UN environment programme | PARTNERS FOR RESILIENCE | Funded by the European Union

The Netherlands Red Cross | care | Cordaid BUILDING FLOURISHING COMMUNITIES | Wetlands INTERNATIONAL

2022

CASE STUDY

Upscaling community resilience through Ecosystem-based Disaster Risk Reduction in India

Upscaling community resilience through Ecosystem-based Disaster Risk Reduction in India.

This publication was funded by the European Union. The views expressed in this publication do not necessarily reflect the views of the European Union, nor the United Nations Environment Programme (UNEP). Content in this publication developed by third parties for educational purposes does not constitute endorsement or recommendation by UNEP or the European Union. We regret any errors or omissions that may have been unwittingly made.

United Nations Environment Programme (2022). Upscaling community resilience through Ecosystem-based Disaster Risk Reduction in India.

Prepared by the Partners for Resilience (PfR) India Team: Dhruv Verma and Jeroen Jurriens with support from the UNEP Eco-DRR team: Malikah Amril and Mikhail Fernandes

Special thanks to Karen Sudmeier, Mohammad Hasnain, Vincent Van Haaren, Dr. Ritesh Kumar, Bindu Aggarwal, Marta Vicarelli, Anamaria Georgescu, Kerry Judge, Asiel Arroyo, Htike Htike Aung, Jennifer Nelson, Jessica Mooring, Nujhat Purnata, and Yin Yin Win.

Design and Layout: Ahmad Reza Amiri

EXECUTIVE SUMMARY

Since 2019, the United Nations Environment Programme (UNEP) in-collaboration with Partners for Resilience (PfR) have developed and implemented scalable Ecosystem-based Disaster Risk Reduction (Eco-DRR) models, working alongside various governments and their respective communities in strengthening their capacity and shaping Eco-DRR policy interventions.

This case study highlights Eco-DRR interventions in India focused on integrating Eco-DRR measures on improved water management into local development plans and schemes (such as disaster, wetlands and rural employment) through capacity-strengthening and participation of communities and (local) governments. The key risk being addressed within this context is how wetland degradation reduces community resilience against water-related hazards such as floods, droughts, and storm surges. To address this, the project aims to strengthen resilience of 60,000 women and men to water-related risks and national upscaling model for improved water management focusing in 3 key project sites: Tampara Wetland (Odisha), Kabartal Wetland (Bihar), and a northern dryland region in Gujarat.

A model for upscaling community resilience has been developed through three core components of Eco-DRR: Ecosystem Restoration/Protection, Disaster Risk Reduction, and Climate Smart Livelihoods. In India, there is a greater emphasis on Ecosystem Restoration and Protection through a focus on water related, risk sensitive wetlands restoration and capacity building activities. The project has reached 29,216 beneficiaries, out of which 36% were women. 32 Community-based Organisations were trained on Eco-DRR and 224 women (members of Self-Help Groups) were trained on sustainable livelihoods and wetland wise use, among other capacity building achievements. 3,312 hectares (ha) of wetlands and community common pool resources (ponds, drainages) have now been protected and restored. A Cost-Benefit Analysis (CBA) performed by the University of Massachusetts Amherst demonstrated that the benefits of Eco-DRR and resilience enhancement interventions outweigh the value of their initial costs.

This case study lays the foundation for demonstrating the need for large-scale implementation of Eco-DRR in advancing the implementation of the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Agenda. The content for this case study has been developed by the United Nations Environment Programme (UNEP) in collaboration with Partners for Resilience (PfR) – a global alliance between the Netherlands Red Cross, the Red Crossand Red Crescent Climate Center, Cordaid, Wetlands International, and CARE along with partner civil society organisations in the countries where they work.

TABLE OF CONTENTS

LIST OF ACRONYMS

ADRI	Asian Development Research Institute
CBOs	Community-based Organisations
CCA	Climate Change Adaptation
CSO	Civil Society Organisation
DG-INTPA	Directorate General for International Partnerships
Eco-DRR	Ecosystem-based Disaster Risk Reduction
EMR	Ecosystems management and restoration
GPDPs	Gram Panchayat Development Plans
HVCA	Landscape Scale Risk Assessment
Ha	Hectares
IBA	Important Bird Area
IFRC	International Federation of Red Cross and Red Crescent Societies
JJH	Jal Jeevan Hariyali
Mahatma Gandhi NREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
NAC	Chatrapur Notified Area Committee
NIDM	National Institute of Disaster Management
NPCA	National Plan for Conservation of Aquatic Ecosystems
NbS	Nature-based Solutions
PRI	Panchayat Raj Institution
PfR	Partners for Resilience
SEEDS	Sustainable Environment and Ecological Development Society
SHGs	Self-Help Groups
WISA	Wetlands International South Asia

INTRODUCTION

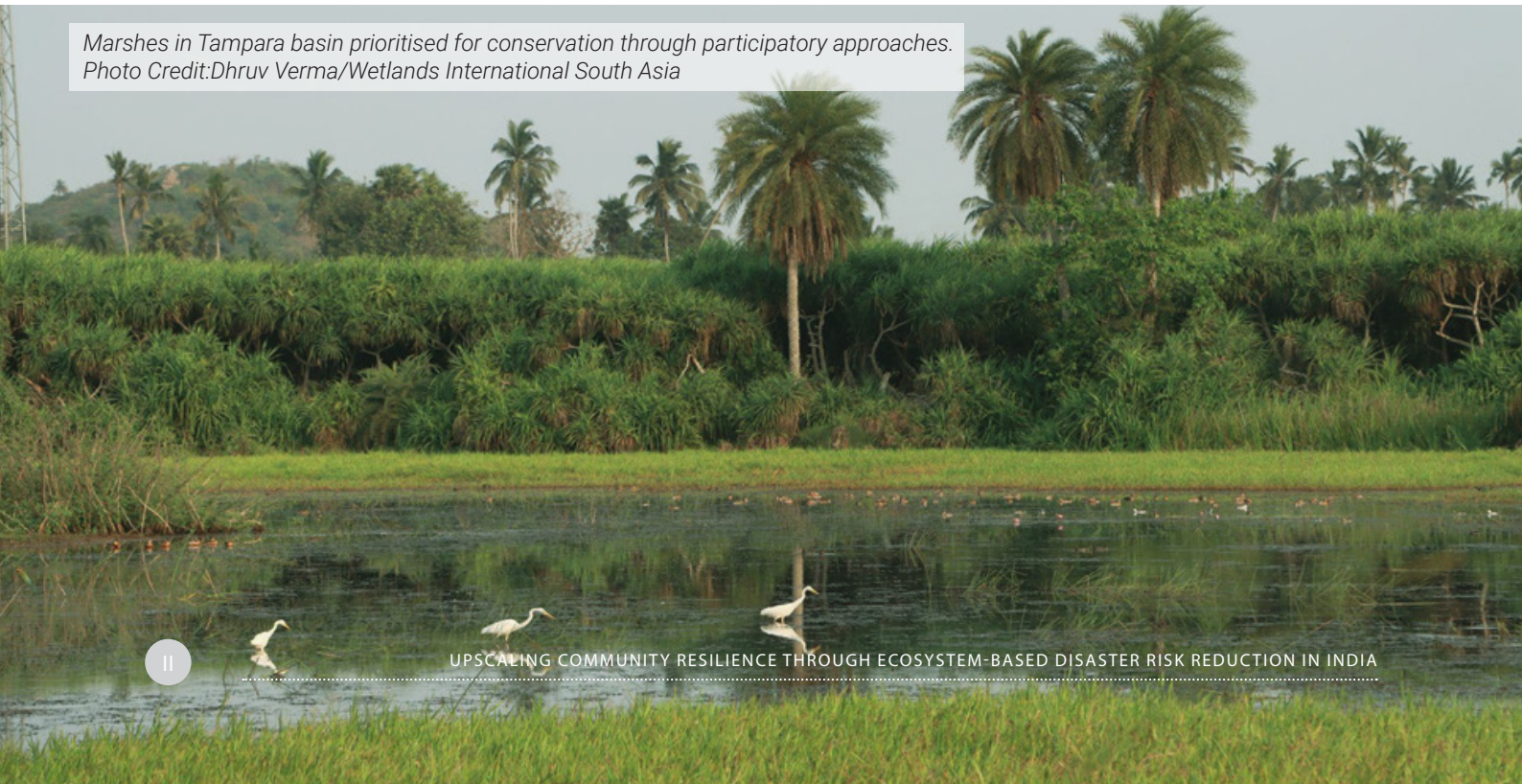
This case study documents the experiences, results, and lessons learned from the Ecosystem-based Disaster Risk Reduction (Eco-DRR) project in India undertaken by Wetland International and the Indian Red Cross with funding from the Directorate General for International Partnerships (DG-INTPA), European Commission. The objective is to upscale community resilience through Eco-DRR activities in selected regions of India. The project was implemented from May 2019 to June 2022 in the Indian states of Odisha, Bihar, and Gujarat.
These areas were selected because they experience frequent floods, drought, and storm surge. Over the last 50 years, an increase in the frequency and intensity of floods, tropical cyclones, and heat waves has amplified and exacerbated an increasingly water-insecure economy. This has led to frequent livelihood disruptions and has deepened poverty, particularly among the most vulnerable. Dryland farming constitutes about 62% of cultivated area in India, supporting a majority of farming, pastoral, and artisan communities. As agriculture remains the backbone of India's rural economy, a larger percentage of the population has become more dependent on limited natural resources, exacerbating the depletion of groundwater and increasing desertification.

