

MANGROVE REFORESTATION, PROTECTION, AND CONSERVATION INITIATIVES: THE CASE OF SORSOGON BAY *ROMPEOLAS*, PHILIPPINES

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ABSTRACT: Mangrove losses have been observed in several parts of the world including the Philippines despite its explicit directive through Republic Act 8550 or the Philippines Fisheries Code (PHILIPPINES, 1998) in ensuring the conservation, protection, and sustained management of the country's fishery and aquatic resources. This qualitative research made use of a case study design at Sorsogon Bay *Rompeolas* through observation, field visits, and interviews to describe and evaluate the milestones and challenges encountered in the mangrove reforestation and protection initiatives among volunteer stakeholders. The study found out that the post-implementation (monitoring) phase of the project was the least participated activity while the project implementation phase was the fully participated activity of the different stakeholders involved in the project. Waste pollution, unsustainable participation of residents, and natural calamities are the challenges encountered by the project. The Local Government Units (LGUs) in collaboration with the concerned national authorities may adopt blended infrastructure projects with the environmental protection program in the preservation and enhancement of the current state of the coastal ecosystem for future generations.

Keywords: Mangroves, stakeholders' participation, Conservation Initiatives, Case Study, Sorsogon Bay *Rompeolas*, Sustainability Plan and Measures.

RESUMO: As perdas de manguezais foram observadas em várias partes do mundo, incluindo as Filipinas, apesar de sua diretiva explícita através da Lei da República 8550 (Filipinas, 1998) ou do Código de Pesca das Filipinas para garantir a conservação, proteção e gestão sustentada dos recursos pesqueiros e aquáticos do país. Esta pesquisa qualitativa fez uso de um desenho de estudo de caso em Sorsogon Bay *Rompeolas* por meio de observação, visitas de campo e entrevistas para descrever e avaliar os marcos e desafios encontrados nas iniciativas de reforestamento e proteção de manguezais entre as partes interessadas voluntárias. O estudo descobriu que a fase de pós-implementação (monitoramento) do projeto foi a atividade menos participada, enquanto a fase de implementação do projeto foi a atividade totalmente participada das diferentes partes interessadas envolvidas no projeto. Poluição de resíduos, participação não sustentada dos moradores e calamidades naturais são os desafios encontrados pelo projeto. As Unidades do Governo Local (UGLs) em colaboração com as autoridades nacionais competentes podem adotar projetos de infraestrutura mistos com o programa de proteção ambiental na preservação e valorização do estado atual do ecossistema costeiro para as gerações futuras.

Palavras-chave: Manguezais, participação das partes interessadas, Iniciativas de Conservação, Estudo de Caso, Sorsogon Bay *Rompeolas*, Planos e Medidas de Sustentabilidade.

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1. INTRODUCTION

With the advent of civilization as shown by the rapid sociocultural and economic development, environmental degradation has been unescapable (Xiang-chao, 2018; Zhang, Liu, Wu and Wang, 2018). Climate change in turn remains to be one of the most serious threats our humanity is facing today. The United Nations Framework Convention on Climate Change (UNFCCC) attributed climate change directly or indirectly to human activity in addition to the observed natural climate variability over time that alters the composition of the global atmosphere (Cruz *et al.*, 2017). It is estimated that under current emissions trends, by 2100 average temperature will increase between 4° and 7°C, with potentially catastrophic social and environmental consequences, including rising sea levels, inundation of coastal cities, and large-scale ecosystem transformations (Amazon Institute for Environmental Research, 2005).

The United Nations through its scientific experts reported that more than 95 percent probability has warned our planet by human activities over the past 50 years. Industrial activities in our modern civilization have raised atmospheric carbon dioxide levels from 280 parts per million to 400 parts per million in the last 150 years. Bhartendu (2012) argues that deforestation from coastal to upland areas is one of the contributors to the increase in carbon dioxide emissions that causes climate change. Scientists, policymakers, and environmentalists agree that reducing CO₂ emissions in all sectors of human activity, including power generation and deforestation is a critical piece of any international urgent scientific concerns (Institute for Environmental Research, 2005, Yoro and Daramola, 2020; Amazon).

The Endangered Species International Organization (ESI, 2011) reported that the International Union for Conservation of Nature (IUCN, 1983) classifies the Philippines as the “center of the center” of marine ecosystem diversity and home to about half the world’s mangrove species. Mangrove ecosystems are reservoirs of species of plants and animals, bound together over a long evolutionary time (IUCN, 1983). Mangrove forests are typically made up of trees, shrubs, and palms that have adapted to the harsh conditions of high salinity, warm air and water temperatures, extreme tides, muddy, sediment-laden waters, and oxygen-depleted soils. They are fertile nurseries for many marine species, and also serve as the first line of defense against hurricanes and tsunamis by dissipating wave and wind energy (NASA, n.d.). Mangroves are defined in PD 705 in the Philippines as a type of forest occurring in tidal flats along the seacoast, extending along the streams where the water is brackish. Mangroves serve as

nurseries and feeding areas that support coastal fisheries and as a buffer for coastal settlements that minimize damages in times of typhoons and strong waves (ICRMP and DENR, 2013).

However, mangrove losses have been observed in several parts of the world including the Philippines. Aside from the climate change effect on the forest structure and functions of mangrove ecosystem services (Ward, Friess, Day and MacKenzie, 2016; Jennerjahn, Gilman, Krauss, Lacerda, Nordhaus and Wolanski, 2017), major local threats experienced worldwide include clear-cutting and trimming of forests for urban, agricultural, or industrial expansion; hydrological alterations; toxic chemical spills; and eutrophication. In many countries, much of the human population resides in coastal zones, and their activities threaten the integrity of mangrove forests.

