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

THE GREEN-GREY INFRASTUCTURE (GGI) STORY OF BARANGAY BAGONGON

May 2022

CONSERVATION INTERNATIONAL Philippines

FONDS FRANÇAIS POUR L'ENVIRONNEMENT MONDIAL

The GGI Project in Bagongon, 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 Barangay Council of Bagongon and the Bagongon Fisherfolk Association (BFA)

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-Gray Infrastructure (GGI) Story in Barangay Bagongon. 19 pages.

Acknowledgment

The GGI story of Bagongon 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.org[1] and Conservation International with inputs from the Municipal Engineering Office of the Local Government of Concepcion and the local community of Bagongon.

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

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 projects[3] 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.

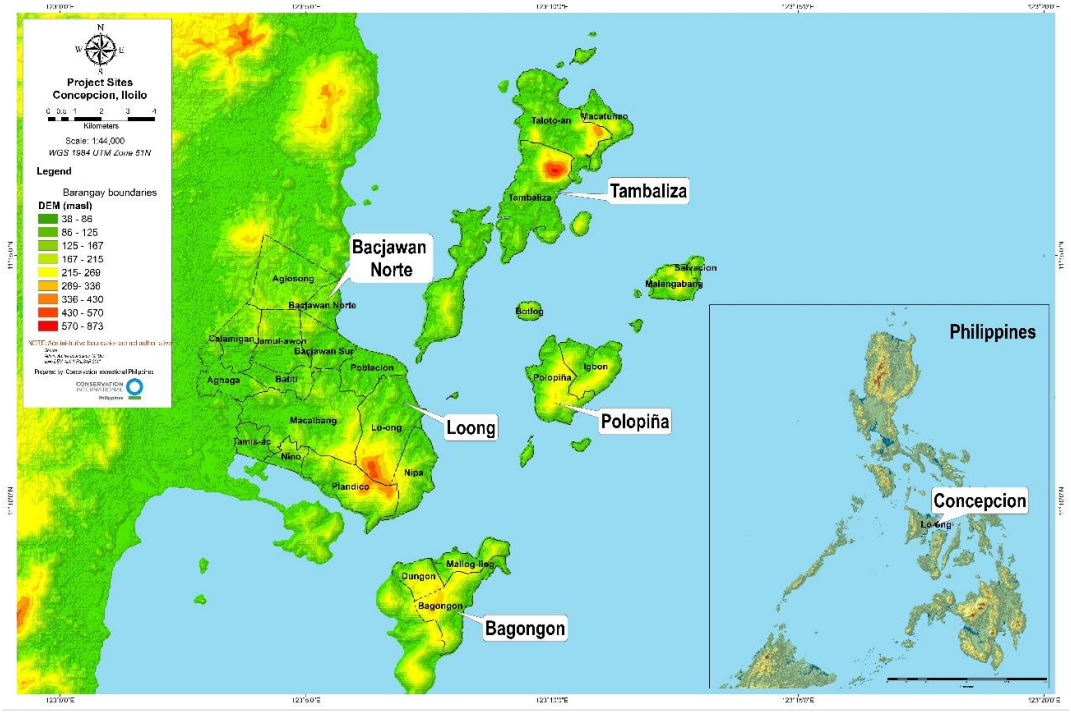

Figure 1. The FFEM-GGI Project sites in Concepcion, Iloilo, Philippines.

The Green-Grey Infrastructure (GGI) Project in Barangay Bagongon

Rationale for GGI Solutions in Bagongon

Bagongon is an island village in Concepcion, Iloilo located at the southeast portion of the municipality. It has an area of 416.09 hectares with coastline length of approximately 4 kilometers and a 150-meter-wide intertidal zone. The overall landscape of this island is steep and rugged, and mostly covered with bamboo and coconuts. The beach is shallow and narrow, and generally covered with fine white sand. Some portion of the beach going towards the south of the island is covered with coarse white sand and rocks. Its tidal flat is approximately 500 meters wide. The beach in the barangay proper is somehow coved.

Bagongon is composed of six *puroks*. It is 14 kilometers away from the town proper and is accessible only by an hour boat trip. It is very much exposed to open sea since it directly faces the Visayan Sea. The winds and the waves get relatively stronger in the area during the southwest monsoon season, which usually occurs in the months of June to October. An old seawall still exists behind the beach but requires repair. A proposal for its expansion is pending with the Office of Civil Defense. During typhoons and strong monsoon winds, the island community of Bagongon is practically totally isolated from mainland Concepcion. Most of the population are densely concentrated (489 households) in a cove where the storm surge potential is high. Ninety-five percent (95%) of the households are dependent on fishing, which becomes adversely affected during harsh sea conditions. Most of the women have no stable livelihood. There are 349 households, which are directly exposed to storm surge and sea level rise as they are located within 40 meters from the coastline with 172 of these made of light materials and can be easily damaged by strong winds. Additionally, flooding from uphill and stormwater run-off is prevalent in Bagongon. The overall situation places Bagongon among the top vulnerable communities in the municipality of Concepcion.