Overall objective: Enhanced resilience of 12,000 households to water-induced disaster risks

Specific objective: Upscaling and mainstreaming Eco-DRR approaches into practice and policymaking for building community resilience to water-induced disaster risk covering 12,000 households (appr. 60,000 people).

Project Outcomes:

1. Participative Eco-DRR interventions are implemented within two pilot lake basins and one dryland area (summary description of the intervention sites, selection rationale and disaster risk context provided in methodology section)
2. Key ministries acknowledge wetland restoration as Eco-DRR approach for reducing water induced risks in urban landscapes
3. Selected national institutes adopt curriculum on Eco-DRR to support policy and practice mainstreaming, and modules are integrated in training calendars
4. The Partners for Resilience (PfR) India country team has demonstrated the effectiveness of Eco-DRR to civil society stakeholders and governments at local, national, regional, and global level in a resource package that consolidates good practices and facilitates the replication and scaling up of the Eco-DRR approach.



Marshes in Tampara basin prioritised for conservation through participatory approaches. Photo Credit:Dhruv Verma/Wetlands International South Asia

INDIA PROJECT LOCATION

The project was implemented in the Indian states of Odisha, Bihar, and Gujarat.

Table1: *Expected results/targets.*

Number of community-based / local level organisations that have been trained to implement Eco-DRR activities	25
Number of hectares of ecosystems restored or protected as a result of Eco-DRR field project implemented	4,000
Number of people who are benefiting (directly or indirectly) from community-based model of Eco-DRR field project	60,000

Key Implementing partners: Wetlands International South Asia; International Federation of Red Cross and Red Crescent Societies (IFRC/Indian Red Cross), Sustainable Environment and Ecological Development Society (SEEDS), Pallishree and Panchayat Raj Institutions.

1

Rationale

Resources for wetlands management are highly dependent on central government funding, the level of mainstreaming within local development programmes is low.

1.1 Drivers of Risk

1. *Kabartal/Kanwar wetland*, Bihar - Kanwar Jheel is the largest of a series of shallow permanent and ephemeral wetlands. The Burhi Gandak River is a "plains-fed" river, characterised by high sediment loads that cause meandering and instability. During the monsoon, Kanwar connects with 17 adjacent waterbodies to form an inundated area extending to nearly 6700 hectares (ha). As the monsoon season concludes, the inundation shrinks to around 600 ha forming two small patches, exposing 2600 ha of grasslands. Resulting in a mosaic of landforms including open water, marshes, plantations, agricultural lands, and interspersed settlements.

   Hydrological connectivity between the river channel, riparian zone, and floodplains underpins the high biological diversity and habitat heterogeneity in Kanwar. The richness of biodiversity in Kanwar is indicated by the recorded presence of 44 phytoplankton, 77 terrestrial plants, 46 macrophytes, 71 zooplanktons, 17 mollusks, 51 fish and over 200 bird species. The wetland provides wintering ground to migratory waterbirds and is identified as an Important Bird Area (IBA) in the Central Asian Flyway and a wetland of international importance under the Ramsar Convention.

   Nested in the Burhi Gandak basin, flooding is a recurring feature of the Kanwar landscape. Although the frequency of flooding and its intensity have reduced in the landscape during the last 10-15 years, the basin has experienced severe flooding in 1987, 2002, 2004, and 2007. The risk of flooding is attributed to the Burhi Gandak river's behaviour and morphology in the landscape. Hydrological factors such as the meandering nature of the river, an extreme influx of sediments, physical alterations in the flow regime, and breaches of embankments cause spilling and lateral overflows in peak season. Further, erratic yet high precipitation and the loss of wetlands to permanent agricultural systems make plains along the river Burhi Gandak prone to water scarcity in the lean season (the season between planting and harvesting when job opportunities are scarce). Thus, floods and droughts are the major risks in the area.

   Kawar being a floodplain wetland, acts as a natural filter for pollutants while also absorbing peak monsoon flows. However, its capacity to act as a buffer to floods has reduced due to a mix of factors, the major ones being impeded drainage and erratic rainfall patterns, rapid conversion of wetlands to agricultural, plots and increased extraction of groundwater. Kanwar plays an important role in maintaining hydrological regimes in the region. Besides being an important water source, Kanwar buffers adjoining settlements from flood risk by accommodating a significant proportion of runoff and bank flows of the river Burhi Gandak. Nearly 15,000 households residing around the wetland harvest fish and aquatic plants for use as food, fodder, and thatch. Despite such high ecological and socio-economic significance, the sustainable management of Kanwar has received little attention in the region's developmental programming. Driven by perceptions of the area being characterized as a "waterlogged wasteland", the wetland complex has been subject to extensive hydrological regime fragmentation and conversion for permanent agriculture. The shrinking resource base has accentuated conflict between farmers and fishermen and thus increasing their vulnerability to floods and droughts.

2. *Tampara Wetland,* Odisha - Tampara is a freshwater wetland situated in the Chattarpur block of the Ganjam district on the east coast of Odisha State. The freshwater wetland covers an area of 409 hectares (ha) within a direct catchment of 2280 ha. At the landscape scale, the Tampara basin spans 142,029 ha along Odisha's east coast, forming part of the drainage system of the river Rishikuliya. Historically, Tampara was directly connected with the river drainage, but the surface connection has been lost on account of landscape transformations. Yet, at landscape scale, the basin is dotted with wetlands connected by a network of streams. These wetlands are the basis for agricultural and human settlements within the basin. The wetland is the primary source of water for over 25,000 households in Chattarpur Municipality, and a source of irrigation in and around Chattarpur. Tampara and other smaller wetlands supply water for domestic or irrigation purposes, fishing and agriculture activities, tourism, and recreation. These wetlands also regulate landscape hydrological regimes and reduce water-mediated disaster risks.

Ganjam being a coastal district of Odisha, its geographical setting and regional atmospheric processes make it prone to tropical cyclones and cyclone-induced flooding and lightning. Communities residing in near-coast and river floodplains are vulnerable to cyclones, storm surges, and cyclonic floods. In recent years, heavy downpour, and winds (cyclones such as Phailin, Fani and Titli) impacted the landscape, leading to huge loss of life and property.

The natural setting of the basin, comprising hill tracts as part of the Eastern Ghats and coastal plains along the Bay of Bengal, restricts the length of the rivers, making their course short and prone to annual floods. The district has experienced major flood events in 2003, 2006, 2009, and most recently in 2018. Communities residing in low-lying areas and near river floodplains are vulnerable to floods and waterlogging. Flood risks are largely attributed to the rapid transformation in the area around the Tampara and Rushiukliya river courses. From 1988 to 2017, the area under wetlands declined from 8390 to 2433 ha which is approximately 70% of its original size. The river floodplains and streams, which aid absorption of peak monsoon flows and overall water conveyance in the landscape, have been choked and encroached upon, impeding connectivity within the landscape.

3. *Suigam Dryland,* Gujarat State - Suigam is situated toward the western part of Gujarat and represents the most drought-prone area in the country. Suigam taluka in Banaskantha Districts has one of the highest water-related problems in the region. There are no rivers or tributaries that pass through Vav, Suigam, and the adjoining Tharad and Deodar talukas (sub-districts). Many of the villages are almost totally dependent on water tankers for drinking water and monsoon rain for farm crops. Farmers have dug borewells to irrigate their land, but the groundwater is falling as the entire district has been classified as one with "over-exploited" groundwater resources. Existing village ponds are dry except when some of them store rainwater for a couple of days or weeks. Tubewells that used to be hand-pumped are now drying up as the groundwater levels fall. There is intrusion of salinity from the neighbouring salt pans in the Little Rann of Kutch.

   Banaskantha is part of the desert and semi-desert region of western India. The district has a continental, semi-arid climate characterised by extreme temperatures, daily fluctuations, high evaporation rates with low humidity levels, erratic rainfall, strong winds, and drought . The district has limited groundwater and surface water resources, and there is a gradual deterioration in the quality of groundwater from the west to the east zone of the district. Over two-thirds of the people depend on natural resources for their livelihoods. This includes farming, dairy, minor forest produces and crafts. However, scarcity of water has been threatening their livelihoods, forcing the people to migrate for wage-based labour. Banaskantha is also at the bottom of Gujarat's Human Development Index.

