Economic appraisal of Ayeyarwady mangrove forests

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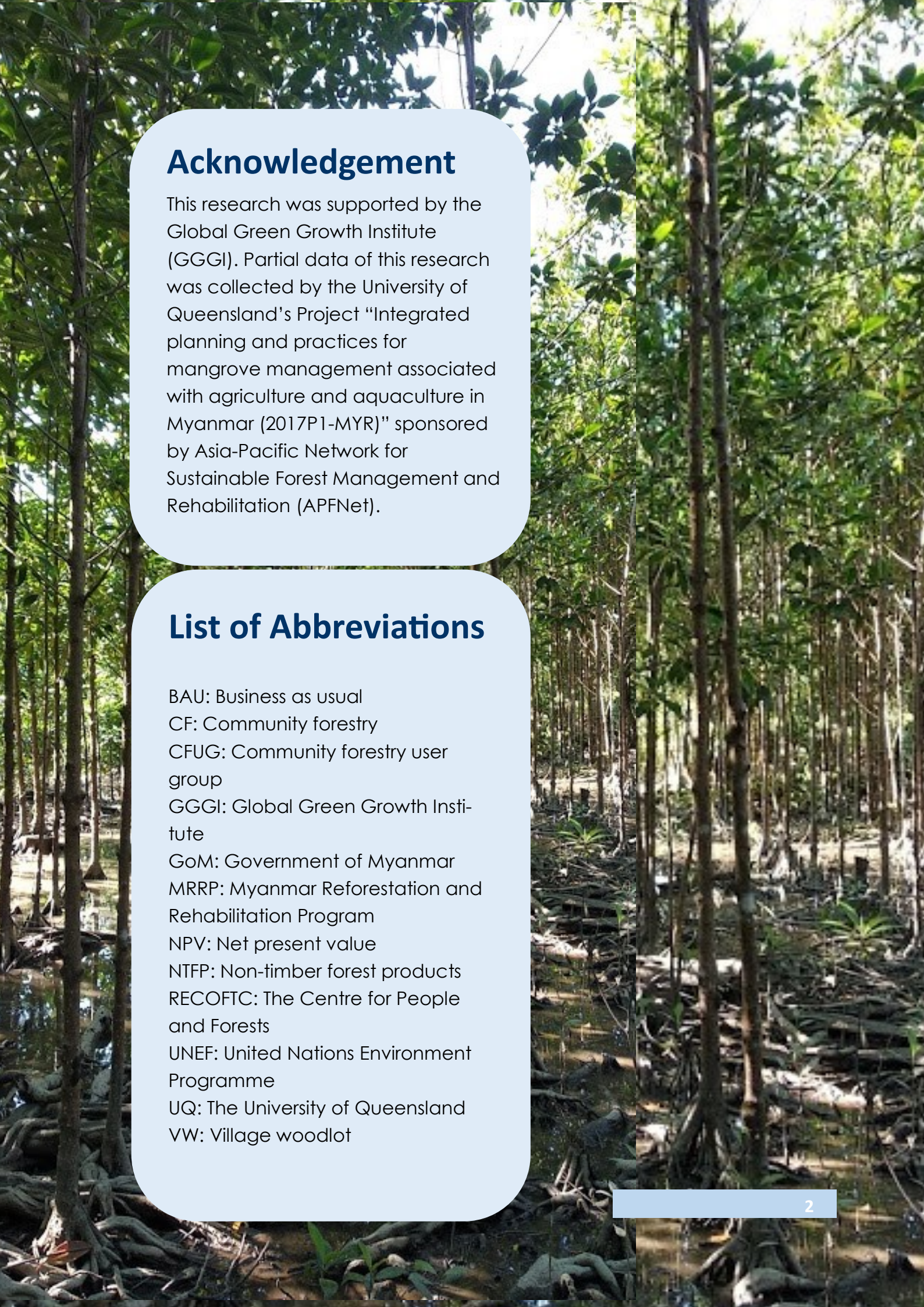
Prepared for the Global Green Growth Institute



