VI. WHERE WE STAND: A SYNTHESIS OF STATUS REPORTS OF MANGROVES IN NORTHWESTERN LUZON

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I. Biophysical and Socio-economic Setting

Northwestern Luzon has over 8,600 km of the Philippine shoreline, and is composed of 8 cities, 73 municipalities and 909 barangays. It is part of the northern section of the West Philippine Sea biogeographic region and is home to over 14.5 million individuals (14,240,907), around 10% of whom live in coastal areas (**Table 26**).

Northwestern Luzon's coastal ecosystems – which have significant ecological, socio-cultural and economic importance – include coral reefs, seagrass beds and mangrove forests. Mangrove forests are primarily seen as a critical spawning and breeding ground for various terrestrial and aquatic species. They function as shoreline protection and erosion control, and also provide sources of food and livelihood. Among the raw materials/products that coastal residents gather from mangroves and sell for income are wood, nipa (shingles, vinegar, syrup and wine), fish and shellfish. The propagules used in seedling production for mangrove planting programs are from existing mangrove forests. Mangrove forests are also recognized as important sites for research and ecotourism in some localities.

Table 26. Provinces in northwestern Luzon showing the total (and % coastal population) per province

Province/ Municipality/Zone	Total Population	Coastal Population (% of total)
Bataan	687,482	292,390 (42.5)
Bulacan	2,924,433	43,005 (1.5)
Cagayan	1,124,773	173,257 (15.4)
Ilocos Norte	568, 017	85,363 (15.0)
Ilocos Sur	658,587	132,098 (20.1)
La Union	741,906	185,083 (23.5)
Pampanga	2,014,019	61,598 (2.6)
Pangasinan	2,779,862	809,990 (29.1)
Subic Bay Freeport Zone	99,437	nd
Zambales	534, 443	190,120

All provinces reported fishing as the main source of income of coastal communities, followed by fish vending, fish processing and farming. Other livelihoods mentioned are the gathering and selling of seaweed, seagrass and mollusks; livestock production; merchandising; salt and bagoong making; sea urchin culture; aquaculture; food processing; welding and metal craft; charcoal making; and tourism (specifically for Bani and Masinloc).

Many of the provinces reported poverty as the most pressing social issue experienced by their coastal communities. Poverty is further aggravated by increasing populations, with an annual growth rate of 1.04–3.37% (National Statistical Yearbook 2013), limited livelihood opportunities, inaccessibility of schools and health service providers, and lack of social safeguards. Another issue is the decrease in fish catch. A notable example is the province of Bataan, which claims 1.08 tons per hectare per year as the estimated reduction of fish catch for every hectare of mangrove loss. The decline in fish catch is further worsened by the presence of illegal fishers and poachers. The pollution and overfishing of coastal areas by informal settlers were also identified among the social and environmental issues. These issues are compounded by weak law enforcement. There are also concerns about poor waste management, the lack of sustainable resource practices and the unpreparedness of coastal communities for natural disasters.

II. Mangrove Status

Data on the extent of mangroves in northwestern Luzon (**Table 27**) are notably insufficient and often with inconsistencies. The extent of mangroves widely varies across the region - from less than a hundred hectares (Ilocos Norte) to around 4,000 ha (Cagayan). Most provinces have no data on the remaining old growth stands. The extent of new planted mangrove stands also varied widely. All provinces however reported a steady increase of mangrove plantation areas in the last ten years resulting in approximately 838.6 ha of new plantations. Except for Cagayan, most provinces declared around 10% as mangrove protected area.

Mangrove areas in northwestern Luzon add up to 6,010.1 ha, with old stands, secondary growth and new plantations at 504.7, 870.3 and 838.6 ha, respectively. A large expanse of old stands is found in the province of Pangasinan, followed by Bulacan and Subic Bay Freeport Zone. New stands are mostly distributed in Cagayan, Bataan and Bulacan. These figures and description of distribution need to be verified, considering the lack of data for other provinces. All provincial reports provided higher estimates of mangrove forest cover compared to estimates derived from spatial analyses of remote sensing data by Long et al. (2011, 2013) and Pagkalinawan (see his report in this Proceedings).

Table 27. Summary of mangrove information per province showing the total, old and new stands as well as the coverage of mangroves declared as protected areas.

Province/ Municipality/ Zone	Total Area (ha)	Old Stands (ha)	Secondary growth	Plantation (ha)	Protected Areas (ha)
Bulacan	585.14	72.43	318.71	194	24.64
Bataan	121.08	nd	nd	120.2	0
Subic Bay Freeport Zone	65.57	61.63	nd	3.94	62
Zambales	326.5	nd	211	nd	115.5
Masinloc, Zambales	109	37.75	39.25	32	0
Pangasinan	615.02	283	332.02	nd	52.25
Bani, Pangasinan	66.91	nd	nd	nd	42.25
La Union	140	nd	nd	80	60
Ilocos Sur	122.95	26.88	8.58	87.49	5
Ilocos Norte	66	23	nd	43	nd
Cagayan	3,967.87	nd	nd	278	nd
Total	**6010.1**	**~504.7**	**~870.3**	**~838.6**	**319.4**