The technical feasibility study conducted by CI[4] showed that Bagongon ranked the highest, of seven barangays assessed, for integrated green-grey solutions. In terms of engineering fitness, Bagongon has a high potential for breakwater installation. It also has good potential for mangrove restoration due to good substrate and beach profile. The site includes a few remnant patches of mangroves and beach forests. Existing mangroves along the shoreline are dominated by *Sonneratia alba (pagatpat)* and *Avicennia marina (bungalon)*. A Community-Based Marine Protected Area (MPA) composed mostly of coral reefs has also been established in the waters off the barangay, but MPA regulations are not fully enforced due to the community's limited capacity. According to elders in the community, Bagongon had a significantly wider beachfront as recently as the 1980s, but that beach erosion started after the mangroves lining the shoreline were cut down for construction material. Based on the accounts of community members, the beachfront extended around 200 meters farther from the current shoreline area and houses used to occupy this part of the coastal area.

[4] Conservation International. 2018. Technical Feasibility Study: Building coastal resilience for disaster risk reduction and climate change adaptation in small island communities in the Philippines through green-grey infrastructure. 110 p. + 4 attachments.

Thus, the objectives of the identified GGI project in Bagongon were 1) to rebuild coastal sediment to replant with mangroves; 2) to halt the on-going beach erosion; and 3) to reduce the effects of extreme weather events on residents living in the Bagongon cove.

To this end, the GGI project design in Bagongon consisted of a combination of wave attenuation fences, sediment trapping fences, and low-crest semi-permeable breakwater as grey solutions, and mangrove restoration and the establishment of a community-based Marine Protected Area (MPA) as green solutions (Figure 2).

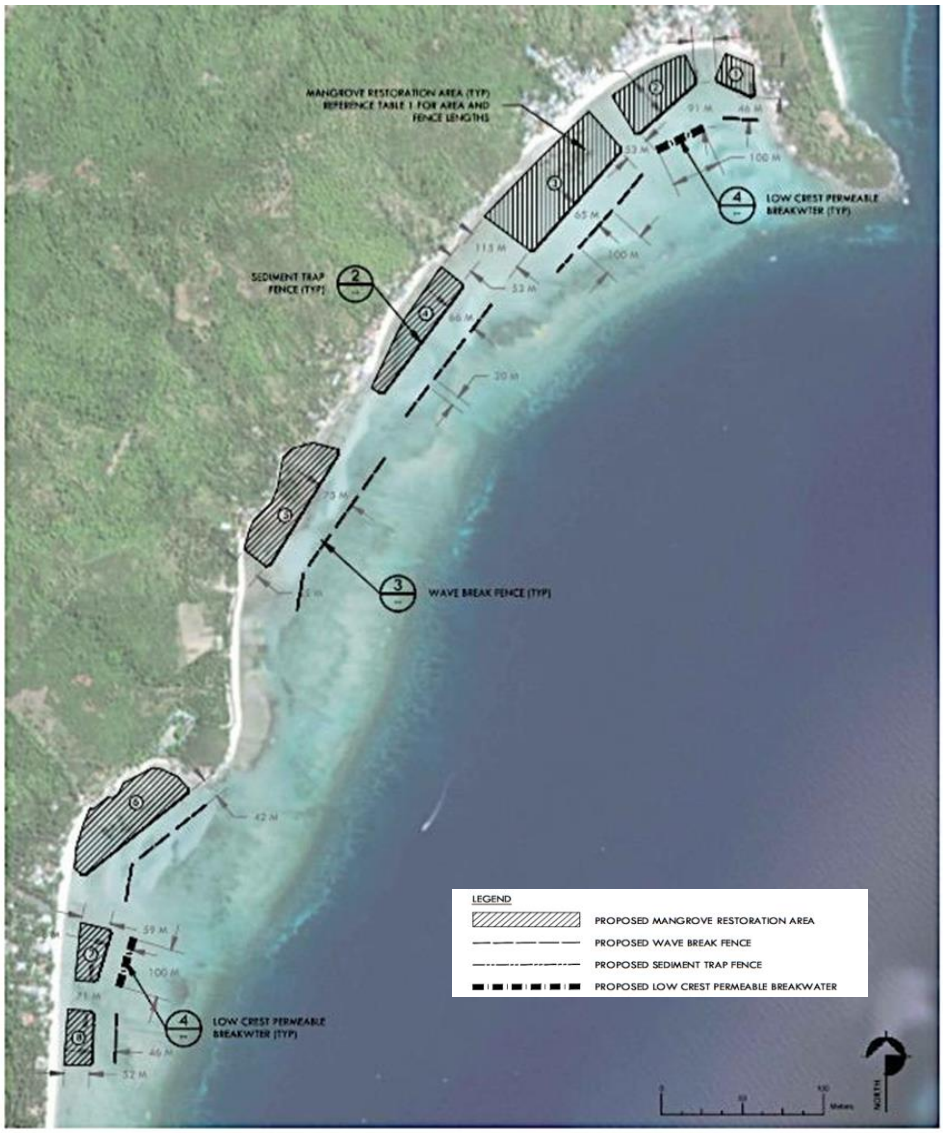

Figure 2. Green-grey infrastructure design in 8 sites in Bagongon.