Acknowledgement

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List of Abbreviations

BAU: Business as usual
CF: Community forestry
CFUG: Community forestry user group
GGGI: Global Green Growth Institute
GoM: Government of Myanmar
MRRP: Myanmar Reforestation and Rehabilitation Program
NPV: Net present value
NTFP: Non-timber forest products
RECOFTC: The Centre for People and Forests
UNEF: United Nations Environment Programme
UQ: The University of Queensland
VW: Village woodlot

Preface

The Government of Myanmar (GoM) and the Global Green Growth Institute (GGGI) agreed to collaborate on promoting sustainable landscapes in its Country Planning Framework. This includes a programmatic approach to drive policy reform and scalable investments towards landscape restoration and reduce deforestation, by enhancing the value of forested landscapes in Myanmar's national and local economy. The first phase includes planning, policy strengthening and financial assessments to build an economic and investment case for coastal landscape and mangrove restoration, including blue carbon as a potential revenue generating flow. Phase 1 (2019-2020), will have an emphasis on strengthening GoM capacities, policies and building the case; and that will set the stage for a longer-term Phase 2 (2020-2030) where climate and natural capital positive interventions and technologies, green business models and investment pipelines will be further developed, replicated and scaled through regulatory and policy reforms, more accessible finance, improved cross-sectoral governance and public/private sector collaboration. This report, developed in collaboration with The University of Queensland, is a component of Phase 1. It describes a Return on Investment Analysis of improved mangrove management and mangrove restoration in order to quantify the financial, environmental and social benefits of improved

Economic appraisal of Ayeyarwady mangrove

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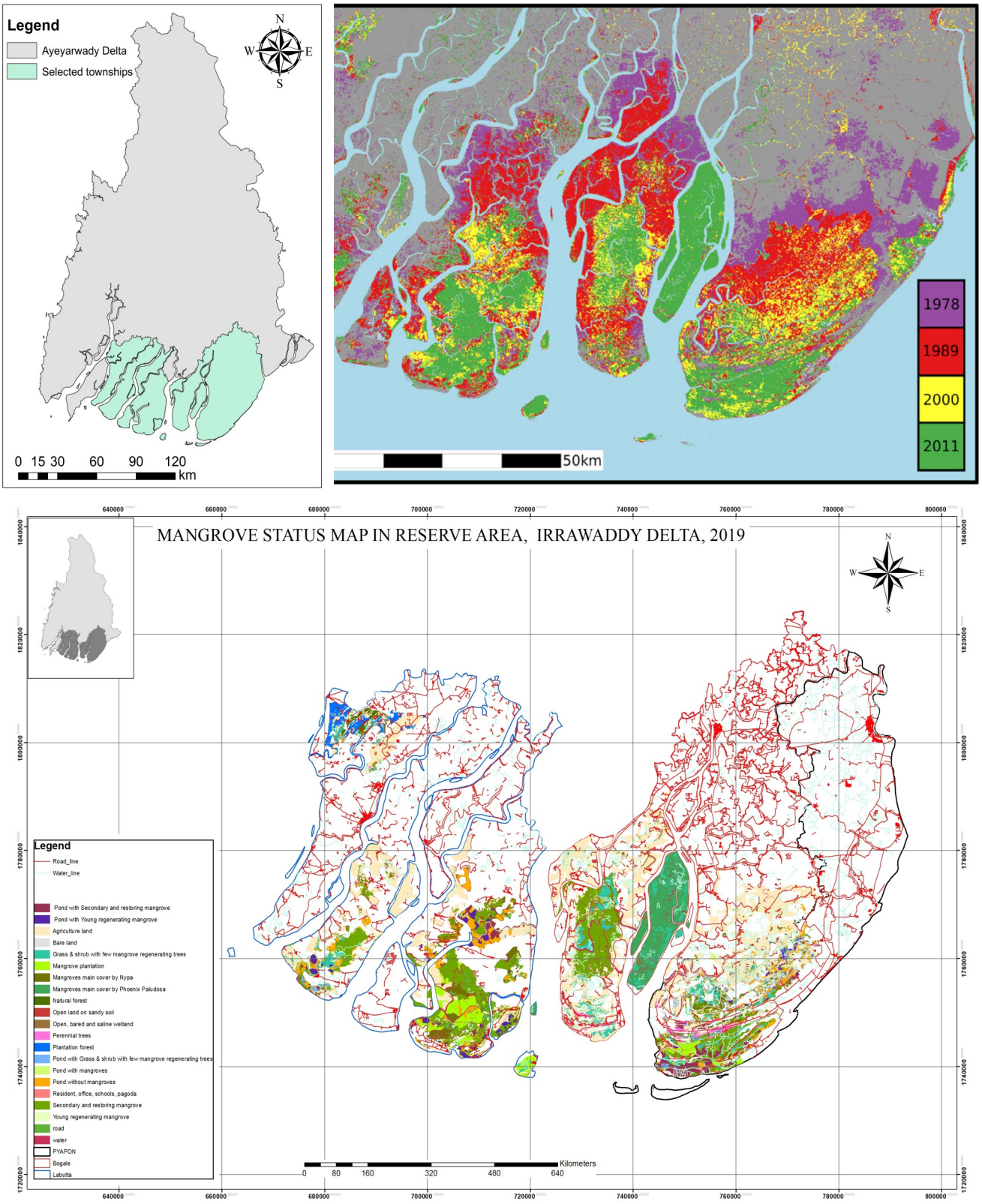