Specific Challenges

- High dependence of community members on wetlands for livelihood activities in Odisha and Bihar.
- Full range of wetland ecosystem services and biodiversity values are not integrated into developmental planning such as Gram Panchayat Development Plans. The ecosystem services of wetlands, as manifested through their role in groundwater recharge, reducing flooding risk, and providing water and food security have not been considered while developing and implementing these plans.
- Cross-sectoral arrangements for implementation or upscaling of Eco-DRR are absent.
- Resources for wetlands management are highly dependent on central government funding, the level of mainstreaming within local development programmes is low.
- Requires intensive advocacy and capacity building to promote ownership of local government institutions in owning wetlands management for reducing water mediated risks and integrating Eco-DRR measures into local/Gram Panchayat Development Plans (GPDPs).
- Increasing conflicts between farmers and fishermen over Kanwar wetland complex resource use. There is presently no institutional mechanism at the local level to resolve these conflicts with due consideration to the needs of wetland management.

1.2. Strategies for Addressing Drivers of risks

- **Enhancing capacities of the key user groups of the degraded ecosystems.**

  In Odisha and Bihar, the project built capacity of local community networks such as Fish Cooperatives, Women Self-Help Groups, and other Community-based Organisations (CBOs) who can form the core of community-based Eco-DRR programme, given their direct dependence on wetlands for livelihoods. Similarly, in Gujarat, the project trained women farmers, Self-Help Groups and local CBOs on agroforestry, water harvesting, mulching, and drought resistant crops. It also promoted thermal-insensitive and drought-resistant crops and raised awareness about tree planting, water harvesting, and early warning systems.

- **Support the conservation of the wetland ecosystem services.**

  This could be done by enhancing their management regime, preparing their integrated management plans, getting them endorsed by concerned government departments, and getting them designated under the Ramsar Convention on Wetlands of International Importance. In Odisha and Bihar, Tampara and Kanwar have been identified as important wetlands for conservation and management by the respective State Wetlands Authorities. Similarly, protection regime of Kanwar wetland as a Ramsar site and a Bird Sanctuary provides regulatory support in restoring and managing wetland habitats and its ecological process and functions.

- **Capitalizing on the relevant local government programme.**

  Jal Jeevan Hariyali (JJH) is a flagship programme of the Government of Bihar where wetlands, rivers, wells, and barren lands are restored for water security in the region. The project team trained the Fish Cooperatives and mobilised the fishing community to identify wetlands for restoration under the JHH scheme. In Gujarat, the project advocated for the Mahatma Gandhi National Rural Employment Guarantee Scheme (Mahatma Gandhi NREGS) to plant the drought-resistant crops.

- **Restoring the wetlands and their hydrological channels in the basins.**

  Restoration of wetlands and rejuvenation of village ponds is undertaken along with capacity building of the local community members and Panchayat Raj Institution (PRI) leaders in ecosystem management.

- **Advocating the community-based wetland management.**

  The State Fisheries Department operates through fish cooperatives to regulate and manage fishing in the wetland complex. The Cheriya-Bariarpur Matasaya Jivi Samiti (Fish Cooperatives) registered under the Bihar Co-operative Societies Act, 1935 is the major fish cooperative operational within the wetland complex. Through leases and permits, local community members practice their fishing rights in the wetland complex. These local institutions can form the core of community-based wetland stewardship programmes, given their direct dependence on wetlands for livelihoods. In Odisha, the project empowered the local communities to develop and implement their own wetland management plans to conserve and wisely use these ecosystems, engaging the local government.

2

Success Story

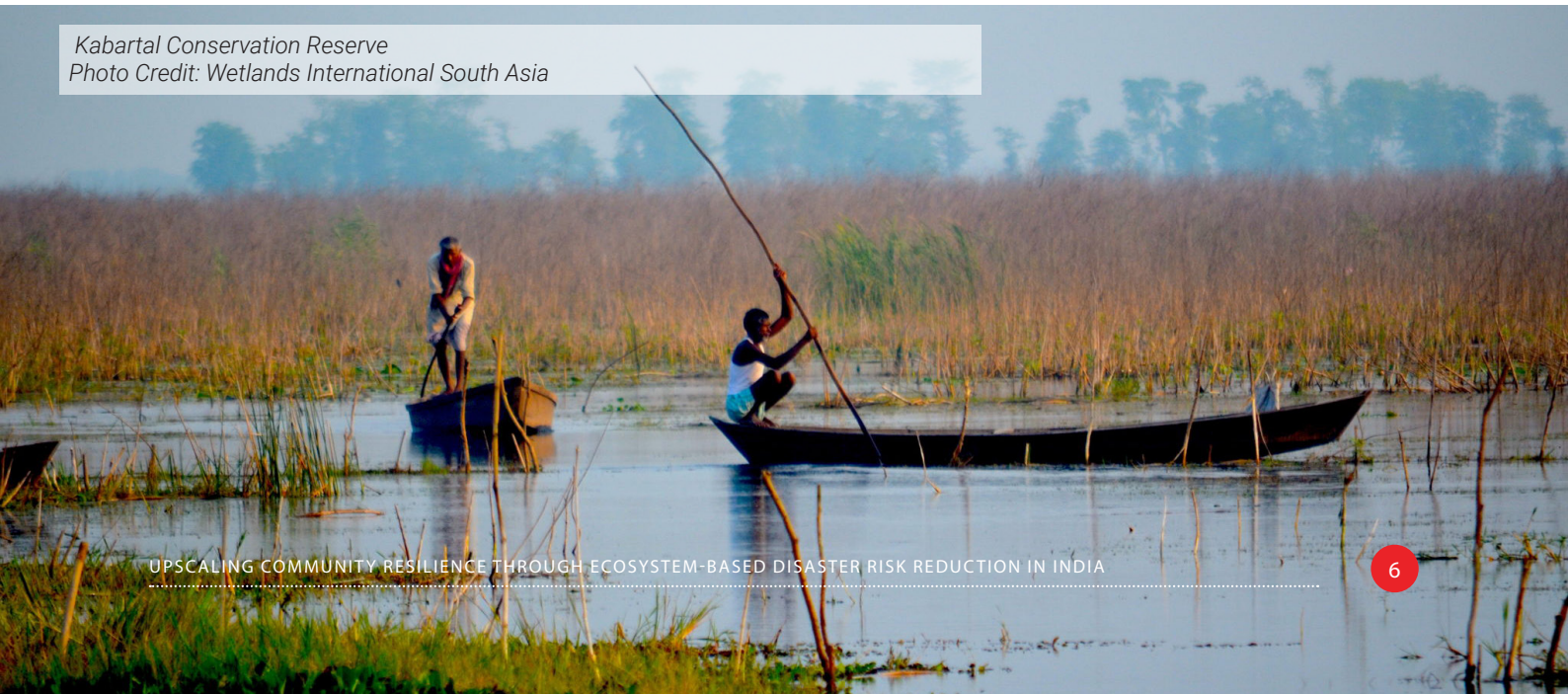
"Healthy wetlands provide clean water and fish for our livelihood while also building our resilience towards floods, cyclones, and droughts"

Tampara is a freshwater wetland, spanning the Rishikulya coastline in Odisha, India. This wetland serves as a habitat to 61 avian species, 23 species of fish, and a diverse variety of flora and fauna. Tampara is a source of water for over 10,000 households and supports the livelihood of community fishermen. The wetland area is also being developed as a tourism site and receives over 25,000 tourists every year. It acts as a flood, cyclone, and drought buffer, protecting habitation in its landscape.

In recent years, the Tampara wetland has suffered immense degradation due to anthropogenic pressures. The area of the wetland has been reduced due to construction and agriculture activities. The hydrological connectivity within the Rishikuliya River has been lost as inflowing streams have been diverted to agricultural fields or have been choked with garbage. Wetland degradation has also led to a decrease in the number of fish species found in the wetland.

To combat wetland degradation and biodiversity issues, collective community action has been initiated under the project focusing on wetland restoration. These actions fall under the Tampara Management Plan, which was developed through a participatory approach involving community members to restore the wetland. The initiatives taken by community members with the support of Wetlands International South Asia and a local CSO (Netcoast) are listed below:

- Community task forces have been organised in 9 target Panchayats to act on conservation through awareness drives, adopting sustainable livelihood practices, and encouraging the use of indigenous knowledge to devise solutions.
- Training of stakeholders on wetland conservation and sustainable livelihood practices was organised to empower them to take decisions towards the sustainable use of the wetland and improve their livelihoods.
- Conservation actions such as the cleaning of wetland channels, waterways, inlets, and outlets; the removal of invasive water hyacinth; the monitoring of wetland health and organising local wetland champions to spread awareness on wetland and biodiversity conservation are ongoing.
- A total stretch of 5.5 kms of wetland inlets and outlets has been cleaned by the community members so far. To regulate pressure on Tampara wetland for water abstraction, a total of 30 village ponds have been selected for rejuvenation, which includes cleaning, nutrient regulation, and re-stocking of fish fingerlings.
- Indigenous and traditional practices such as making organic fishing gear and nets, and the plantation of local plant species are being encouraged.
- Awareness-raising among community members and youth on Ecosystem-based Disaster Risk Reduction (Eco-DRR) practices are also being organised benefiting over 18,000 community and CBO members in the basin.



