

Building Coastal Resilience for Disaster Risk Reduction (DRR) and
Climate Change Adaptation (CCA) in Small Islands in Concepcion,
Iloilo, Philippines

THE GREEN-GREY INFRASTRUCTURE (GGI) STORY OF
BARANGAY BACJAWAN NORTE
May 2022



The GGI Project in Bacjawan Norte, Concepcion was under the auspices of:

Building Coastal Resilience for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) in Small Island Communities through Green-Grey Infrastructure (GGI) Project
Municipality of Concepcion, Iloilo Province, Philippines
November 2015-June 2022

Supported by:

Fonds Français pour l'Environnement Mondial (FFEM)

Implemented by:

Conservation International (CI) Philippines in partnership with the Department of Environment and Natural Resources-Biodiversity Management Bureau (DENR-BMB) and the Local Government Unit of Concepcion in Iloilo Province

The community partners in the implementation of the GGI Project in Bacjawan Norte were:

The Barangay Council of Bacjawan Norte and the Tigbatas Fisherfolk Organization (TFO)

@Photos by Conservation International Philippines

Recommended Citation:

Conservation International Philippines. 2022. Building Coastal Resilience for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) in Small Islands in Concepcion, Iloilo, Philippines: The Green-Grey Infrastructure (GGI) Story of Barangay Bacjawan Norte. 14 pages.

Acknowledgment

The GGI story of Bacjawan Norte was prepared by Evangeline Miclat, Maria Josella Pangilinan and Lovella Magluyan of Conservation International Philippines.

The GGI design was prepared by the engineers of Bechtel.org¹ and Conservation International with inputs from the Municipal Engineering Office of the Local Government of Concepcion and the local community of Bacjawan.

Additional inputs to the green solutions were provided by the Municipal Planning and Development Office and Coastal Resources Management Office of the Local Government of Concepcion, and the Department of Environment and Natural Resources- Community Environment Natural Resources Office-Sara.

Guidance in the preparation of GGI designs was provided by the members of the Scientific and Technical Advisory Group, i.e., Mr. Tam Nguyen (Bechtel Corporation), Dr. Emily Pidgeon and Engr. Emily Corwin (Conservation International), Dr. Severino Salmo III (Ateneo de Manila University), Dr. Earl Dranreb Juanico (Technological Institute of the Philippines), and Engr. Takashi Hino (Taisei Corporation).

Overall management of the GGI Project was by Enrique Nunez, Jr., Country Executive Director of Conservation International Philippines.

Partners, consultants, and CI Technical and Operations staff are acknowledged for their valuable support.

¹ Bechtel.org is a social enterprise that was established to deliver Impact Infrastructure to help improve the lives of people.

Table of Contents

List of Figures _____	iv
Introduction _____	1
The Green-Grey Infrastructure (GGI) Project in Barangay Bacjawan Norte ____	3
Rationale for GGI Solutions in Bacjawan Norte _____	3
Results _____	4
Green-grey solutions and benefits _____	4
Livelihood Incentive _____	9
Strengthening TFO as a community organization _____	10
Capacity building on Disaster Risk Reduction and Climate Change Adaptation _____	10
Challenges and Lessons Learned in implementing the GGI Project in Bacjawan Norte _____	12
Sustainability, conclusion and recommendations _____	13