Results

The GGI project in Bagongon was implemented in partnership with the Bagongon Fisherfolk Association (BFA). Figure 3 summarizes the interventions and accomplishments of the GGI Project implementation in Bagongon.

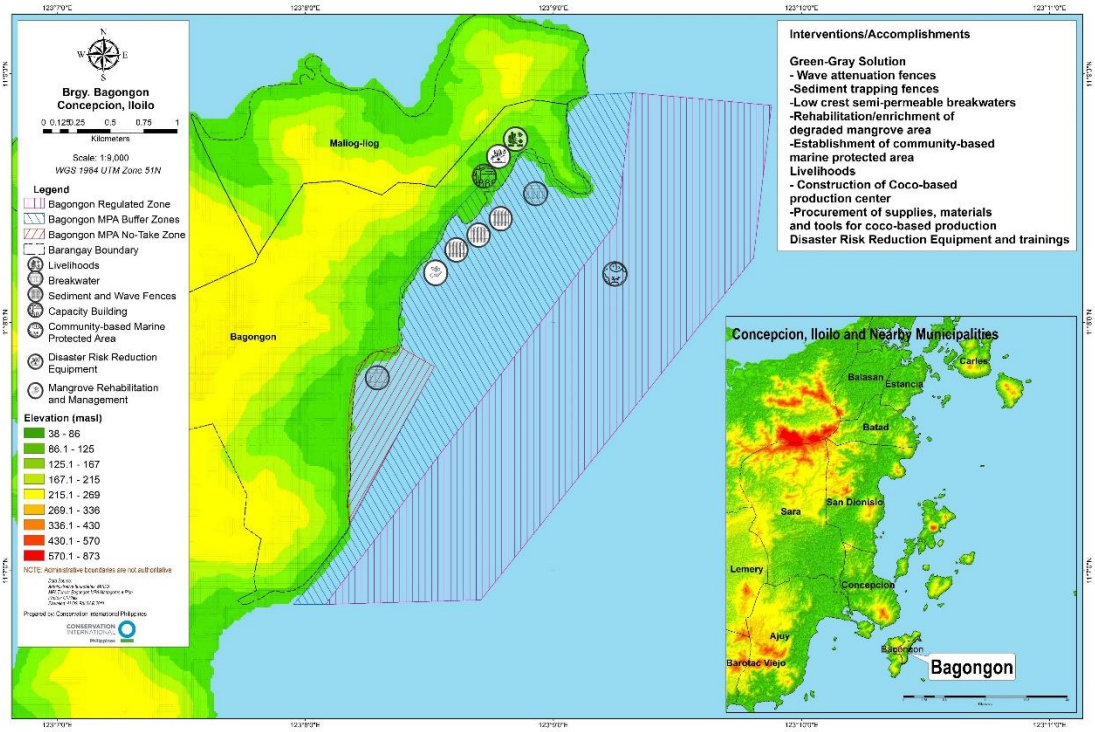

Figure 3. Map of green-gray interventions in Barangay Bagongon, Concepcion, Iloilo.

Green-gray solutions and benefits. BFA members constructed eight (8) wave attenuation fences with a total length of 1,145 meters, extending from Purok Proper to Palina in Bagongon. This is shorter than the planned length by nine (9) meters to accommodate the community's request for boat passage and navigation. The wave attenuation fences were made of two layers of bamboo poles separated by 0.5 meters, with the spaces in-between filled with smaller coconut branches. The smaller branches aim to move with the wave action and absorb the wave energy (Figure 4). The wave attenuation structures were placed on the "surf side" of sediment trapping fences to reduce the effects of wind waves and storm surge on the communities and prevent coastal erosion until the mangrove rehabilitation (green solution) is in place. Five (5) sediment trapping fences spanning 895 meters were also constructed. The sediment trapping fence was set on the beach side of the wave attenuation fence. The sediment trapping fence has one row of 5-cm diameter poles, placed very closely together with a layer of bamboo mat attached. Support frames were attached to both sides of the sediment trap fence for added stability (Figure 5). The ends of the sediment trapping fence were angled at 45 degrees towards the beach and each end measured 10 meters in length (Figures 6-7).