Kabartal Conservation Reserve
Photo Credit: Wetlands International South Asia

Mr. Lokanath Behera, Humara Village - Odisha is a local fisherman who has been making organic fish nets using bamboo. He strongly believes in traditional practices such as these to promote local crafts and also lower dependence on plastic nets that are harmful for the wetland. Photos: Eco-DRR project /Netcoast .

Namita Behera and Jharana Behera of Humara village - Odisha are among the many women who participate in the project activities such as plantations. They have been involved in plantation drives along the wetland to restore its ecological value. They are motivated to act on saving their wetland as they feel they depend on it for many reasons, like freshwater, fishing, and crop cultivation. Photos: Eco-DRR project/Netcoast.

Ejuamin Khan from the Chatrapur Notified Area Committee (NAC) has been working towards making Tampara plastic free. Along with his fellow community members, he organise drives to collect plastic waste left behind by tourists around the wetland. He and his team are also engaged in making tourists aware of this degradation for halting further pollution of the wetland. Photos: Eco-DRR project/Netcoast.

3

Main components and model

Integrate Eco-DRR measures on improved water management into local development plans and schemes through capacity-strengthening with the participation of communities and local governments.

3.1. Eco-DRR Components

Capacity Building

At the national level, the project has developed contextualized training curricula and modules on Eco-DRR, including specific wetlands management and Integrated Risk Management methodology, in collaboration with the National Institute of Disaster Management (NIDM), for use by sub-national level disaster management agencies. The development of a Training of Trainers is envisaged to support the upscaling of Eco-DRR. It includes training of practitioners for the District Disaster Management Authorities and other relevant stakeholders to highlight the need for Nature-based Solutions (NbS) and wetlands to manage disaster risks in an effective way.

At the local level, the project has focused on developing capacities and empowering various community groups, particularly those who rely on ecosystems. These include women, fishermen, youth and children groups. The activities are focused on enhancing the knowledge, improving sustainable livelihood practices, and increasing awareness on the sustainable management of wetland and dryland ecosystems.

The project has demonstrated the following results:

- 32 Community-based Organisations (CBOs) trained in support of ecosystem restoration with risk reduction activities.
- 224 Women (members of Self-Help Groups) trained on sustainable livelihoods and wetland wise use.
- 11 Task Force groups comprising over 150 wetland champions are established and actively engaged in wetland conservation/Eco-DRR.
- 1,500 fishermen sensitized on wetland management and sustainable fishing.

Field Implementation

It includes landscape-scale risk assessment using Hazard Vulnerability Capacity Assessment tool, Ecosystem Services Shared Value Assessment, participatory community scale disaster risk reduction planning to understand risk context and devise suitable Eco-DRR measures for building resilience. Implementation of Eco-DRR actions includes restoring natural water regimes of wetlands by restoring their natural inlets, strengthening embankments with vegetation, and removing solid waste from the wetland. It also includes sensitising communities about the efficient use of water and wetlands management. Other Eco-DRR actions include afforestation around wetlands and other community-owned areas and rainwater harvesting. Most of these actions were implemented through inclusion of these actions in GPDP and convergence funding, especially the Mahatma Gandhi NREGS and other relevant schemes. Further, the Eco-DRR actions will be integrated in local developmental planning for mainstreaming and upscaling purposes.

The project has demonstrated the following results:

- 29,216 beneficiaries reached of which 36 percent are women.
- 3,312 hectares (ha) of wetlands and community common pool resources (ponds, drainages) are protected and restored.
- Local farmer and fisher communities are adopting sustainable livelihood practices to reduce direct dependence on the wetlands through measures like organic farming, discontinuing use of zero-size fish nets and ecosystem management.

Advocacy with Government

This activity includes the drafting and dissemination of a policy brief on (1) Eco-DRR approaches for reducing water-related disaster risks in urban and peri-urban spaces and (2) Integration of disaster risk elements in wetlands management. Here, in collaboration with the National Institute for Disaster Management (NIDM), the project is working on policy briefs on Eco-DRR approaches targeting urban and peri-urban spaces. These policy prescriptions will call for prioritizing wetlands in overall urban development regimes and bringing in DRR and Climate Change Adaptation (CCA) perspectives.

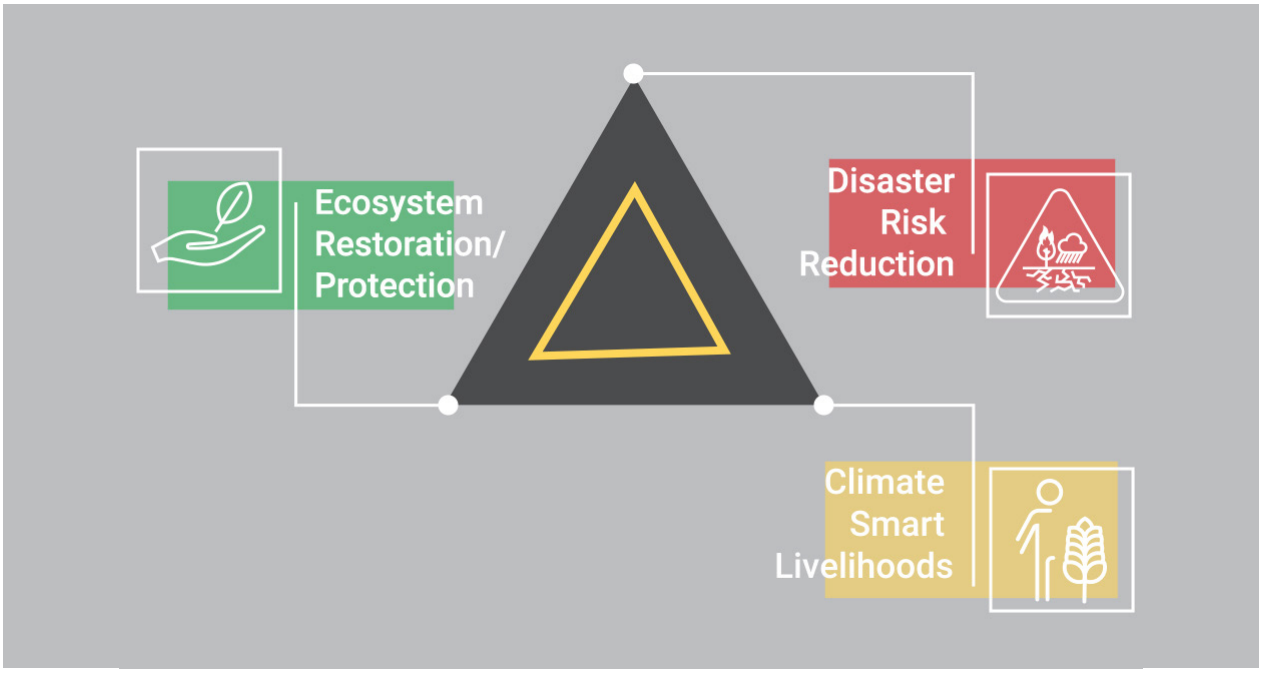
The project has demonstrated the following results:

- Supporting State Governments in enhancing management regimes of the two wetlands to achieve conservation and wise use-goals.
- Kanwar Nature Club and Fish Co-operative are strongly advocating for protection of wetland biodiversity and its values.
    - Development of Integrated Management Plans for Kabartal (newly designated Ramsar site) and Tampara wetlands (a proposed Ramsar site, expected to be designated in remaining project period)
    - Implementation of community-based wetland management actions in Tampara basin to enhance community resilience
- 5 Panchayats (local government institution) have incorporated a myriad of Eco-DRR measures in their annual developmental plan (GPDP).
- Organised a regional consultation workshop with Ramsar focal points and site managers to develop guidelines on Eco-DRR for Ramsar site managers.
- Partnered with National Institute for Urban Affairs and World Resources Institute for Constitution of the India Forum for Nature-based Solutions.

Action planning on community based wetland management plan by members of a primary fish cooperative society
Photo Credit: Dhruv Verma / Wetlands International South Asia

3.2. India Upscaling Model

Integrate Eco-DRR measures on improved water management into local development plans and schemes (such as disaster, wetlands, and rural employment) through capacity-strengthening and the participation of communities and local governments.



In India, Wetlands International South Asia (WISA) leads the project's implementation. The project team leveraged the momentum of WISA's continuous engagement with central and state government agencies, especially wetland authorities and disaster management authorities, and capitalized on technical material developed under the previous project to design the pathway for upscaling Eco-DRR in target states and possibly in more states in the country.

