

**YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF APPLIED ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

**A STUDY ON MANGROVE FOREST CONSERVATION AND
LIVELIHOOD OF LOCAL PEOPLE IN AYEYARWADY
REGION
(CASE STUDY: BOGALAY TOWNSHIP)**

**AUNG YE WIN
EMPA - 5 (18th BATCH)**

AUGUST, 2023

**YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF APPLIED ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

Academic Year(2019-2022)

**A STUDY ON MANGROVE FOREST CONSERVATION AND
LIVELIHOOD OF LOACAL PEOPLE IN AYEYARWADY
REGION
(CASE STUDY: BOGALAY TOWNSHIP)**

A thesis submitted in partial fulfillment of the requirements for the Degree of
Master of Public Administration (MPA)

Supervised by

Dr Khin Thu Thu Thein
Lecturer
Department of Applied Economics
Yangon University of Economics

Submitted by

Mg Aung Ye Win
EMPA-5
EMPA 18th Batch
2019-2022

AUGUST, 2023

YANGON UNIVERSITY OF ECONOMICS

MASTER OF PUBLIC ADMINISTRATION PROGRAMME

This is to certify that the thesis “A Study on Mangrove Forest Conservation and Livelihood of Local People in Ayeyarwady Region (Case Study: Bogalay Township)” submitted in partial fulfillment towards the requirement for the degree of Master of Public Administration has been accepted by the Board of Examiners.

BOARD OF EXAMINERS

1. Professor Dr. Khin Thida Nyein
Pro- Rector
Yangon University of Economics (Chief Examiner)

2. Professor Dr. Kyaw Min Htun
Pro- Rector(Retd.)
Yangon University of Economics (External Examiner)

3. Professor Dr. Su Su Myat
Programme Director and Head of Department
Department of Applied Economics
Yangon University of Economics (Examiner)

4. Associate Professor Daw N Khum Ja Ra,
Department of Applied Economics
Yangon University of Economics (Examiner)

AUGUST, 2023

YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME

This is to certify that the thesis entitled “A Study on Mangrove Forest Conservation and Livelihood of Local People in Ayeyarwady Region (Case Study: Bogalay Township)” submitted in partial fulfillment towards the requirement for the degree of Master of Public Administration has been accepted by the Board of Examiners.

Board of Examiners

Dr. Khin Thida Nyein
(Chief Examiner)
Pro-Rector
Yangon University of Economics

Professor Dr. Kyaw Min Htun
(External Examiner)
Pro-Rector (Retd)
Yangon University of Economics

Dr. Su Su Myat
(Examiner)
Professor/Head
Department of Applied Economics
Yangon University of Economics

Daw N Khum Ja Ra
(Examiner)
Associate Professor
Department of Applied Economics
Yangon University of Economics

Dr. Khin Thu Thu Thein
(Supervisor)
Lecturer
Department of Applied Economics
Yangon University of Economics

AUGUST, 2023

ABSTRACT

This thesis is mainly focusing on mangrove forest conservation and livelihood of local people in Ayeyarwaddy Region. The objective of the study is to examine the local people's livelihood concerned with mangrove forest and mangrove forest conservation in Ayeyarwaddy by using descriptive method. The research finding shows that successful mangrove forest management and conservation activities directly relate to the people's livelihood system. The local people in study areas are still highly dependent on mangrove forest products as firewood for daily cooking and also for construction. The mangrove forest management and conservation should be implement with the government organization, INGOs and NGOs and local community to fulfill the local people basic need as well as sustainable mangrove forest management. The community forestry enterprise is a new approach for mangrove forest management and conservation.

ACKNOWLEDGEMENTS

Firstly, I would like to express my sincere gratitude to Professor Dr. Tin Tin Htwe, Rector of the Yangon University of Economics, for allowing me to undertake this study as a partial fulfillment towards the Master Degree of Public Administration. I would also like to express my appreciation and thanks to Professor Dr. Kyaw Min Htun Pro-Rector (Retired) of Yangon University of Economics. I would like to acknowledge my indebtedness to Professor Dr. Khin Thidar Nyein, Pro-Rector and Professor Dr. Tin Tin Wai, Pro-Rector of Yangon University of Economics.

Secondly, my sincere thanks to Professor Dr. Su Su Myat, Head of Department, Department of Applied Economics, Yangon University of Economics and Programme Director of MPA Programme, for her extensive and constructive suggestions, her supporting excellence lectures and comments to complete this thesis.

I am heartily grateful to my supervisor, Dr. Khin Thu Thu Thein, Lecturer, Department of Applied Economics, Yangon University of Economics for her guidance, supervision, advice and encouragement in preparing to complete this study successfully.

I would like to give my special thanks to my wife Daw Ei Mya Mya Htwe and my family as a whole for their continuous support and understanding when undertaking my research and writing my thesis. Your prayer for me was what sustained me this far.

I would like to express my sincere gratitude to all the teachers, and visiting lectures who have made their grateful efforts in rendering knowledge sharing of MPA Program during these two years. In addition, I would like to extend my appreciation to the faculty and all the staff in the Department of Applied Economics who have provided me with any administrative support and strength during my academic years.

Finally, my sincere appreciation goes to my colleagues for their sincere support. Their willingness to participate and effective cooperation make me accomplish this study successfully.