Figure 1. (a) Map of the study area in the Ayeyarwady Delta; (b) map of mangrove area remaining (green) and prior years of mangrove loss (from Webb et al. 2013); (c) detailed map of land uses, and condition of the remaining mangrove in the study area in 2019. Of the remaining mangrove area much of it is degraded.

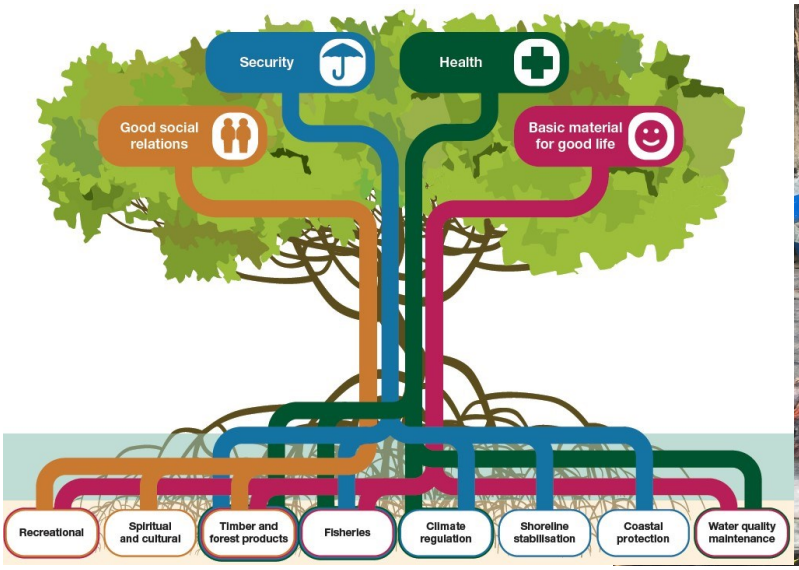


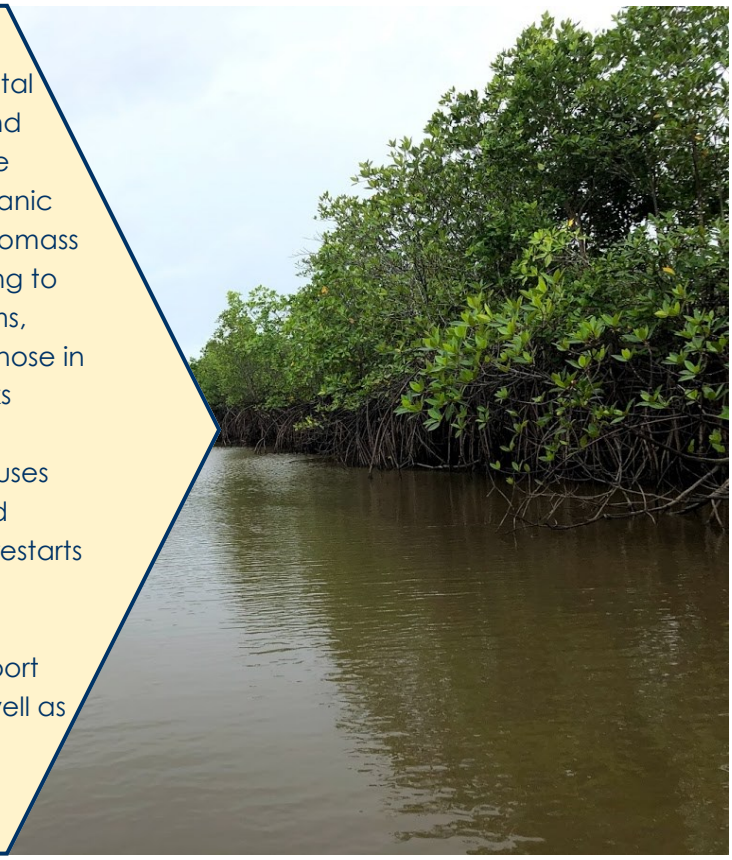
Figure 2. (a) Goods and services of mangroves and their relationship to human wellbeing* and (b) mangrove wood on sale in a village in the study area. *from UNEP (2014). The Importance of Mangroves to People: A Call to Action. van Bochove, J., Sullivan, E., Nakamura, T. (Eds). United Nations Environment Programme World Conservation Monitoring Centre, Cambridge.