The Eco-DRR India programme targeted mainstreaming of wetland-based Eco-DRR measures into Gram Panchayat Developmental Plans. These annual plans are the guiding documents for implementation of various social upliftment schemes like National Rural Employment Scheme (Mahatma Gandhi NREGS), Livelihood Mission, and Jal Jeevan Hariyali (JHH). A suite of activities was identified under Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA) and Ecosystems Management and Restoration (EMR) that contribute to building community resilience towards water-related risks.

These ground interventions are upscaled through trainings, awareness events, and advocacy to gauge momentum for wetland-based solutions for addressing water-related risks. The field learnings are upscaled through dialogues with State Wetlands Authorities and State Disaster Management Authorities. To upscale Eco-DRR approaches in Disaster Management sector, WISA has partnered with the National Institute of Disaster Management, India (NIDM) to develop a practitioner's manual on NbS and its application in project landscapes, as well as upscaling through nationwide training curricula on NbS for water-related risks. A guidebook has been prepared for district disaster management professionals to integrate NbS in their disaster management plans. Subsequently, the project and NIDM are preparing training courses for sub-national disaster management authorities.

Ecosystem Restoration/Protection

- Empower CBOs such as Fish Cooperatives, Women Self Help Groups and others to identify, restore, and protect ecosystems with wetlands management plans;
- Restore natural water regimes of wetlands, natural vegetation, rainwater harvesting, efficient use of water, and blending wetland ecosystem functioning with built infrastructure.

Climate Smart Livelihoods

- Local communities are empowered to engage with the local government for the resourcing and implementation of various social upliftment schemes such as Mahatma Gandhi NREGS and JJHM;
- Local community networks form the core of community centric wetland stewardship programme, for livelihoods enhancement.

Disaster Risk Reduction

- Landscape scale risk assessment include ecosystem services and are embedded within community-based disaster risk reduction planning;
- Regeneration of natural water sources (village ponds) around wetland basins.

3.3. Common roles or key issues to be considered

- Regular engagement with the relevant technical government agencies, such as Krishi Vigyan Kendra (part of the National Agricultural Research System) in Odisha, Bihar, and Gujarat, for scientific backing in pond management, fisheries, and agricultural work. This engagement could provide a scientific foundation in preparing training on sustainable livelihoods and developing an action plan for village pond rejuvenation.
- Advocacies to the state-level wetland authorities could facilitate the recognition and prioritization of conservation and sustainable management of wetlands by the relevant authorities.
- Taking advantage of the relevant government programme on natural resource management, including wetlands, rivers, and forests such as Mahatma Gandhi NREGS and JJH Schemes, provides a good entry point to upscale Eco-DRR.
- Capitalizing and empowering the existing local community networks, such as Fishermen and Women Self-Help Groups who directly depend on the wetlands for livelihood, creates a strong foundation for a wetland stewardship programme.
- Engagement and partnership with reputable and local scientific think tanks such as the Asian Development Research Institute (ADRI) in Bihar is essential to support the development or improvement of the wetland management plan and its replication in the neighbouring states.

3.4. Scalable feature

The Eco-DRR India programme targeted the mainstreaming of wetland-based Eco-DRR measures into local sectoral plans. It includes district disaster management plans, wetland management plans, and local level development plans (also known as Gram Panchayat Developmental Plans – GPDP). A suite of activities was identified under DRR, CCA and EMR that contribute to building community resilience towards water-related risks. These activities include wetland restoration and enhanced protection, promotion of wetland wise use, and capacity building of relevant stakeholders to uptake Eco-DRR measures. The model could be scaled up with the following actions:

- **Disaster Risk Reduction: Mitigating the flood and drought hazards**

Restoring hydrological channels at a landscape scale; providing alternative livelihoods for Women Self Help Group members to buffer disaster loss and damages incurred by the household, sensitizing the community on risk insurance; and promoting indigenous traditional knowledge on early warning of extreme climate events.

- **Ecosystem Restoration/Protection: Conservation and wise use of wetlands**

Plantation of native species to buffer physical impacts of cyclone, stabilises the wetland shorelines to check soil erosion and removal of wetland invasive species to improve fish habitat quality, foster participation of communities in wetlands conservation by designating them as wetland *mitras* or Eco-DRR champions, and developing science-based wetland management plans for the two landscapes to support conservation and wise use of their biodiversity and ecosystem services values.

- **Climate Smart Livelihoods: Enhancing technical capacities**

Training and technical support on climate smart fisheries and farming to fishermen and farmer groups who depend on wetland ecosystems.

The flagship feature is the convergence of wetlands and disaster related plans to ensure sectoral plans that contribute to overall resilience of communities at risk to water-related hazards.

- It addresses the fragmented local development programmes, especially between environmental conservation and disaster management sectors
- It encourages the recognition and corroboration of critical wetland ecosystems as protected areas (such as Ramsar site) from the relevant authorities
- It empowers those highly dependent on the wetlands (fishermen, farmers, women, etc.) as the prominent custodians of these valuable ecosystems

How to scale up the convergence of wetlands and disaster-related plans

- Identify and empower the key user groups (e.g., fishermen, farmers, women groups) of the wetland ecosystem
- Recognize the roles of wetlands and Nature-based Solutions (NbS) in reducing disaster risks, both for buffering the physical impacts of hazards and for providing life supporting services
- Advocate the results to the relevant government programmes or schemes on natural resource management or conservation
- Follow up the advocacies of integration of wetland and disaster plans within local development planning processes

These approaches are also scalable at the national scale because these plans are made under the ambit of national-level policies and action plans, viz. National Plan for Conservation of Aquatic Ecosystems (NPCA) and the National Disaster Management Plan (2019). Both plans and their guiding regulations and policies have supportive regime for integration and upscaling of Eco-DRR approaches.

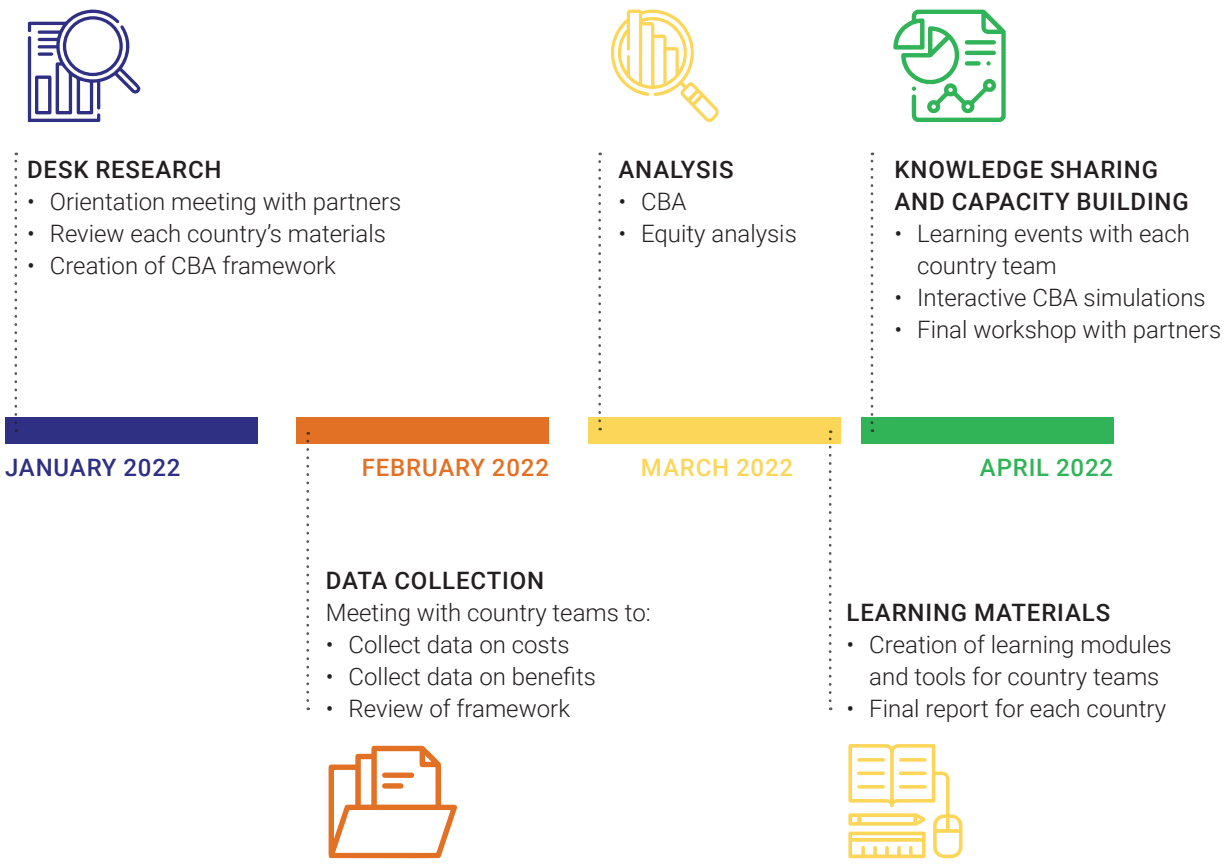
4

Eco-DRR Cost-benefit Analysis (CBA) Study

This study was conducted when the project was still ongoing. The Eco-DRR interventions analyzed in this study, including the size of the target population and the extent of the ecosystems protected and restored have been evolved since then. The study presented the estimated economic net benefits of applying Eco-DRR approach.