The Philippine Fisheries Code approved in February 25, 1998 through Republic Act 8550 (Philippines, 1998) is explicit to its directive that the state shall ensure the conservation, protection and sustained management of the country’s fishery and aquatic resources. The increasing economic demand and needs of growing populations strongly alter both the ecological and economic potential of the coastal resources of the country, especially in urban cities (Yuwono, Jennerjahn, Nordhaus, Riyanto, Sastranegara and Pribadi, 2007). The difficulty in preserving and protecting the good aquatic coastal conditions including the mangrove areas is currently experienced in many parts of the world. The doubling human populations and economic activities directly and indirectly generates an increasing garbage and coastal pollution (Vikas and Dwarakish, 2015) in most cities. Losses of mangrove forests resulting from various human economic activities, disposal of waste so close to the waterways has produced many unforeseen problems along the coastal areas.

The Bicol region in the Philippines had approximately a total of 6,698 hectares of mangrove forest as of 1999 (ICRMP and DENR, 2013). Sorsogon as one of the provinces in Bicol region is situated in the tip of Luzon with one city and 14 municipalities serving as gateway to Visayas and Mindanao areas and vice versa is rich in sociocultural heritages and natural resources both inland and fisheries resources. The abundance of mangrove species in the Province of Sorsogon offers positive effect in the promotion and preservation of the fisheries resources such as sea grasses, mollusk, crustaceans, fishes as well as local birds. These resources contributed to the tourism attractions in the province such as in the Town of Prieto Diaz, Bacon, Gubat, Bulusan, Sta. Magdalena, Pilar, and Donsol’s *Butanding*. The abundance of Mangrove Species in Prieto Diaz transformed the town into an ecological sanctuary that

provides seedlings for reforestation not only in the whole province but also in Bicol region and even beyond while Donsol's mangrove species offers the growth of unique phytoplankton which serves as food of the *Butanding* (or whale shark) that made it as the whale shark Capital of the world.

Sorsogon City (Figure 1) as the only city in the province of Sorsogon is the largest in terms of land area covering 31,292 hectares (120.82 sq. mi.) characterized by an irregular topography; mountain ranges on the north-west, sloping uplands on the central part of the city, plain areas southwestern and central north and south-east portion, and marshlands on the southeast deltas. It is also surrounded by water, with Sorsogon Bay to the west, Albay Gulf to the north east, and Pacific Ocean in the east (Sorsogon City, 2022). The Census (2020) puts the city's population at 182,237 with a growth rate of 0.93%, or an increase of 35,706 people,

from the previous population of 792,949 in 2015 (PhilAtlas, 2022). Sorsogon City ranked as the 3rd largest city in terms of population in the Bicol region (Sorsogon City, 2022).

The province encloses the Sorsogon bay through the municipalities of Pilar, Castilla, Sorsogon City, Caiguran, Juban, and Magallanes as shown in Figure 1 which is a major source of unique commodities such as oysters, crabs, mussels, pen shells locally known as "*baluko*" among others. This serves as a major source of food and livelihood of the local communities along the coastal barangay areas. It was reported by Calleja (2013) that Sorsogon Bay is one of the various areas in the country being eyed in commercial-scale culture of oysters to boost about 20,000 tonnes (t) Philippine yearly production, which has prospective export markets in China and South Korea.