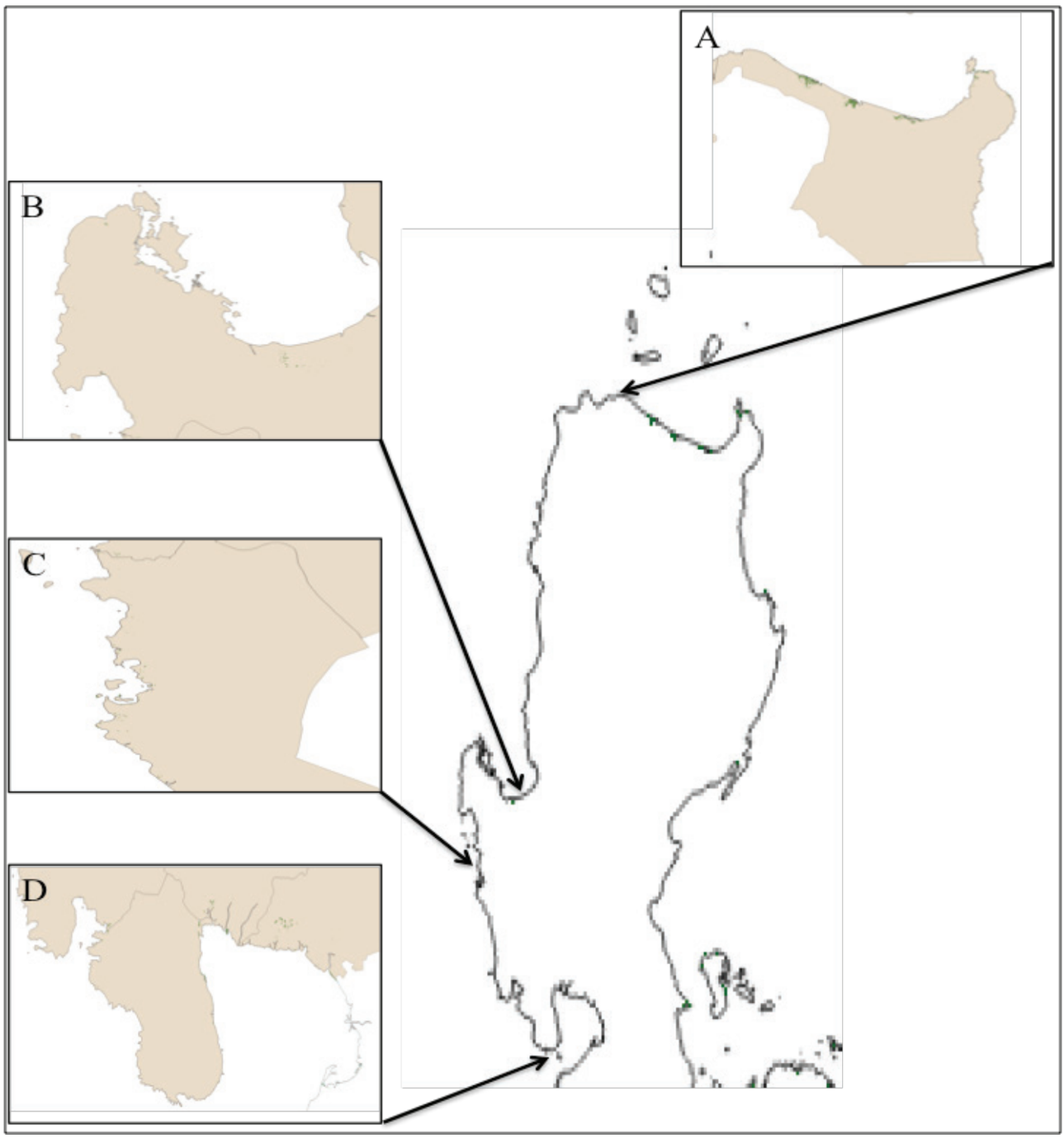

Figure 19. Mangrove distribution in northwestern Luzon (extracted from Long et al. 2013): (A) Cagayan, (B) Pangasinan, (C) Zambales, and (D) Bataan peninsula. Other provinces have very minimal mangrove forest.

Figure 19 shows the mangrove distribution in northwestern Luzon based on the most recent satellite image (extracted from Long et al. 2013). The total mangrove area is estimated at 5,655 ha and is mostly found in Cagayan and Zambales. The mangroves of northwestern Luzon constitute 2.34% of the total mangrove forest in the Philippines.

Table 28 provides a list of the mangrove species found in northwestern Luzon. There are 33 true mangrove species and 23 associate species reported in the region. Pangasinan has the highest species richness with 25 species, followed by SBMA and Zambales both with 21 species. Ilocos Norte has the least species number of species (7). The species that are present in most provinces are *Avicennia marina, Nypa fruticans, Rhizophora apiculata, R. mucronata, R. stylosa* and *Sonneratia alba*. Species that are less common across the region are *Acanthus sp., Acrostichum aureum, Avicennia alba, Bruguiera parviflora, Osbornia octodonta, Pemphis acidula* and *Sonneratia ovata*. The rare species *Camptostemon philippinense* known to have limited distribution (mainly in the central Philippines) was also reported in Pangasinan and Zambales. These information, however, need further verification.