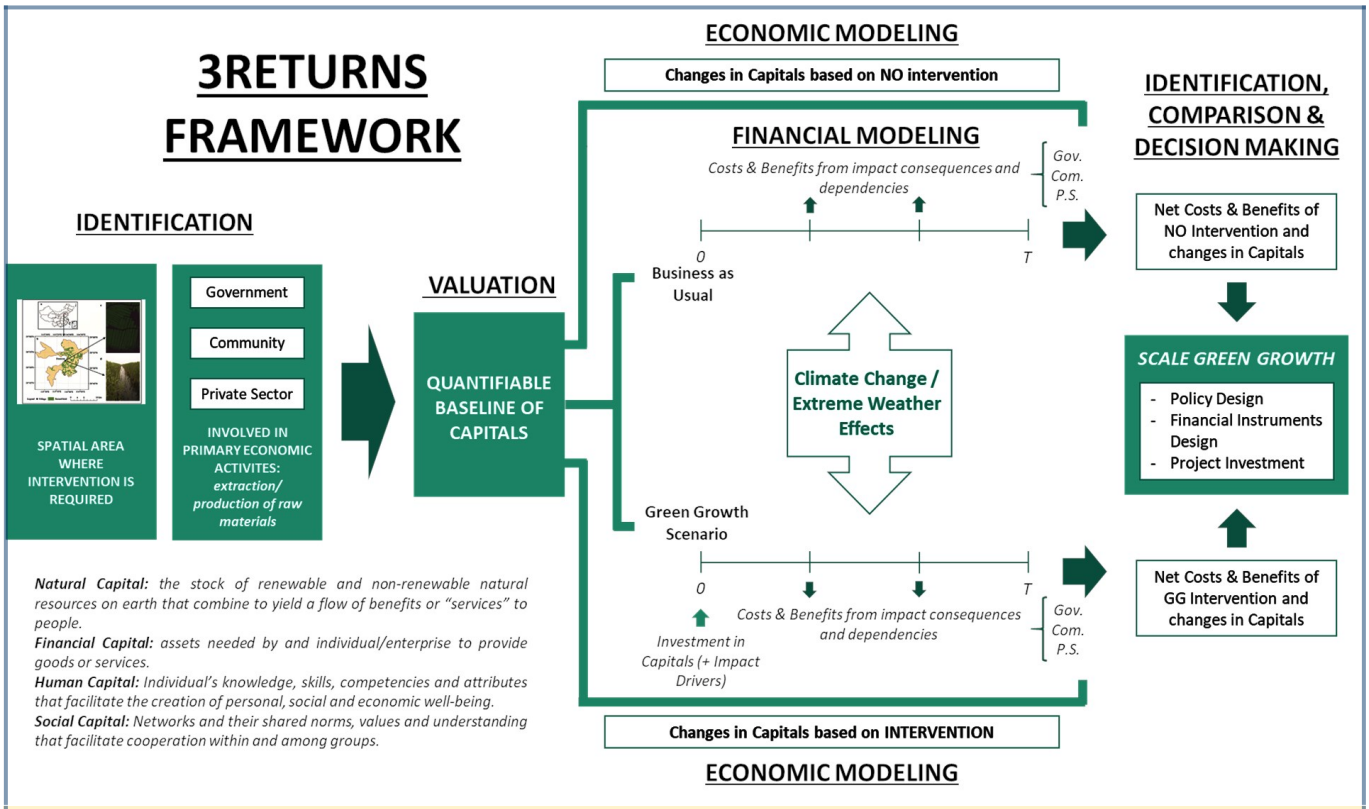
The importance of mangroves to coastal communities of Myanmar