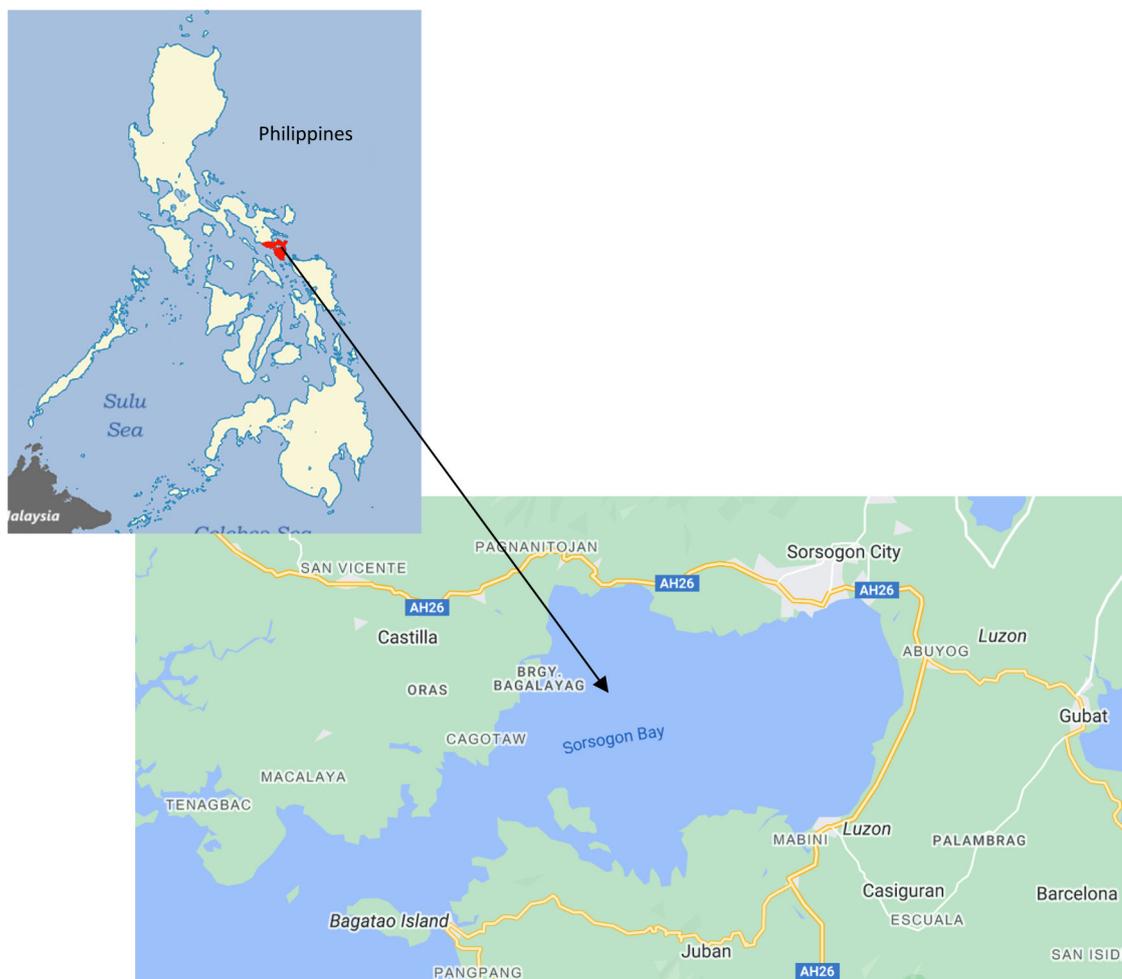


Figure 1. Sorsogon Bay Map [Source: Googlemap, 2022].

The records show that the City of Sorsogon is composed of 37 coastal barangays with more than 4,400 fisherfolks. The annual typhoons that struck the province brought significant effect to the socioeconomic and ecological habitat among coastal communities. It was reported that there is a need for a rehabilitation of the natural habitat along the Sorsogon Bay, especially those who are prone to storm surge, landslide, and flooding. The Sorsogon City Government identified 5 coastal barangays which are most vulnerable to storm surge, such as Brgy Talisay, Brgy. Cambulaga, Brgy, Sampaloc, Brgy Balogo and Brgy Bitan-o which were identified according to the criteria such as storm surge exposure, doability, accessibility, and urgency.

With the intent of protecting the coastal communities along Sorsogon Bay from the natural disasters, the Build, Build, Build (BBB) banner program of President Rodrigo Roa Duterte as part of the Philippine Development Plan (PDP) 2017-2022 in the country (Cuenca, 2020) has brought significant infrastructure improvement through the completion of the coastal road covering the *Rompeolas* area in Sorsogon City, part of Sorsogon Bay that served as seawall or breakwater. The *Rompeolas* is a Spanish term for breakwater commonly used by the Sorsoganon (people of Sorsogon, Philippines) residents referring to the pier site which historically served as the beach area and the tourist site destination during holidays or weekends in the Province. Due to the degradation of the coastal area and the growing number of populations together with the increasing volume of waste that damages the Bay, the seawater in the area became not advisable for swimming. The current *Rompeolas* area expanded by the completion of the coastal road that extended from Barangay Talisay to Barangay Bitan-o of the northern part and to Barangay Balogo of the southern part, see Figure 2. The recent infrastructure development projects blended with the environmental preservation and restoration efforts of the local community through the mangrove reforestation project.

The five barangays covering part of the *Rompeolas* were identified as vulnerable coastal areas because of the loosing number of mangroves trees, presence of waste from households and business establishments, and infrastructure development projects that affect the natural ecology. These coastal barangays, particularly the *Rompeolas* area, were part of the city development plan towards an ecotourism site destination. Considering the importance of mangrove forest in the coastal ecology, the local community composed of the academe, local government units (LGUs), residents, and other volunteers initiated the reforestation and protection of mangrove species along Sorsogon Bay. The mangrove rehabilitation initiatives of the

local community complemented the environmental protection laws, including the funding capacity of the government agencies.

One of the vital components in the success of the project, either funded or unfunded, is the inter-stakeholder's active participation (Muswar, Arifin, Puspita, Syambarkah and Kristanto, 2011). The mangrove rehabilitation-initiated project along Sorsogon Bay is an offshoot of the mangrove planting partnership between the Sorsogon City LGU and the Sorsogon State University (former Sorsogon State College) in 2015. This is in contrast to any other environmental projects in which the restoration and plantation establishment has come at the expense of the local people and volunteers, including the project monitoring and evaluation. The documented experiences and lessons learned from the case of Sorsogon Bay *Rompeolas* in the Philippines could therefore provide useful information for other interested parties in the local and international audiences who are pursuing the restoration and conservation of mangrove forests through stakeholders' volunteering initiatives.

The study explored the challenges, milestones, and nature of participation of the different stakeholders in the mangrove reforestation, protection, and conservation initiatives at Sorsogon Bay *Rompeolas*, Sorsogon City. The following are the specific objectives of the study: (1) determine the nature of participation of different stakeholders in mangrove reforestation, protection, and conservation initiatives; (2) document the milestones of the project, (3) identify the challenges encountered in the project implementation; and (4) propose sustainability plan and measures.

2. MATERIALS AND METHODS

2.1. Research Design

This qualitative research made use of a case study design through observation, field visits, and interviews. This case study described and evaluated the nature of the participation of different stakeholders, the milestones as well as the challenges encountered in the mangrove reforestation and protection initiatives through volunteerism among the stakeholders in Sorsogon Bay *Rompeolas*, Sorsogon City, Philippines.

2.2. The Study Site

While mangrove rehabilitation projects are taking place at numerous sites along Sorsogon Bay in the Philippines, it was not logistically feasible to visit a large number of sites, so the study site focus was at *Rompeolas*, Sorsogon City. Figure 2 shows the aerial view of the study site, a kilometer-long bay walk with the

picturesque view of the sea. The *Rompeolas* (Spanish term for breakwater) term commonly used by the local Sorsoganon refers to a pier that hosts different small cargo ships delivering goods (from Visayas and Davao, Philippines) that the province does not have. The current *Rompeolas* expanded and is covered within the five barangays of Talisay, Bitan-o, Sirangan, Sampaloc, and Balogo in Sorsogon City due to several infrastructure improvements such as coastal road and bridges that connect the *pinaculan* islet to the pier site.