Table 28. List of true (A) and associate (B) mangrove species in Northwestern Luzon

Species/Province	Local Name	Bataan	Bulacan	Cagayan	Ilocos Norte	Ilocos Sur	La Union	Pangasinan	SBMA	Zambales
A. True species										
Acanthus ebracteatus	*tigbau*								X	
Acanthus ilicifolius	*tigbau*		X	X						
Acanthus volubilis	*diluario*		X							
Acrostichum aureum	*lagolo*		X		X					
Aegiceras corniculatum	*saging-saging*	X				X		X	X	X
Aegiceras floridum	*tinduk-tindukan*			X				X		X
Avicennia alba	*bungalon-puti*							X		
Avicennia lanata	*piapi*		X					X		X
Avicennia marina	*bungalon*	X	X	X	X	X	X	X	X	X
Avicennia officinalis	*api-api*	X	X	X		X		X	X	X
Bruguiera cylindrica	*pototan-lalake*	X	X			X		X	X	X
Bruguiera gymnorrhiza	*busain*	X	X	X		X		X	X	X
Bruguiera parviflora	*angarai/langarai*							X	X	
Bruguiera sexangula	*pototan*	X				X		X	X	X
*Camptostemon philippinense**	*gapas-gapas*							X		X
Ceriops decandra	*malatangal*	X		X		X		X	X	X
Ceriops tagal	*tangal*	X						X	X	X
Excoecaria agallocha	*buta-buta*		X	X		X		X	X	X
Heritiera litoralis	*dungon late*			X		X		X	X	X
Kandelia candel	*candel*			X						
Lumnitzera littorea	*tabau*								X	X
Lumnitzera racemosa	*kulasi*					X		X	X	X
Nypa fruticans	nipa/*sasa*	X	X		X	X	X	X	X	X
Osbornia octodonta	*taualis*					X				X
Pemphis acidula	*bantigi*					X	X			
Rhizophora apiculata	*bakauan-lalake*	X	X	X	X	X		X	X	X
Rhizophora mucronata	*bakauan-babae*	X	X	X	X	X	X	X	X	X
Rhizophora stylosa	*bakauan-bato*	X	X	X	X	X		X	X	
Sonneratia alba	*pagatpat*	X	X	X	X	X		X	X	X
Sonneratia caseolaris	*pedada*	X		X		X		X		
Sonneratia ovata	*pagatpat baye*							X		
Xylocarpus granatum	*tabigi*			X				X	X	X
Xylocarpus moluccensis	*piagau*							X	X	
Total		**14**	**14**	**15**	**7**	**18**	**4**	**25**	**21**	**21**

Table 28 (continued)

B. Associate species									
Acacia fernasiana	*aroma*	X							
Barringtonia asiatica	*botong*		X	X				X	
Barringtonia racemosa	*botong*							X	
Caesalpinia nuga	*sapinit*	X							
Calophyllum inophyllum	*bitaog*			X					
Casuarina equisitefolia	*agoho*		X						
Cerbera manghas L.	*banato*		X						
Derris trifoliata	*tuble*			X					
Dolichandrone spathacea	*tui*	X			X				
Euphorbiacea 1			X						
Hibiscus tiliaceus	*malubago*		X			X	X		
Intsia retusa	*ipil laut*							X	
Ipomea pes-caprae	*lambayog*	X		X					
Morinda citifolia	*bangkoro*	X							
Myristicaceae									
Myrtaceae			X						
Terminalia catappa	*talisai*	X	X	X				X	
Thespecia populnea	*banalo*	X						X	
Pandanus tectorius	*pandan dagat*		X	X				X	
Pongamia pinnata	*bani*		X	X					
Rubiceae	*nino*		X						
Sesuvium ilicifoliu	*dampalit/diluario*	X							
Sesuvium portulacastrum	*dampalit*			X					
Total		**8**	**10**		**8**	**1**	**1**	**7**	

* for verification

III. Issues and Threats

All provinces reported declines of mangrove forests but the rates of losses are unclear, given the insufficient available information. For 73% of the region, the primary cause of mangrove decline is the conversion of mangroves into aquaculture ponds and residential or commercial areas. Also contributing to mangrove decline are extensive cutting for firewood and housing materials; water contamination from pollution and siltation; soil erosion and sedimentation; and floods caused by extreme rainfall events.

In addition to typhoons and storm surges, other reported threats to the coastal communities of northwestern Luzon are sea level rise, algal bloom, coastal erosion, saltwater intrusion, liquefaction, land subsidence, the swelling of foreshores and the occurrence of sinkholes. Human-induced threats include improper solid waste management, organic loading (due to the absence of adequate sanitation and sewage facilities), industrial pollution, oil spills, mine tailings, black sand mining, groundwater extraction, deforestation, the mismanagement and overexploitation of natural resources, and the extraction of aquatic and mineral resources. Some inter-municipal administrative concerns include boundary disputes in municipal waters, encroachment and unwarranted development of coastal areas into residential or commercial areas, and weak coastal law enforcement.

The main problems can be generally categorized into two: (a) conversion of mangrove habitat to aquaculture ponds and residential areas, and (b) vulnerability to natural disasters (**Fig. 20**). The provinces of Pangasinan, Zambales and Bulacan attributed high mangrove loss due to conversion to aquaculture ponds. Most of the massive conversion of mangrove areas happened in the 1970s, opening spaces for building residential, commercial and even industrial areas (**Fig 20A**). Notable examples are the provinces of Bulacan and Bataan, which became hotspots for high human migration and urban centers because of several industries that were established.