CONTENTS

	Page
ABSTRACT	i
ACKNOWLEDGEMENTS	ii
CONTENTS	iii
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF ABBREVIATIONS	vii
CHAPTER 1 INTRODUCTION	1
1.1 Rationale of the Study	1
1.2 Objective of the Study	3
1.3 Method of Study	3
1.4 Scope and Limitations of the Study	3
1.5 Organization of the Study	4
CHAPTER 2 LITERATURE REVIEW	5
2.1 Natural Resources and Development	5
2.2 Local Livelihoods and Natural Resources	6
2.3 Mangrove Forests	8
2.4 Review on previous studies	11
CHAPTER 3 THE PRESENT SITUATION OF MANGROVES IN MYANMAR	12
3.1 Forest in Myanmar	12
3.2 Mangrove in Myanmar	13
3.3 Conservation Practices and Management Strategy in Mangrove Forest	16
3.4 Plan and Strategies	18
3.5 Mangrove Ecosystem Services	19

3.6	Causes of Mangrove Forest Degradation	20
3.7	Mangrove Protection and Restoration Protected Areas	21
3.8	Myanmar Reforestation and Rehabilitation Programme (MRRP) (2017-18 to 2026-27)	21
CHAPTER 4	SUVERY ANALYSIS	23
4.1	Survey Profile	23
4.2	Survey Design	25
4.3	Survey Results	26
CHAPTER 5	CONCLUSION	43
5.1	Findings	43
5.2	Recommendation	47
REFERENCES		
APPENDIX		

LIST OF TABLES

	Page
Table (4.1) Genera information of the two villages	25
Table (4.2) Demographic characteristics of respondents	26
Table (4.3) Average annual household income	29
Table (4.4) Environmental and weather Status	29
Table (4.5) Go to mangrove forest in Survey Area	31
Table (4.6) The Most Useful Mangrove Forest Product	31
Table (4.7) Most Favorable income for respondent of mangrove forest product	32
Table (4.8) Access to mangrove products	33
Table (4.9) Mangrove forest is important for aquacultures species	33
Table (4. 10) Mangrove Forest Income among Different Income Level	34
Table (4. 11) Conservation Practices	35
Table (4.12) Natural Disaster and Fuel for Daily Cooking	36
Table (4.13) Forest Cover in Bogalay Township	38
Table (4. 14) Plantation Establishment in Bogalay Township	39
Table (4. 15) Natural Regeneration in Bogalay Township	40
Table (4. 16) Community Forestry in Bogalay Township	41

LIST OF FIGURES

	Page
Figure (3.1) Changes in mangrove forest cover between 1978 and 2011 in the Ayeyarwady Delta region	14
Figure (3.2) Mangrove distribution by 2015 based on SERVIR-Mekong Land cover data	15
Figure (4.1) Location Map of the study area	24
Figure (4.2) Ownership of Agricultural Land	28
Figure (4.3) Forest Cover in Bogalay Township	38

LIST OF ABBREVIATIONS

ACTMANG	-	Action for Mangrove Reforestation
ASEAN	-	The Association of Southeast Asian Nations
CF	-	Community Forest
CFI	-	Community Forestry Instructions
CITES	-	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DFID	-	The Department for International Development
FD	-	Forest Department
FUG	-	Forest user group
INGOs	-	International non-governmental organization
MRRP	-	Myanmar Reforestation and Rehabilitation Programme
NBSAP	-	National Biodiversity Strategy and Action Plan
NGOs	-	A non-governmental organization or non-governmental organization
NTFPs	-	Non-Timber Forest Products
SOC	-	Soil organic carbon

CHAPTER I

INTRODUCTION

1.1 Rationale of the Study

Mangroves Forest support essential ecosystem service and function that provide local people. Mangrove Forest give numerous tangible and intangible benefit for the environment. Although the mangrove forest is important, they have been degrading and deforesting. And then the loss of resilience of local community and environmental damage are occurred. Globally, Mangrove Forests are changed and converted to other landuse types. In Myanmar, the rate mangrove forest loss is high. To restore and better quality forests, Forest Department launched the Myanmar Reforestation and Rehabilitation Program (MRRP 2017-2026) in 2016. It aims to degraded and deforested mangrove forest to shift to sustainable mangrove forest management. It is also reinforce restoration and conservation efforts, with the Community Forestry (CF) establishment to support the capacity of communities, to formulate the management plan according to an agreement to manage and use for their livelihood.

Service of Mangrove ecosystem is invaluable for the delta and costal community because both local people and people living in the different places near and far coastal regions. For both people and marine animal and plants, the ecosystem of Mangrove is essential and very important. Mangroves are not only supporting forest product and the protection of natural disaster risk but also it is the breeding grounds for aquaculture species.

The Mangroves Forest support ecosystem functions and services that provide coastal communities. Although they support essential ecosystem and their importance, they have been cleaned, removed and degraded globally. Therefore the result is in loss of economies, resilience, their communities. The protection of natural disaster such as

storm and flooding, regulating carbon and nutrient cycles, and providing fisheries has been provided. The capacity of mangrove forest degradation and deforestation effect is in lowering as a buffer against waves and storm surges.

Mangrove Forest reforestation and conservation for their ecosystem functions and services is become a high priority because it is very import for climate change adaption and mitigation process. Investment to improve the management of mangrove forest is required for restoration and conservation. Local community product producing activities commodities for providing the recovery of mangrove forest. The ecosystem services benefits such as the protection storm and flood are value at regional scales. The capacity and knowledge on mangrove conservation and restoration is required for the local communities and individual households to get the better environment. The value chain characteristics and the value mangrove products is important for job creation and income generated. The limited knowledge for the value of mangrove products limits the investment strategies development to manage mangrove resources sustainable management

Mangroves are important for both the people and marine ecosystem around those areas, and finally relating to all people living around the world. Mangrove can provide not only many forest products, plus enormous foods related fisheries in and around those areas but also healthy environments. If there is no mangrove forest, people from those areas will get nothing mangrove forest products, decline yield for fishery products and crop yield, and the directly suffer from natural disasters. The factors of develoment will be negatively affected by the the mangrove forest loss. Without environmental consideration such as mangrove forest conservation will not be a complete process for development.

Mangroves are unique intertidal ecosystem that occur primarily in tropical places of the world. They support genetically diverse communities of terrestrial and aquatic fauna and flora, and their ecosystem are of direct and indirect economic , social and environmental values to societies of human throughout the world. The mangrove ecosystem sustainable developments imply the maintenance and rational use of the natural resources to ensure ecological resilience and economic opportunities for all generations including present and future. Since the recent

decades, the mangrove ecosystems are recognized as high carbon sequestration and sinks that attract climate change mitigation initiatives in the world. Most importantly, after the Indian Ocean Tsunami 2004, the whole world has been awakened by the role of mangrove serving as a significant function in protection coastal regions from such huge waves and catastrophic storms. The Cyclone Nargis highlights the values of mangroves that saved thousands of people in the Ayeyarwaddy Delta.

