

Evaluation of Mangrove Ecosystem Services in the Ayeyarwady Delta: A Step Towards Integrated Coastal Zone Management in Myanmar

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Abstract

Mangrove systems around the world's coastlines are providing numerous ecological services and economic benefits, yet are increasingly under threat. In Myanmar, mangrove forests significantly disappeared by the indiscriminate felling for firewood and by conversion of land for agriculture and aquaculture expansion due to population growth and economic development. Deforestation of mangrove forest beef up the degradation of coastal watersheds and have increased upstream erosion, undermined the long-term multiple resource uses and potential of the natural ecosystem goods and services bases. Proper inclusive management plans based on ecological data and natural value could contribute to long-term multiple uses of mangrove which are environmentally sound, socially acceptable and sustainably development. These plans could be part of a broader strategy of Integrated Coastal Zone Management (ICZM) for the country. The aim of this research is to – by looking at a case study of mangrove services values in the Ayeyarwady delta – identify entry points for involving local communities in the creation of ICZM plans. It does so by using an integrated research approach covering fishery, forestry and community perspectives and linking it to the current institutional framework on coastal zone management. The key questions asked in the study are: 1) What are the services provided by the mangrove system in the case study according to the communities and how have they changed in

the past decennia? 2) What are strategies of government and communities to deal with degrading services and 3) What are potential incentives for mangrove conservation and/or restoration as part of an Integrated Coastal Zone Management strategy?

Introduction

Myanmar has a long, elongated coastline extending almost 3000 km from the west to the south-east of the country. Large portions of the coast are covered with mangrove forests. These are typical salt-tolerant forest ecosystems which are formed when the marine water reaches the coastal area. The term “mangrove” is used to define both the plants that occur in the tropical tidal wetland forests and to describe the community itself.

Mangrove forests are a key marine biome supplying valuable ecosystem goods and services. The surrounding vicinity of mangrove area are rich in fishery resources and act as nurseries and spawning grounds for a large number of species of fish, molluscs and crustaceans. They are major sources of employment and income generation for local livelihoods, and many coastal communities are largely dependent on mangrove which provides many economic benefits such as firewood, charcoal, logs and other minor forest products to the dwellers. In addition, mangroves cover a wide range of functions such as flood control, coastal stabilization, prevention of erosion, habitats for wildlife and endangered species and are more recently increasingly serving recreation/ ecotourism purposes.

The multiple functions and socio-economic benefits from mangroves are under threat: over-exploitation for fuel wood and timber production has degraded about 26% of mangrove forests around the world (Valiela et al., 2001) and similar figures are likely to apply with mangrove loss in Myanmar. Shrimp aquaculture has contributed to about 38% of global mangrove loss and other types of aquaculture account for approximately another 14% (Ellison, 2008). While direct anthropogenic impacts are the biggest threat to mangrove ecosystems, climate change will probably pose even greater risks in the future (Gilman et al., 2008).

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The aim of this research is to – by looking at a case study of mangrove services values in the Ayeyarwady delta – identify entry points for involving local communities in the creation of ICZM plans. It does so by using an integrated research approach covering fishery, forestry and community perspectives and linking it to the current institutional framework on coastal zone management. The key questions asked in the study are: 1) What are the services provided by the mangrove system in the case study according to the communities and how have they changed in the past decennia? 2) What are strategies of government and communities to deal with degrading services and 3) What are potential incentives for mangrove conservation and/or restoration as part of an Integrated Coastal Zone Management strategy?

Study Site

The study area, around Meinmahla Island, is located in the Ayeyarwady delta in Myanmar. The island is composed of mudflats at about 1 meter above sea level and is almost entirely covered by mangrove forests. The island itself is scarcely inhabited and surrounded by small size villages with a total population of 9681 inhabitants. In 2008 this area was heavily hit by cyclone Nargis and since then has been the center of several mangrove restoration efforts. The livelihoods in the

area are mainly linked to fisheries that depend strongly on the health of the mangrove systems.

