they show that in highly diverse settings, structural problems are – to a certain extent – often similar; natural resources are highly degraded due to the pressures of a growing population and high rates of urbanisation, high natural resource needs and limited capacities to adapt conventional land use practices to more sustainable approaches. In most settings, it is predicted that climate change will lead to increasing climate variability, increasing numbers and intensity of extreme events (floods and droughts), accompanied by greater difficulties in forecasting the cycles of these events. Effects of climate change will mostly be felt through the impact on water resources. In many local settings, people are already experiencing the above-mentioned effects of climate change. Coping capacities are often low, and EbA as a means to increase the resilience of the water sector is still fairly unknown outside of the environmental sector. IWRM as a 'leitmotif' for water resource management is in part well anchored in national policies and planning; in other contexts, it is still fairly new, which enables the introduction of IWRM and EbA at the same time.

Practical experiences also display similarities. This facilitates the introduction of proposals for a set of guiding principles concerned with the development and implementation of coupled EbA-IWRM approaches, and also aids the merging of selected elements into ongoing EbA or IWRM projects. The principles outlined on the following pages are understood to support the integrated thinking of EbA and IWRM approaches, and have been set out for discussion among practitioners.

5.1 GUIDING PRINCIPLES FOR INTEGRATED PROJECT DESIGN

The proposed set of guiding principles consists of three strategic lines: a) understand, acknowledge and shape the settings for coupled EbA-IWRM approaches, b) develop shared concepts of EbA and IWRM and c) develop (practical) tools and mechanisms.[31]

Understand, acknowledge and shape the settings

The local settings define the potential range of change. Designing projects that can foster sustainable transformation requires two elements: a) to understand the external settings (socio-economic, cultural, political, legal, ecological or technical) that shape a project context and that can only be changed over longer time frames; as these features often extend time-spans of projects, they can help define limits and limitations to change; and b) to understand internal settings as framework conditions in the close context of a project (organisational, individual, technical) that can be influenced and shaped during project design and implementation.

> A.1 Understand and acknowledge the politics, be patient and assign time

→ **Understand and accept the political nature of IWRM and EbA:** IWRM is a highly political approach, aiming for a balance between stakeholders' interests and human and ecosystem needs. EbA adds to this complexity by introducing additional concepts, stakeholders and their perceptions and interests. Political will is the key to the success of IWRM and EbA implementation. This requires a political economy perspective when developing coupled EbA-IWRM approaches, in order to unpack and acknowledge water and conservation sector politics.

→ **If required, work towards policy and sector harmonisation:** high numbers of (partially inconsistent) development plans, policies and strategies as well as unclear or overlapping roles and mandates between the water, climate and environmental sectors can hamper coupled EbA-IWRM approaches, which therefore require further efforts to achieve policy and sector harmonisation.

→ **Be patient and assign time:** merging EbA with complex multi-level water governance approaches requires trustful relationships with and across a high number of key actors from policy and society, and from various other sectors. To develop relationships and trust as the basis for collaboration in complex and contested settings needs time.

> A.2 Apply a multi-level approach

→ **Shape the settings by merging top-down with bottom-up approaches:** coupling EbA with IWRM requires a process-oriented, holistic approach to climate resilience, based on the needs of communities, and ensuring ownership through multi-level and multi-sectoral support. Successful integration of EbA with IWRM ideally occurs simultaneously at different levels: at the national and regional policy and planning levels, so that organisations adopt EbA and IWRM in their mandates, and at the project implementation level, to facilitate practical experiences and to showcase the effectiveness of EbA measures. This requires institutional leadership at all levels.