Figure 2. Study Site. [Source: Aed Cielo, 2020].

Aside from serving as a venue for recreation, the *Rompeolas* area originally provides livelihood opportunities to the coastal communities that served as the commercial venue for the fishermen and fish vendors as well as the source of seashells, mud crabs, blue swimming crabs, pen shells, among others available along the coastline. The healthy environment deteriorates as time goes by, as reflected by the loss of mangrove forests. Hence, the mangrove rehabilitation project was initiated with the intent of restoring the natural ecology of the area despite several infrastructure improvements.

2.3 The Mangrove Rehabilitation Project

The mangrove rehabilitation project in Sorsogon Bay was composed of reforestation, protection, and conservation. There are three phases of the project: Phase 1 was the pre-implementation stage, Phase 2 was the implementation, and Phase 3 was the post-implementation. The following were the activities conducted after the project planning stage of Phase 1:

1. Coordination with the Provincial Environment and Natural Resources (PENRO),

2. Coordination with the city Local Government Unit (LGU),
3. Coordination with the government agencies involved in the infrastructure development plan of the city LGU,
4. Coordination with the barangay LGU,
5. Mobilization of the individual and group volunteers, and
6. Identification of the local resident volunteers.

Generally, Phase 1 of the project involved the planning stage, coordination with the agencies involved, and mobilization of the individual and group volunteers. The planning stage involved the identification of the feasible area for the mangrove rehabilitation project, blending with the current infrastructure development projects. The planning stage involved the provincial, municipal, and barangay leaders in-charge of the environment and waste management. The Department of Public Works and Highways (DPWH) situated in the Province as well as the City Engineering Office were also consulted on the identification of the most feasible project area. After the identification of the project site, individual and group volunteers composed of the academe, local residents, and government and non-government agencies were identified to support the project.

The Implementation Phase (Phase 2) is composed of the reforestation, protection, and conservation initiatives of mangrove species. The reforestation component of project Phase 2 includes:

1. Identification of the mangrove species available and naturally thrive at Sorsogon Bay,
2. Collection of wildings for seedling reproduction,
3. Training-orientation of the local residents and volunteers, and
4. Planting activities.

The mangrove protection component of project Phase 2 is composed of the following activities:

1. Identification of the existing available mangrove species,
2. Mapping of mangrove forest in the covered project area with the addition of the newly planted mangrove species, and
3. Identification of the factors to the decline of the mangrove species.

The coastal clean-up drive was identified as the major activity of this component project because of the growing number of

household waste, and waste from the business establishments and tourists visiting the *Rompeolas* area. This concern was also included in the training orientation provided to the volunteers and local residents to strengthen their awareness. The outcome and issues and concerns of this project Phase 2 component were also reported to the city LGU for inclusion in their future operational plan and programs. The mangrove conservation component of the project covers all the activities conducted for the reforestation and protection components.

Phase 3 of the project included the turnover of the project to the immediate barangay community, as well as the monitoring and evaluation activities. The monitoring of the mangrove seedlings planted was made to ensure a lower mortality rate. The monitoring and evaluation activities included continuous communication with the barangay LGU the immediate community of the project. There were annual symposiums or forums with the local residents held as part of strengthening the awareness campaign and maintaining their support for the project.

2.4 Key Informants

There are four groups of stakeholders involved in the project composed of four participants from Local Government Units (LGUs), three from the academe, eight barangay residents, and three other volunteers who served as key informants in this study. The Local Government Units (LGUs) at the provincial, municipal, and barangay levels are represented by the Committee Chairman on Environment as a focal person on any project and activities related to Ecological Solid Waste Management (ESWM). The LGUs include the DENR- Provincial Environment and Natural Resources Office (PENRO), city/municipal level focal persons, and barangay officials. The academe includes the extension workers, composed of faculty members and students. The barangay residents are the immediate beneficiary households

in the covered area of the project. Other volunteers consist of government and non-government organizations (G/NGOs), government agencies, individuals, and community groups of individuals.

2.5 Data Collection and Procedures

The case study framework of analysis as shown in Figure 3 underpins the data collection and procedure of the study. The data collected through observation and field visits were gathered from 2016 to 2022. The data recorded (through note-taking) through observation on stakeholders' participation in the project, challenges encountered, and project milestones is strengthened by actual field visits in the area from the pre-implementation to the post-implementation stages. The data from the observation notes were supported by the compilation of photographs (images) taken since the beginning of the project from reforestation (mangrove planting), protection, and conservation efforts implemented at *Rompeolas* area of Sorsogon Bay.

The interview guide was administered to substantiate the initially collected data during the observation and field visits. It was first distributed and the face-to-face informal interview was then conducted to further clarify and validate their responses.