In Myanmar, forest degradation have been caused by the demand for forest land by rural people who need a place to live and farm, and to use the forest products. There are occupations of large areas of forest by capitalist/businessmen for construction, large scale agriculture, such as oil palm plantations and rubber plantations in territorial forest. Other causes of mangrove forest degradations are forest product extraction, rapidly growing investment in establishing shrimp ponds.

1.2 Objectives of the Study

The objectives of the study are;

1. To study the local people's livelihood concerned with mangrove forest in Ayeyarwaddy Region
2. To study the mangrove forest conservation in Ayeyarwaddy Region

1.3 Method of Study

This study used the descriptive method with primary and secondary data. The descriptive method was used with questionnaires by conducting a survey with sample (185) selected from Ayeyarwaddy Region. To collect the required sample, simple random sampling method was used. The secondary data were collected from the relevant documents from Forest Department, libraries and on the websites.

1.4 Scope and Limitations of the Study

. The study is focusing on sustainable mangrove forest conservation practices and local people's livelihood system in Ayeyarwaddy Region. Primary data were collected from study area. Government agencies and website were included as main

sources for receiving secondary data. The limitations are the available time and budget.

1.5 Organization of the Study

This study is organized into five chapters: Chapter one is introduction that includes the rationale of the study, objectives of the study, method of study, scope and limitation of the study and organization of the study. Literature review is presented in chapter two. In chapter three provides the present situation of mangrove in Myanmar. Chapter four contains analysis the difference between the mangrove forested land and the non-mangrove forested land in Ayeyarwaddy Region. Chapter five contains conclusion with findings and recommendations.

CHAPTER II

LITERATURE REVIEW

This chapter reviews related literature guiding the required set in chapter one. It includes concepts, theories, definitions, previous research data related to the scope of the study on mangrove forest conservation practices, people's livelihood system, socio-economic status, mangrove forest condition, etc.

2.1 Natural Resources and Development

The Natural resources are useable as raw materials that we get from the Earth. Natural resource occur naturally, which means that humans cannot create natural resources. Instead, human use and modify the natural resources in many ways to get the benefit. (study.com)

Natural resources can increase economic development because it accelerates the exports so that the more goods can be imported to set up the economy, and also because the natural resource rents can be used to boost the national investment.(Richard M Auty, 2003)

2.1.1 Natural Resources

There are two kinds of natural resource, namely renewable resources and nonrenewable resource. One kind of natural resources is renewable resources that are those that can be replenished during our lifetime, such as sunlight, wind, water, plants, and animals. Renewable resources are replenished may differ (study.com).

Renewable resources such as fresh water, trees, or fish could become in short supply or even be depleted due to over consumption. It is because these renewable resources are replenished more slowly. Consider, if an entire forest is clean, it can be renewed by seeds are planted, but it will take many years before those trees are large enough to be useful(study.com).

Nonrenewable resources are resources such as fossil fuels and minerals are , which means that the Earth is not replenishing them quickly, more slowly or at all. For example, To get the fossil fuels, it takes millions of years. So if we entirely use them, we will not have any more during our lifetime (study.com).

The forests support the essential ecosystem services namely, provisioning, regulating, cultural and supporting services. Forest conservation is not only a cost-effective way to mitigate climate change, but also means that many other benefits including biodiversity, soil and water resources, pollination are provided to local communities and a wider society. Myanmar is noted with high forest cover of 42.92 % of the country's total area (FRA 2015). The forestry sector is important for the sustainable development of the nation. There are six imperatives identified in the Forest Policy (1995) to formulate with a holistic content and formalized the commitment and intent of the state to ensure sustainable development of forest resources. Besides environmental priorities being accorded, sustainable management of forest resources has always been the prime mandate to manage and utilize forests and their resources rationally and sustainably to meet the needs of the growing population.

The preservation and careful management of the environment and of natural resources decreasing wastage of materials and degradation of environment is defined as “conservation”. The non-renewable resources can be managed by conservation way as they cannot be replenished. Nonrenewable resource such as fossil fuels needs to be reserves because they are limited and man is heavily dependent on these resources for daily use. But the renewable resources can be used and managed judicious way as they can be replenished. (Tutorvista.com, 2011).

Theodore Roosevelt said that the fundamental problem is conservation of natural resources is unless we solve that problem, it will avail us little to solve all others.

2.2 Local Livelihoods and Natural Resources

The analysis of the factors involved in the way in which people build a living is the analyzing livelihood systems and this is called the “livelihood system” “Livelihood” refers to “means of living” according to Infection Control Risk Assessment (ICRA) Learning Resources. Some express, the way people make a living is the livelihood. The livelihood supported for is an raising property of a coherent and

interrelated set of activities that are implemented within a broader environment. “How do you earn your livelihood” means “What do you do for a living?” (ICRA, 2012).

According to Wikipedia, the concept of livelihood extends to include social and cultural means, "the command an individual, family, or other social group has over an income and/or bundles of resources that can be used or exchanged to satisfy its needs. People’s livelihood referrer as their "means of securing the necessities of life". For example, the fishermen's livelihood depend on the sources of fish. This may consist social networks ,information, cultural and knowledge, tools, land and other physical resources, and and legal rights. (Wikipedia, Livelihood, 2012).

The Department for International Development (DFID) defined as ‘*A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base*’ (DFID, 1999).