> **Experiences from Mexico:** *'The project worked in a top-down as well as bottom-up approach, ensuring both – institutional support from the national level as well as active civil society engagement.'*

> **Experiences from the Democratic Republic of Congo:** *'The holistic and intertwined EbA-IWRM approach capacitated local and national stakeholders to set a stronger focus on disaster prevention in the basin and strengthened coping capacities at the local and national level.'*

> A.3 Develop EbA entry points

→ **Develop entry points for EbA:** implementing and mainstreaming coupled EbA-IWRM approaches is facilitated by developing framework conditions that cater for EbA implementation. This can cover support for national and sectoral policy development, climate-proofing of water sector policies or basin plans or introducing and establishing practical tools and mechanisms that can cater for EbA implementation, such as water funds or Environmental Flow Assessments.

> A.4 Ensure willingness and ownership for coupled EbA-IWRM approaches

→ **Experiencing climate change impacts increases the willingness to integrate EbA and IWRM:** direct experience of climate change impacts on local water resources shapes a shared understanding of the issues and objectives. This increases the willingness of stakeholders to try coupled EbA-IWRM approaches and to collaborate with other stakeholders to achieve shared objectives. This in turn supports the development of ownership.

31 The clustering of the guiding principles is based on the logic of the boundary work framework, as developed by Mollinga (2008, 2010), and as further developed to facilitate collaborative action in the water sector (Dörendahl, 2015)

→ Thus, merging EbA with IWRM is well supported in locations that directly experience the impact of climate change. Selecting project locations where climate change impact has already been experienced can support willingness and ownership for coupled EbA-IWRM approaches.

Experiences from the Thailand: *'Due to two consecutive harsh drought-years the need to adapt to climate change, especially in the water sector, is meanwhile widely acknowledged, which enables introducing EbA as a new approach.'*

Develop shared concepts

> B.1 EbA within IWRM is fairly new – facilitate capacity building towards shared concepts

→ **Facilitate capacity building:** coupling EbA and IWRM is a fairly new approach in many countries; it requires capacity building measures for stakeholders, on a local, regional and the national level. It needs to include theoretical and practical elements, through data collection, communication and workshops, and through active involvement in practical and hands-on implementation of pilot and demonstration measures.

→ **Capacity building is also needed for the private sector:** construction companies are often reasonably experienced in implementing conventional infrastructure projects but lack skills in designing and implementing 'green' EbA measures. Capacity building also needs to focus on the construction sector to capacitate companies to implement EbA measures in watersheds.

Experiences from the Philippines: *'Within the local communities, knowledge on past changes in climate and natural disasters (floods and droughts) has been passed down over generations without written documentation. However, the level of knowledge on projected climate change and related risks to local ecosystems as well as EbA as conceptual approach was low. The introduction of a new concept and approach required a strong focus on capacity building measures at the local and at the national level.'*

> B.2 Select the appropriate scale

→ **Shared concepts can be developed more easily on smaller, less conflictive scales:** introducing merged EbA-IWRM approaches at smaller River Basins, compared to contested and politicised large-scale basins, is considered by practitioners as the more appropriate scale for EbA.

Develop tools and mechanisms

> C.1 Work with River Basin organisations and assure participation and inclusivity

→ **Work with established local organisations, like River Basin Committees:** working in watersheds together with established River Basin committees or water user associations enables the introduction of coupled EbA-IWRM approaches.

Experiences from Peru: 'A vital role is played by the River Basin Councils, including non-governmental and governmental stakeholders and private sector organisations. The importance of these organisations lies in establishing neutral spaces for dialogue among stakeholders and actors and assuring transparency and efficiency in fund management. This supports building long-lasting trust among the different stakeholders.'

→ **If no formal structures are in place for IWRM, informal structures can be developed:** if no (formal) basin committee or water user association is in place, and the local situation or project realities do not allow the establishment of a (new) organisation, informal gatherings of interest groups from upstream and downstream can also facilitate collaboration across stakeholders and sectors within a River Basin.