2.6 Data Analysis Procedures

The data gathered from the pre-implementation, implementation, and post-implementation stages of the project through observation and field visits were triangulated by the interview as shown in Figure 3. The written responses of the key informants were coded according to the study objectives. The coded responses were then categorized that show the themes and subthemes under study. The themes were cross-analyzed with the recorded data, which were documented through note-taking and photographs (images) from observation and field visits. The

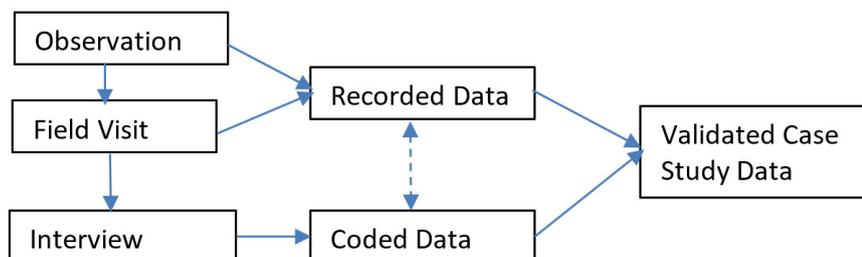


Figure 3. The case study framework of analysis.

evolving themes and subthemes of the challenges encountered by the stakeholders and the project sustainability plan were presented using tables, while the nature of participation of stakeholders and the milestones of the project were presented in textual format.

3. RESULTS AND DISCUSSION

3.1 Nature of Stakeholders' Participation

This section discusses the scope and nature of participation of the different stakeholders in mangrove reforestation, protection, and conservation initiative as shown in Figure 4. The discussion is divided into three Phases: Phase 1 (Pre-implementation), Phase 2 (Implementation), and Phase 3 (Post-Implementation).

Phase 1 (Pre-implementation). The pre-implementation phase is the planning stage of the project on mangrove reforestation, protection, and conservation which was initiated by the academe represented by faculty members, non-teaching personnel, and student organizations through its community extension services function. The academe was in charge of the proposal preparation based on the feedback, inputs, and field visits in the identified area of interest. The initiated environmental projects and activities of the academe are always in collaboration with the concerned Local Government Units (LGUs) providing usable inputs in the conceptualized project proposal. The identified community needs in the target project site were confirmed by the LGU based on the available baseline data bank and information. The LGUs served as the direct link between the academe and the barangay residents needed in the project development and implementation.

Environmental scanning through site visits and data information from the Local Government Units (LGUs) was secured to identify the priority areas of the project which became the bases to goal setting of project activities and schedules. The identifying characteristics of the coastal areas using the set criteria on vulnerability were provided by the concerned LGU during the planning of the pre-implementation phase. The project component and activities were determined during the pre-implementation phase as follows: mangrove planting, coastal clean-up drive, advocacy campaign, and mangrove protection.

To ensure the sustainability of the project the initiator consulted and requested the government agencies in charge of the infrastructure development composed of the Department of Public Works and Highways (DPWH), the Provincial Planning and Development Office, and the City Engineering Office of the copy of their plans in 2016. The introduction of the BUILD BUILD BUIL banner program of the President Duterte Administration (2016-2022) became an opportunity for the proponents to offer blended environmental protection and reforestation efforts with the infrastructure projects in the City of Sorsogon.

Phase 2 (Implementation). The implementation phase began with the orientation and information dissemination conducted by the academe initiator to the identified coastal communities in coordination with the barangay focal person after approval of the concerned authorities. The technical experts of the LGUs in the DENR-PENRO, City Agriculture Office, and City Environment and Natural Resources Office (CENRO) were tapped for a demonstration lecture on the propagation of appropriate mangrove species which includes the selection of mangrove varieties, proper potting, planting, maintenance, monitoring, and evaluation.

PHASE:	PRE-IMPLEMENTATION	IMPLEMENTATION	POST-IMPLEMENTATION	
			Monitoring	Evaluation
PROJECT COMPONENT:	Conservation			
	Reforestation		Protection	
LGU	Fully Participated		Fully Participated	
Academe	Fully Participated		Partially Participated	Fully Participated
Residents	Fully Participated		Partially Participated	No participation
Other Volunteers	No participation	Fully Participated	Partially Participated	No participation

Legend: Fully Participated Partially Participated No participation

Figure 4. Nature of Participation of the Stakeholders in the Project Component

To increase awareness among the different groups in the community during the project implementation, the project team spearheaded advocacy campaigns utilizing different forms of media such as Information, Education and Communication (IEC) materials available in different media such as Facebook® and printed materials in tarpaulin, conduct of small group conferences, and orientation drive. Part of the orientation-training was the discussions on the importance of the mangrove forest in the coastal areas. With these initiatives, different stakeholders and volunteers were involved in the project such as the Philippine Army, Philippine National Police, Brgy. Officials and constituents, Jail Officers from the Bureau of Jail Management and Penology, Alpha Phi-Omega Fraternity, and the different Student Organizations among schools.

The barangay residents, students, and other volunteers have been fully involved during the implementation phase along with the project component of reforestation, protection, and conservation. A resident in the area said, “*I am one of the volunteers in the scheduled coastal cleaning and mangrove planting*”. The importance and value of mangrove seedlings including factors that affect the growth of mangroves have been emphasized during the orientation to the residents and other volunteers so that they will appreciate more and give value to the project. The proponents in the academe and the LGUs served as the trainers and providers of technical services during the implementation phase.

Phase 3 (Post-Implementation). The maintenance responsibility of the newly planted mangrove seedlings in the area including the existing mangrove forest/trees became part of the responsibility of the barangay through its focal person and the barangay residents. However, due to some overlapping concerns, both personal and official, the maintenance responsibility was not fully implemented. The maintenance of the area covered includes the coastal clean-up and regular mangrove inspection, which are part of mangrove protection initiatives. Other stakeholders such as the academe, LGUs, and other volunteers were partially involved in the monitoring and maintenance of the project site.

The responsibility of the evaluation phase of the project was given to the academe, being the project proponent. The evaluation phase determined whether the expected outcome of the project has been accomplished and achieved within the expected timeframe based on the proposal. The LGUs receives and provides inputs in the accomplishments and evaluation reports of the project. On the other hand, the barangay residents and other volunteers were not involved in the project evaluation.