2.2.1 Rural Development and Forestry

There is a close relationship between the resource (eg.forest) and rural development. The people in a rural area are mainly dependent on the forest resources for income, food, shelter and living. If the forest source is enough for the development, this rural areas originate and are developed because of the wealth of the forest. The rural development is closely related the forest resources, for example, building for timber, fuel wood and medicinal plants for health, etc. The activities and services and activities relate to the rural people (local people) livelihood systems as distribution of assets and wealth, the nutrition, income, household security, etc. To get the sustainable development, the management and control of forest resources can affect the strength of social structures and local institutions, contributing to their empowerment, decline or fragmentation.

2.2.2 Household Economy and Forest

The forest based income and employment opportunities are particularly important to the poor because of ease of access and very low thresholds of capital and low skill labour to enter and engage in most of them. Their forest raw material problems are often worsened by unfavorable harvesting controls, exclusive allocation

of users, complicated licensing or auctioning procedures plus demands for heavy deposits, monopoly distribution systems and high prices due to state monopolies.

2.2.3 Management

Natural resource management is concerned with the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. The management of natural resource is related with the concept of sustainable development, a principle for land management and environmental governance all region of the world. In contrast to the policy emphases of urban planning and the broader concept of environmental management, Natural resource management specifically focuses on a scientific and technical understanding of resources and ecological factors and the capacity of life supporting capacity. Around 70% of the population in Thailand, Myanmar and most Asian countries are living around or near the forest, and sometimes even in the forest area. The population growth is rapidly, while the physical size of each country does not increase. Regarding to a researcher in 1st International Student Conference, COLA, *KKU on January 2012 noted that there are 3 people born every second in the world.* So, to get the sustain natural resources, natural resource management is essential and very important.

2.3 Mangrove Forests

The Mangroves forests are tree-dominated ecosystems and occupying intertidal areas in the tropics and subtropics region of the world, The communities and ecosystem functions of mangrove are governed primarily by the interaction among the sediments and nutrients from the landward side, flows of freshwater, and tidal flooding from the sea. For about two centuries, mangroves have been managed and exploited with practically no concern for their hydrology. Many studies have noted them as wetlands, characterized by hydrology as the major determinant of their functions and structures of the mangrove species. The Mangrove forests are well recognized for their high biodiversity and contribution to coastal resources or species.

Mangroves have been the subject of numerous studies worldwide and in recent years have attracted greater attention in the context of experiences from tsunamis and climate change. In the tropics and subtropics region of the world, there is unanimity over the fact that they occur in intertidal areas, that the system includes trees and

shrubs. Food and Organization(FAO) noted that it to the entire forest community, often described also as 'coastal woodland' or 'tidal forest'—terms which basically reflect their location (FAO 1994; Melana et al. 2000).

2.3.1 Mangrove Forests Value

Local people are using mangrove forests for their livelihoods as many purposes, both 'tangible' and 'intangible'. Some tangible or direct benefits of the mangrove forests are;

1. Lumber or wood for their construction and economic
2. Poles, posts, fuel wood, fishing gear, etc., for their needs
3. As Raw materials (forest products) for various wood-based industries, including board mills, rayon mills, match factories and charcoal products,
4. Products from non-timber raw materials for leather industries (mostly from bark), for fishing-net processing units, thatching material for roofing, and raw materials for indigenous medicine,
5. Mangrove forest products such as honey and wax, game animals, meat and fish, fruits, drinks and sugar, etc.

According to E.Shakerdargah, Mangrove ecosystems gives many intangible or indirect benefits:

1. Provision and protection of natural aquacultures resource such as spawning ground for fish and crustaceans, especially for shrimp and prawn,
2. Supporting to mud flat formation and control of erosion,
3. Capability to check inland salinity intrusion,
4. Enhanced capability as the protection of the impact of cyclone and tidal surge,
5. Enhanced capability as a natural shelter from storms and cyclones (E.Shakerdargah, 2008).

2.3.2 Carbon Storage

People are living among the composition of chemicals including carbon, chemical sign for carbon is “ C ”, and physical factors in the world. Carbon is also an essential element of life on earth. The chemical property of Carbon isn't only useful in the chemical cling process but is also essential in the food chain for both mortal being and creatures. Carbon is set up far and wide for case, wood and watercolor, and leaves naturally include carbon. When they're burned carbon is changed into Carbon dioxide(

CO₂) or Carbon monoxide(CO) and is dangerous to people's health. But, it's necessary in the process of photosynthesis which also releases the oxygen(O₂) back into the terrain which is essential for humans and creatures. To reduce global warming, carbon storehouse areas are useful and essential moment. timbers including mangrove timber. Carbon storehouse capacity is different among factory species. Mangrove species ' carbon storehouse capacity is two times advanced than territorial timber tree species. During the day time, every species of tree absorbs carbon dioxide(CO₂) from the atmosphere through veritably bitsy pores on the face of leaves. At night, they release oxygen(O₂) which is essential for all living brutes, for healthy air quality, and for a clean terrain. Carbon(C) storehouse in timber ecosystems involves multitudinous factors including biomass C and soil C. The total ecosystem C stock is large and in dynamic equilibrium with its terrain. Because of the large areas involved on the indigenous and global scale, timber soils play an important part in the global C cycle((Detwiler and Hall, 1988),(Bouwman and Leemans, 1995),(Richter et al., 1995),(Sedjo, 1992) and(Jabágy and Jackson, 2000)). Land use change causes anxiety of the ecosystem and can impact the C stocks and fluxes. In particular, conversion of timber to agrarian ecosystems affects several soil parcels but especially soil organic carbon(SOC) attention and stock. The conversion to agrarian land use always results in the reduction of SOC stock by 20 – 50((Schlesinger, 1985),(Post and Mann, 1990) and(Davidson and Ackerman, 1993)). The reduction of SOC stock is attributed to multitudinous factors including drop in the quantum of biomass(above- and below- ground) returned to the soil, change in soil humidity and temperature administrations which accentuate the rate of corruption of organic matter, high decomposability of crop remainders due to differences in CN rate and lignin content, tillage- convinced disquiet, drop in soil aggregation and reduction in physical protection of the soil organic matter, and increase in soil corrosion. therefore, agrarian soils and especially eroded agrarian soils generally contain lower SOC stock than their implicit capacity. Afforestation of agrarian land can reverse some of the declination processes and beget improvement or insulation of SOC stock((Ross et al., 2002) and(Silver et al., 2000)).