→ **Support institutional strengthening of River Basin Organisations, assure participation and inclusivity as a basis for broader acceptance of the organisations:** integrating EbA and IWRM can work well if local structures such as basin organisations are already in place. However, established structures are often weak. As water is a highly politicised natural resource, water basin organisations have occasionally lost their inclusivity and instead have developed into sector lobby groups. This can cause a lack of acceptance and trust by other sectors and communities and demands institutional strengthening of existing basin organisations in the first place. Broad participation of key stakeholders and active engagement provides the basis for building trust in the organisation to assure ownership in the long-term.

Experiences from the Philippines: *'The participatory and early involvement of civil society and its acceptance of EbA was crucial for the successful project implementation and for upscaling.'*

> C.2 Implement pilot and demonstration projects

→ **Get practical! – the need for pilot and demonstration projects:** the implementation of pilot and demonstration measures is crucial to experience and showcase the effects and benefits of EbA. It fosters a general understanding both of the ecological connectivity within watersheds and the effects of upstream degradation on downstream communities and ecosystems. Capacity building measures, as a key to EbA, must provide for action learning and include implementation of pilot measures on the ground.

> C.3 Develop sustainable financing mechanisms for EbA

→ **Upscaling requires independent and long-term funding mechanisms:** EbA within IWRM offers practical long-term solutions but is often introduced through projects with relatively short life spans. Funding is often confined to implementation and demonstration measures. Enabling upscaling of successful approaches requires the establishment of independent, long-term funding mechanisms.

> **Experiences from Costa Rica and Panama:**
> *'Scaling up and mobilising funds for EbA was enabled through the promotion of EbA measures through the 'resilient farmers' network', through close coordination with the Ministries of Agriculture and agricultural agencies of both countries, and learning formats about EbA and its integration into public policies.'*

> C.4 Invest into Monitoring and Evaluation

→ **Urgent need to demonstrate benefits:** it needs to be proven that ecosystem-based solutions are cost-effective and flexible options for climate-resilient water management. Developing and implementing M&E systems supports knowledge generation on the impact and effectiveness of measures.

> **Experiences from Thailand:** *'Demonstration of benefits: EbA measures still lacked proof of their effectiveness. Hence, establishing M&E on the effectiveness of EbA was required to support a mind shift away from conventional grey infrastructure measures.'*

5.2 FUTURE NEEDS

Practical experiences of the systematic integration of EbA and IWRM are still scarce. In addition, there is as yet a limited understanding of complex socio-ecological systems behaviour, the local impact of climate change on the water cycle and the outcomes of management action. All demand further knowledge generation, and the implementation of flexible management and M&E approaches; this would allow adjustment of management action, based on the direct climate change impact on watersheds. Developing flexible management schemes can be achieved with the help of Strategic Adaptive Management (SAM) approaches. Research is ongoing on how to best merge adaptive management approaches into IWRM with the inclusion of Integrated and Adaptive Water Resources Management (I/AWRM). Coupled EbA-IWRM needs further enhancement by a stronger inclusion of a governance perspective, which acknowledges sector politics as well as an understanding of the limitations of fully participatory approaches in varying political contexts. This highlights the need to include political economy analyses. Future needs therefore cover the following points:

Advance conceptual thinking to integrate IWRM and EbA

→ **Systematic climate proofing into IWRM approaches:** conceptual developments are needed to enhance IWRM through a **systematic inclusion of climate proofing into IWRM principles, mechanisms and tools** – not as an option for stakeholders, but as an imperative for IWRM to safeguard water security and with it, sustainable development in a changing climate.

→ **A stipulated preference on EbA through IWRM:** IWRM should acknowledge the strengths of EbA for increased resilience in watersheds and promote EbA with this in mind.

→ **An inclusion of adaptive management principles into coupled approaches:** to acknowledge the complexity of socio-ecological systems and recognise the inadequate understanding of system behaviour in the face of climate change, adaptive management principles need to be merged into coupled EbA-IWRM approaches.

