

Mangrove Management: Lessons and Experiences¹

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The Forest Foundation Philippines (formerly known as Philippine Tropical Forest Conservation Foundation) was established in 2002 through bilateral agreements between the government of the Philippines and the United States of America. The Foundation is a grant-making organization that provides financial and technical support to organizations and individuals that empower the people to protect the forests. Since 2005, more than 450 projects were supported including mangrove conservation projects. For 2017 to 2021, it employs sustainable forest landscape approach as guided by its Results Framework in Sierra Madre, Palawan, Samar-Leyte and Bukidnon-Misamis Oriental to attain the outcomes “Grow Forests, Grow Livelihoods, Grow Partnerships and Grow Advocates.” As its core business, grants must directly contribute to conserving and protecting forests, address the livelihoods of the communities, develop partnerships with communities, civil society organizations and mandated government institutions, and engage the younger generations especially the millennials to widen advocacies on forest conservation.

With the number of mangrove conservation projects supported by the Foundation that were implemented in various places in the country, experiences and lessons were generated to enhance mangrove conservation efforts. These lessons hope to address the practice of planting mostly *Rhizophora* species, direct planting of propagules, planting in inappropriate sites and low survival of seedlings.

1. Science-based interventions

Mangrove conservation must be guided by science that considers the appropriate sites and species. Areas naturally covered with mangroves must be the priority for restoration while remaining mangroves must be protected. The tidal zone and substrate of the restoration site must determine the species to be used for restoration. In areas where *Sonneratia* species (e.g. Pagatpat) or *Avicennia* species (e.g. Miapi) dominates, planting of *Rhizophora* species is discouraged as this shall have high mortality. Mangrove areas converted to aquaculture ponds but are now abandoned, undeveloped or underutilized must be reverted back to mangroves. Moreover, non-mangrove seaward areas especially the seagrass beds should not be planted. Mangrove plantations in seaward areas are prone to mortality due to wave actions, presence of debris and barnacle infestations. For restoration of seaward mangrove areas with infestation of barnacles, *Sonneratia alba* (Pagatpat) must be planted instead of



Figure 1. Pagatpat showing its shedding bark

¹ Presentation during the 1st National State of Mangroves done in Citadines Bay City, Manila on October 9-11, 2019.

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Rhizophora (Bakawan). The Pagatpat can survive barnacle infestation due to the regular shedding of its bark, resulting to natural removal of the barnacles.

Table 1 indicates the appropriate species for planting based on the location (zonation) and substrate of the planting site as reference for mangrove restoration efforts.

Table 1. Site-species suitability.

Location/zonation	Substrate	Appropriate species
Downstream/estuaries	muddy	<i>Sonneratia alba</i> (Pagatpat)
Seaward	muddy	<i>Sonneratia alba</i> (Pagatpat)
Seaward	sandy/coralline	<i>Avicennia</i> , <i>Rhizophora stylosa</i>
Landward	muddy	Rhizophora
Upstream	muddy	Nipa

As a requisite for ensuring species-site suitability, there is need for mapping to determine baselines information, determine priority areas for restoration and protection, and basis for management planning and zoning. This shall also serve as reference for the quantification of impacts after the project implementation.

2. Mangrove nursery management

Nurseries serve as production and nurturing area for seedlings prior to planting, ensuring the production of the desired quality and required quantity, as well as ensuring availability of the suitable species. Depending on the species, seedlings require at least 4 months in the nursery prior to planting to meet the suitable size and quality of plantable seedlings. The quality of the seedling significantly affects its survival and growth once planted in the field. Nurseries are provided with nets or fence to protect the seedlings. The nursery can be established in areas reached by tide water during high tide and protected from wave action. This eliminates the need for labor-intensive watering. Small-sized fruits/seeds of mangroves are initially propagated in seedbeds/seedboxes then transferred later to



Figure 2. Elevated potted seedlings

containers/plastic bags, while bigger seeds and propagules can be planted directly in the containers/plastic bags. If there is limited area for land-based nurseries, floating nurseries can also be established using bamboo poles as raft. In case of pest infestation on the seedlings (especially crawling animals like crabs and snails), the seedbeds/seedboxes and potted seedlings can be elevated or raised.