2.3.3 Ecosystem services are what nature provides.

Nature supports us when the ecosystem or terrain is balanced. Environment includes inland timber, mangrove timber, marine ecosystems, etc. Nature provides us with the veritably rudiments of life. It gives us clean air and water; enables us to

produce and gather food, energy, and raw accoutrements from the land and ocean; regulates our climate; stems flood tide waters and pollutants pollution. It also gives us particular benefits in the form of pleasure which increases our health and happiness.(Department for Environment, 2012) Because of the mangrove ecosystem, not only can people have food, jobs for earning income for their families, natural sanctum, construction accoutrements , healthy terrain, recreation, etc. but also submarine creatures have a parentage place for new generations and a sustainable niche. These all can be nominated as mangrove ecosystem services.

2.4 Review on previous studies

According to Mr. San Win report he studied with two main objects as original people's livelihoods in Myanmar and Thailand and the status of mangrove timber and the practices of mangrove timber conservation. People in Thailand use natural gas and electricity for diurnal cuisine and they use a little of mangrove product for construction. But people in Myanmar use mangrove as fuel wood and charcoal for cooking and for construction. They also depend on mangrove timber products as wood and watercolor, fish, grouser and prawn, etc. The area of mangrove timber in Myanmar is larger than the area in Thailand. Through a sufficient diurnal living system and secure life style, sustainable mangrove timber conservation practice is to fulfill the requirements of original people. The difference for ecosystem services and livelihood systems should be taken into account for sustainable mangrove timber conservation practices.

Also, other affiliated study of EMPA Myanmar campaigners by Jacqueline Pee Gyaw(EMPA 6th batch) analysis “ A study on the status of mangrove timbers in the Ayeyarwaddy Delta(1990 – 2008). This thesis noted that has been destroyed over the decades and the associated reasons and to compare in the present status of mangroves in Myanmar with neighboring countries. Mangroves timbers are over exploited and destroyed by the original people occupants for numerous reasons. It was observed that people of rural areas wasn't give with enough education, they completely depend for their livelihood on mangroves. The government should give the usefully policy to mangrove conservation conditioning. The people of rural areas whose dependence is important on the mangroves must be handed with enough impulses for not to destroy the precious trees.

CHAPTER III

THE PRESENT SITUATION OF MANGROVES IN MYANMAR

3.1 Forest in Myanmar

The Republic of the Union of Myanmar is located in Southeast Asia between latitudes 9°32' and 28°31'N and longitudes 92°10'E and 101°11'E. Myanmar is neighbored by China, Laos, Thailand, Bangladesh and India. The total area of Myanmar is 676,577 km², stretching for 936 km from east to west and 2,051 km from north to south. The topography of Myanmar can roughly be divided into four parts: namely the Western Hills Region, the Central Valley Region, the Eastern Hills Region and Tanintharyi Coastal Strip.

The hot season, rainy season and cold season occur in Myanmar, The Dry Zone of Central Myanmar has an annual rainfall of less than 1,000 mm while costal area receives more than 5,000 mm. Besides, the average highest temperature in the Central Myanmar is about 43.3° C while in Northern Myanmar, it is about 36.1° C and on the Shan Plateau, between 29.4° C and 35° C. Due to these ecological diversity, Myanmar is endowed with a rich diversity of habitat types. For sustainable Development, Myanmar has been practicing protecting and conserving its diverse biological resources.

According to FAO FRA 2015, about 42.92% of the country's total land area is still covered with forests. Forests are socially and economically important for the country. Over 70% of the country's total populations are rural and dependent on forest resources for basic needs such as food, fodder, fuel, and shelter. Despite high dependency on forests, considerable extent of natural forests in the country is an indication of the consistent exercise of sound forest management practices for years. The forestry sector of Myanmar plays important role for sustainable development of the nation. Particularly, it significantly contributes not only to the national economy through the export of timber and non-timber forest products but also to the livelihood improvement of the rural communities. Myanmar's forests, covering 42.92 percent of

the country's area, stabilize the ecosystems, sustain a rich variety of biodiversity, maintain the environment, preserve soil and water resources and ameliorate climate which are the key attributes to ensure viable agriculture on which the economy of the country is based.

3.2 Mangrove in Myanmar

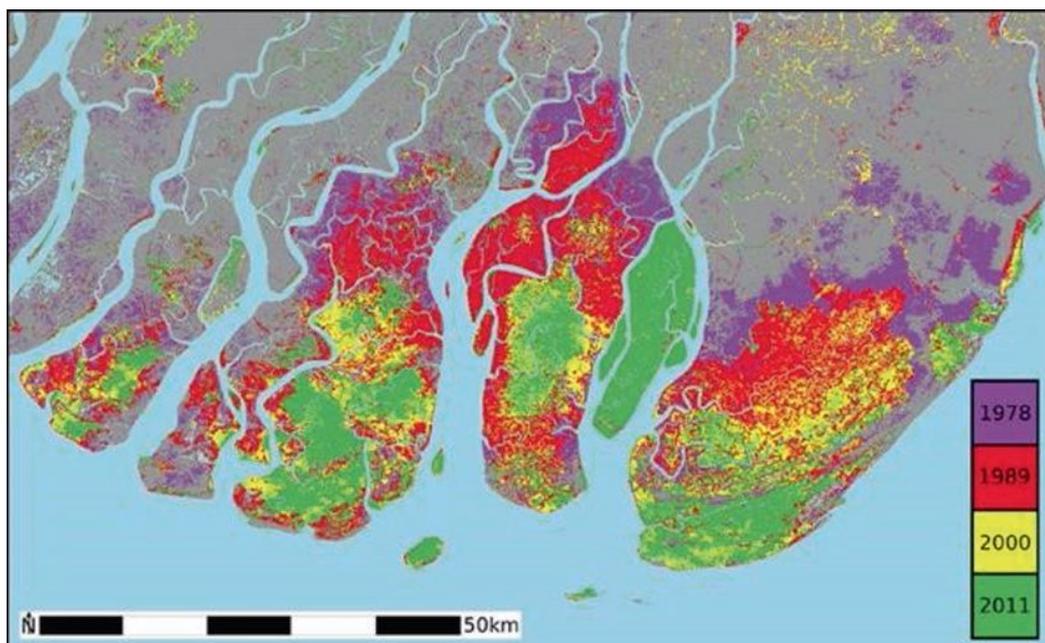
Myanmar is the largest country with a continuous coastline of almost 3000 km, extending along the Bay of Bengal and Andaman Sea In mainland Southeast Asia. According to Spalding et al, it held an estimated 437,000 ha of mangroves in 2007 and holds the 8th largest mangrove forest in the world (4% of the world mangroves) and stands 3rd largest in Southeast Asia (8.8% of Southeast Asia mangroves); (Spalding et al. 2010) but according to Richards and Friess, mangrove forest is losing rate is fastest of all countries (Richards and Friess 2016), due to aquaculture and encroaching agriculture, settlement areas and development activities.