The foregoing discussions revealed the academe as the primary stakeholders, being the initiator and the proponent of the project. The secondary stakeholders are the LGUs who serve as the partner agencies of the project. The third level stakeholders are the direct beneficiaries of the project represented by the barangay residents in the coastal area, while the fourth level stakeholders are the volunteers who have the willingness to embrace and get involved in the project during its implementation. Moreover, the fifth level stakeholders are those people with indirect involvement in the project who were the indirect beneficiaries.

3.2 Challenges Encountered in the Implementation of the Project

The key informants identified the three major challenges encountered in the implementation of the mangrove project namely; waste pollution, unsustained participation of residents, and natural calamities. These major challenges identified in the implementation of the projects are presented in Table 1 with the corresponding coping strategies among the implementers.

Table 1. Stakeholders' Challenges and Coping Strategies.

CHALLENGES	COPING STRATEGIES
Waste Pollution	<ul style="list-style-type: none"> • Regular conduct of clean-up drives • Review and operationalization of the local ecological solid waste management ordinances
Unsustained Participation of residents	<ul style="list-style-type: none"> • Regular schedule of evaluation and monitoring activities • Conduct of awareness campaign and symposia • Constant communication among stakeholders
Natural Calamities	<ul style="list-style-type: none"> • Flexible schedule of activities • Offer a disaster-resilient infrastructure for protection from natural calamities

Waste Pollution. Poor industrial waste disposal and inappropriate domestic litter disposal were identified to be the major causes of waste accumulation in coastal areas in Sorsogon. This problem has seriously contributed to environmental pollution and ecological deterioration. The sources of this waste were attributed to the city and provincial-wide activities held in the *Rompeolas* area, the growing number of business establishments, improper waste disposal, absence of the IEC materials, insufficient waste disposal materials/facilities, and poor implementation of the Ecological Solid Waste Management Act of 2000.

The provincial or city-wide activities including the installation of tentative ground or stage for the activities accumulated wastes and traps sediments, subsequently resulting in increasing environmental damage. The participation of a thousand Sorsoguenos and tourists in the activity area added to the formation of waste on the sea coasts. Sunlu (2003) mentioned that negative impacts from tourism occur when the level of visitor use is greater than the environment's ability to cope with this use within acceptable limits of change. Thus, destructive activities may put pressure on the area and impact the coastal resources such as degrading the mangrove area that serves as the basis for food security, economic development, and biodiversity conservation.

The growing number of business establishments installed at the *Rompeolas* is one of the physical impacts of coastal tourism development, which attracts several human activities that eventually harm the environment. One of the residents mentioned that the litter from the food stalls was found floating in bodies of water and even in the mangrove area. According to one of the residents "An mga kinaunan ninda, minsan intatarapok lang or inibilin sa gilid gilid kaya ang basura napapakadto sa dagat" (*"People frequently throw trash all over the place, most of which ends up in the ocean"*). Increasing water pollution was also attributed to the waste released from various establishments near the coastal areas like food establishments. This sewage and waste water which comes from sinks, and toilets and from commercial, industrial, and agricultural activities cause major environmental havoc by polluting the bodies of water. This is one of the main contributors of waste in the area which harms physical habitats, transports chemical pollutants, threatens aquatic life, and interferes with human uses of the river, marine, and coastal environments (US EPA, 2020). The development of tourism facilities such as business establishments, restaurants, and recreation facilities may result in sand mining, beach and sand erosion, soil erosion, and extensive paving leading to land degradation and loss of wildlife habitats, and deterioration of scenery (Sunlu, 2003).

Wastes from within the city that flows to Sorsogon bay through canals, dikes, and rivers harmed the marine resources including the salinity, siltation, and water quality of the bay, often leading to mangrove losses. Numero (2019) found out that the disposal of solid waste in mangrove forests and wetland areas is associated with the overwhelming production of waste from highly populated city dwellers with little or no technology to handle the waste surge. Hence, a good waste management system can be worked out to address this environmental concern. According to the residents,

proper sanitation and waste segregation among the business establishment should be strictly implemented.

People's lack of information and knowledge is also a concern of this project since there are limited Information, Education and Communication (IEC) materials circulating in the community on proper segregation and disposal of wastes. The IEC is seen to be one of the effective mediums in spreading awareness and providing information about the project at the grassroots level. The key insights in the study of Hartley, B.L, et. Al. (2015), if people are aware and concerned about marine litter, they are more likely to appreciate the need for action and engage in pro-environmental behavior.

The presence of trash bins and other garbage disposal materials may minimize the waste that is scattered in the seashore. However, insufficient waste disposal materials such as trash bins nearby mangrove areas create problems in the effective management of waste. The absence of waste collectors in the water areas is also a concern, since the street sweepers are only assigned to maintain the cleanliness and orderliness in the streets and surroundings of the barangay and/or *Rompeolas*. There are no assigned people to collect and maintain the waste in the water/sea areas. Thus, trash along the coastlines was disregarded and accumulated. In addition, the poor implementation of the City Ordinance "No Segregation, No Collection Policy" is also an environmental concern since the collected waste at different sites is mixed up at home by residents. Uncollected garbage due to insufficient truck collectors of waste delimits the maintained cleanliness along coastal communities.

The existence of city and barangay ordinances in Sorsogon on waste segregation is a good policy that will help the barangays improve their waste management system. The problem encountered here is that some of the informants reported that although ordinances are in place, there is no strict implementation and monitoring of the said policies and there is no penalty. Jeremias and Fellizar (n.d) stated in their study that it is important to ensure that ordinances are strictly implemented and instill discipline in people. A stricter, more effective penalty system should be put in place instead of just asking for monetary fines. Community services can also be done along with attendance in a lecture on ESWM by the CENRO or the barangay's IEC officer on ESWM. This educates perpetrators about their violation and encourages them to refrain from persisting with their negative practices. In addition, the majority of the stakeholders' concern is the absence of a specific municipal ordinance to protect the mangroves and the continuous destruction of the mangroves.