Localities reported as highly vulnerable to natural disasters were consistently the same localities that had massive losses of mangrove areas. The most serious threats are typhoon damage, erosion, land subsidence and sea level rise. Cagayan is known to be a passageway of most strong typhoons in the country. Coastal erosion, combined with quarrying activities, further aggravates land subsidence. Aside from typhoon, the provinces of Pangasinan, Zambales and Ilocos Sur also reported storm surges. Some of these catastrophic typhoons happened in the last ten years. These provinces also documented evidences on shoreline change attributed to sea level rise. Some coastal areas drop ~0.5–1 m of elevation and lost ~100 m of shoreline.

There are some conflicting and unclear policies on mangrove management in the region. It involves bureaucratic conflicts on setting priorities on mangroves – either viewed as a forest protection/rehabilitation zone, or as a fisheries production zone. The LGUs, by virtue of the Local Government Code (R.A. 7160) may also assert their rights on implementing mangrove management programs. But in some cases, mangrove areas are classified as Alienable and Disposable Lands, which can be interpreted as an area that can be designated for other uses aside from conservation and preservation. The absence of a comprehensive land and coastal use plan for most provinces in the region complicate mangrove management.

The loss of mangroves affects both the safety and livelihoods of coastal residents. With fewer mangroves serving as barriers, communities are further exposed to dangers posed by tidal flooding, sea level rise, and high events of erosion and siltation. The loss of mangroves has also been observed to result in a decrease in fish catch, biodiversity and coastal habitat productivity – directly affecting thousands of people whose main source of income depends on mangrove-derived fisheries.

IV. Management

A Brief History of Mangrove Management in the Philippines

As the third longest coastline in the world, the Philippines is expected to have considerable mangrove resources. Brown and Fisher (1918) reckon that the country had over 500,000 ha of mangrove cover in the 1900s. However, by 1995, this number had dwindled to 117,700 ha. Most of the mangrove loss occurred from the 1950s to the 1990s (Primavera 2000) – a period of mangrove deforestation for firewood collection or for conversion into aquaculture ponds. Other coastal ecosystems were similarly exploited, resulting in a serious decline in fish catch.

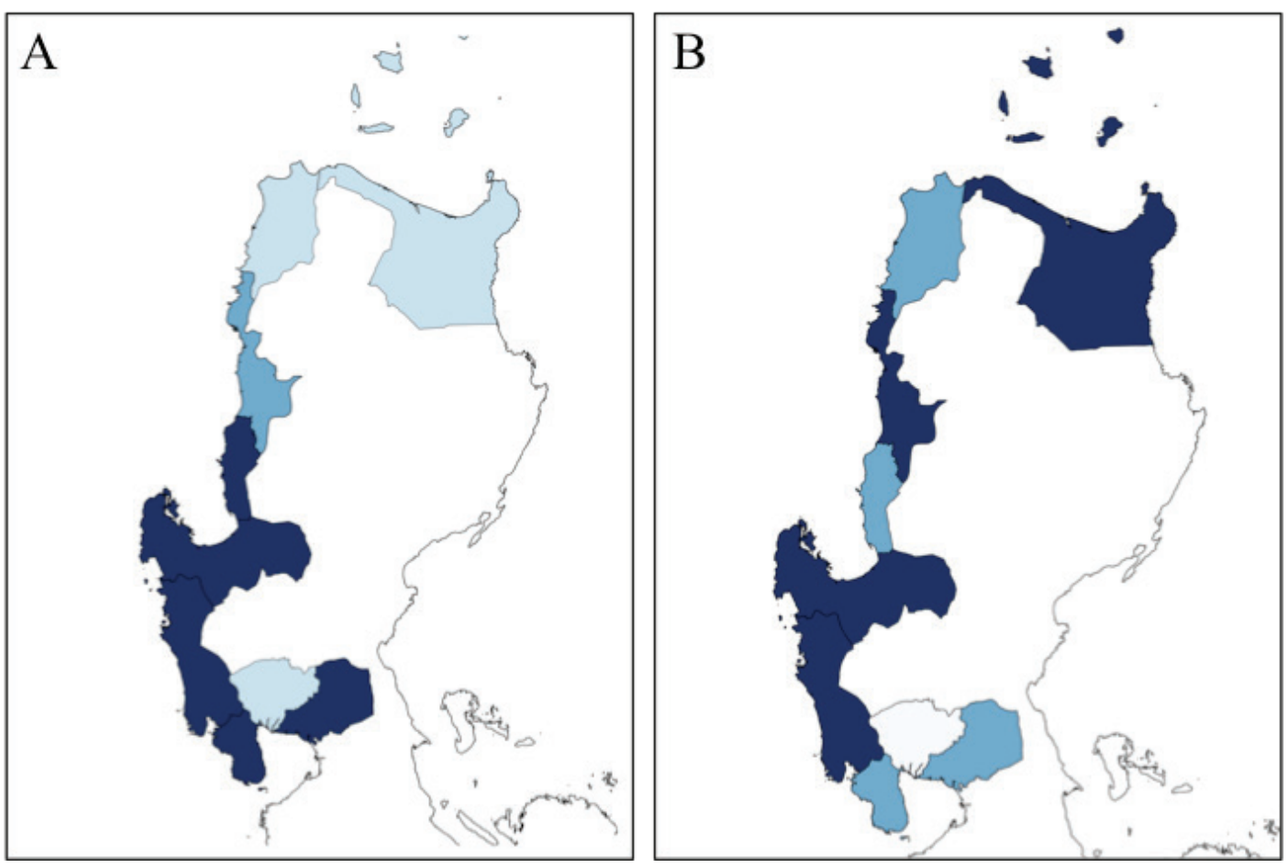

Figure 20. Provinces with severe concerns on (A) conversion of mangrove into aquaculture ponds and residential areas, and (B) areas exposed to natural hazards (e.g. erosion, land subsidence and sea level rise). Darker shades indicate more severe problems.