Figure 1. Study area of communities around Meinmahla island located in the Bogale district in Ayeyarwady delta, Myanmar



Methods

In order to connect drivers of mangrove degradation or incentives for their conservation with the value (or absence thereof) attributed to ecosystem services provided by mangroves, this study uses a combination of land use change analysis, institutional analysis and analysis local communities' perception on values of ecosystem services. The institutional analysis links to the identification of policies and (non-) governmental programs in place to conservator the mangroves and aims at identifying avenues for integrated coastal zone management. Land use changes are analyzed based on a combination of satellite data (NASA Myanmar Ecological Forecasting, 2014) and reports provided by the Forestry Department at the Ministry of Natural Resources and Environmental Conservation (MONREC). The perceptions on values of ecosystem services are collected through a field survey with semi-structured interviews in different communities around the Meinmahla Island.

The semi-structured interviews were held in 5 selected villages around Meinmahla Island and included questions on household composition, sources of livelihood and income and a number of questions linking to the services provided by

mangrove systems and how they are perceived by the local communities, including different gender perspectives. These five villages are Nga Poke Tin Tan, Asi Lay, AsiGyi, DaminNaung and HtawPaing which are located in the Bogalay Township. Group Interviews with local fishermen, gardeners and other local stakeholders were conducted. At least 5 household representatives were interviewed in each village, balancing male and female respondents. Furthermore key informants at Fisheries Department and Forestry Department in Bogalay Township were interviewed.

Figure 2: a) Households and demographics in the villages interviewed during field survey and b) semi-structured interviews at the village level



	Nga Poke Tin Tan	Asi lay	AsiGyi	DaminNaung	HtawPaing
#households	92	95	201	256	269
#survey interviews	5	6	7	7	6
Female	3	3	5	4	3
Male	2	3	2	3	3

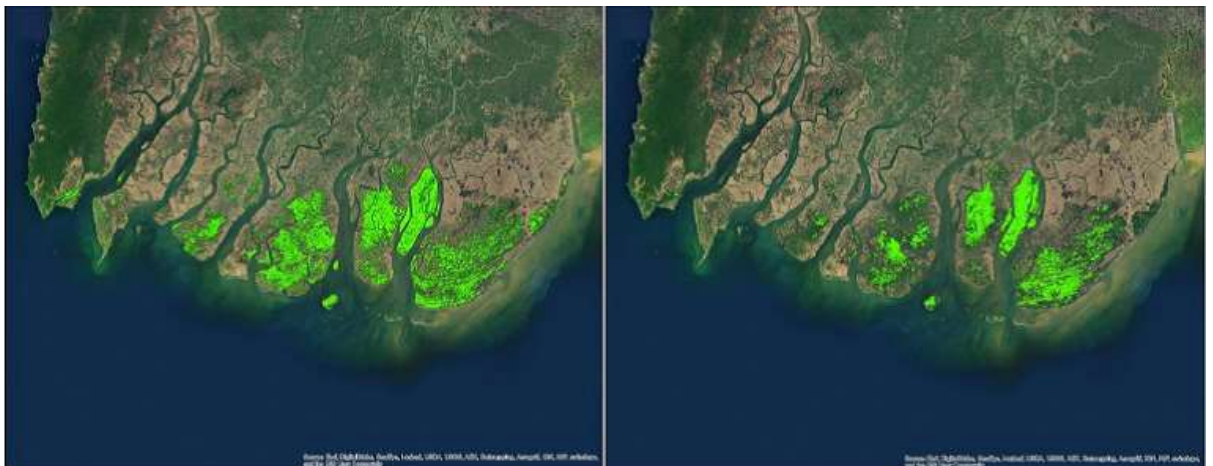
For the analysis of land use changes, NASA Myanmar Ecological Forecasting (2014) was used to identify the main areas of mangrove cover and its evolution in the period from 2000 to 2013.