Unsustained Participation of Stakeholders. Unsustained participation of the immediate barangay of the coastal communities poses a challenge in the project implementation. During the interview with one of the barangay captains of the coastal barangay, he stated: “*One of the challenges encountered in the implementation of the mangrove protection is encouraging the community to participate in the reforestation project*”. This result may be attributed to their livelihood concerns, resulting in less participation because they had to go to work for additional income. Another factor leading to unsustained participation is there are no regular activities scheduled for the residents to monitor the progress of the mangrove project. Their participation during the monitoring and evaluation is a significant part of the project being the grass root and beneficiary of the project. As part of their corporate social responsibility, these challenges led to the formulation of a regular schedule of evaluation and monitoring activities headed by the academe, constant awareness campaign and reorientation to the residents about environmental mindfulness, and establishment of constant communication among stakeholders for the sustenance of environmental protection and conservation.

Natural Calamities. Mangrove act as natural barriers against natural calamities such as coastal floods and typhoons. It minimizes the impact of natural hazards on the lives of people sheltering in coastal communities. However, natural calamities also result in the destruction of the mangroves, especially the young ones, when natural calamities hit the municipality of Sorsogon City. One of the respondents in Brgy Talisay shared from her experience that whenever there is a typhoon in the province, the storm surges carrying large debris damage the mangroves in the area due to its impact. This sea debris is the garbage from the broken boats and the thrashes which were accumulated in the area. It is therefore suggested that since natural calamities are inevitable, there should be a strategic and flexible schedule of activities held in order to lessen the impact of mangrove damage when there is a natural calamity. The infrastructure development projects blended with the environmental preservation and restoration efforts of the local community through the mangrove reforestation project through the offering of disaster resilient infrastructure for protection to natural calamities of the people in the coastal community.

3.3 Milestones of the Project

In 2018, the project concentrated on Brgy Talisay at the *Rompeolas* area in preparation for the ecotourism site destination by 2020 of the city. This area was selected since major projects

of the DPWH, Provincial Government, and City Government of Sorsogon are lined up in this area, causing major environmental problems. Moreover, *Rompeolas* is considered one of the tourist destinations in the province of Sorsogon. The following paragraph specified the identified major accomplishments of the project as revealed by the key informants.

Risk and Pollution Reduction. A series of clean-up drives were undertaken as a holistic approach to the project to ensure that the area is safe for the growing mangroves. Proper coordination with several external stakeholders created a big task force to clean up the polluted area. It was observed that after participating in the activity, the residents were significantly more concerned to reduce the pollution that causes mangrove destruction and environmental degradation. The project contributed to pollution reduction by reducing the amount and toxicity of potentially harmful substances removed from the area.

After clearing out the waste and preparing the planting area, more than 3,000 additional mangrove species have been planted in the *Rompeolas* area. Mangrove planting aims to reforest the lost mangrove trees in the coastal area. Mangrove forests are highly diverse coastal ecosystems that play a crucial role as a nursery for marine life. The photos below (Figure 5) are the significant changes in the mangrove area.

Biodiversity Conservation. Aside from the fact that mangroves can protect shorelines from damaging storms and surges, mangroves also provide a habitat to support rich biodiversity from marine life forms to birds that nests in the branches of the tree. Mangrove protection and reforestation are significant actions in environmental conservation to safeguard the integrity of the mangrove area as well as the well-being of its people. With active community involvement, at least 3,000 mangroves were added and growing during the 5-year project implementation along the coastal areas within and near the *Rompeolas* site.

Mangroves provide essential ecosystem services that are vital for the well-being food security, and protection of coastal communities. They host a spectacular diversity of flora and fauna, provide forest products and sustain fisheries, protect the coastline from erosion and extreme weather events, contribute to water quality, and help fight climate change (Soriano, 2021). According to Spaninks and Beukering (1997), as cited in the full thesis of Mita, Kazi Samsunnahar (2015), mangroves provide a number of valuable ecosystem services that contribute to human wellbeing, including provisioning (e.g., timber, fuel wood, and charcoal), regulating (e.g., flood, storm and erosion control; prevention of saltwater intrusion), habitat



Figure 5. Before [left] and after [right] project implementation.



Figure 6. A group of coastal residents searching seashells at *Rompeolas* during low tide (left) and fence for the mussel cultivation (right)

(e.g., breeding, spawning and nursery habitat for commercial fish species; biodiversity), and cultural services (e.g., recreation, aesthetic, non-use) (Mita, 2015).

Awareness of Environmental Protection and Conservation Among the Stakeholders. The promotion of environmental awareness among the people and residents was participated by different stakeholders. This is also one of the highlights of the project because it is the hope of the researchers that the protection and preservation of a healthy environment and ecological balance is everybody's concern.

With the goal of the City Government of Sorsogon to become a center of ecotourism site destination amidst the growing business establishments and climatic conditions, the project contributed to an awareness campaign and establishing the project site model synchronizing the developmental plans of the

city. The project has also promoted both economic and social development and environmental conservation that benefitted residents in the area (Figure 6).

Livelihood/Sustained Livelihood. The conservation efforts along Sorsogon Bay have sustained its natural richness in terms of providing livelihood to the fisherfolk. Many of its unique marine species such as mussels, pen shell "*baluko*", seashells, seaweeds, and other unique species in the bay brought significant contributions in terms of the Sorsogon economy which needs to be sustained through a cooperative, environment-friendly, and vigilant Sorsogon communities. Cooperation, collaboration, and strong partnerships have been observed among several stakeholders of Sorsogon City.