List of Figures

Figure 1. The FFEM-GGI Project sites in Concepcion, Iloilo, Philippines.....	2
Figure 2. Green-grey infrastructure design for Bacjawan Norte.....	3
Figure 3. Map of green-grey interventions in Barangay Bacjawan Norte, Concepcion, Iloilo.....	4
Figure 4. Manual piling of stones by TFO members during low tide.....	5
Figure 5. Detailed design of the permeable living breakwater in Bacjawan Norte....	5
Figure 6. The 108-m permeable living breakwater in Bacjawan Norte.....	6
Figure 7. Community members from Bacjawan Norte collect shellfish and crabs near the breakwater.....	6
Figure 8. Mangrove seedlings produced in Bacjawan Norte.	7
Figure 9. Mangrove outplanting site in Bacjawan Norte.	7
Figure 10. Mangrove enrichment planting in Bacjawan Norte, 11-17 May 2021.....	8
Figure 11. View of the planted mangrove seedlings and the living breakwater at high tide.....	8
Figure 12. The breakwater reduces wave energy before it hits the shore and provides protection	9
Figure 13. Signages of poultry farm (left) and poultry coop (right).....	10
Figure 14. Left: eggs being loaded in the setter. Right: chicks from hatched eggs in the hatcher.....	10

Introduction

The Philippines is highly vulnerable to the impacts of climate change that include sea level rise, increased frequency of extreme weather events, rising temperatures, and extreme rainfall. This is due to its high exposure to natural hazards (cyclones, landslides, floods, droughts), dependence on climate-sensitive natural resources, and vast coastlines where all its major cities are located and most of the population reside. This exacerbates the increasingly depleting natural and marine resource base that supports livelihoods and provide critical ecosystem services to communities such as shoreline protection, flood control, soil stability, and habitats for biodiversity. Nature-based solutions (NBS) are considered strategic priorities by the government due to its remarkable potentials for enhancing national and local resilience to various climate change impacts.

The Fonds Français pour l'Environnement Mondial (FFEM) supports projects that strengthen coastal resilience, help coastal communities adapt to climate change, and are replicable and innovative. From November 2015 to June 2022, the agency supported the implementation of the 'Building Coastal Resilience for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) in Small Island communities through Green-Grey Infrastructure (GGI) Project"², in Concepcion, Iloilo, which was one of the severely devastated areas by Typhoon Haiyan in the Philippines in 2013. The project aimed to demonstrate the potential for natural systems to adapt to the consequences of climate change and the relevance of setting up grey (classic/traditional engineering) and green (ecosystems conservation) infrastructures to build resilience into coastal territories and communities especially during typhoons. The combined green-grey solutions are expected to have greater benefits to building climate change resilience and adaptations than the use of just one of two approaches.

To evaluate and select specific sites for green-grey infrastructure (GGI) implementation, a technical feasibility study was conducted, and results were subjected to stakeholder consultations. Based on vulnerabilities to climate change, mitigation potential, and applicability of green-grey engineering solutions, four (4) sites - Bagongon, Tambaliza, Loong and Bacjawan Norte - were selected for green-grey solutions, and one (1) site – Polopina - was considered for implementation of green solutions (Figure 1). The green solutions in Polopina, however, supported the implementation of green-grey solutions in other sites and contributed to the overall objective of building coastal resiliency in the Municipality of Concepcion.

Conservation International (CI) Philippines adopted a community-build model in the implementation of the GGI Project in Concepcion. The model emphasized the participatory, person-centered approach in designing, planning, implementing, assessing, and evaluating the project. Site-based GGI projects³ were implemented by community organizations with funding support and technical assistance from CI Philippines. To become effective partners in the implementation of this innovative approach in building coastal resiliency to the effects of climate change, capacity

² The implementation of the FFEM-GGI Project was covered by a Memorandum of Understanding (MOU) between the DENR-Biodiversity Management Bureau and Conservation International (CI) Philippines and the MOU between the Local Government of Concepcion and CI Philippines

³ In addition to the MOU between the Local Government of Concepcion and CI Philippines, site-based implementation was covered by Barangay Resolutions and Conservation Agreements among the Local Government of Concepcion, concerned Barangay Council, concerned implementing community organization and CI Philippines.

building activities on ecosystem-based adaptation and GGI, mentoring support, organizational development programs, and livelihood incentives were provided to partner community organizations.