Mangroves and mudflats are found in the coastal provinces and are widely distributed along coastline. The Central Delta of the Ayeyarwaddy Region is important for mangroves, which are concentrated along the southernmost parts of the Ayeyarwaddy Delta Region. But, in recent decades, the mangroves deforestation and deforestation is found. Also along sheltered coasts in the Rakhine State and Tanintharyi Regions are also important. The FAO (2010) reported 437,931 ha, but recent data from Webb et al. (2014) show decline in the Ayeyarwaddy Delta. All other regions decline since the 1980s. According to Richards and Friess (2016) estimated the overall loss from 2000–2012 to only 5.53%. The Deforestation and Degradation of Mangrove Forest in Tanintharyi Region is less than other parts of Myanmar. The loss of mangrove forest area can be found within the remaining mangrove stands is obvious and seems to continue even in protected sites, such as Wildlife Sanctuary of Meinmahla Kyun (Yong 2016, Moses and Zöckler 2015, Zöckler 2016a). From Zöckler, the degradation has been observed across all areas in the vast remaining mangroves in Tanintharyi Region and has been unabated since (e.g. Zöckler 2016b). The distribution of mangroves in the three main regions: Rakhine in the northern coastal area, Ayeyarwaddy in the delta and Tanintharyi in the southern coastal line.

3.2.1 Ayeyarwaddy Division

Restoration activities between 1980 and 2004 resulted in replanting of 14,000 ha with mangroves in the delta of Ayeyarwaddy region, substantially on old rice paddies and abandoned agricultural sites. The damage caused by the tropical storm Nargis has been estimated at 35,000 ha of mangrove forest in two divisions of the delta region (FREDA and ACTMANG 2012). The delta area of the Ayeyarwaddy Basin is covered by mangrove forest as far as 60 km inland. Originally, over 270,000 ha were seen in the Ayeyarwaddy Delta. The population pressure has led to the loss of over 64% of mangrove forest over the past 35 years, further 80% (Webb et al. 2014). In protected areas such as the Meinmahla Kyun Wildlife Sanctuary, groundwork suggests that mangroves are suffering from precipitous declination and infrequently reach maturity (Moses and Zöckler 2016; Yong 2016). Comparison of satellite images between 1974 and February 1995 in the Ayeyarwaddy Delta area indicates mangrove losses from 32.2% to 5.8% of the mangrove forest area in Laputta and from 51.9% to 19.5% in Bogalay (Figure 3.1).

Figure (3.1) Changes in mangrove forest cover between 1978 and 2011 in the Ayeyarwaddy Delta region (Based on Webb et al. 2014)