Nurseries can also be developed as an enterprise of the community/fisherfolk association, as exemplified by the Lian Kingfisher Association in Lumaniag, Lian, Batangas. The association produces seedlings (mostly *Avicennia*) and sell at P 15/piece (includes preparation of the planting site), to groups interested on mangrove planting like students and civic organizations. The income on the seedlings is shared between the association and the members/owners of the seedlings.



Figure 3. Mangrove nursery in Lian, Batangas

3. Address economic needs

Any conservation effort must be linked to the economic needs of the people, especially those directly dependent on the mangrove forest. Mangroves serves as nurseries, breeding ground and habitat for fish, shells, shrimps and other resources that are being collected or gleaned by fisherfolks as food or sold. Thus, efforts on conserving and restoring the mangroves definitely impact on the economic conditions of the people. However, while restoration and regeneration of mangroves are underway, support for additional or alternative sources of income consistent with mangrove conservation are needed such as fish and crab culture. The Foundation supported the culture of oyster

(talaba), fish (lapu-lapu) and mud crab in Zamboanga Sibugay. Aside from contributing to food availability, these are now contributing income to the communities. Expansion and replication to other coastal communities are being done for economies of scale and as incentive for enhanced mangrove conservation. Having direct impact on the economic condition of the people results to stronger concern and attitude to conservation.



Figure 4. Lapu-lapu culture in Kabasalan

Aside from contribution to economic development, mangrove conservation also contributes to resiliency of the communities against natural calamities. A project in Zambales exemplified how mangroves helped protect the communities from strong waves and tidal surges, as compared to a concrete structure (sea wall).

4. Biodiversity conservation

Mangroves are habitat of diverse flora and fauna. Restoration coupled with protection efforts ensure the regeneration of mangrove biodiversity such as shrimps, fish, shells and birds. In one of the mangrove conservation sites in Siay, Zamboanga Sibugay, the population of flying foxes thriving in Kabog Island significantly increased as the mangroves forests are protected. Aside from habitat of biodiversity, the island is now an ecotourism destination that provides additional livelihood opportunities to the coastal communities.



Figure 5. Flying foxes in mangrove forest

5. Community participation and stewardship

Community participation is crucial to ensuring stewardship and sustainability of any mangrove conservation effort; thus, communities must be engaged as partners and not just project beneficiaries. Communities directly depending on the mangroves are exerting pressures on these resources, but they are also the key to the effective conservation of such resources. Thus, mangrove conservation effort must include community engagement, capacity building and advocacies, to transform the people as stewards of the mangroves and other coastal resources.



Figure 6. PO members planting Pagatpat seedlings

6. Tenure and institutionalization

Crucial to any natural resource management is a tenure over the area. Partners of Forest Foundation in Zamboanga Sibugay have mangrove co-management agreement with the Department of Environment and Natural Resources (DENR) and Local Government Unit (LGU), as legal basis for the mangrove conservation efforts. With the agreement, support for coastal resources management where mangrove conservation is included, are allocated in the LGU-Annual Investment Plan. This assures institutionalization and sustainability of the mangrove conservation.

7. Community-based resources monitoring and protection

Mangrove conservation is not just about planting but must include sustained monitoring and protection even beyond the project duration. This is linked with community participation and stewardship where sustainability of monitoring and protection is based. Project must ensure adequate capacities of communities on monitoring and protection, including provision of initial incentives, while long-term support from mandated agencies are being worked-out and the direct benefits from the mangrove forest being conserved are yet to realize. Existing volunteer Bantay Dagat are tapped to monitor and protect not just the coastal areas but also the mangroves (existing forest and restoration areas). Identified timber poachers were given opportunity and incentive to transform and help in forest monitoring. There is designated area for utilization and harvesting but needs permission and approval from the PO managing the resources.



Figure 7. Bantay Dagat in action

8. Alternative materials

Coastal communities mostly derive their material for houses, fish drying facilities, fish cages and fish corral from the mangrove forest. These include fuelwood, poles, posts, and roofing materials. With the increasing population in the coastal areas, demand for these materials also increases. Without sustainable source and alternative materials, the mangrove forest will continue to be threatened. Bamboo is also a material for houses, cages, fish corrals and fish drying facility and usually sourced outside of the coastal communities. However, due to declining quantities of naturally growing bamboo stands and increasing remoteness on the sources of these bamboo, the qualities and quantities are declining while prices are increasing. Thus, to help reduce dependency on the mangrove forest, and ensure availability of alternative materials, bamboo propagation and planting and woodlot establishments are also supported by the projects. Bamboo cuttings are planted along river banks or intercropped with existing coconut farms, while woodlots planted with fast growing tree species are established in private lands (covered by agreement between land-owner and the PO).