The ecotourism site attraction concept among the mangrove species will also boost livelihood at Sorsogon Villager. This

could be supported by the result of the case study of Soreda and Estonanto (2016) on the Buhatan eco-adventure which provides implications on job opportunities, fostering cooperation, balanced economic and environmental activities, inter-sector linkages that profit most of the boatmen, culinary group members, and cooperative.

4. SUSTAINABILITY PLANS AND MEASURES (SPM) OF THE PROJECT

The future of Sorsogon Bay lies in the hands of the Sorsoguenos and the kind of projects and activities they are implementing. The Sorsoganon are benefitting so much in the area in terms of socioeconomic activities through its natural habitat, marine resources, and tourist attractions. The sustainability plans and measures (SPM) aims to elevate the milestones of the project while minimizing the challenges encountered considered the feedback provided by the local residents along Sorsogon Bay as shown in Table 2. The following are some of the solutions offered by the community:

1. Strengthened advocacy campaign through information dissemination in different modes, seminar-workshops, and training;
2. A specific place for mangrove plantation shall be identified and consulted to all stakeholders and concerned agencies;
3. Designate a focal person in the barangay for the project maintenance and monitoring; and
4. Designate a specific area for fishing boats with prescribed distance from the mangrove nurseries and plantation.

Each of the identified groups of stakeholders and agencies composed of the academe, LGUs, local residents, and other volunteers shall have roles and responsibilities in the proposed SPM. The following matrix shows the objectives, activities, and expected outcome of the proposed SPM to strengthen advocacy campaigns, community participation, linkages, and policy support.

Table 2. Sustainability Plans and Measures (SPM) of the Project.

Objectives	Activity	Expected Outcome
ADVOCACY CAMPAIGN SP 1. Increase awareness of the community	Environmental Advocacy campaign: House to house Visitation, Barangay assembly, Provision of IEC materials/video clips, trainings Research & Development projects on sustainable marine resources	Increase community involvement; Improve fisheries production
COMMUNITY PARTICIPATION SP 2. Sustain Barangay participation, partnership and cooperation	Barangay Clean-up Day; Intensify " <i>Tongod ko, Linig ko</i> " and implement the " <i>Tongod ko, Tanom ko</i> " for family; Monthly Monitoring	Clean and green Barangays; Mitigate Effect of Storm Surge
LINKAGES SP 3. Strengthened linkages with the volunteers and agencies	Launching of Adopt-A-Coastal Barangay among partner agencies (BFAR, DENR, DTI, DPWH, DA, DOST, etc), NGOs and volunteers Monthly or Weekly coastal clean-up drive activity for each business establishments along the coastal areas as requirements for the renewal of the business permits; Intensify the use of paper bag or eco bag instead of plastics among the supermarkets as well as wet markets	Strong partnership, collaborations and cooperation among stakeholders
POLICY SUPPORT SP 4. Policy development, implementation, and support from the LGU	Review of the municipal Ordinances related to environmental protection and gap analysis; drafting policy brief for the sustenance of the project	Established model mangrove project in Sorsogon City

It is envisioned in this SPM strengthened participation and partnership of the different stakeholders (from the first to the fifth level) through a community-based participatory approach. The community-based participatory work among stakeholders will be executed from the planning, implementation, monitoring, and evaluation stage of the SPM. This community-based participatory approach may ensure the active participation of each of the key players. Ordinances will be drafted such as environmental community service adopting this project as requirements for the renewal of the licenses of business establishments along the coastal areas; also, for those households, groups, or individuals violating the solid waste management act and/or local ordinances.

5. CONCLUSIONS

The stakeholders' nature of participation in mangrove reforestation, protection, and conservation initiatives depends on their priorities and engagement in the project. The post-implementation (monitoring) phase of the project was the least participated activity while the project implementation phase was the fully participated activity of the different stakeholders. Waste pollution, unsustainable participation of residents, and natural calamities are the challenges encountered in the project implementation. On the other hand, risk and pollution reduction, biodiversity conservation, awareness of environmental concerns, and sustained livelihood among residents were the milestones of the project. The project offered sustainability plans and measures with four components of an advocacy campaign, strengthening community participation, linkages, and policy support were identified based on the challenges and milestones of the implemented project.

RECOMMENDATIONS

The concerned local organizations and agencies may implement and adopt the strategies, sustainability plans, and measures offered in this mangrove reforestation, protection, and conservation project in their respective coastal barangay. The institutionalization of the Ecological Solid Waste Management Act of 2000 modeled by the Philippine Republic Act No. 9003 (Philippines, 2000) is necessary for the reduction of waste pollution in the coastal communities. The local government units (LGUs) in collaboration with the concerned national authorities may adopt blended infrastructure projects with the

environmental protection program to encourage the preservation, maintenance, and protection of mangrove species as natural coastal infrastructure. Every citizen in the world shall treat the coastal environment and river banks as a sanctuary limiting social and economic activities, if inevitable, with precautionary measures, in the preservation and enhancement of the current state of the coastal ecosystem for future generations.

CONTRIBUTIONS

RVD: conceptualized the research.; supervised the overall process.; wrote and polished the manuscript.

CMRS: collected the data; wrote the manuscript.; conducted interviews and field documentation.

Both authors of this study have directly participated in the planning, execution, or analysis of this study. Both authors read and approved the final version of the document.

ACKNOWLEDGEMENTS

The authors acknowledge the administrators of Sorsogon State University for allowing the researchers to conduct the study and for the support of the local government unit of Brgy. Talisay, Sorsogon City, where the project area is situated.

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