Result and discussion

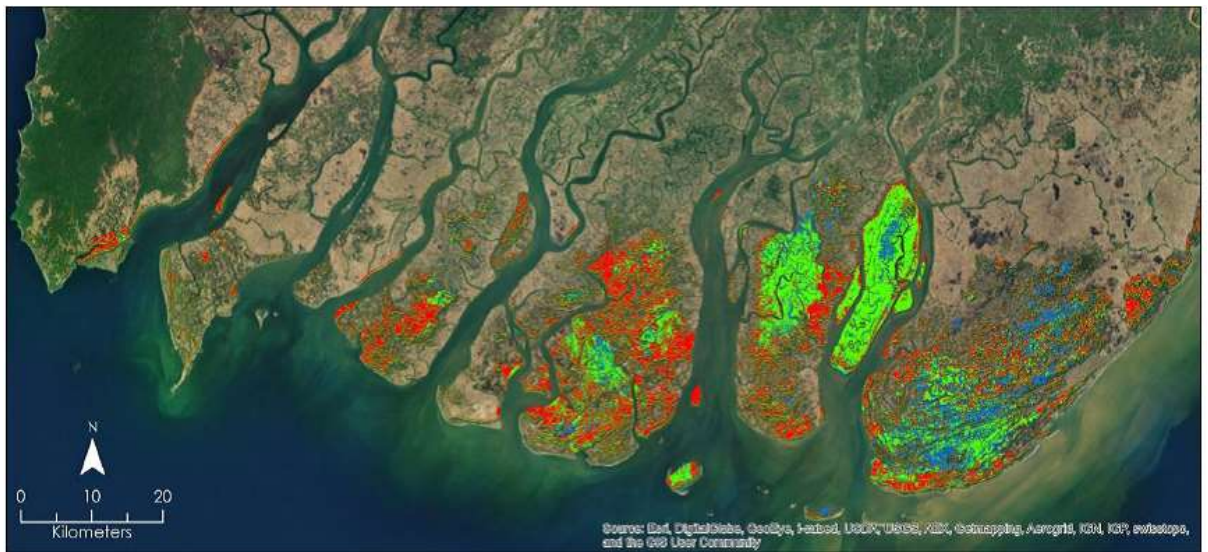
The results are presented in 3 parts: (1) evaluation of land use changes, (2) livelihoods and (perceived) value of ecosystem services and (3) overview of policies and government initiatives for protection or conservation of mangrove systems.

In their analysis of LANDSAT images (figure 3), Weber et al. (2014) report an overall decline in the Ayeyarwady delta mangrove cover over the period 2000-2013 from 818km² to 356km².

Figure 3: Total area of mangrove cover in 2000 and 2013 and change detection of deforested and afforested areas for that period



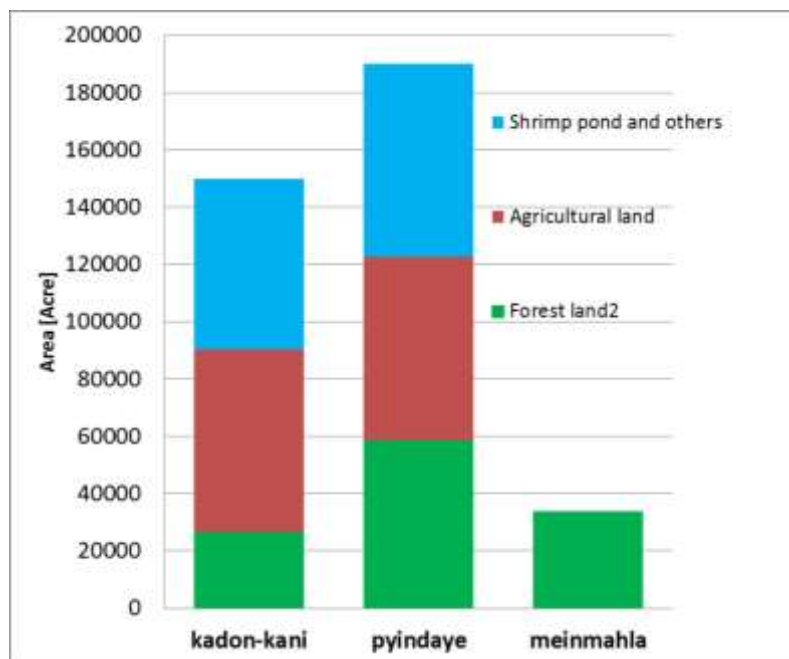
Evolution of mangrove cover in green from 2000 (818km²) to 2013 (356km²)