The communities of the densely populated Ayeyarwady Delta are highly dependent on mangroves, for fuel, food and coastal protection from extreme storms (Figure 2). Yet the mangroves of the Delta have been degraded through conversion and over-exploitation which has increased the vulnerability of people to extreme weather events, as demonstrated by the devastating Cyclone Nargis in 2008, and the reduced well-being of communities as fisheries and the availability of fuel wood have declined. Conservation, restoration and improved management of mangroves is a solution to the environmental degradation faced by the people of the Ayeyawady Delta.

The conservation and restoration of coastal mangroves is a priority in line with Myanmar's Nationally Determined Contribution commitments to the Paris Agreement because of the reduction in climate-associated vulnerability and the role of mangroves in carbon sequestation or blue carbon (Box 1). But conservation and restoration requires substantial investment. Investment is more likely if the returns on investment are clearly known. Thus, the aim of this project was to characterize the returns on investment with restoration and improved management of mangroves in townships of the lower Ayeyarwady Delta. Our goal was to identify Green Growth alternatives to enhance the wellbeing of the communities of the Ayeyarwady Delta.

Box 1. Blue carbon is carbon that is contained within the biomass and soils of coastal ecosystems, including mangroves, seagrass and saltmarsh. The plants of coastal ecosystems are highly productive, and a proportion of the organic matter produced is stored within the woody biomass and flooded soils for thousands of years, leading to high levels of carbon stocks in these ecosystems, which are on average four times higher than those in terrestrial forests. High ecosystem carbon stocks result in high levels of CO_2 emissions when mangroves are converted to alternative land-uses as CO_2 is released when soils are disturbed and biomass burned or decomposed. Restoration restarts carbon sequestration. Payments for CO_2 sequestered with restoration or avoided CO_2 emissions if degradation is avoided could support communities to manage their mangroves as well as contributing to improved livelihoods.





Box 2. The 3Returns Framework followed by Green Growth Institute. In this project we have considered changes in natural, social & human, and financial capital, and the communities' dependency on them under a business as usual scenario, as well as under different levels of enhanced restoration and community management of mangroves.

Economic Stimulating Green Growth through investment in mangrove restoration and enhanced management

Restoration and improved management of mangroves can increase production of mangrove products and provide opportunity for enhanced livelihoods. Improved management of mangroves increases the supply and sustainable harvest of mangrove timber, which is extensively used as there are limited options for fuel for household cooking or for preserving fish catch. Conserving mangroves increases production of crabs (and other fish) which are an important high-value product for the landless members of communities. Finally, within mangroves, crab aquaculture is practiced which are stocked from larvae from the wild. Crab aquaculture has smaller scale than shrimp aquaculture and has the potential to provide high returns to land-holders with less degradation of mangroves compared to that which occurred with shrimp aquaculture over much of Asia.

Using an extensive field data set that included land-use mapping, mangrove biomass, growth rates, carbon sequestration, costs and success of mangrove restoration, data on value chains of mangrove products, levels of employment and training as well as information on government policies and practices (see Appendix 1), we used a 3Returns Framework to establish the return on investment in restoration and improved management of mangroves (Box 2). Our analyses also included estimates of the impacts of climate change on agriculture and mangrove distribution, although these impacts are highly uncertain due to a lack of data and models for the region (Box 3).

Box 3. Considering climate change impacts on Green Growth scenarios for the Ayeyarwady Delta

The Ayeyarwady Delta is low lying landscape that is highly exposed to the effects of climate change. The Delta is important for rice production, which is predicted to be adversely affected by increasing temperatures and salinization of soils associated with declining rainfall and river flows and increasing seawater inundation associated with sea level rise and storm surge. Based on data from Bangladesh, even with significant adaptation of rice agriculture, production could decline by 0.4% per year. The coastal intertidal habitat of mangroves are also highly exposed to sea level rise, with additional influences of changing wind and waves associated with storms, which can enhance erosion of shorelines and altered species composition and declining productivity as habitats become increasingly saline. As sea level progresses mangroves are predicted to replace landward agricultural land-uses.