4.1. CBA Methodology

The methodological approach adopted in this study includes five components: desk research, data collection, cost-benefit and equity analysis, creation of learning materials, and knowledge sharing.



Overall project timeline and methodological approach for efficiency analysis (which includes a cost benefit analysis) and equity analysis

4.2. Strength, Limitations and Recommendations

The economic efficiency assessment of the project through a quantitative Cost-Benefit Analysis (CBA) and a qualitative analysis includes a vast array of non-monetary benefits too. The quantitative estimates show that the benefits of the Eco-DRR and resilience building interventions outweigh their implementation costs. The qualitative analysis complements these findings presenting a rich bouquet of long-lasting benefits associated with the three Eco-DRR core components: DRR strategies, Ecosystem Management, and Sustainable Livelihood Practices. **This economic efficiency assessment is corroborated with an equity analysis providing a comprehensive overview of the distributional impacts of the intervention on different socio-economic groups.** The large amount of qualitative data and preliminary quantitative data provided by the country team contributes to the strength and relevance of the analyses. Despite the tight time constraints, the country team assisted the research team to the best of their abilities, often collecting new data from the field, thus laying the groundwork for possible future data collection efforts and analysis.

The analysis presented in this report is based on an approximation of the frequency and magnitude of hydrological hazards in the region. More precisely, the key figure relevant for our CBA is the yearly average of the economic impact of the damages due to hydrological hazards. The analyses assume that the local population experiences 2% yearly loss in properties and GDP per capita in the project area. This assumption is based on a conservative approximation of historical trends (Bahinipati et al. 2015) and based on the data provided by the country team. Storms and floods are expected to worsen with climate change; therefore,

the CBA could be underestimating the benefits of wetland restoration and protection. This would make an even stronger case in support of the Eco-DRR intervention. The study includes robustness checks applying a 5% yearly loss in properties and GDP per capita in the project area and the results are similar. The analyses assume that the Eco-DRR intervention will be able to reduce this risk and mitigate losses.

Ideally the CBA estimation performed in this study should consider:

1. Historical frequency (i.e., probability of occurrence) and magnitude of climatic extremes (i.e., El Nino and Climate Change) that may induce hydrological hazards in the project region, at least over 30 years.
2. Observed correlation between intensity of extremes (e.g., storms, floods) and damages to properties.
3. Observed correlation between intensity of extremes (e.g., storms, floods) and income losses.

Such data would allow to better ground the value of the yearly economic damages due to climatic extremes into a robust statistical framework. Due to limited data availability the above components were not included in the analysis. Moreover, the short time available to complete the analysis did not allow us to collect primary data about these components.

Another variable that would need to be better estimated to strengthen the robustness of the CBA is the percentage of damage avoided due to the Eco-DRR intervention. Since the project is in its early stages, there is not ample empirical evidence of the protective power of the nature-based solutions implemented in the project area. The estimation assumes that, starting in year 6 after the end of the project implementation, the Eco-DRR intervention is able to completely prevent the annual damages to properties and income losses. We adopted a conservative approach in assuming that until the 5th year after the end of the project implementation (included), while the ecosystem is maturing, there is progressive increase in benefits (i.e., 10% of benefits the first year, 20% the second year, 30% the 3rd year, 40% the 4th year and 50% the 5th year). This may lead to an underestimation of the benefits.

This quantitative analysis lays the foundation for a possible future broader CBA of the Eco-DRR intervention in this region. Recommendations for future research, if a longer time frame for data collection and analysis is possible, include the following: collect data related to the three components highlighted above and reproduce the CBA estimation; plan a rigorous data collection schedule in the project area to measure the observed efficacy of the local Eco-DRR interventions in limiting disaster risk. In five to ten years, the collected data could be used to perform an empirically rigorous project evaluation.

4.3. Scenarios

SCENARIO 1: Eco-DRR intervention

Benefits include reduction in property damages and income losses
Benefits **do not** include carbon capture and pollution reduction

SCENARIO 2: Eco-DRR intervention

Benefits include reduction in property damages and income losses
Benefits include carbon capture and pollution reduction

4.4. Results

SCENARIO 1: After **5 years** (at a 0.07 discount rate) - when benefits **do not** include carbon capture and pollution reduction, but do include reduction in property damage, and income losses - the present value of net benefits is **1,426,735.19 USD.**

After 10 years the present value of net benefits is **4,168,704.31 USD**

SCENARIO 2: After **5 years** (at a 0.07 discount rate) - when benefits include carbon capture and pollution reduction, reduction in property damage, and income losses - the present value of net benefits is **2,738,127.19 USD.** After 10 years the present value of net benefits is **14,246,584.62 USD**

Assumptions

The Cost-Benefit Analysis framework adopts the following assumptions and specifications:

- The present value of net benefits (i.e., Net Present Value, NPV) is estimated over a time horizon of 10 years from the end of the project implementation.
- The full costs of the project implementation are paid only once in year 0, which corresponds to the end of the implementation.
- The ecosystem associated with the eco-DRR intervention (i.e., forest) reaches maturity after 5 years.
- There is a 2% yearly loss in properties and GDP per capita in the project area (we also perform robustness check with a 5% yearly loss).
- Until year 5 included, while the ecosystem is maturing, there is a progressive increase in benefits (i.e., 10% of benefits the first year, 20% the second year, 30% the 3rd year, 40% the 4th year and 50% the 5th year).
- The ecosystem restored/protected by the eco-DRR intervention reaches maturity after 5 years, and starting in year 6 it provides full benefit.

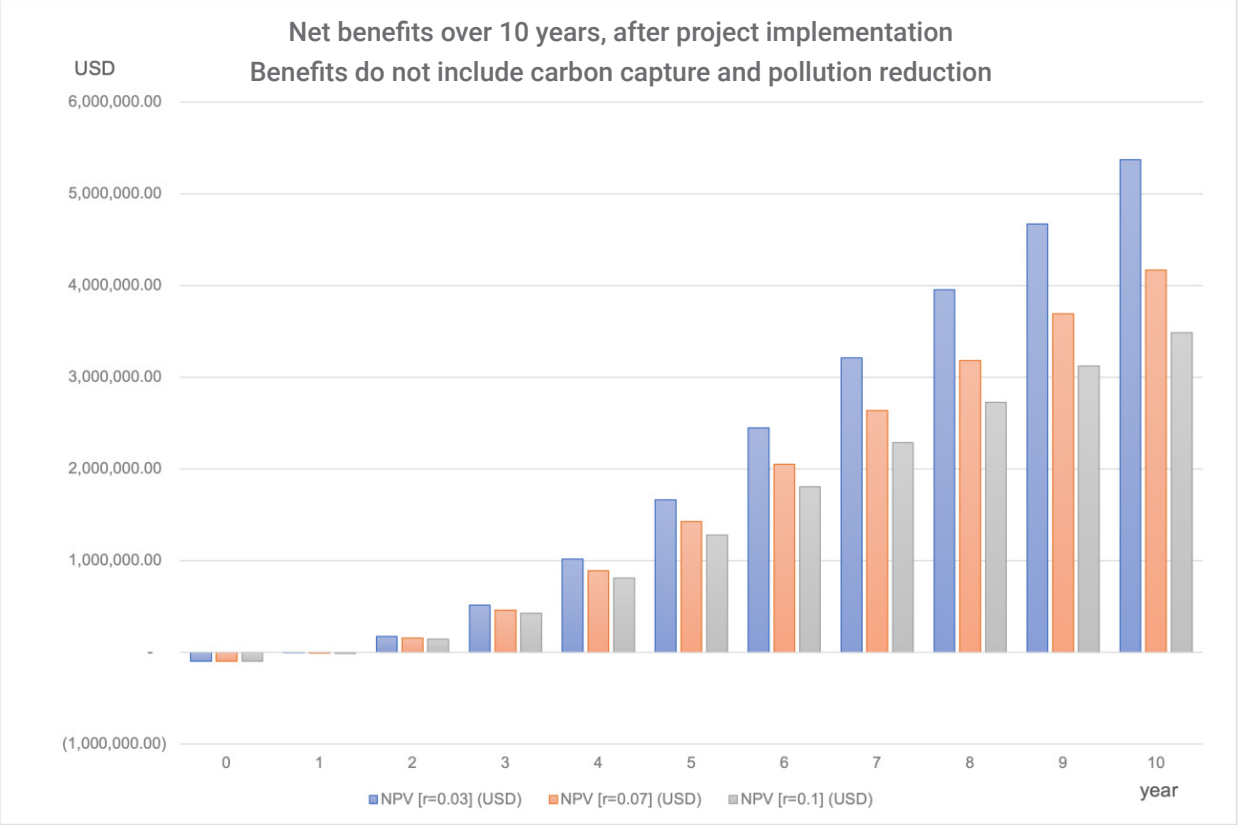
Discount rates

The CBA estimations are performed using three discount rates (i.e., 0.03, 0.07, and 0.1) to allow comparisons across outcomes and robustness checks. Higher discount rate values lead to a lower weight of future benefits and costs in the CBA estimation. Ecosystem-based interventions may generate long-term benefits that might be underestimated with high discount rates. For this reason, it is important to adopt a range of discount rates and perform sensitivity tests. Three percent and seven percent are the discount rates generally recommended by the US Office of Management and Budget (OMB) (Congressional Research Service, 2016; Li, Q. and Pizer, W.A., 2021).