Change detection of mangrove in period 2000-2013: red = deforestation, blue=afforestation
 (source: Weber et al., 2014)

These data confirm earlier analysis by Forest Department (2009) on land use changes in Bogalay township, indicating a shift from forest land to agricultural land and shrimp farming in the areas surrounding Meinmahla island (figure 4)

Figure 4: Land use in reserved forest areas in Bogalay Township



(Source: Forest Department, 2009)

Zockler et al. (2013) point at aquaculture as one of the biggest threats to mangroves in the Ayeyarwady delta. Despite the restoration and plantation of mangrove in suitable areas, the appearance of shrimp ponds is said to remain a considerable threat.

Analysis of livelihoods and income levels in the villages in the study area, show large differences in income across villages and over different years (Table 1)

Table 1: Income distribution over villages in the Bogalay district and evolution over 2014-2015

Village	Population	Income 2015 (million MMK)	Income 2014 (million MMK)
A Si Gyi	1102	71,52	3,74
A Si Lay	417	17,42	6,92
DhammaThuka	721	0,78	0,12
HteikChaung	556	47,96	6,30
Kant Malar Chaung	814	33,73	14,81
Kone Tan Pauk	454	74,47	5,23
Kun Thee Chaung	1355	13,58	2,90
PyinBoeGyi	771	22,82	0,23
PyinBoe Lay	197	2,09	0,53
SeinYa Ti	502	18,28	1,14
ThauKhaWadi	Villages located outside of Meinmahla island, no exact population data available	125,01	24,01
KwinSakhan		15,52	4,27
KyeeChaung		19,62	3,37
ThaKanNgu		5,61	1,60
TharPhyan		4,75	1,69
YwarThir		10,77	4,93

When asking villagers for the reasons behind the increase in income in 2015 in the majority of the villages, it was reported to be linked to the re-appearance of a before lost fish species of capture fish. Apart from direct economic benefits

provided by the mangrove supported catch fisheries, respondents mentioned following functions and its evolution.

- Provisioning services: decline in catch
- Supporting services: Loss of fish species, hibernation, flood protection, bank erosion
- Regulatory services: Loss of windbreak

With regard to the latter service provided by mangrove forests, several respondents mentioned that during the Nargis cyclone, “if one grabs a branch of tree during the storm-surge, his/her life was saved”. The lessons learned from Nargis point at a high value perception of the mangrove forests, which according to the local inhabitants’ voice then also leads to full willingness in environmental restoration programs.

Government strategies to maintain the mangrove cover have been in place since 1980s with increasing efforts on mangrove plantations by the Forestry Department in the 1990s. In the period 1992 till 2010, an average of 800 acres of mangrove was planted each year in Bogale Township, Ayeyarwady Delta. The current District Forest Management Plan from Pyapone mentions an average of 400 acres to be planted each year from 2017-2026.

Apart from the Forestry Department and its mangrove plantation strategy, there are a myriad of legal frameworks and institutions sharing roles and responsibilities linked to ecosystem services provided by mangrove forests, as revealed in the institutional analysis.