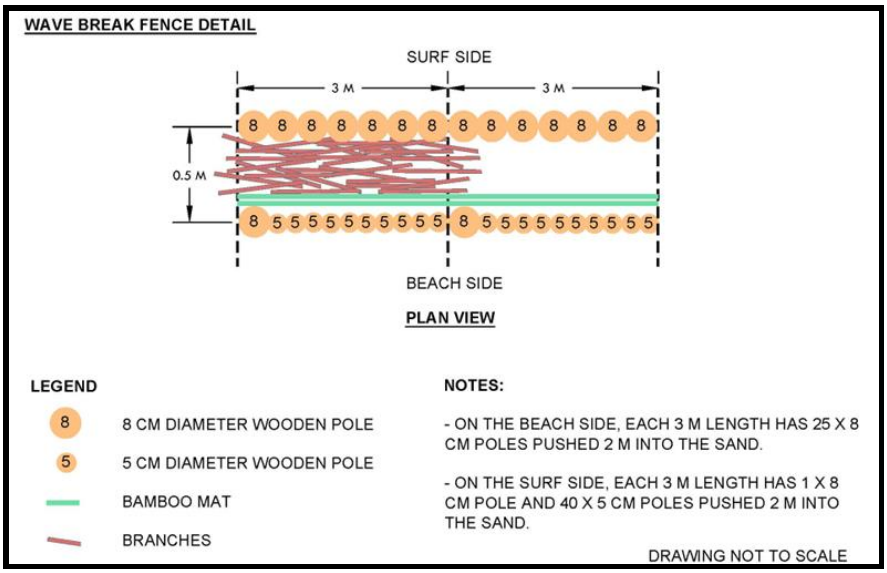

Figure 4. Details of the wave attenuation fence.

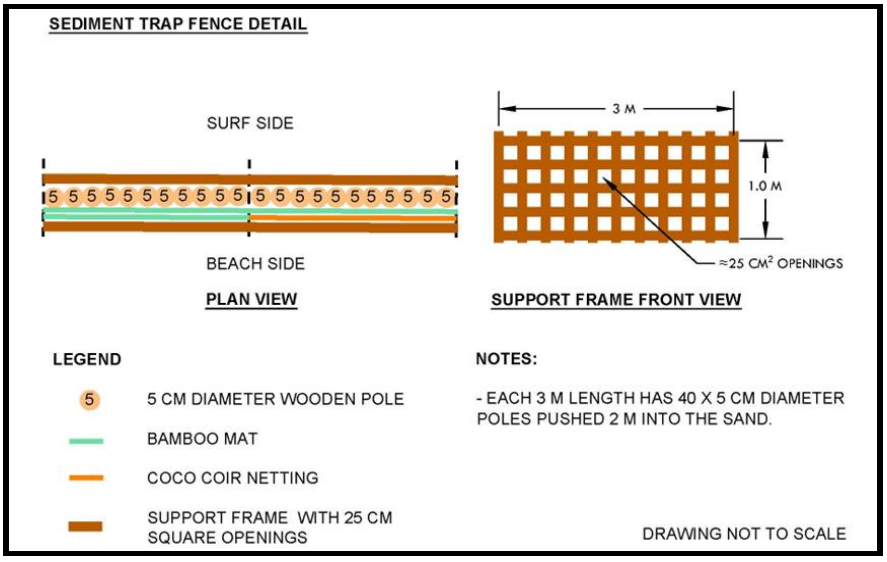

Figure 5. Details of sediment trapping fence.

Figure 6. Top view of wave attenuation fence (right) and sediment trapping fence (left).

Figure 7. Wave attenuation fence (left) and sediment trapping fence (right).

All the wave attenuation fences, and sediment trapping fences were completed in December 2019. However, during the October 2020 typhoon, strong winds and waves damaged portions of the wave attenuation fences. Reinforcement of the structures with stones were done in April-May 2021 in three (3) out of eight (8) sites, where attenuation fences were built in Bagongon. A total length of 160 meters with 0.5-meter height stone reinforcement were installed in the damaged wave attenuation fences in Site 1 (15 meters), Site 3 (65 meters) and Site 6 (80 meters) (Figures 8-10).

Figure 8. Stone reinforcement in the wave attenuation fence in Site 1 in Bagongon

Figure 9. Stone reinforcement in the wave attenuation fence in Site 3 in Bagongon

Figure 10. Stone reinforcement in the wave attenuation fence in Site 6 in Bagongon

In March 2020, the construction of the low crest semi-permeable breakwaters was initiated. It was put on halt in the following months by the lockdowns imposed due to pandemic brought about by the spread of the COVID-19 virus. It was picked up in June 2020 when some restrictions were relaxed but work was again interrupted by typhoons and harsh sea conditions. Finally, in December 2020, two (2) units of 75-linear meter low crest semi-permeable breakwaters were installed in Bagongon – one in Purok Proper and another in Purok Palina. The breakwaters are made of core stones with armor stones placed along the exterior, with an underlying coco coir geonets between the placed stones and native bed material (Figures 11-12).