It is worth emphasizing that the estimated results are very conservative and benefits might be much higher than what the calculations indicate. There are multiple reasons for that:

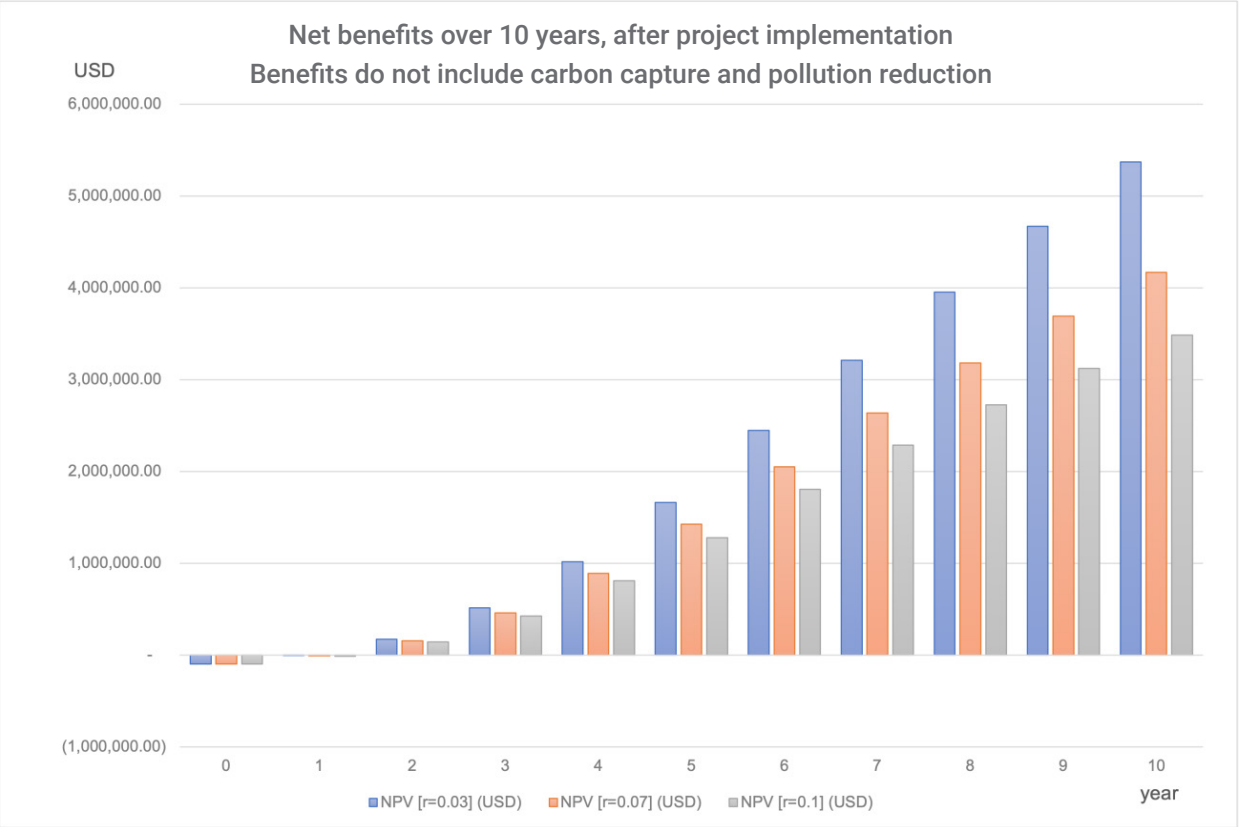
- The CBA assumes a 2% yearly loss in properties and GDP per capita in the project area, however historical data shows higher losses, and risk is expected to increase in relation to climate change.
- The analyses assume that benefits associated with wetland protection reach their maximum value 5 years after the end of the project implementation (the underlying assumption is that the ecosystem will reach maturity at that point). However, a large portion of the almost 4,000 ha covered by this project is already a mature ecosystem, hence benefits are underestimated.
- The CBA assessment considers only socio-economic benefits associated with reduced property damage and reduced GDP per capita losses. Because of lack of data we could not include other important benefits related to health improvements and agricultural productivity ((discussed in Section 4.2).

This means that the interventions could be even more beneficial to local communities than estimated in the quantitative analysis.



SCENARIO 1 - Present Value of Net Benefits			
Benefits do not include carbon capture and pollution reduction			
Discount rates	r=0.03	r=0.07	r=0.1
year	**NPV (USD)**	**NPV (USD)**	**NPV (USD)**
0	-$95,351.00	-$95,351.00	-$95,351.00
1	-$4,288.52	-$7,692.73	-$10,083.41
5	$1,663,145.32	$1,426,735.19	$1,277,113.02
10	$5,368,487.03	$4,168,704.31	$3,484,825.99

Scenario 2



SCENARIO 2 - Present Value of Net Benefits			
Benefits include carbon capture and pollution reduction			
Discount rates	r=0.03	r=0.07	r=0.1
year	**NPV (USD)**	**NPV (USD)**	**NPV (USD)**
0	-$95,351.00	-$95,351.00	-$95,351.00
1	$74,168.66	$67,831.48	$63,381.05
5	$3,178,222.48	$2,738,127.19	$2,459,594.25
10	$18,459,771.28	$14,246,584.36	$11,845,743.02

4.5. Details about benefits used in the calculations

BENEFITS					
			SCENARIO 1	SCENARIO 2	
	Variable	Total	USD (3/29/22)	USD (3/29/22)	notes
1	**Reduction in property damages** from avoided hazards (annually)	18,662,805.00	373,256.10	373,256.10	Communication from country team
2	**Avoided GDP losses** reduction losses from business interruption (annually)	28,234,370.00	564,687.40	564,687.40	Reserve Bank of India (2022)
3	**Carbon stored in trees** (this benefit is not an annual rate)			4,292,772.00	benefits are estimated using program iTree
4	**Carbon Capture** and sequestration (annually)			329,036.00	benefits are estimated using program iTree
5	**Other pollution** reduction (annually)			1,691,236.60	benefits are estimated using program iTree
		46,897,175.00	**937,943.50**	**7,250,988.10**	

The cost-benefit analysis includes all ecosystem restoration implementation costs (95,351 USD)[1] and the following benefits:

- **Reduction of property damage from avoided risks** - The following estimates were communicated by the country team:
  - Number of people protected by Eco-DRR intervention in project area:
    - **Tampara** - 18,000
    - **Kanwar** - 23,500
- Properties protected (based on rough estimates provided by country team):
  - **Tampara** = 4,500
  - **Kanwar** = 6,000
- Property prices - Different houses have different cost (i.e., concrete or asbestos or straw made houses). Apart from that, the size of the house also decides the cost involved in it. Here, we consider the minimum Govt. cost for one family under Indira Awas Yojana (Gramin Awas Yojana or Rural Housing Scheme). It is equal to Rs. 135,000.00." (1,777.41 USD)
  - **Total property value = 18,662,805 USD**

1. Budget documents provided by the country teams show that the cost of the intervention associated with *Community-based Eco-DRR Planning and Ecosystem Restoration and Protection* activities amount to 365,594 USD. We assume no maintenance after the end of the project implementation (June 2022).

- **Reduction of GDP losses from avoided risks** - In 2020, Indonesia GDP per capita was 1,927 USD (World Bank, 2020). However Odisha and Bihar are poorer than average:
    - Per Capita Net State Domestic Product (Reserve Bank of India):
        - **Odisha: 1037.92 USD**
        - **Bihar: 406.46 USD**
    - Number of people protected:
        - **Tampara (Odisha) - 18,000**
        - **Kanwar (Bihar) - 23,500.**
    - Estimated total annual GDP in project area = (18,000*1037.92)+23500*406.46)= 28,234,370 USD
    - Estimated avoided yearly GDP losses = 2% of annual GDP in project area

The Indian economy is one of the worst impacted by floods. Between 1970 and 2014, floods related damage corresponded to 63% of annual economic losses in India (World Bank, 2015). Annual losses and damage associated with floods in Odisha and Bihar are estimated to be between 2.5% and 3.5% of their state Gross Domestic Product (GDP) (Bahinipati et al. 2015; communication from country team). Based on these estimates, the analyses assume a conservative 2% yearly loss in property values and GDP per capita in the project area. Floods are expected to worsen with climate change, therefore the study includes robustness checks by applying a 5% yearly loss in property values and GDP per capita in the project area (results available upon request).