Figure 8. Bamboo cuttings to be planted as alternative material to mangroves

9. Partnerships and networking

The support of Forest Foundation is limited to forest conservation, thus, partnership with other funding organizations are necessary to address other needs of the communities. The implementation of projects funded by the Foundation and the success of the mangrove conservation efforts enabled the partner PO (KGMC) to establish track record, build network, linkages and partners. This enables them to partner with other organizations (local and international) to address other PO/community concerns such as education, health, enhancement and expansion of the enterprises, support for infrastructure and continued capacity building.

10. Local champion, effective leadership

Likened to a boat where the success to reach the desired destination greatly depends on the skills and capacity of the boat captain to navigate not just calm waters but also turbulent wind and waves that maybe encountered along the way, an organization needs an effective leader. This is the key to the success of KGMC in Kabasalan, Zamboanga Sibugay thru the leadership of Roberto Ballon. Mr. Ballon's leadership and dedication to mangroves, fishery and coastal resources management enabled the organization to attain its present status, recognized through local and national awards. He is the local champion for mangroves, fishery and coastal resources management not just in Kabasalan but in Region 9 and even extending his knowledge, expertise and passion to other coastal communities in the country. He is also the chairperson of the Coalition of Municipal Fisherfolks Association of Zamboanga Sibugay (COMFAZ) – a federation of 34 coastal POs of Sibuguey Bay. The experiences and success of KGMC in Barangay Concepcion, Kabasalan are now replicated and expanded in the whole Sibuguey Bay composed of 8 municipalities. The Federation enabled them have stronger voice and influence to lobby support for enhancing coastal resource management in the Bay with the LGUs, DENR, DA, BFAR and DILG.



Figure 9. Roberto Ballon - mangrove champion

Project implementations involve innovations to adapt to the realities of field conditions. These innovations significantly enhances mangrove conservation efforts not just in the project sites but in other mangrove forests; the propagation of Pagatpat seeds which mangrove scientists and researchers claimed as difficult to propagate ensures production and planting of appropriate species; the use of coconut husk minimizes use of plastic bags; while the fabrication of PVC paddle boat reduces the use of wood for boat construction and contributes to recycling.

1. Use of coconut-husk as rooting /potting medium

Consistent with the effort on nursery operations to produce ready-to-plant seedlings, the use of coconut husk as potting media was explored. This is an alternative to plastic bags that are costly and not environment-friendly. This was innovated by a partner NGO (SIKAT) and its partner POs in Siargao, Surigao del Norte. Similar to the principles of marcotting, the coconut husks are wrapped around the lower end of the propagule. The husk absorbs water during watering (or during high tide if the nursery is placed in areas reached by tide water) and retain the moisture needed for the germination and survival of the propagule. The



Figure 10. Coconut husk as potting medium

seedlings produced are lighter and easier to transport compared to seedlings placed in plastic bags with soil. Since the coconut husks are bio-degradable, the germinated propagules are planted directly without disturbing the root system. This results to high survival of the seedlings. The use of coconut husk was also tried for propagating *Avicennia* seeds and proves feasible. However, the coconut husk needs to be trimmed to smaller size as this tends to float when planted especially in areas exposed to waves.

2. Propagation of Pagatpat

Species suitability is a crucial factor in the survival and growth of seedlings. However, in most mangrove reforestation projects, only the *Rhizophora* species are being planted and mostly through direct planting of the propagules. The planting of *Rhizophora* in inappropriate sites results to low survival and leads to monoculture. One of the causes of mortality is the infestation of barnacles on the planted seedlings. The planting of species naturally growing in the area is constraint by the availability of seedlings attributed to lack of knowledge on the propagation. Small seeded mangrove species such as Pagatpat and *Avicennia* requires propagation to produce seedlings. Thus, the seed propagation for Pagatpat was developed by PTFCF and KGMC in Kabasalan, Zamboanga Sibugay. This propagation technique resulted to mass production of Pagatpat seedlings that are planted in appropriate sites, significantly