In the late 1970s, as concern over aquaculture resources grew, the national government created the National Mangrove Committee to formulate policies and recommendations for sustainable mangrove management and conservation. The Mangrove Forest Research Center was also established to generate technologies for mangrove management.

In the 1980s, the government appeared to take mangrove health more seriously and steps were taken to more concretely protect mangrove resources. For instance, in 1981, Presidential Proclamation No. 2151 declared several islands "containing an aggregate area of 4,326 hectares, more or less, subject to future delineation and survey for foreshore protection, maintenance of estuarine and marine life, including special forests for the exclusive habitats of rare and endangered Philippine flora and fauna and for such other purposes."

In the same year, Presidential Proclamation No. 2152 declared Palawan as a Mangrove Swamp Forest Reserve "containing an aggregate area of 74,267 hectares, more or less, subject to future ground survey and delimitation, for conservation and protection purposes by reason of their ecological, scientific, educational and recreational values, including flora and fauna and marine life found therein and other values."

By the 1990s, more widespread coastal management initiatives such as the Coastal Environment Program (1993) and the Coastal Resource Management Project (1996) were initiated. By this time, stakeholder engagement was already recognized as an integral part in the success of coastal ecosystem management.

While the (re)planting of mangroves has been a standard practice in coastal resource management, there is still a dearth of data regarding their success, status and impacts. A common critique of traditional mangrove planting activities is the use of inappropriate species and planting in inappropriate areas (i.e., highly saline and inundated shoreline). For example, propagules of *Rhizophora* were commonly planted near the shoreline even if this species is naturally found in mid-forest or middle intertidal zone (Samson & Rollon 2008). This practice often led to dismal survival rates and, in rare cases where the propagules did survive, converting the previous mudflats or seagrass beds along the shoreline resulted in detrimental effects such as loss of habitat and feeding grounds for shorebirds and some species of fish. Thus, there is a need to improve and enhance mangrove replanting strategies. In addition, more and more mangrove managers are beginning to see the advantages of stronger community involvement.

In the past decade, mangrove restoration and conservation has become a prominent adaptation and mitigation strategy against the impacts of climate change. For instance, among the most recent initiatives include Executive Order 26, series of 2011, or the National Greening Program (NGP) and the Philippine National Aqua-Silviculture Program (PNAP). The NGP declares that "It is the policy of the State to pursue sustainable development for poverty reduction, food security, biodiversity conservation, and climate change mitigation and adaptation." As such, it requires the planting of 1.5 billion trees by 2016 in suitable lands, which include mangrove and protected areas.

The PNAP, the MOA of which was also signed in 2011, is geared towards mangrove rehabilitation and livelihood provision as a measure to address food security and poverty, and climate change. The Bureau of Fisheries and Aquatic Resources (BFAR), the primary implementing agency, has identified the following strategic interventions:

1. Replanting of destroyed mangrove resources;
2. Establishment of community-based multi-species hatcheries; and
3. Provision of aquasilviculture livelihood projects to fisherfolk-beneficiaries

In addition to these, the Reducing Emissions from Deforestation and Forest Degradation (REDD+) program of the United Nations Framework Convention on Climate Change (UNFCC) is now thought to be a possible mechanism that can arrest further mangrove degradation. The Philippine National REDD+ Strategy aims to determine the drivers of greenhouse gas emission arising from both deforestation and mangrove forest degradation (Ramos & Osorio 2013).

Mangrove Management in Northwestern Luzon

In northwest Luzon, mangrove management has long been part of the region's history. One of the earliest mangrove management programs can be traced with the declaration of Hundred Islands National Park (HINP) in Alaminos City, Pangasinan as protected area by virtue of Presidential Proclamation 667 by then President Manuel Quezon in 1940. The HINP covers the foreshore areas, including mangroves. Ironically, most foreshore areas are also the same site where massive conversion to aquaculture ponds happened until 1980s. In the late 1980s to early 1990s, the Municipal Government of Bani initiated the first mangrove rehabilitation program in the region. The mangrove plantation was eventually enacted as a marine protected area. This program garnered several provincial, regional

and national environmental management recognitions. Its success inspired the other neighboring municipalities and provinces such that by mid- to late-1990s, massive mangrove rehabilitation programs were implemented in the region. Most of these programs received funding mainly from the national government (e.g. the Coastal Environment Program, and Integrated Coastal Resources Management Program of DENR), and, in some cases, from local and international NGOs. It also becomes a norm that the remaining natural mangrove stands are declared as mangrove protected area.

All provinces in northwestern Luzon have reported implementing mangrove reforestation projects through multi-sectoral partnerships and/or through their respective Integrated Coastal Resources Management Plans. There are approximately 838.6 ha of planted areas in Northern Luzon. This figure does not include plantations from Pangasinan and Zambales, whose plantation data were not specifically identified. Most projects used *Rhizophora sp.,* although Pangasinan has initiated multispecies planting. The survival rate of planted seedlings average at 58% with regular weekly to quarterly monitoring (Table 3).