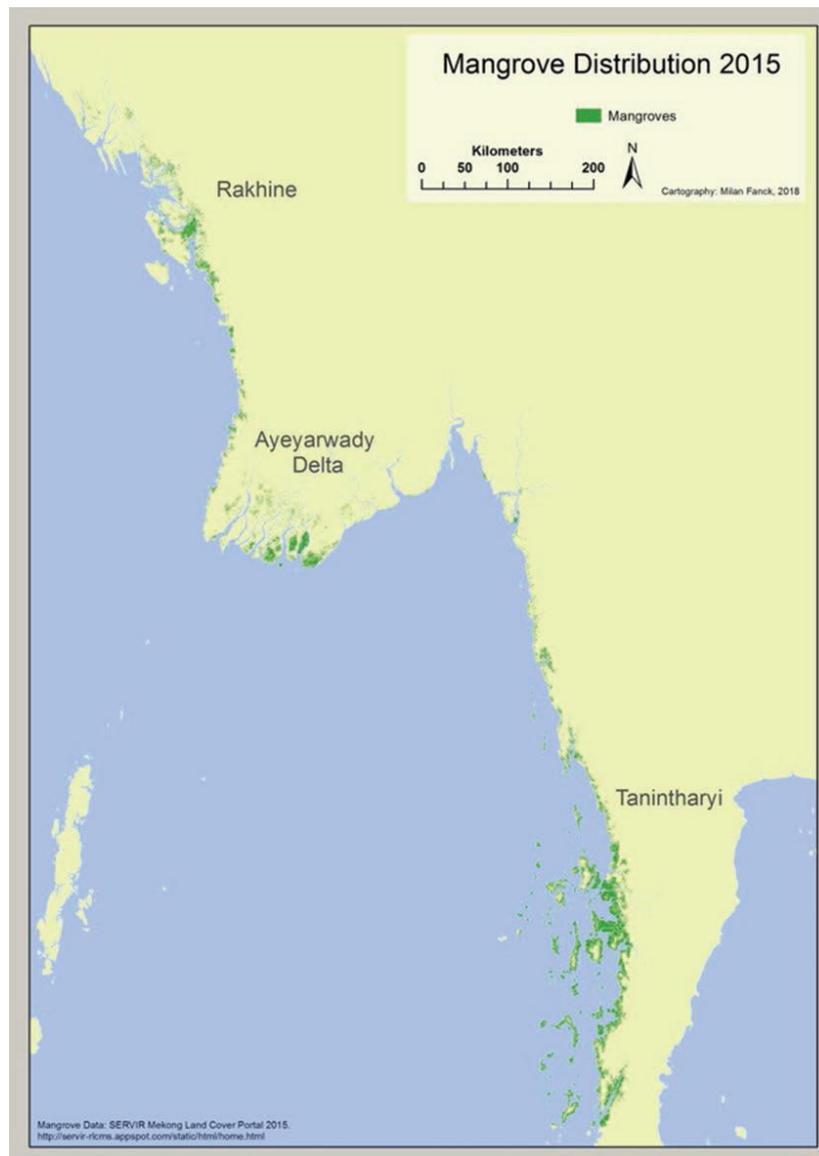


Source: Webb

3.2.2 Rakhine State

Pressure on the mangrove forest resource of Rakhine is reduced by developing activities such as deep sea ports, gas pipelines, infrastructure projects, and hotels, and shrimp farming practices, etc.,. Adverse anthropogenic impacts on mangroves are anticipated to come indeed more pronounced as Myanmar opens its doors to increased foreign investment in agriculture and development (Zöckler et al. 2013). The mangrove forest resources declination in the Rakhine region between 1974 and 1995 has been documented by Myint Pe (2002).

Figure (3.2) Mangrove distribution Land cover data.



Source: Webb

3.2.3 Tanintharyi Region

Although the mangrove are in the Tanintharyi Region is still large, this area has also decreased from 262,000 ha in the 1980s.

3.3 Conservation Practices and Management Strategy in Mangrove Forest

Forest Department(FD) in Myanmar are main organizations responsible for conducting or carrying out direct conservation of territorial and mangrove forest, at present, use both direct conservation method and indirect method. **In Myanmar**, all types of Forests are protected by forest policy, law and rule and regulation such as by formation and nomination of Reserved Forests, Protected Area, and National Park under Forest Department, Ministry of Environmental Conservation and Forestry. Forest Department has yet to develop infrastructure facilities, patrolling system and efficient law enforcement to discourage excess extraction of wood and encroachment for paddy and shrimp farming inside the reserved boundary.

3.3.1 Conservation of Existing Mangrove

Forest Department establishes all types of plantations every year according to setting 5 year management plan and following instruction of FD head quarter. Two common species, *Rhizophora spp*: (family; Rhizophoraceae), *Bruguiera gymnorhiza* (L.) Savigny (family Rhizophoraceae) are mainly used for planting. *Rhizophora mucronata* Lam. is demanded species for its quality as wood, charcoal, firewood and usefulness in construction among local people.

3.3.2 Law Enforcement

The old Forest Law (1992) was repealed by the new Forest Law enacted in 2018. The basic principle, management of forest land, conservation and protection, administrative actions, and offences and penalties were revised and updated in the new Forest Law (2018). The new Forest Law comprises 58 sections and nine basic principles under 13 Chapters, highlighting the constitution of reserved forest and declaration of protected public forest, management of forest land, establishment of forest plantation, extraction and removal of forest produce, disposal of drift, stranded and waif timber, establishment of wood-based industry, administrative action (search, arrest and administrative action) in respect of offences and penalties. The new Law

recognizes local and indigenous peoples' rights, encourages people's participation in forest management, private sector involvement in forestry sector development, human resource development and extension to local people.

3.3.3 Conservation of Biodiversity and Protected Areas Law

In May 2018, the Union parliament enacted the "Conservation of Biodiversity and Protected Areas Law" which replaced the "Protection of Wildlife and Protected Areas Law" (1994). There are three major changes found in the new law, which enable a much greater role for local communities while promoting co-management, support international obligations such as Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and increase penalties for legal infringements. Most significantly, "Community Protected Areas" are recognized as a category of protected area. So the new Law provides opportunities for more effective conservation while recognizing the rights and the potential roles of local communities.

3.3.4 Environmental Conservation Law

Environmental Conservation Law was enacted in 2012 and it aims at implementing the Myanmar National Environmental Policy, laying down the basic principles and giving guidance for systematic integration of the matters of environmental conservation in the sustainable development process and enabling to emerge a healthy and clean environment and enabling to conserve natural and cultural heritage for the benefit of present and future generations etc. It mandates to form Environmental Conservation Committee to conserve the environment of the country.

3.3.5 Community Forestry Instructions

The new Community Forestry Instructions (CFI) was issued by Forest Department in 2019 replacing the former CFI 1995. The new CFI comprises of 26 sections although the old one has 21 sections. In the new CFI, the specific objectives and definitions for community forestry were clearly defined, the types of land that can establish CF were increased (for example, CF is allowable in the buffer zone of the protected area), and the production from CF was considered not only for the subsistence needs of local people but also for the small scale to commercial scale enterprises. The new CFI focuses a significant development in the aspects of

partnership, participation and decentralization. The local communities are granted trees and forest land tenure rights for an initial 30-year period, which is extendable. The Forest Department provides the technical assistance and plays the leadership role in the exercise of community forestry and the development of CF based enterprises.

3.4 Plans and Strategies

Planning is an integral component of forest management and is for determining and expressing the goals and objectives and for deciding the targets and steps that should be taken in order to achieve those objectives. Forest Department developed 30-year National Forestry Master Plan (2001-02 to 2030-31) to manage the forests on a sustainable basis.

National Forestry Master Plan outlines the strategic direction for the sector and covers a range of issues, including conservation, restoration, protection, production, watershed management, law enforcement, and the promotion of fuelwood substitutes. The National Forestry Master Plan provides a guiding framework for ten-year forest management plans developed by the Forest Department for each forest district.