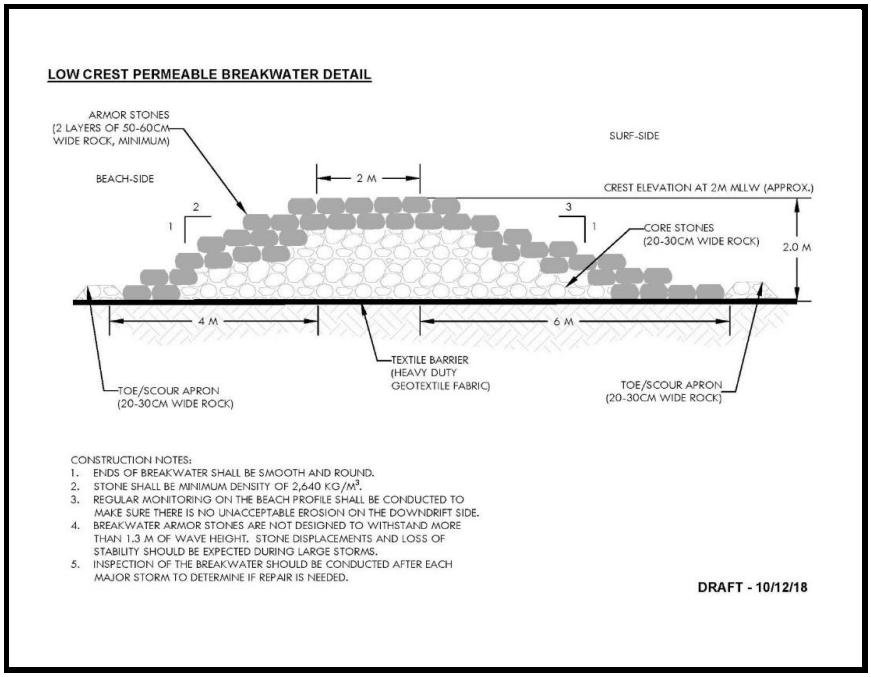

Figure 11. Details of breakwater in Bagongon.

Figure 12. Low crest semi-permeable breakwaters in Purok Proper (left) and Purok Palina (right) in Bagongon.

Around 250 BFA members built the wave attenuation fences, sediment trapping fences and low-crest semi-permeable breakwaters. The men were involved on the actual construction of the grey solutions, while the women were involved in the weaving of bamboos mats, collection of vines and coconut palms that were used for the sediment trapping fences. By June 2021, the residents shared that the gray structures installed along the coast helped minimize the impacts of waves during monsoon season and storm surges during typhoons. Moreover, the breakwaters have been colonized by native shellfish and become supplemental food sources for the residents.

For the green solutions, BFA embarked on mangrove rehabilitation through planting and establishment of community-based MPA. The former is covered by a Barangay Bagongon Mangrove Rehabilitation Plan for March-October 2021. To rehabilitate 12 hectares of degraded mangrove area, BFA needed to plant 112,000 seedlings. Sources of the seedlings were: 1) the community-based mangrove nursery established by BFA in Sitio Palina in Bagongon, 2) barangays Plandico and Talotoan in Concepcion Municipality through the coordination of BFA with local community members and organizations, and 3) the Municipality of Ajuy near the boundary of barangays Bagongon and Polopina. Rehabilitation and enrichment planting was done in Palina Grande, Palina Diutay and Purok Proper from April to July 2021 (Figure 13). Seedlings were planted in rows (strip planting), equally spaced from each other at 1 x 1 meter. For this planting pattern and spacing, one hectare of mangrove required 10,000 seedlings. A total of 110,363 seedlings were planted that included various species of *Avicennia* and *Sonneratia* and *Rhizophora stylosa* and *R. apiculata* and covered 11 hectares of mangrove rehabilitation area. The target of 12 hectares was reduced to 11 to provide space for boat navigation, as requested by the community. It was observed that *Avicennia* and *Rhizophora* survived better than the other species. Some planted seedlings were damaged by either boats, worm predation or algae that were washed ashore. BFA members maintained a backyard mangrove nursery to sustain replacement planting of damaged seedlings.

Figure 13. Community members engaged in mangrove planting in Bagongon.

As for the **establishment of a 769.7-hectare community-based marine protected area (CB-MPA)** composed of 59.7-hectare of No Take Zone (NTZ), 241-hectare buffer zone (BZ) and 689- hectare regulated use zone (RUZ) the support provided by the GGI project in Bagongon came in the following forms:

- Review and updating of the community-based MPA Management Plan for 2021-2025
- Provision of basic equipment and supplies (i.e., life jackets, solar light with sensor for marker buoys, life buoy ring, megaphones with sirens and mobile phones) for effective MPA enforcement and patrolling
- Delineation of MPA boundaries through definition of coordinates and Installation of five (5) MPA marker buoys. Two (2) MPA signages were installed to increase community awareness and support to MPA protection (Figure 14). This leveraged support from the Local Government of Concepcion, which provided an additional of 10 marker buoys for the MPA.
- Provision of capacity-building support through training and facilitation of community-based MPA plan formulation
- Re-establishment of the Bagongon MPA Management Council

Figure 14.MPA marker installation (left) and MPA signage in Bagongon (right).