Table 2: Institutions and legal frameworks for mangrove ecosystem services protection

Forest Department	Environmental Conservation Department (ECD)	Fisheries Department
Forest Law (1992)	Environmental Law (2012)	Marine Fisheries law (1990)
Wildlife Law (1995)	Environmental Rules and Regulations (2014)	
Community Forestry Instructions (2016)	Environmental Impact Assessment Procedure (2015)	
National Biodiversity Strategy and Action Plan (2011-2030)		

Overall government initiatives to maintain and/or restore the services provided by mangrove systems can be summarized as: conservation policy and establishment of community forestry. However issues with landownership have made these policies limited successful in the Bogalay Township, where the community forestry (CF) area is limited to 250 acres only (contrasting with larger and more successful CF areas in neighboring township Pya-Pone). On the other hand the policy of establishing integrated fish farms, has proven to lead to land use conversion to create fish ponds and undermine the conservation policies of other departments.

The way forward to increase success rate of government initiatives in protecting mangrove services and to capitalize on the value that is attributed to mangrove forests, is to provide true incentives for sustainable livelihoods that will counter the illegal felling and conversion of mangrove areas to agricultural land or fish ponds. Alternative jobs have to be created and this can partly be done by creating added value to the mangrove products locally through establishing local food processing factories. Furthermore extension and education is needed.

Furthermore coordination of different government initiatives is needed and Integrated Coastal Zone Management provides an opportunity to do that. Our study identified the following elements as building blocks for such an ICZM

- Environmental Impact Assessment: enhances science-policy integration and can be useful to integrate knowledge across sectors (Environmental Law 2012, Environmental Rules and Regulation 2014, Environmental Procedure 2015)
- Planning hierarchy: an effective mechanism to integrate policies across government levels, with the latter also promoting public-government integration
- Marine spatial planning: is a multi-faceted mechanism with the potential to promote all types of integration (National Water Policy 2014, Environmental Law)

Conclusions

The study illustrates, through a combination of land use analysis and field interviews, how mangrove ecosystem services are swaying between conservation by (non-)government initiatives and appreciation of values by local villagers on one hand and degradation through strong driving forces for illegal felling and land use conversion on the other hand. Limited success of previous (non-)government initiatives to (re-) establish mangrove cover, can only be countered by a thorough understanding of incentives for mangrove protection. The study identifies three key focus areas to improve mangrove restoration and protection in the future: (1) need to elaborate legal framework to combine and streamline policies over different government departments, potentially through establishment of integrated coastal zone management and planning (2) identify real incentives for local communities to engage in sustainable livelihoods and (3) clarify land ownership relations, particularly important when looking at community forestry initiatives.

References

- Ellison AM, 2008. "Managing mangroves with benthic biodiversity in mind: Moving beyond roving banditry" *Journal of Sea Research* 59: 2-15
citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.466.9994&rep=rep1&type=pdf
- Gilman E, Ellison J, Duke N, Field C, 2008. "Threats to mangroves from climate change and adaptation options: A review", *Aquatic Botany* 89 (2):237-250.
www.iucn.org/sites/dev/files/import/downloads/aquatic_botany_mangrove_article2008.pdf
- Valiela I, Brown JL, York JK, 2001. "Mangrove Forests: One of the World's Threatened Major Tropical Environments" *Bioscience*, 51(10), 807-815
- Weber S, Keddell, L, Kemal M, 2014. "Myanmar Ecological Forecasting: Utilizing NASA Earth Observations to Monitor, Map, and Analyze Mangrove Forests in Myanmar for Enhanced Conservation" NASA publication, pp 16.
www.burmalibrary.org/docs22/NASA_Myanmar_Ecological_Forecasting-2014.pdf
- Zöckler, C. Delany, S. & Barber, J. 2013. Scoping Paper: Sustainable Coastal Zone Management in Myanmar. ArcCona Ecological Consultants, Cambridge, UK.
[www.lighthouse-foundation.org/fileadmin/LHF/PDF/Myanmar - Scoping Paper Myanmar Coastal Zone Management 211113 96dpi.pdf](http://www.lighthouse-foundation.org/fileadmin/LHF/PDF/Myanmar_-_Scoping_Paper_Myanmar_Coastal_Zone_Management_211113_96dpi.pdf)