The software iTree Canopy is a global forestry analysis and benefits assessment tool from the United States Department of Agriculture's (USDA) Forest Service. iTree allows to calculate carbon sequestration and storage as well as pollution reduction of a given vegetation area, selected via Google Map. The 3,826 ha of land restored in India is estimated to sequester roughly 17,517,751.84 tons of carbon annually, and the overall carbon storage capacity for the same area is estimated at 229,335,526.78 tons. iTree also provides estimates of the corresponding monetary values, which were used in the CBA calculations (Table 1).

- **Carbon stored in trees** - The carbon stored in reforested area (3826 ha) corresponds to 229,335,526.78 tons. This is not an annual benefit, it is a one-time benefit reached at maturity of the forest, after 5 years.
- **Carbon sequestered thanks to Eco-DRR reforestation efforts** - The carbon sequestered annually by the surface currently reforested (3,826 ha) is 17,517,751.84 tons per year.
- **Pollution reduction thanks to Eco-DRR reforestation efforts** - Pollutants reduced by the surface currently reforested (3,826 ha) correspond to 5121.84 kg per year: Carbon Monoxide, Nitrogen Dioxide, Ozone, Sulfur Dioxide, Particulate Matter less than 2.5 microns, Particulate Matter greater than 2.5 microns and less than 10 microns.

4.6. Equity Assessment

In addition to the benefits described above, these interventions promote socio-economic equity and gender sensitivity in the target communities. This equity assessment considers the equity implications of the interventions from four perspectives: inclusivity, economic equality, participation, and capacity building.

Inclusivity

The interventions have been developed and implemented in an inclusive manner that aligned with the project's goal of capacity building. Community based organizations (CBOs) and Women's Self-Help Groups (SHG's) were central to the planning and implementation process, engaging women as participants and beneficiaries to ensure that interventions were gender-sensitive. Additionally, indigenous knowledge relating to sustainable agricultural and fishing practices were incorporated into the interventions where possible.

Economic Equality

The interventions in India help to fulfill basic human needs and improve socio-economic outcomes for women, men and for the communities as a whole. As a result of the disaster-risk reduction achieved through wetland conservation and management, afforestation and capacity building, communities will be more resilient to natural hazards and less likely to suffer economic losses via damage to crops and interruptions to agricultural activities, protecting beneficiaries' needs to a home and livelihood. Reduction in vulnerability to hazards, combined with the numerous sustainable livelihood initiatives introduced in these communities (e.g., sale of forest products, women engaged in nature-based entrepreneurships like pandanus, duck rearing, mushroom, vegetable cultivation and backyard kitchen garden activities, sale of organic fishing nets) will also decrease the risk of poverty traps. The poorest and most marginalized individuals will benefit the most from vulnerability reduction.

Interventions such as afforestation using fruit bearing trees, wetland restoration, and other activities increasing water security promote basic human needs to potable water and food. The availability of fresh fruits (including mango, cashew, jackfruit, coconut, banana, and neem) from these trees provided nutritional support to many families.. As a result of the wetland restoration activities, communities have increased access to clean water following heavy rains and flooding, which has led to a reduction in water-borne illnesses from consumption of non-potable water. Additionally, the expansion of the reach of the Basudha scheme (as part of this project) has increased water availability in the target villages by providing safe water via pipe system. In addition to providing safe water, this reduces the time women and children spend obtaining water, greatly decreasing the opportunity cost associated with doing so. With less time spent on unpaid labor, women now have more time to participate in economic activities and children are able to invest more time in education.

The interventions also promote economic equality between women and men by training and empowering women to earn wages through Sustainable Livelihood Practices (as described above), which has been accompanied by a reduction in gender-based violence in the project villages in Odisha. This is thought to be associated with an increase in women's incomes, reduced workloads, and increased representation in local government (Panchayati Raj Institutions) planning process. Additionally, in Bihar, women have been trained/ involved in water related issues, wetland restoration, and sustainable livelihoods and are active participants in the wetland restoration activities.

Participation

There has been a high level of participation through the engagement of task force groups, cooperatives, and other Community-based Organisations for participatory wetland management planning. Eleven task force groups and over 100 wetland champions have been sensitized to disaster risk reduction and conducted awareness raising on wetland and biodiversity conservation. Additionally, the Tampara Wetland Management Plan that initiated the wetland conservation and protection activities in the area was developed through a participatory approach and is centered around community members themselves participating in the wetland restoration. Key participants in the planning and implementation have included local Women's Self-Help Groups and Fish Cooperatives.

Capacity building

The interventions have enhanced the capacity of local communities and local governments through economic and environmental benefits. The transfer of knowledge is perpetuated through capacity building interventions, such as CBOs' role in Landscape Scale Risk Assessment (HVCA). These efforts ensure the wise use of wetlands, flood resilient farming, kitchen gardening, zero net fishing, and sustainable fishing strategies. Women's Self-Help groups have provided knowledge for duck rearing, plantation and marketing of Pandonus plant (*kewda*). The centrality of training and community participation to the interventions ensures that stakeholders have the necessary knowledge, skills, processes, and resources in place to continue these sustainable practices in the future, as well as adapt to future challenges that may arise.

Link to the full CBA report: Marta Vicarelli - Cost Benefit of Eco-DRR (google.com)

5

Lesson learned

Integration of both Eco-DRR and wetlands conservation in the operations of technical institutions, local CSOs and Community-based Organisations will ensure sustainability of results.

5.1. Project lessons learned

- Understanding the local context (historical, socio-economic, level of knowledge and attitude, etc.) is essential to ensure community engagement and secure ownership. This was done through baseline surveys, participatory risk profiling, and ecosystem services assessment. The results helped in devising Eco-DRR interventions, which are supported by the local communities.
- Adoption of hybrid solutions (grey and green structures) are the most appropriate resilience building measures as communities at-risk accorded higher scores for specific structural mitigation and also appreciated the roles of ecosystems and non-structural measures in reducing exposures & vulnerabilities.
- Identifying community-based volunteers and organisations to champion Eco-DRR has been effective in successful project implementation. Similarly, partnerships with landscape-based NGOs and knowledgeable local partners helped in developing Eco-DRR conscious wetlands management plans.
- Review of existing sectoral plans that guide developmental actions in the landscape was helpful in identifying entry points for Eco-DRR and its upscaling.

5.2 Gender Mainstreaming

Gender mainstreaming has been a vital component of Eco-DRR implementation in India, taking into consideration the gender nuances in India, which is very diverse from area to area. Engagement with male and female community members in planning and implementing Eco-DRR measures has been strategic and progressive. The project engaged with women as community members, female members of Panchayat Raj Institution/Local Self-Government, female school students, and various women-centric Community-based Organisations such as Self-Help Groups. This is to ensure their opinions, views and suggestions are reflected in baseline surveys, training, and implementing Eco-DRR actions. Women have a growing interest in participating in the decision-making process of local development plans (ward and Panchayat levels). It is necessary to engage with a local CSO partner on gender mainstreaming efforts at an early stage.

5.3. Recommendations for upscaling

- Build convergence between Eco-DRR and relevant developmental programs and schemes of the government to secure political leverage, funds, and cross-sectoral support.
- Establishing proof of concepts through extensive research on the roles of healthy wetland ecosystems in reducing disaster risks and managing climate risks.
- Establishing and advocating a plausible business case for Eco-DRR, which could be done through economic valuation of medium- and long-term advantages of Eco-DRR (cost and benefit analysis).
- Establishing a country-wide network of Eco-DRR or NbS experts, generating knowledge products and policy recommendations to pursue its upscaling in relevant policies and programs.

5.4. Recommendations for future Eco-DRR projects

- Designation of wetlands as protected areas (e.g Ramsar site) will ensure the conservation and management of this ecosystem with the best of available resources and political will.
- Integration of Eco-DRR actions into wetlands management plans shall have an adequate emphasis on institutional arrangements, wetland monitoring, and community participation to nurture wetland ecosystem services and address climate and disaster-related risks.
- Development of training manual and imparting Eco-DRR knowledge to local Disaster Management Authorities will facilitate the integration of this approach into their planning and actions.
- Integration of both Eco-DRR and wetlands conservation in the operations of technical institutions, local CSOs and Community-based Organisations will ensure sustainability of results.

This case study highlights Ecosystem-based-Disaster Risk Reduction (Eco-DRR) interventions in India focused on integrating Eco-DRR measures on improved water management into local development plans and schemes (such as disaster, wetlands and rural employment) through capacity-strengthening and participation of communities and (local) governments. The key risk being addressed within this context is how wetland degradation reduces community resilience against water-related hazards such as floods, droughts, and storm surges.