- **A stronger inclusion of a governance perspective:** policy and politics of the water and conservation sectors need to be understood and addressed, to assure ownership and political will at different levels. The field of political economy needs to be merged more decisively into coupled EbA-IWRM approaches.
- **An assessment and evaluation of additional IWRM-tools and mechanisms, suitable for the inclusion of EbA** (e.g. from GWP's IWRM Toolbox)[32]. The study covered an assessment of two selected mechanisms, i.e. of water funds and Environmental Flow Assessments, to cater for integrating EbA and IWRM. An analysis of additional IWRM-tools and mechanisms regarding their suitability to support EbA-integration would maximise the strengths of both approaches.

Increase practical experiences

Implementing EbA in watersheds is a well-known approach in the field of natural resources management and nature conservation; however, implementing EbA as an intrinsic element of climate-sensitive IWRM is rather new. This requires empirical evidence on the strengths and effectiveness of coupled EbA-IWRM approaches for improved resilience in watersheds. Merging EbA and IWRM can happen at various levels and at different stages of project implementation.

- **Design of integrated EbA-IWRM projects:** the design of coupled EbA-IWRM projects allows for the development of tailor-made project concepts in selected contexts that favour the application of this novel approach. New projects are needed to reflect upon and test the guiding principles against further local realities and contexts.
- **Merging EbA into ongoing water projects:** there is often only limited room and flexibility available to merge a new approach into ongoing projects. Nevertheless, including EbA in ongoing water projects can strengthen climate resilience in watersheds. Especially in contexts where people have already experienced the effects of climate change (for instance through increasing climate variability or floods and droughts), the (urgent) need for combined action can support the promotion of a coupled approach.

Foster knowledge management and mutual learning

- Developing new knowledge products, fostering knowledge management, exchange and networking needs to be further advanced to support mutual learning on integrating EbA and IWRM to contribute to increased resilience in watersheds.

The study showed that merging EbA and IWRM can provide answers to pressing questions on sustainable development under climate change. It fosters knowledge generation of integrated thinking from the perspectives of water, environment and climate. Finally, it favours the abandonment of thematic silos. In a developing world, complex socio-ecological problems require truly integrated action.

32 www.gwp.org/en/learn/iwrm-toolbox/About_IWRM_ToolBox

→ Annex

ANNEX 1: THE LANDSCAPE LEVEL AND INTERDEPENDENT NATURE OF WATER

The water cycle is directly linked to ecosystems like rivers, watersheds, grasslands and forests, both in natural and urban environments. Ecosystem components such as biodiversity, vegetation, soil, surface temperature of water bodies, infiltration and evaporation processes influence water quality, availability and variability. Ecosystems play a key role in ensuring water security and reduce the risks posed by climate change (WWAP/UN-Water, 2018b).

The water cycle describes the continuous movement and storage of water on, above and below Earth's surface. Ecosystems in the water cycle (Box 13) are the key to its functioning and depict the need for a holistic and integrated IWRM approach. The continuous cycle of water is vital for the health of ecosystems and, in turn, healthy ecosystems form the foundation for the water cycle to function without disruption. Figure 17 depicts the interconnections of different ecosystems with regard to the pathways of water flows. These pathways are shown by the arrows along the forest, groundwater, surface water and soil ecosystems. The regulatory services provided by a healthy water cycle allow for the sustainability of provisional ecosystem services such as drinking water and water for irrigation. This means that the integrity of the ecosystems is a precondition for water security and explains why landscape approaches are required in the face of climate change impact.

The role of ecosystems in the water cycle

'The physical, chemical and biological properties of ecosystems affect all the hydrological pathways in the water cycle (Figure 17). Biological processes in a landscape, and especially in soils, influence the quality of water as it moves through a system, as well as soil formation, erosion and sediment transport and deposition – all of which can exert major influences on hydrology. There are also large energy fluxes associated with this nature-driven cycle: for example, the latent heat involved with evaporation can exert a cooling effect and is a basis for NBS for regulating, for example, urban climates.'