The MPA in Bagongon was established in 2002, however, its management was inactive over the past years. Through the GGI project, the Bagongon MPA Management Council (MMC) was re-established. The re-establishment of the MMC made possible the updating of the MPA management plan, which

embodied among others the implementation of green, gray, livelihood and capacity building activities of the GGI Project in Bagongon.

Livelihood incentives. As an incentive for the community participation in GGI project implementation, livelihood grants were awarded to BFA by CI Philippines. Two livelihood projects, which were identified for Bagongon were: 1) the production of coconut-based products such as coco coir geonet and other products and 2) the production of virgin coconut oil (VCO) as liniment and ointment. These livelihoods are expected to contribute to increasing social resilience of the community, which relies heavily on fishing and experiences decrease in food availability and income during typhoons and strong monsoon winds.

Coco coir is a durable fiber extracted from discarded coconut husks and widely used as basic material in making nets, rolls, and mats as protective covers for soils and slope. To establish the coco coir processing livelihood, CI Philippines provided BFA with the following support:

- Linkage with the Philippine Coconut Authority (PCA), provider of technical assistance and training on coco-based product development and continuous mentoring support beyond CI Philippines' engagement in the GGI project
- Provision of 30,000 pieces of coconut husks as raw materials for coco coir production (Figure 15)
- Provision of basic equipment (i.e., 1 decorticating machine, 8 twining machines and 3 weaving machines) for the coco-coir production (Figures 16-19)
- Construction of 64-square meter coco-based processing center (Figure 20) to house the equipment, supplies and materials to produce coconut-based products such as coco coir geonet and other products, and virgin coconut oil (VCO). The structure is composed of a working shed area, soaking vat area that can hold 2,000 pieces of de-husked coconut, and open storage area for raw materials (whole coconuts and husks).
- Labor fee for initial production of coco coir geonets. This amount served as initial revolving capital.

Figure 15. Procured coconut husks for BFA to start coco coir processing.

Figure 16. Male BFA members dehusking the coconuts (left) and feeding the husks soaked overnight into the decorticating machine.

Figure 17. Women members of BFA twining the coco fiber, one working on the spindle to twist the fiber (left) the other feeding out the twined coco coir into the basket.

Figure 18. BFA members operating the weaving machine (left) to produce geonets (right) from twined coco coir.

Figure 19. BFA members used twined coco coir in producing coco pots and poles sold as planting materials.

Figure 20. Coco coir processing center constructed in Bagongon.

The Association of Concepcion Micro, Small, and Medium Enterprise (CMSME) has also assisted BFA's coco-based livelihoods by fabricating and donating a mechanical coconut dehusker. The Philippine Coconut Authority also donated a decorticating machine. As counterpart, BFA provided materials, such as, hose for water supply and 5 units of twinning machines, as well as labor for the fabrication of de-huskers. It also entered into a rent-to-own contract with one of the community members for a 100-square meter lot for a period of 15 months where the coco-based processing center was built through GGI Project support. Examples of immediate benefits derived from coco-coir production are presented below:

- The decorticating process produces two things: coco peat and coco fiber. Sun-dried coco peat is used as soil conditioner by ornamental plant growers. In May-July 2021, BFA was able to sell 12 sacks of coco peat at Php250.00 per sack. The coco fiber on the other hand is manually sorted

to remove remaining coco peat and fed into the twinning machine to produce twined ropes.

- 28 women members of BFA are involved in twining. Usually, other household members are involved. One family can twine 60 to 70 pieces of ropes per day that translate to additional income of 300.00 to 350.00 pesos per day.
- Thirty-one (31) BFA members, composed of 26 females and 5 males, were involved in coco pot production. They produced 2,018 pieces of coco pots from May to July 2021 and sold 626 pieces through on-line selling and participation in trade fairs organized by the Provincial Government of Iloilo and supported by the Municipal Government of Concepcion. The sales amount was 31,394.00 pesos. BFA was also able to sell 78 pieces of coco plant poles in the amount of 4,225.00 pesos.
- Bagongon has almost 300 hectares of fruit bearing coconut trees. The coconut husks from copra are being burned as these are nested with dengue carrying mosquitoes and pose health risk to the community. In 2019, Bagongon ranked 2nd in dengue cases in the Municipality of Concepcion. The coconut husks can now be procured and used for coco coir production. This reduces the health risks of the community to dengue infection.