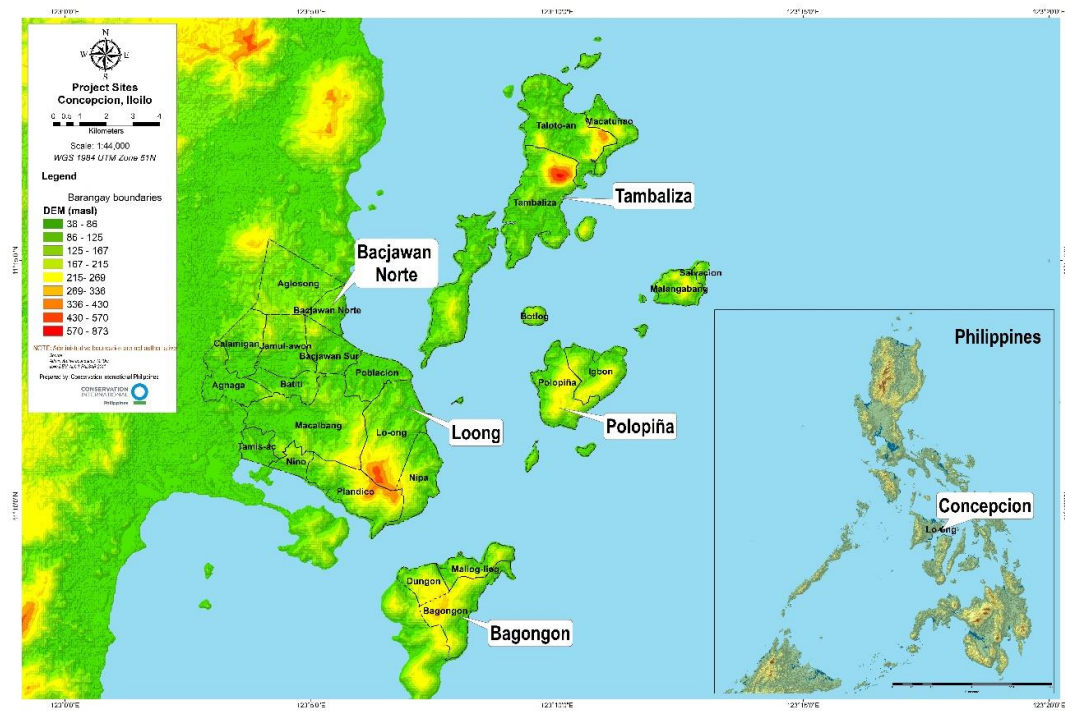


Figure 1. The FFEM-GGI Project sites in Concepcion, Iloilo, Philippines.

The Green-Grey Infrastructure (GGI) Project in Barangay Bacjawan Norte

Rationale for GGI Solutions in Bacjawan Norte

Bacjawan Norte is a lowland coastal barangay in Concepcion that is annexed to the mainland. It is composed of six (6) smaller units called *sitios*, which are situated in the northeastern part of mainland Concepcion. The barangay is accessible by land through all types of vehicles and by sea. Its wide beach area is part of Concepcion Bay. Its physical location and position in the bay make it exposed to open seas and defenseless against coastal hazards, such as, storm surge, monsoon winds and strong wave action. Its coastline is lined with patches of mangroves, which have been mostly cleared in the past decade for timber, housing material, fuel, human settlements, and boat docking. As mangrove trees are only in patches, they cannot serve as barriers to strong waves and storm surges. Mangroves left are mostly species of *Avicennia*, *Sonneratia* and *Rhizophora* with stunted growth.

For Bacjawan Norte, therefore, the project design consisted of mangrove restoration (green solution) and establishment of a permeable living breakwater (grey solution) adjacent to the mangrove restoration area (Figure 2). The living breakwater is designed to reduce wave energy, to facilitate sediment accumulation that favored mangrove growth and restoration, and as aid to natural shell colonization. The permeability of the breakwater in Bacjawan Norte allows it to serve as dwelling for juvenile fishes and shallow-dwelling shellfish thus the term “living breakwater”. If maintained, the living breakwater can be an immediate source of supplemental food and livelihood for community members.