Global analyses suggest that if coastal squeeze is avoided mangroves may expand in the Delta by up to 40% (0.54% per year). In contrast, if coastal squeeze occurs, losses of mangrove cover of 25% may occur (loss of 0.29% per year). Detailed spatial assessments of the effect of climate change on agricultural production and mangrove habitats in the Ayeyarwady Delta is impeded by a lack of data, including high resolution digital elevation models of the coastline.

Mangrove restoration and management scenarios

The management of mangroves in Myanmar is controlled by the Forest Department which manages the Reserve Forests (72,452 ha) and National Parks (13,000 ha). Illegal cutting of the mangrove for fuel wood is a major threat which is difficult for the Forestry Department to defend against, given long shorelines, limited number of officers and boats and the importance of extraction of resources from mangroves for livelihoods. Management of some of the mangrove has been handed over to Community Forestry User Groups (7,895 ha, 11% of Reserve Forest), which must have a management plan that complies with forestry regulations (Box 4), including thinning regimes (currently 3 – 5 years). The Forest Department of Myanmar and other non-government organizations are engaged in mangrove restoration, restoring approximately 1100 ha per year.

Community forestry activities results in improved outcomes for mangroves and restored forests, mainly because community members actively defend their mangrove against illegal wood cutters (Figure 3). Therefore, to estimate the economic benefits of improved management scenarios that increased allocation to community forestry (to 50% of Reserve Forest) were explored (Table 1 by 2026). Improved management scenarios also included increased time to thinning (5 – 6 years), a focus on leaving maternal trees to enhance natural recruitment and increased restoration effort to 2,000 ha per year for rehabilitation of degraded mangrove areas, with government funding for restoration allocated to community forestry groups.

Figure 3. Illegal fuelwood logging in reserve mangrove forests and national park in the Delta.

Mangrove restoration and management scenarios

Box 4. Community forestry is a broad term used to describe models of forest management that give local people the majority say in making decisions. With an aim to reduce poverty, community forestry is participatory and should serve all community members equitably (The Centre for People and Forests - RECOFTC).

Figure 4. (a) Training for community forestry user group on mangrove friendly crab fattenning; (b) Community forestry members learning about mangrove seeds and nursery techniques .

Table 1. Improved management scenarios explored for extended cost benefit analysis including the Business as Usual Scenario and improved management scenarios