All provinces, with the exception of Bataan, have mangrove plant monitoring systems in place. Provinces that mentioned an established monitoring system, whether by the municipal government or by fisherfolk/POs are Bulacan (40–50% survival rate) (90% survival rate based on BFAR data), La Union (100% survival), Pangasinan (53% survival in river banks, 43% survival in intertidal flats), Bani, Pangasinan (34-64% survival rate), Subic Bay Freeport Zone, and Zambales (65–100% survival rate). Ilocos Norte did not provide details of their monitoring system but reported evaluation data. There were no reported values for growth rate. These reported figures, however, need to be verified and standardized as the survival rates are inconsistent with the mangrove status in each province. For example, if these survival rates are indeed accurate, then, the mangrove cover should have increased by at least 200 to 300 ha.

There is no systematic and standard monitoring systems in place despite the fact that most of these provinces have been doing mangrove planting programs for at least 15 to 20 years. There is also no monitoring data, except for Bani, Pangasinan. In addition, the metrics and methods used for monitoring are not clear. Most provinces reported visual observations and did not have actual growth and survival measurements. Similarly, there is no systematic impact monitoring system. If the planted mangrove trees grown and survived for 15 years, it is interesting to know what have been the actual contribution of these mangroves in terms of fisheries production, in stabilizing the shoreline, in protecting the coast as buffer against typhoons, and in performing other ecosystem functions. Only the municipality of Bani reported that rehabilitation projects helped increase their municipality's fish catch from 2.0 kg in 1995 to 3.25 kg in 2000 and then to 6.68 kg in 2007.

Problems encountered in the planting programs include natural impact from tidal and wave actions during typhoons; high salinity; high inundation; extreme sunlight exposure; infestation of barnacles and tussock moths, algal blooms; poor management practices such as improper care and maintenance, improper timing of planting, planting of poor quality propagules; and disturbances or damages from fishing, gleaning, trampling of boats, stray animals and entanglement with garbage or debris.

In addition to mangrove planting, other provinces have also taken steps to improve the health of their coasts by dredging rivers, planting trees in upland areas to prevent erosion, prohibiting the building of illegal structures along riverbanks, sustaining activities of Marine Protected Areas, regulating fishing activities, providing livelihood projects, and strictly implementing Municipal Fisheries Ordinances. Some provinces also have active partnerships with local fisherfolk and POs, which strengthen community-based management.

Summarized in **Table 29** are the mangrove planting programs and projects reported by the provinces, and the municipalities of Masinloc and Bani. The SBMA has no mangrove projects as no increase or decline in mangrove forests have been observed in recent years.

V. Experiences and Lessons

The mangrove management programs in northwestern Luzon can be traced back as early as 1940s. Mangrove rehabilitation programs started in late 1980s. There have been some measurable and considerable successes as well as difficulties. Several facilitating (and constraining) factors can be learned from these experiences.

Institutional networking and linkaging facilitates continuous technical assistance, both in technical and financial concerns. Most provinces are recipients of grants and projects from various funding institutions showing that the region was recognized for its accomplishments in mangrove management. The provision of incentives, such as annual recognition awards, has long been practiced in Region 1, but are more prominent in the provinces of Pangasinan and La Union. The awards, aside from the

financial incentives, will give recognition on the role of mangrove managers. Hence it provides regular challenge and inspiration among mangrove managers to sustain their projects.

Mangrove management projects will be sustainable in area where there is a pro-active participation from the local communities, and more importantly, if the communities are organized. In most cases, members of POs are the ones doing the actual planting, replanting and maintenance of the plantation. An enabling mechanism to sustain community participation is the stipulation of community empowerment provisions in integrated land/coastal development plan. A policy on long-term (at least ten years) mangrove management plan should be enacted. This aspect was clearly shown in Pangasinan, Zambales and Bataan.

The declaration of remaining natural mangrove stands as protected areas serves as a good strategy to help ensure that there will be no further mangrove loss through cutting. Eco-tourism, though only currently practiced in the municipalities of Bani and Masinloc, hold promise in providing economic incentives to mangrove managers. These two municipalities were able to package mangroves with bird watching and snorkeling activities.

Most provinces in the region still widely practice monospecific planting and putting plantations in the wrong sites despite the fact that it has been discouraged since mid-1990s. Fortunately, the provinces of Pangasinan and Zambales slowly did away with monospecific planting and actually already attempted to practice multispecies planting. For optimal results, mangrove managers are encouraged to consider the natural species zonation pattern in choosing the mangrove species to plant. If possible, mangrove planting in intertidal zone should be avoided, and instead prioritize planting in abandoned, undeveloped and underutilized (AUU) aquaculture ponds.

VI. Future Directions, Gaps and Recommendations

The role of mangroves in disaster risk reduction has never been as acutely recognized in the Philippines as in recent years. Reports of the impacts of Typhoon Haiyan with respect to mangrove cover have highlighted the critical role that proper mangrove management plays in mitigating sea level rise, storm surges and string wave action, among others. However, more stringent monitoring systems must be set in place to collect better quantitative and qualitative data that will inform policies and management strategies.