Figure 2. Green-grey infrastructure design for Bacjawan Norte.

As an incentive to the community members, who actively implemented the GGI project, assistance for livelihood development (i.e., organic native chicken production) and appropriate capacity building support for climate change adaptation (CCA) and disaster risk reduction (DRR) were provided.

Results

The GGI project in Bacjawan Norte was implemented in partnership with the Tigbatas Fisherfolk Organization (TFO). Figure 3 summarizes the interventions and accomplishments of the GGI Project implementation in Bacjawan Norte.

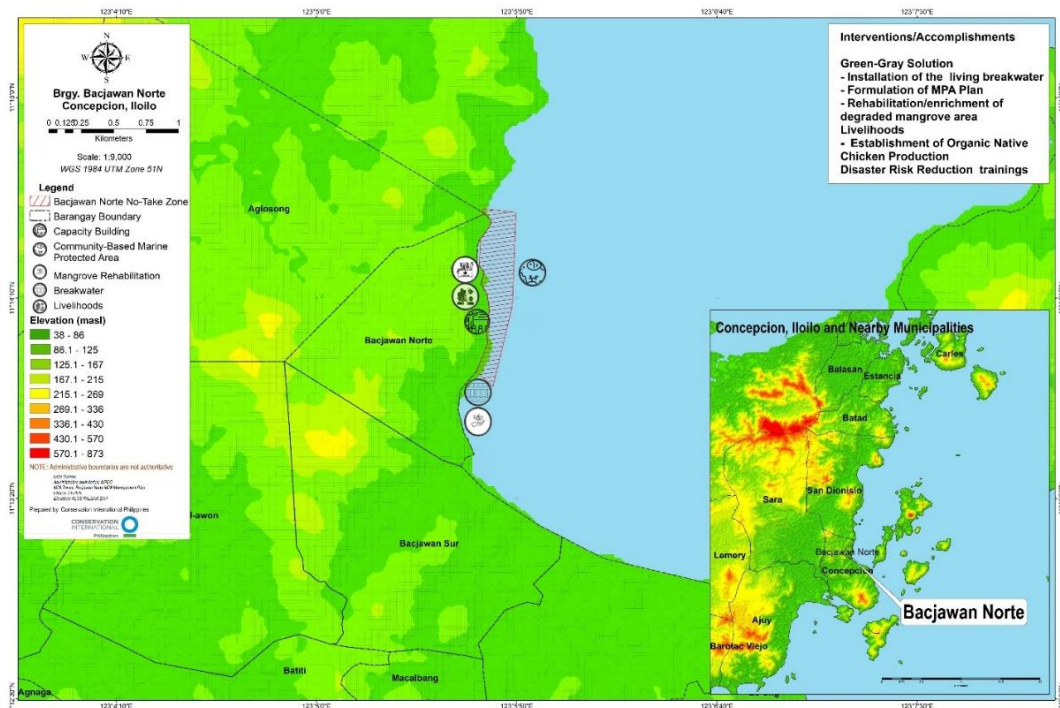


Figure 3. Map of green-grey interventions in Barangay Bacjawan Norte, Concepcion, Iloilo.

Green-grey solutions and benefits. The permeable living breakwater was installed to promote sediment accumulation in the target area for mangrove restoration, protect communities along the coasts, and serve as shellfish (oyster) reef where shellfish gathering could be done by women and children in the community. The grey structures that were piloted in Bacjawan Norte were also intended to be movable, in case, necessary adjustments in the orientation or location of the structure had to be done.

TFO members constructed the breakwater in 57 days between 2 September 2019 and 8 March 2021. Work was interrupted due to several factors that included sea and weather conditions and COVID-19 pandemic issues. During high tide, stones were placed on a raft and dropped in designated spots along the coast and during low tide, stones were piled manually (Figure 4) according to the detailed design of the living breakwater (Figure 5).