	Business as Usual (BAU)	Scenario 1. Enhanced MRRP+	Scenario 2. MRRP + VW/ CFUG (balanced between CFUG and VW)	Scenario 3. Enhanced MRRP + CFUG	Scenario 4. Enhanced MRRP + VW
Rice and aquaculture	All rice field and aquaculture ponds remain in the present converted condition	All rice field and aquaculture ponds remain in the present converted condition	Aquaculture ponds remain the same area, but production techniques are improved (crabs and shrimp). Production will be improved in all mangrove area, including CF area.	All rice field and aquaculture ponds remain in the present converted condition	All rice field and aquaculture ponds remain in the present converted condition
Allocation to community forestry	**11 %** Reserve Forest managed by community forest user groups (CFUGs). **3.0 %** of mangrove habitat is managed village's common woodlots (VWs) Annual increase of CFUGs and VWs as current increase rate in practice	**11 %** Reserve Forest managed by community forest user groups. **3.0 %** of mangrove habitat is managed village's common woodlots Annual increase of VW according to MRRP plan 689 ha to 2026, Total CF mangrove area 22% by 2026	**25 %** of mangroves are allocated and managed by communities (CFUGs) and **25 %** VWs by 2026.	**47 %** of mangroves are allocated and managed by communities (CFUGs) and **3 %** for VWs by 2026.	**11 %** of mangroves are allocated and managed by communities (CFUGs) and **37.7 % VWs** by 2026.
Community Forest management	Thin every 3-5 years; clear-cut every 7yrs in practice	Thin every 5 - 6 years; ban clear-cutting	Thin every 5 years; ban clear-cutting; protect maternal trees and species diversity; increased capacity building of community groups	Thin every 5 years; ban clear-cutting; protect maternal trees and species diversity; increased capacity building of community groups	Thin every 5 years; ban clear-cutting; protect maternal trees and species diversity; increased capacity building of community groups
Government activities	Current level of investment of law enforcement for Forest Estate reserves and new plantations; current level of community forestry monitoring and support	Improved investment in law enforcement in Forest Estate reserves and new plantations; current level of community forestry monitoring and support	Improved investment in law enforcement in Forest Estate reserves and new plantations; current level of community forestry monitoring and support; increased focus on protection of maternal trees and species diversity.	Improved investment in law enforcement in Forest Estate reserves and new plantations; increased focus on protection of maternal trees and species diversity; increased investment in capacity building for community	Improved investment in law enforcement in Forest Estate reserves and new plantations; increased focus on protection of maternal trees and species diversity; increased investment in capacity building for community forestry;
Restoration effort	Government restoration effort 1,130 ha annually	Government restoration effort 1,820 ha annually	Government restoration effort 1,820 ha annually	Government/other investor restoration effort 1,820 ha annually. 50% of funding for restoration allocated to community forestry groups.	Government/other investor restoration effort 1,820 ha annually (Community forestry restores 1,500 ha and 500 ha restored in government forest reserve); 75 % of funding for restoration allocated to community forestry groups
Climate change	0.4% per year decline in rice production due to climate change and sea level rice	0.4% per year decline in rice production due to climate change and sea level rice	0.4% per year decline in rice production due to climate change and sea level rice	0.4% per year decline in rice production due to climate change and sea level rice	0.4% per year decline in rice production due to climate change and sea level rice

Return on investment for improved mangrove management and restoration

With all improved management scenarios benefits in all three categories environmental, social & human and financial increased above the BAU scenario (Figure 5 & 6). Increases in benefits were particularly evident for natural capital (Scenario 2, 3 and 4), coastal protection (Scenario 2, 3 and 4) and net present value (Scenario 2, 3 and 4). Return on investment was high for all scenarios, even the BAU, providing evidence that even limited investment in mangrove restoration provides high levels of benefits. However, the ROI for BAU declines over time reflecting the decrease on benefits given the lack of reinvestment or replenishment of key capitals. The returns on investment for mangrove restoration and management exceed those for typical infrastructure projects in South East Asia.

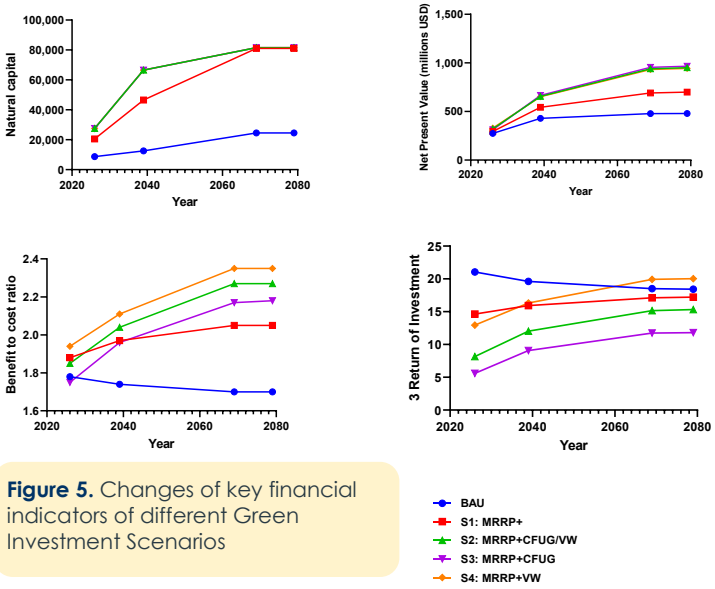


Figure 5. Changes of key financial indicators of different Green Investment Scenarios