BFA also ventured into virgin coconut oil (VCO) production. For this CI Philippines supported BFA by providing: 1) funds to purchase 5,000 pieces of mature coconut and 2) training for VCO processing.

Figure 21. Mature coconuts purchased for VCO production of BFA.

The Philippine Coconut Authority provided BFA with initial equipment and supplies such as electric grater, mechanical presser, canisters, containers, and tumblers to start up the production of VCO (Figure 22).

Figure 22. BFA members extracting coconut meat using the electric grater (left) and coconut milk using mechanical presser (right).

To produce a liter of VCO, twenty-five (25) freshly picked mature coconuts are selected. The coconuts are de-husked and washed before splitting into two. The meat of the coconut is extracted from the shell using an electric grating machine. The grated coconut meats are collected, then coconut water is mixed with meat and placed in a clean sterilized nylon plastic screen bag. The bag is placed in a manual mechanical presser to extract the coconut milk. The milk collected from the extraction is placed in a clean tumbler or plastic container with cover. The plastic containers are placed in a storage with a temperature of 32°C for 10-17 hours. Incandescent light bulbs are used to maintain the temperature during storage. Coconut oil naturally separates from water and cream after 10-17 hours. The cream is carefully scraped from the plastic containers to harvest the oil. The oil, on the other hand, is carefully filtered using a clean funnel to avoid mixing the oil with the bottom water layer. The oil is filtered at least twice during the process. The oil should be colorless. Filtered oil is transferred to clean plastic bottles for packaging (Figure 22).

Figure 23. Extracted coconut milk (left) and packaged virgin coconut oil (right).

Building community capacities for financial security. One of the challenges in small islands, especially those distant from mainland like Bagongon, is the lack of savings and access to low-interest credit. Thus, the World Vision's Community Managed Savings and Credit Association or CoMSCA was introduced to partner communities where needed. This is an economic development project model that aims to provide simple savings and loan facilities to underprivileged communities where access to finance is difficult. It provides a mechanism for members of the community to save together, lend savings to each other, and share profits from joint investments. Using the funds pooled together with CoMSCA, members who need quick access to money for emergency situations can easily be accommodated with a loan or a grant.

In 2018, a training to establish CoMSCA groups was conducted and resulted in the formation of three (3) CoMSCA clusters in Purok 1 and Purok 2 in Bagongon. To encourage additional CoMSCA membership, a CoMSCA Trainer's Training was conducted on 19 February 2019.

For Bagongon, seven groups have already been established with more than 175 members as of time of writing. As of 19 February 2022, the current total fund of the CoMSCA groups in Bagongon was US$ 16,962.85 (Php 867,650.00). COMSCA groups in Bagongon also set up environmental fund, social fund, and sustainability fund. At every meeting (which is weekly for Bagongon), each member contributes US$.10 or Php 5.00 for environmental fund, US$.10 or Php 5.00 for social fund and US$ 0.02 or Php 1.00 for the sustainability fund. The

current environmental fund is US$ 272.14 or Php 13,920.00. The social fund is utilized by the group to provide additional support to its members during emergencies such as healthcare, hospitalization, and death. Each member can only avail of the social support for one time per cycle. The social fund has been fully utilized by the members since there were a number of health emergencies in the community including COVID-19 for the past two years. The sustainability fund is used to assist new COMSCA groups to set-up by helping purchase the COMSCA box and to fund the officers in attending meetings or trainings outside Bagongon.

Capacity building on Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). Bagongon is one of the few villages in Northern Iloilo where very limited relief assistance and no DRR interventions were provided after the 2013 Typhoon Yolanda (Haiyan). Based on the results of Participatory Capacities and Vulnerabilities Assessment (PCVA) conducted by CI Philippines in early 2017 and the Barangay Local Climate Change Action Planning, one of the weaknesses of the village that stood up was the community's lack of awareness on and understanding of DRR and CCA. Thus, particularly for Bagongon, CI Philippines came up with and implemented the necessary capacity building program as described below:

- Sitio -level DRR-CCA awareness sessions on DRR-CCA was conducted to reach as many community members as possible.
- Training on First Aid and Basic Life Support was provided to enable selected community members, barangay officials and schoolteachers to assist any person suffering from sudden illness or injury especially during emergencies.
- A network of community emergency response volunteers was established.
- An emergency response simulation drill was also conducted to test the skills that have been learned by participants from the training.
- Basic DRR supplies, materials, and tools were also provided to the community. These included hand-held radios, cervical collars, emergency hardhats, emergency handheld lights and rescue gloves.

Challenges and lessons learned in implementing the GGI Project in Bagongon

In an exposed area like Bagongon, it was necessary to adapt the design of the gray solutions, specifically the wave attenuation fence and the sediment trapping fence. For the wave attenuation fence, stone reinforcement of the base had to be figured in to add stability to the bamboo structures. For the sediment trapping fence, the plant-based twines used for tying and in making the bamboo support frames rotted easily after a few weeks, thus they were replaced with plastic twines.