Box 13: the role of ecosystems in the water cycle (Source: WWAP/UN-Water, 2018b:25)

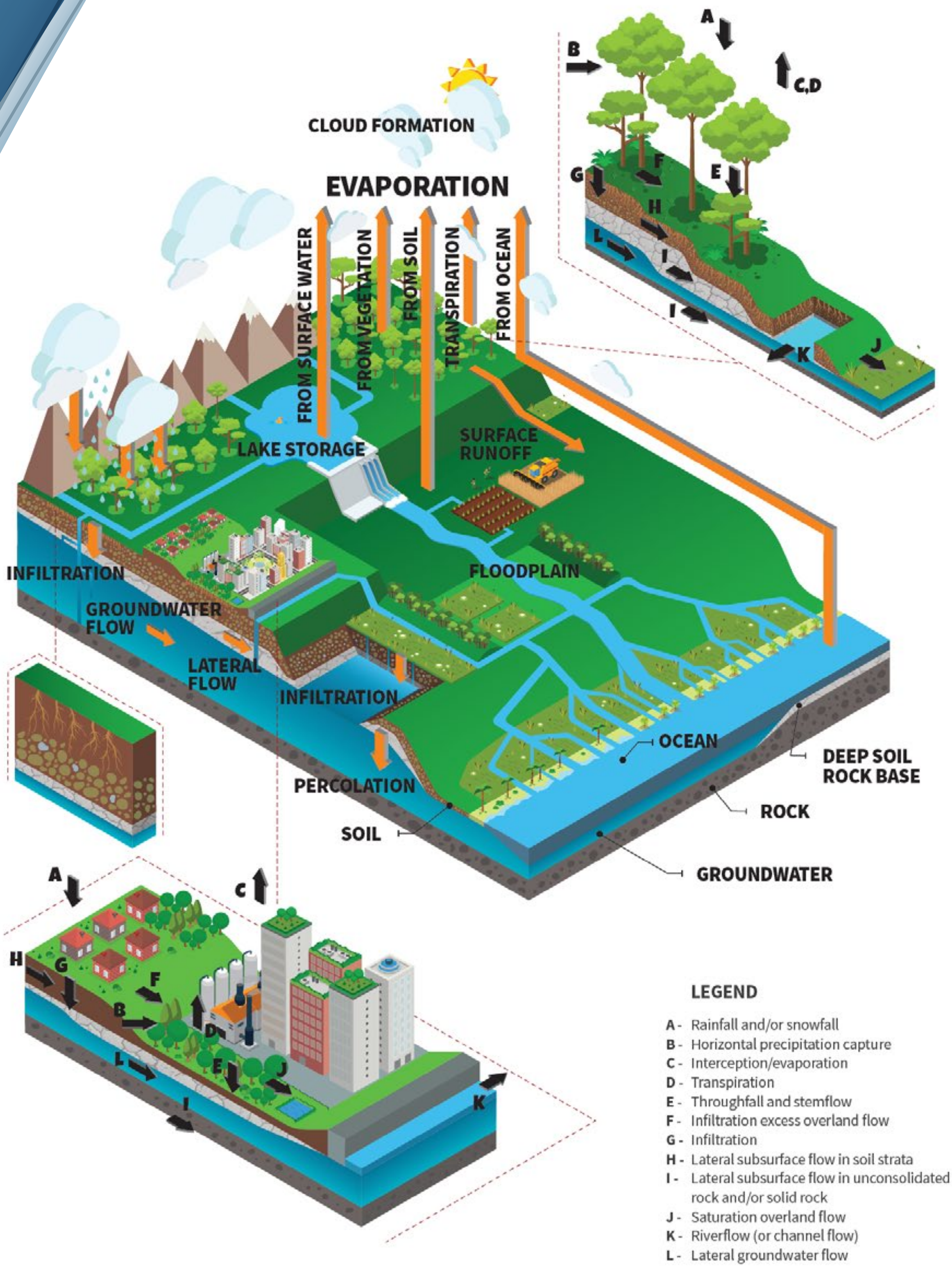


Figure 17: generalised hydrological pathways in a natural landscape (top) and an urban setting (bottom)
(Source: WWAP/UN-Water, 2018b:26)