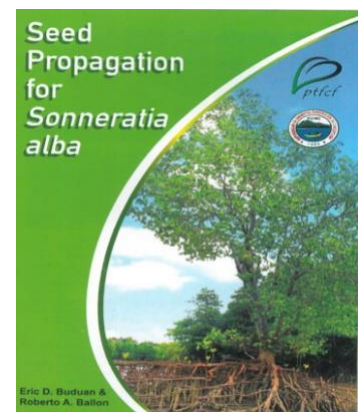


Figure 11. Pagatpat propagation brochure

contributing to successful mangrove restoration in Zamboanga Sibugay. The propagation technique is already disseminated thru training, learning visits, presentation in mangrove fora/conferences, sharing in the internet and the printing/distribution of the brochure, not just to partners and networks of the Foundation but to broader stakeholders of mangrove conservation.

3. Fabrication of PVC paddle boat

As an alternative to wood, the use of PVC drums for the fabrication of paddle boats were also done in Siargao. The fabricated boats are lighter compared to wooden paddle boats, the production cost is lower and the boat floats better and can be used even in shallow water. These boats are now widely used in Del Carmen and San Benito, Siargao, Surigao del Norte and also introduced in Busuanga, Palawan. This innovation reduces the use of wood for paddle boat construction and contributes to recycling efforts. It is ideal for navigation in mangrove forest or rivers where the water is relatively calm but not recommended for open sea where there are waves.



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The lessons and innovations discussed above contributed to the achievement of mangrove conservation efforts of the Forest Foundation and its partner organizations. However, the threat and challenges to mangrove conservation still persist, requiring broader interventions and more awareness and capacity building activities. The impacts of climate change are now felt, affecting not just the lives and properties of people but also the natural environment.

a) Siltation

Mangroves helps in addressing siltation as the root system helps in trapping sediments and sediment flow is crucial to mangrove survival. However, if the siltation exceeds the adaptation capacity of the mangroves, the mangroves will be eventually affected that may result to death. Prone to the destructive impact of siltation are those mangroves in the estuaries and the aqua-culture enterprises of the PO. The conversion of forest to agriculture and the lack of soil and water conservation interventions in the uplands significantly contribute to soil erosion and siltation. Hence, forest conservation and sustainable farming must be promoted in the upland to complement mangrove conservation.



Figure 12. Siltation in mangroves and estuaries

b) Increasing population

The more mouth to feed, the greater the pressure on natural resources. This is the direct correlation of increasing population to natural resources management. In Barangay Concepcion, Kabasalan, Zamboanga Sibugay, the improvement of mangrove forest resulted to increased population of fish, shells and shrimps, thereby improving catch per unit effort. Fisherfolks need not to go fishing in the offshore but just in nearshore



Figure 13. Concepcion, Kabasalan, Zamboanga Sibugay

areas, reducing exposures to risk from sea turbulence and pirate attacks. However, said improved catch also serves as magnet for former residents of the barangay, who migrated to other places in search of better livelihood, to return and re-establish residency. These returning residents including new settlers in the area poses additional pressures on the recovering natural resources, that may eventually impact on the carrying capacity of the mangroves and coastal resources.

c) Planting for publicity

Tree planting is mostly the default activity when dealing about environment or conservation. Moreso, there are a number of grand and much-publicize tree planting activities aiming for international records/recognition but are ineffective and unsuccessful. Such planting for publicity, if unavoidable, must be properly designed to contribute to conservation and not a waste of resources (especially money). Planting must be complemented by maintenance and protection for at least 3 years, and not just posts in social media and news items for publicity.

d) Natural calamities

Natural calamities such as typhoons are predicted to be lesser in numbers but stronger in intensities as an effect of climate change. Mangroves protects the landward areas from strong winds and waves, but suffer the brunt of these calamities. The impact of Super Typhoon Yolanda in Samar and Leyte shows how mangroves reduces the damage to coastal communities, but also shows how the mangroves are significantly affected by the calamity. The resiliency of Pagatpat are clearly manifested in the Yolanda affected mangroves.



Figure 14. Impact of Super Typhoon Yolanda on mangrove forest in Samar