Workers had difficulties in burying the bamboo poles used in sites where substrate is hard and seagrass beds are present. These factors should have been considered in the GGI design. In two sites where the low-crest semi-permeable breakwaters were installed, it was observed that there was no need to maintain the sediment trapping fences as the breakwaters already facilitated sediment accumulation for mangrove to grow.

The logistical preparation and arrangement to establish green-grey infrastructures in coastal areas and small island settings posed a number of challenges to the project. Of all five implementation sites, Bagongon is the island farthest from the mainland and most exposed to rough sea and bad weather conditions. This delayed delivery of construction materials and timely delivery of gray solutions. The availability of the barge to deliver the stones from the mainland to Bagongon or the need to repair the barge were added layers of issues that delayed the construction of the gray structures. Tidal patterns also affected the unloading of stones in construction sites.

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. A number of activities were postponed and some cancelled, e.g., the fleet training for law enforcement was repeatedly postponed since bringing in resource persons from Iloilo City was not allowed for a certain period of time that eventually resulted in the cancellation of the activity.

One of the objectives of the GGI project is to prove that ecosystems when conserved and/or restored and aided by gray 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 of time.

Sustainability, conclusion and recommendations

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

- The establishment of wave attenuation fences, sediment trapping fences and low-crest semi-permeable breakwaters which combined effects are to minimize wave impacts on the shore and facilitate sediment accumulation to provide favorable substrate for growth of planted mangroves.
- The establishment of a 11-ha mangrove rehabilitation area where enrichment planting was conducted and would be continued by the community to maintain the green solution to shoreline protection. The expected combined benefits of the gray and green solutions, if maintained, are to halt beach erosion and reduce the impacts of extreme weather events on the coastal communities.
- The re-establishment and strengthening of a 769.7-hectare coral reef community-based marine protected area (CB-MPA) composed of 59.7-hectare of No Take Zone (NTZ), 241-hectare buffer zone (BZ) and 689- hectare regulated use zone (RUZ) through the re-activation of the MPA Management Council, updating of the MPA Management Plan, definition of the technical boundaries and demarcation of the MPA for enforcement of regulations and management actions, and installation of awareness materials for public awareness and support.
- The establishment of the coco-coir processing livelihood, i.e., facility, materials and equipment for processing and local capacities for developing various sellable products.
- The establishment of virgin coconut oil livelihood, i.e., materials and capacities for VCO production and packaging.
- The establishment of CoMSCA, a mechanism for members of the community to save together, lend savings to each other, and share profits from joint investments. Using the funds pooled together with CoMSCA, members who need quick access to money during emergency situations can easily be accommodated with a loan or a grant.
- 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 to CCA and DRR.

Small island communities like Bagongon can benefit greatly from the GGI project. The community-build model has been important to emphasize the value of local stakeholders in project implementation. Replication of the GGI project in small island communities must greatly consider factors such as geographic location, tide levels and monsoon season. These factors greatly affect timely implementation and costs for hauling and delivery of materials for gray structures. In the case of Bagongon, the adaptability of the GGI design in local situation was an advantage as it could be modified to suit local conditions.

Given that Bagongon is the most exposed of all GGI project sites in Concepcion, it is important to consider some planted seedlings in the mangrove rehabilitation area

can be damaged and that continuous supply of seedlings for replacement planting must be ensured until the rehabilitation area becomes well established.

The establishment of the coral reef CB-MPA and rehabilitation of degraded mangrove area are a perfect combination of green solutions in Bagongon. But since the MPA Management Council was just re-established under the GGI project after years of irregular functioning, more capacity building training has to be provided to make the council truly effective in MPA management.

The role of the Local Government of Concepcion is crucial in providing sound technical assistance and ensuring the involvement of the community members in advocating for mangrove conservation, disaster preparedness and mainstreaming climate change adaptation into the local plans and policies. Participatory and community-based strategies are effective when local leaders and organizations are actively involved.

Incentives through diversified supplemental livelihood are also helpful for long term monitoring and sustainability of the GGI structures. This livelihood however must be cost-effective in utilizing locally available materials and resources in the community. The Local Government of Concepcion has been very supportive in promoting the livelihood products of Bagongon. Its continuous support is important, especially in ensuring that these products reach more markets external to Concepcion.

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, removing trash and debris that settle in the mangrove rehabilitation area, continuous monitoring of the integrity of the grey structures, enforcing regulations to protect the mangroves and nursery, strengthening MPA management, 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 Bagongon is covered by a Conservation Agreement signed by CI Philippines, the Local Government of Concepcion, Barangay Council of Bagongon and BFA. The roles of each signatory in the implementation 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 Bagongon.

The Local government of Concepcion is at the forefront of promoting the good results of the GGI project. These results can already 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 Bagongon 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)