ANNEX 2: NBS FOR MANAGING WATER AVAILABILITY, WATER QUALITY AND WATER RELATED RISKS

NbS for managing water availability, water quality and water related risks

NbS for water availability: NbS manage key processes for precipitation, humidity and water storage, infiltration and transmission, and enhance water availability in location, timing and quantity:

'NBS mainly address water supply through managing precipitation, humidity, and water storage, infiltration and transmission, so that improvements are made in the location, timing and quantity of water available for human needs. The option of building more reservoirs is increasingly limited by silting, decrease of available runoff, environmental concerns and restrictions, and the fact that in many developed countries the most cost-effective and viable sites have already been used. In many cases, more ecosystem-friendly forms of water storage, such as natural wetlands, improvements in soil moisture and more efficient recharge of groundwater, could be more sustainable and cost-effective than traditional grey infrastructure such as dams.'

NbS for water quality: ecosystems play important roles in regulating water quality:

'Forests, wetlands and grasslands as well as soils and crops, when managed properly, play important roles in regulating water quality. Source water protection reduces water treatment costs for urban suppliers and contributes to improved access to safe drinking water in rural communities. Forests, wetlands and grasslands, as well as soils and crops, when managed properly, play important roles in regulating water quality by reducing sediment loadings, capturing and retaining pollutants, and recycling nutrients. Where water becomes polluted, both constructed and natural ecosystems can help improve water quality.'

NbS for water related risks: green infrastructure can significantly contribute to risk reduction. Combining green with grey measures can greatly improve overall risk reduction and save costs.

'NBS for flood management can involve water retention by managing infiltration, overland flow, […] making space for water storage through, for example, floodplains. The concept of 'living with floods', […] can facilitate the application of relevant NBS to reduce flood losses and, most importantly, flood risk.
Droughts are not limited to dry areas, as is sometimes portrayed, but can also pose a disaster risk in regions that are normally not water-scarce. […]. Seasonal variability in rainfall creates opportunities for water storage in landscapes to provide water for both ecosystems and people over drier periods. The potential of natural water storage (particularly subsurface, in aquifers) for Disaster Risk Reduction is far from being realised. Storage planning at River Basin and regional scales should consider a portfolio of surface and subsurface storage options (and their combinations) to arrive at the best environmental and economic outcomes in the face of increasing water resources variability.'

Box 14: NbS for managing water availability, water quality and water related risks (Source: WWAP/UN-Water, 2018a:4–6)

ANNEX 3: HOW EBA CONTRIBUTES TO WATER SECTOR RESILIENCE

Storing water and enhancing water quality:
ecosystems such as forests and wetlands play a crucial role in water provision and regulation. They store and gradually release water during drier periods and create a favourable microclimate. This helps to reduce costs for artificial storage and water pumping. Buffer strips and ground cover help to prevent siltation of creeks and rivers.

Minimising impacts from extreme weather events and climate variability:
inland water ecosystems, including rivers and meadows, have a significant risk reduction function for extreme rain and flood events by absorbing and holding excessive water.

Enhancing the ecological integrity and functionality that sustains water regulation:
within a landscape that uses integrated watershed management approaches, the holistic management of ecosystems significantly strengthens water regulation services.

Providing sustainable development benefits:
Ecosystems help to secure and filter clean water for domestic consumption and sanitation, food production and other purposes. If well combined with built infrastructure, they strengthen zero-hunger policies, sustainable communities, good health and well-being.

Co-benefits on climate mitigation: by conserving and possibly enhancing natural carbon stocks.

Contributing to the overall climate resilience of societies: both in rural and urban areas.

Source: (SCBD, 2019:151)

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