Figure 4. Manual piling of stones by TFO members during low tide.

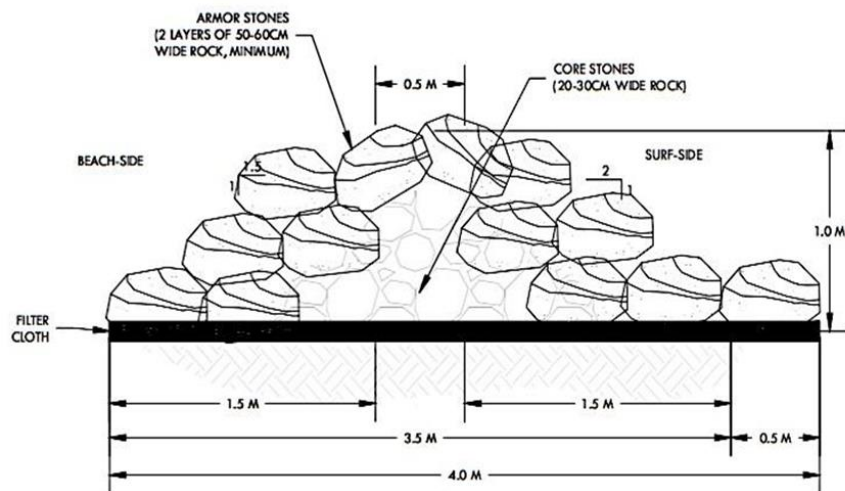


Figure 5. Detailed design of the permeable living breakwater in Bacjawan Norte

In the scope of work for the grey infrastructure in Bacjawan Norte, the planned 115-meter breakwater could be constructed using 200-cubic meter armor stones and 120-cubic meter core stones. However, there were issues in the volume and sizes of the stones that were delivered to Bacjawan Norte. For example, one delivery included blasted and not pre-cut stones and thus included stone rubbles, which do not fit the design of the breakwater. Another delivery included oversized stones, which could not be used as they were too heavy for manual piling by TFO members. As a result, the *permeable living breakwater constructed by TFO for Bacjawan Norte measured 108 meters* (Figure 6). Nonetheless, the difference of seven meters in length from the original breakwater design does not diminish the intended purpose of the living breakwater as informed by the GGI engineer of Conservation International.



Figure 6. The 108-m permeable living breakwater in Bacjawan Norte.

After the completion of the breakwater construction, women, and children in the community started shell gleaning in the breakwater for home consumption and selling (Figure 7). A TFO member (personal communication May 2021) living near the breakwater narrated:

“Damo na sisi kag sihi sa breakwater subong nga bulan. Kaisa may botlog kag pungsuran. Sa isa ka oras nga panginhas, makakuha ka sobra isa ka kabo nga pankinhason. May pang sud-an na sa panyapon. Kung makatsamaba ka, my sili-sili pa.” (There are many rock oyster (*Crassostrea* sp.) and nerite shells (*Nerita* sp.) this year. Sometimes there are turban shells (*Turbo* sp.) and rock shell (*Thais* sp.). In an hour of gleaning, you can get more than one dipper of shellfish. We will have viand for dinner. If you are lucky enough there are also eels”.

The Barangay Council allotted budget for maintenance costs of the breakwater amounting to PhP 5,000.00 or \$97.75.00 charged against the 2021 Annual Investment Plan (AIP) under Preparedness Pillar for the Barangay Disaster Risk Reduction and Management (BDRRM) Fund.



Figure 7. Community members from Bacjawan Norte collect shellfish and crabs near the breakwater.