While the legal framework of mangrove management remains problematic due to overlapping roles and responsibilities, several options already exist to incentivize mangrove protection beyond the legal framework. Lasco et al. (2011) reported that local interest to participate in the carbon market is increasing. There is potential in exploring the value of carbon sequestered by mangrove forests and the ability to offset the opportunity costs of aquaculture might pave the way for better mangrove protection. Thus studies investigating the value of stored carbon, which will not be fruitful without extensive monitoring data, are critical.

A lack of data on the extent and survival of mangroves is evident from the information provided by the provinces. This lack of information contributes to the difficulties of mangrove evaluation, monitoring and management. A thorough evaluation of current mangrove areas will be useful in obtaining baseline data, which can be used in the creation of comprehensive and effective mangrove monitoring and management plans. The data can also be used in making guides for future mangrove planting projects to ensure the success of mangrove management programs.

Crucial to the success of any project is the strict implementation of policies as well as the empowerment of communities in participating in mangrove management. Furthermore, implementation must always have clearly defined goals. Each individual, agency or group should also be clear on their respective role in the implementation to avoid unnecessary confusion and encourage accountability.

A regular venue and network for sharing status reports and best mangrove management practices across the region is needed. From this, a comprehensive national mangrove database can be created and used to produce information and recommendations for improved and updated practices that keep up with our changing climate and coasts.

Table 29. Provincial/municipal mangrove planting projects

Province/ Municipality/ Zone	Name of Project	Duration	Implementing Agencies/Groups	Hectares Planted	Project Location/s	Monitoring Rate	Survival Rate	Factors Affecting Survival
BATAAN	Bataan Integrated Coastal Management Program (BICMP)	2001-2012	LGUs, POs, NGOs, Private Corporations, NGAs, Academe, Bataan Coastal Care Foundation	30.2	Municipality of Abucay (Brgy. Mabatang) Municipality of Orion (Brgy. Daan Pare, Camachile, Capunitan, Balut, Sta. Elena) Municipality of Limay (Brgy. Alangan) Municipality of Pilar (Brgy. Wawa South, Balut II) Balanga City (Brgy. Sibacan, Brgy. Tortugas)	-	70%	-
	Bakawanan sa Bataan	Annual	-	-	-	-	-	-
	BFARs Enhancement Planting	2011	-	18	Orani to Limay	-	-	
	DENR-PENRO Initiative	2007-2010	DENR-PENRO	72	Kabalutan, Orani; Wakas, Pilar; Pto. Rivas, Balanga; Orion; Pilar; Balanga; Abucay; Samal; Orani	-	-	-
	Mangrove Nursery and Mangrove Reforestation Project	2010-2013	Samahan at Ugnayan ng Pangisdaan ng Orion	6	Brgy. Sta. Elena and Brgy. Balut	Monthly	70%	Typhoons, barnacles
	People's Organization Initiative	2003-2006	Sagip Likas Yamang Dagat ng Bataan, Inc. (SALBA)	130,000 propagules or ~13 ha	Orani and Pilar	-	-	-
		2009-2012	Samahan at Ugnayan sa Pangisdaan ng Orion Inc. (SUGPO)	120,000 propagules or ~12 ha	Brgy. Balut, Camachile and Sta. Elena, Orion Bataan	-	-	-
	Private Sector Initiative	2014	Jollibee Group Companies, Rotary Club of Metropolitan Cubao, Association of Safety, Practitioners of the Philippines, Inc., ASSPI and Phil Resins Industries Inc (PRII)	~9, 000 propagules or ~0.9 ha	Sta. Elena and Camachile, Orion	-	-	-
BULACAN	Bulacan Fisheries Resource Management Program (FRM for Improved and Sustainable Harvest) Fish Component II	October 2008 to Present	Provincial Agriculture Office	6	Wawang Capiz, Taliptip, Bulakan, Bulacan	Weekly/ monthly	40%	Trampling by fishing boats, strong waves caused by typhoons
	Philippine National Aquasilviculture Program (PNAP)	May 2012 - December 2013	Bulacan State University and Obando School of Fisheries	130	Malolos, Paombong, Hagonoy, Obando, Meycauayan	Weekly/ monthly	40-70%	Tidal and wave action during typhoon, extreme sunlight exposure, garbage, quality of the propagules or planting materials
	Save Manila Bay Project (BFAR Regular Target)	January 2011 - December 2013	BFAR-RO 3, KMBI	33	Calumpit, Paombong, Hagonoy, Meycauayan and Obando	Weekly/ monthly	10-20%	
					Bulacan and Malolos		55- 60%	
	Mangrove Reforestation	December 2010 - December 2011	DENR - CENRO, Tabang, Guiguinto	25	Bulacan and Paombong	-	50%	Attachment of barnacles to the propagules
CAGAYAN	Integrated Coastal Resource Management Projects (ICRMP)	July 2009 - December 2012	DENR, BFAR	807	Abulug	Quarterly	60% Camiguin Island, 78% Pamplona, 80% Abulug	Force majeure
				39	Calayan			
				64.14	Gonzaga			
				4.25	Sanchez Mira			
				1,093.50	Aparri			
				121.44	Buguey			
				17.5	Claveria			
				702	Pamplona			
				639.24	Sta. Ana			
				340.1	Sta. Teresita			

Table 29 (continued)