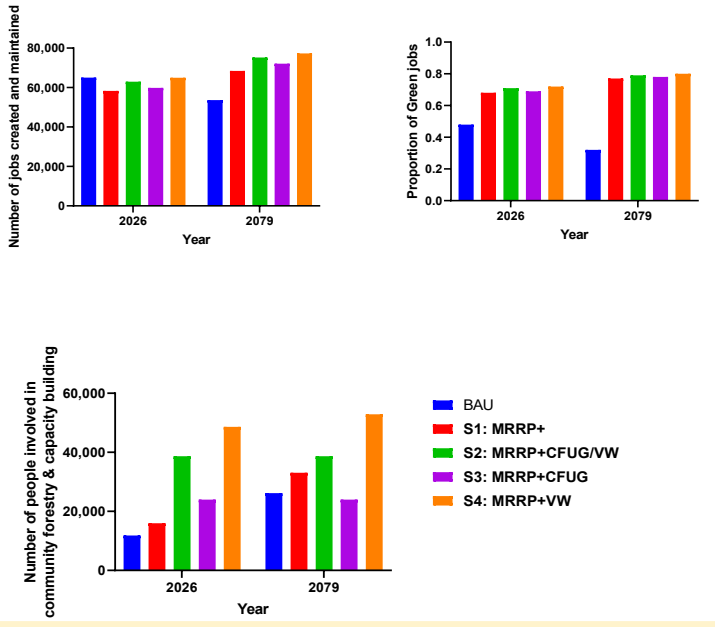


Figure 6. Upper panel shows the number of people involved in community forestry and capacity building in the BAU and other modelled scenarios in 2026. Lower left panel shows the number of total jobs in 2026 under each scenario while lower right shows the proportion of green jobs in each scenario.

Table 2. Policy barriers and enablers matrix for green growth development

	Key Issues	Proposed Policy Intervention	Expected Outcome
Policy for communities	Unclear land use right for village common woodlots (VWs) and community forestry user groups (CFUGs)	Properly land use rights for VWs and CFUGs	Land use rights enable land deposit for loans, Inheritance and transfer rights for long term and sustainable investment on CFUGs farm activities
	Investment needed for mangrove restoration and economic activities associated with mangroves	Increase and diversion of public investments, particularly from ODA and impact investors to CF activities	Continuous and sufficient investments for CF activities bring livelihoods equally for landless people and mangrove rehabilitation
Policy for government	Mangrove resources improved in quantity and quality; sustainable management of CF mangroves	Clear and high quality mapping and zoning of mangroves for management and monitoring purposes	By decentralizing mangrove resources and management to communities, the government does not have to invest more resources to acheive mangrove rehabilitation and management targets
	Effective management of mangrove	Clear and high quality mapping and zoning of mangroves for management and monitoring purposes	By decentralizing mangrove resources and management to communities, the government does not have to invest more resources to acheive mangrove rehabilitation and management targets
	Improve livelihoods for mangrove CF communities	Diversion of budget for development of community forestry	By decentralizing mangrove resources and management to communities, the government does not have to invest more resources to acheive mangrove rehabilitation and management targets
	Include ecosystem services and 3Returns assessment of mangrove resouces to develop government policy	Support to develop green growth policies	Government has solid foundation for development of green growth policies
Policies for impact investor	Regulatory issues	Payment for ecosystem services (PES); benefit sharing between multi stakeholders in the Reserve Forests	Clearer expected outputs for finance and impacts from investment project
	Business/ Financial Risks: Uncertainty in ecosystem services prices	Government could secure buyer(s) for ecosystem services and could set up a national mechanism for paying for essential services	Reduce risks

Conclusions – Pathways to increase the status of mangroves and their sustainable use

Investment in improved mangrove management and mangrove restoration is clearly a high value activity that generates enormous benefits with returns on investment that supports the sustainability and importance of such interventions

(Figures 5 & 6). However, stimulating investment in mangrove projects must overcome a number of challenges. There are challenges for Government, communities and investors (Table 2). Increased information streams of the status of mangroves and their use (mapping and monitoring) would support government policy.

Government support of community forestry would enhance livelihoods as well as reduce the enforcement burden on government agencies.

For communities, increased clarity in land use rights and increased accessibility of finance would enable improved mangrove management by community groups. For investors, the development of national payments for ecosystem service programs and reduced uncertainty around regulations could stimulate investment in mangrove projects. The government could also reduce risks around payments for ecosystem services by securing buyers for ecosystem services.