The increased sediment accumulation brought about by the breakwater made the area ready for mangrove enrichment planting. To support the enrichment planting and mangrove rehabilitation in Bacjawan Norte, a 375-meter mangrove nursery was established. The nursery housed the mangrove wildlings and propagules collected by TFO from the barangays of Bacjawan

Norte, Bacjawan Sur, and Tambaliza and from the neighboring municipality of San Dionisio. TFO members monitored and maintained the nursery to meet the seedling production required to rehabilitate 2 hectares of mangrove area. From the nursery, TFO was able to produce a total of 25,000 mangrove seedlings (Figure 8), which consisted of *Ceriops sp.* (tangkal), *Avicennia* species and *Rhizophora apiculata* and *R. mucronata* (bakhaw) for planting to the designated rehabilitation area near the living breakwater. (Figure 9).



Figure 8. Mangrove seedlings produced in Bacjawan Norte.



Figure 9. Mangrove outplanting site in Bacjawan Norte.

The outplanting site is covered by the Mangrove Rehabilitation and Management Plan approved by the Barangay Council of Bacjawan Norte. Hauling of seedlings from the nursery to the outplanting site could only be done during high tide, i.e. once in the morning and once in the evening. Hauling took 5 days and entailed 22 boat trips.

A total of 120 TFO and non-TFO members of the community participated in the planting from May 11 to May 17, 2021 (Figure 9). Each one planted at least 150 seedlings according to the guidelines provided during the pre-planting orientation.



Figure 10. Mangrove enrichment planting in Bacjawan Norte, 11-17 May 2021.

As a result, 2.5 hectares of degraded mangrove area near the installed breakwater were covered by the produced mangrove seedlings (i.e., 250,000) through enrichment planting, and thus exceeded the project's target of 2 hectares for Bacjawan Norte (Figure 10 and Figure 11).



Figure 11. View of the planted mangrove seedlings and the living breakwater at high tide.

After two months of planting, survival was noted at 95%. The mortality was due to strong waves that uprooted the seedlings near the edges of the mangrove rehabilitation area. Several groups and organizations have directly planted mangroves in the area over the past years but with little or zero survival rate (personal communication with a Barangay Kagawad in May 2021). With the aid of the living breakwater, waves' strength and height are minimized before they hit the coast (Figure 12), thus planted mangroves survive. TFO will continue to monitor and replace dead and damaged mangrove seedlings to ensure their survival.



Figure 12. The breakwater reduces wave energy before it hits the shore and provides protection to the mangrove rehabilitation area and coastal communities.

Livelihood incentive. As an incentive for the community participation in GGI project implementation, a livelihood grant was awarded to TFO. Organic production of native chicken was identified by the community as the livelihood project in Bacjawan Norte based on value chain analysis and business planning workshops. The objective was to establish a sustainable source of native chicken for Bacjawan Norte and to bridge the gap in native chicken production in Concepcion. Intended products are organic live chicken, poultry meat, and native chicks and eggs. To establish this livelihood, **TFO was provided with the following: 1) training on organic chicken production; 2) necessary equipment and materials, e.g., egg incubators and ingredients for feed production; and 3) materials and labor support for the construction of a facility for native chicken production.** The facility consists of the grow-out, breeding, incubation and hatching, and chick-rearing coops, as well as area for organic feeds preparation and poultry farm water system. The Tigbatas Native Chicken Poultry Farm (Figure 13) sits in the 360-square meter lot leased by TFO members for a period of 10 years, renewable every five years. This supplemental livelihood (Figure 14) can help lessen the dependence of TFO members on natural resource extraction while they continue to monitor and maintain their the GGI project. Additionally, an 8-module native chicken production guidebook in local language was developed for TFO. The module elaborates the concept of organic native chicken production, setting up sites for poultry farm, flock health management, flock nutrition management and breeding techniques. Having a module facilitates retention of learning by TFO members that was derived from training provided by the project and transfer of learning to new TFO or community members, who in the future will be engaged in this supplemental livelihood.