Province/ Municipality/ Zone	Name of Project	Duration	Implementing Agencies/Groups	Hectares Planted	Project Location/s	Monitoring Rate	Survival Rate	Factors Affecting Survival
ILOCOS SUR	Mangrove Population Enhancement Program	January 2013-Present	BFAR, MMSU, PGIN, LGU, DENR, DECORMA	483	-	Monthly	100%	Floods, typhoons
ILOCOS NORTE	Establishment and Rehabilitation of Mangrove Areas in the Province of Ilocos Sur	1995-Present	BFAR-RO I, PGIS (OPAG-Fisheries/ ENRMO), LGUS, SUC, DENR	-	-	Monthly	-	Improper care, maintenance and management of the mangrove seedlings; stray animals; force majeure; improper timing of planting
LA UNION	BFAR Plantation	2011-2014	-	~175.75	-			
	Mangrove Population Enhancement Program	2011-2016	BFAR-I, OPAG, LGUs, DENR, Tanim Kalikasan and Fisherfolk Association	33.7	-	Quarterly	-	Barnacles, fungi, strong tidal waves
	Upland Development Program National Greening Program	2009-2016	DENR in partnership with LGUs and coastal communities, coastal barangays and POs	~40	Riverine/ estuarine and coastal areas from the municipalities of Sto. Tomas to Bacnotan	Quarterly	-	Barnacle infestation, tussock moth infestation, poor quality of propagules/ seedlings, stray animals, gleaning, trampling of boats, harsh tidal action, entanglement with debris
PAMPANGA	Enrichment Planting and Mangroves	-	-	5	Sasmuan, Pampanga	-	-	-
	Protection and Maintenance of Existing Mangroves through Enrichment Planting	-	-	38 10 21.7	Brgy. Consuelo Brgy. Batang I Brgy. Batang II	-	-	-
PANGASINAN	Mangrove Reforestation Project	2005-Present	PaGO and LGUs of project locations	62.44	Municipalities of Bolinao, Anda, Infanta, Dasol, Agno, Dagupan, Mangaldan, Sual, San Fabian, Lingayen, San Carlos City, Bugallon, Alaminos City, Labrador, Bani and Binmaley	-	53% along riverbanks, 45% along intertidal flats	In intertidal flats: Wave action, barnacle infestation, algal blooms, sedimentation. In riverbanks: Rapid currents, sedimentation, flooding
	Mangrove Rehabilitation through Enrichment Planting	2011-2012	DENR - Provincial Government of Pangasinan	15 10	Dasol Infanta	-	53% along riverbanks, 45% along intertidal flats	
	Mangrove Reforestation Project	2012-Present	BFAR	76.96	Municipalities of Binmaley, Bolinao, Alaminos City, Infanta, Dasol, Lingayen, Bani, Bugallon, San Fabian and Sual	-	53% along riverbanks, 45% along intertidal flats	
BANI	Riverine Mangrove Rehabilitation	2007-2013	Bigkis Lakas ng Brgy. Masidem, NAGKASAMA, Garrita Fisherfolks Assn., BFARMC, AFAI, LUFA,POFSA	70,845 propagules (32.41 ha)	Banog River, Don Cayo River, Bani River, Putot Lagoon, Garrita River, Embarcadero River, Ambabaay Creek	Annually	34%-64%	Toppling of plantation by *lumut*, heavy infestation of barnacles at the stems, typhoon; damage of defoliation of leaves by insects have also been observed
	Coastal Mangrove Rehabilitation	2007-2013	AFAI, NAGKASAMA, Bangrin Federation, PASS, Alaminos Students	184,802 propagules (37.5 ha)	Bangrin MPA			
SBMA	Mangrove Reforestation Project	2000	Woodward-Clyde (WCPI) Philippines	3.94	Nabasan, Triboa, Silangin and Ilanin	At least annually and at most quarterly (conducted by Ecology Center)	92% directly planted propagules, 90% nursery-raised seedlings	-

Table 29 (continued)

Province/ Municipality/ Zone	Name of Project	Duration	Implementing Agencies/Groups	Hectares Planted	Project Location/s	Monitoring Rate	Survival Rate	Factors Affecting Survival
			Small Fisherholds of the Municipality of Palauig				80-90%	
			LGU of Brgy. Sto. Tomas				82.12%	
			Mangingisda at Magsasaka sa Palauig				86.68%	
			Samahang Mangingisda ng Panglit				80-87%	
			United Palauig—MPC				83%	
			Samahang Magsasaka ng Libaba				86.63%	
ZAMBALES	Integrated Coastal Resources Management Project (ICRMP)	-	Samahang Mangingisda ng Candelaria	326.5	Sta. Cruz, Candelaria, Masinloc, Palauig, Botolan and Cabangan	-	85.37%	-
			Burador Fisherman's Association				87%	
			Samahang Pangkaunlaran ng San Salvador				82%	
			Panan Fisherfolks Movement Association				80%	
			Kalipunan ng Liping Cabangan				65.60%	
			Parel Union for Water Environmental Resources and Social				100%	
MASINLOC	Mangrove Rehabilitation Project	2012 - 2013	DENR, LGU	3	Brgy. Bani	3-month project monitoring and evaluation	80%	Disturbance due to fishing and gleaning, strong waves, soil erosion
				3	Brgy. Taltal			
				9	Brgy. San Salvador			
				41	Brgy. San Lorenzo, Bamban, Sto. Rosario			

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