Figure 13. Signages of poultry farm (left) and poultry coop (right)



Figure 14. Left: eggs being loaded in the setter. Right: chicks from hatched eggs in the hatcher in the Tigbatas Native Chicken Poultry Farm.

Strengthening TFO as a community organization. The GGI project was TFO's first externally funded project through a cash grant. Thus, individual capacity of members and overall organizational capacity to become effective partners, especially in an innovative project like GGI, had to be developed. To this end, Organizational Development (OD) sessions were conducted for TFO and benefitted the members in the following ways:

- o Awareness and recognition of their individual and organizational strengths and weaknesses through the Participatory Organizational Analysis Process (POAP)
- o Learning on organizational commitment, change engagement, and value formation, and acknowledgement of division of responsibilities in GGI project implementation.
- o Improvement in managing the organization, administrative procedures, and financial accounting, including the establishment of rules on livelihood profit sharing, and ensuring funding for TFO projects
- o The training on rules and policies paved the way for the updating and ratification of the TFO Constitution and By Laws. TFO was able to come up with a TFO Manual of Operations which will serve as TFO's guide in its functioning as an organization.

Capacity building on Disaster Risk Reduction and Climate Change Adaptation (CCA). The communities in Bacjawan have been provided with capacity-building support on DRR-CCA by humanitarian and development organizations

as part of the Typhoon Yolanda (Haiyan) rehabilitation since 2013. They also have ready access to the support coming from the local government of Concepcion in view of its location in mainland Concepcion. However, there is still a need to further develop their capacities for DRR and CCA. Among the support provided through the GGI project implementation in Bacjawan Norte were:

- o Training on First Aid and Basic Life Support⁴ for selected members of TFO and the Barangay Council of Bacjawan; and
- o Development of the Barangay Disaster Risk Reduction and Management Plan for Bacjawan Norte which also included Climate Change Adaptation.

⁴ The conduct of the training was covered by a Memorandum of Understanding between the Philippine Red Cross and CI Philippines.

Challenges and Lessons Learned in implementing the GGI Project in Bacjawan Norte

Uncertainties hampered project implementation and challenged the strategies employed for the GGI project implementation. In 2020, the project encountered mobility problems brought about by the COVID-19 pandemic. Several activities were postponed and cancelled. Meetings became limited to at least once a month. Bringing in experts from Iloilo City to provide technical assistance became difficult due to stringent travel protocols implemented by the Concepcion local government. The solution was to tap local knowledge in livelihood training; thus, a farmer-to-farmer learning approach was adopted in establishing the organic native chicken farm in Bacjawan Norte. The physical set up of the meeting place was modified to accommodate the number of participants from TFO while observing social distancing requirement issued by the government.

Also because of the limitations brought about by Covid-19 pandemic, community members could not attend project meetings because they needed to work and make ends meet when they had windows for livelihood activities during the pandemic. Even livelihood related activities of the project were set aside because they had to opt for higher income opportunities to support their families.

One of the objectives of the GGI project is to prove that ecosystems when conserved and/or restored and aided by grey solutions can provide measurable social, environmental, and economic benefits. However, these cannot be measured within the lifespan of the GGI project as these benefits can only be demonstrated over longer period.

Sustainability, conclusion, and recommendations

The GGI Project funding support contributed to building coastal resilience of the communities of Bacjawan Norte to climate change and disaster risks through:

- The establishment of a 2.5-ha mangrove rehabilitation area where enrichment planting was conducted and will be continued by the community to maintain the green solution to shoreline protection.
- The establishment of a mangrove nursery that will be maintained by TFO to be the source of seedlings for necessary enrichment planting.
- The establishment of a 108-m permeable living breakwater, which facilitates sediment accumulation and mangrove growth in the rehabilitation area, minimizes wave impacts on the shore, and provides food and supplemental livelihood for shellfish gatherers.
- The establishment of an organic native chicken production livelihood as incentive to the community members who implemented the GGI project.
- The organizational development of TFO as a lead for GGI implementation and maintenance of the green-grey solutions in the locality and manager of livelihood programs.
- The enhancement and deepening of the understanding by the community of climate change issues and the significance of ecosystem-based adaptation and innovative approaches like GGI, in mitigating the impacts of climate change and related disasters and risks.
- The enhanced preparedness of the community for CCA and DRR.
- The development of the Bacjawan Norte Mangrove Rehabilitation Plan adopted by the Barangay Local Government Unit, which allocated the amount of Five Thousand Pesos (PhP 5,000.00) in its 2021 Annual Investment Plan Budget for maintenance of the living breakwater.
- The recognition of GGI as a CCA solution in the Bacjawan Norte Barangay Disaster Risk Reduction and Management Plan (BDRRMP).

The GGI community-build model emphasized that participatory and community-based strategies are valuable in project implementation. There is a strong foundation when local leaders and organizations are engaged, thus it is recommended that established people's organizations be tapped for effective project implementation. People's Organizations are not political entities; thus, officers and members do not have term limits so project implementation may not suffer from turnover of personnel. Inter-sectoral collaboration with other organizations and community sectors is also important. This was realized during mangrove planting when the activity was not limited to TFO members.

Coastal communities are vulnerable to the effects of the changing climate. Disasters such as strong typhoons can wipe out entire livelihoods. As a coping mechanism, secured funding support is therefore recommended for long term sustainability of the GGI. TFO has set aside 2.5% of the poultry farm's net income as disaster fund which they can use to revive the business just in case a disaster affects it. The Barangay Council which has secured yearly funding through its internal revenue allotment can be involved in the GGI project maintenance. The initiative of the local government of Concepcion is critical in promoting the good results of the project

and in leveraging further support from other government agencies, funding institutions, and other partners to maintain the GGI and sustain the initiatives towards increasing coastal resiliency in Bacjawan Norte.

Coastal resiliency benefits from GGI interventions will not be realized right away but in the coming years. A pre-condition however is that these green-grey infrastructures should be maintained for them to provide coastal protection in the long term. Maintenance means continuous replacement planting of mangroves that do not survive, monitoring of the planted mangroves and the entire rehabilitation area, maintenance of the mangrove nursery as source of seedlings for mangrove planting, continuous monitoring of the integrity of the grey structures, enforcing regulations to protect the mangroves and nursery, setting up regulations on the use of breakwater for shellfish and seafood gathering, sustaining community awareness building and participation in relevant activities, and incorporation of these green-grey solutions in policies and development programs of the local government to facilitate budget allocation and funding support.

The GGI Project in Bacjawan Norte is covered by a Conservation Agreement signed by CI Philippines, the Local Government of Concepcion, Barangay Council of Bacjawan Norte and TFO. The roles of each signatory in the implementation of the GGI project and the maintenance of the infrastructures for a period of five (5) years beginning 2021 are stipulated in the Conservation Agreement. The implementation of the agreement is just one modality to sustain GGI in Bacjawan Norte.

The Local government of Concepcion is at the forefront of promoting the good results of the GGI project. These results can be utilized in leveraging further support from other government agencies, funding institutions, and would-be partners in the academe and private sector to sustain and expand ecosystem-based adaptation in Bacjawan Norte and increase coastal resiliency in Concepcion.



For more information, you may contact:

Municipal Planning and Development Office (MPDO)
Local Government of Concepcion
Concepcion, Iloilo
Email address: rsobremonte.mpdc18@gmail.com

Maria Josella Pangilinan
Director for Climate Resilience Program
Conservation International Philippines
Units 401-A&D, Culmat Bldg.
1270-1330 E. Rodriguez Sr. Avenue
Quezon City, Philippines
Contact details: mpangilinan@conservation.org
(+6392855079223)
ci-philippines@conservation.org (+63 2 8571 3761;
+63 2 8571 3767)