According to the formulation and implementation of short-term and long-term plans, Myanmar's forests have been managed. The forest management plans covering the whole country have been formulated in line with the modern forestry concepts. The plans focus attention on sustainable production of timber and Non-Timber Forest Products (NTFPs), conservation of wildlife and wild plants, and social well-beings of local communities. The present plans for 10-year period (2015-16 to 2024-25) were formulated for 68 Districts throughout the country, and being implemented within the framework of Forestry Master Plan.

Furthermore, the following plans and programmes have been developed to achieve the sustainable forest management as well as biodiversity conservation in Myanmar:

- Myanmar Reforestation and Rehabilitation Programme (2017-18 to 2026-27)
- Inlay Lake Sustainable Development and Environmental Conservation Action Plan (2015-20)
- National REDD+ Strategy
- National Biodiversity Strategy and Action Plan (2015-2020)
- Re-establishing Natural Habitats Programme (2019-20 to 2028-29)

- National Wetland Policy and Strategic Actions

3.5 Mangrove Ecosystem Services

The conception of ecosystem services has come an important model for linking the functioning of ecosystems to societal benefits. Lot of workshop have been done on the valuation styles, data and bracket systems for ecosystem services of terrestrial ecosystems compared to the mangrove ecosystems in all regions of the world. Peer review literature on global profitable valuations of littoral timber like mangrove ecosystems, ocean lawn ecosystems is rather limited. The valuation system for mangrove ecosystem services has not been formalized completely. Economist generally divide the total profitable value of mangrove into three major groups videlicet(i) Direct use value(ii) Indirect use value and(iii)Non-use value. Direct use values relate to consumptive and non-consumptive uses that encompass physical commerce with the mangroves and their services e.g., earnings generated from fishery, timber, energy wood, fodder, honey, wax, and recreation. Regular use values include nonsupervisory ecological functions like flood tide control, storm protection, nutrient retention and corrosion control. Non-use values include actuality and birthright values of mangroves.

The Nargis storm in 2008 stressed the need to emphasize the critical ecosystem services of high- quality mangroves, substantially in guarding littoral communities from storm surges. also, Myanmar's mangroves are largely important for storing carbon and furnishing vital fish, grouser, and shellfish nurseries. Mature mangroves give wood for boat- structure, construction, wood, charcoal, cabinetwork, and fish traps, as well as non-timber timber products similar as mangrove honey, fruit, drug, and indeed wine, and nypa win thatch for roofing and are also used to make saccharinity, juice, wine, and ginger. Mangrove honey is getting a precious commodity in littoral communities. The viscosity and rot resistance of some types of mangrove wood and a corresponding capability to repel exposure to saltwater are the reasons this timber is used in boat- structure and frequently for construction of jetties, walls, and fish traps. The wood of *Rhizophora*, *Bruguiera*, and *Ceriops* species is a heavy hardwood with tannin-rich dinghies and is frequently used as structure material for homes, for road ties, and in the leather assiduity.

Mangrove leaves are used as beast fodder for buffaloes, lamb, scapegoats, and camels. In some locales, certain mangrove species are used in traditional drug to treat

a range of affections from toothache to leprosy and tuberculosis(Govindasamy and Kannan 2012).

In the history, Ayeyarwaddy mangrove was notorious for its *Ceriops* and *Bruguiera* trees. After World War II, a lot of *Ceriops* and *Bruguiera* mangroves were produced for watercolor. *Ceriops* watercolor is of excellent quality and exports from Ayeyarwaddy are notorious. The win *Phoenix paludosa* has been used for ground and house construction(Cherry Aung 1999).

The mangrove seaweed *Catenella nipae* is another mangrove product. It grows at the caddies and pneumatophores of the shops in Kyaikkhami, Mon State. It provides good income for the original people that collect the seaweed and vend it for mortal consumption in the form of a salad. Supporting and regulating services that mangrove territories give include nutrient cycling, carbon storehouse, flood tide control, water quality conservation, ocean front stabilization, deposition balance, land accretion, and the buffering of both land and marine territories from the ravaging impacts of storms and rising ocean situations(Nellemann et al. 2009; McIvor et al. 2012). As mortal habitation along the beachfronts has increased, the rich ecosystem services handed by mangroves have also grown.

The value of mangroves has been estimated in the range of 200,000 – 900,000 USD annually per km². Considering a remaining mangrove timber in Myanmar of about 300,000 ha, this would mean a total value of mangroves of 150 – 400 million USD per time, depending on the ecological functioning of the mangrove systems. Values include littoral protection, fisheries, coral reefs, and tourism(Costanza et al. 2008).

3.6 Causes of Mangrove Forest Degradation

Mangrove ecosystems, which make up lower than 0.4% of the world's forests resources (Spalding et al. 2010), are being lost at the rate of about 1% per year (FAO 2010); according to Richards and Friess, in Myanmar the rate is as high as 5% per year (Richards and Friess 2016). Between 20% and 35% of the world's mangrove area has been lost since 1980 (FAO 2010). The rates of loss are greatest in developing countries where mangroves are cleared for agriculture development and activities, coastal area development, aquaculture practices , and timber and fuel production (Polidoro et al. 2010). Webb et al. (2014) listed agricultural land area expansion for rice production as the main driver for the loss in mangrove area. Conversion for paddy cultivation field of rice is a major threat to mangrove conservation, particularly

in the Delta area of Ayeyarwaddy Region. Agricultural land area expansion into mangrove forest areas to meet the requirements of local and regional food security is also common in the other two coastal regions of the country, especially in the Rakhine region. According to Zöckler et al, Mangrove loss between 2001 and 2013 overall depicts agricultural land replacing former mangrove areas (Zöckler et al, 2013).

Over-exploitation for firewood and timber production has degraded about 26% of mangrove forests resources all over the world (Valiela et al, 2001), and similarly mangrove loss in Myanmar. Shrimp aquaculture practices has contributed to about 38% of global mangrove resource loss, and other types of aquaculture practices account for approximately another 14% (Gilman et al. 2008). For example, the Setse mangrove in Mon State has converted into shrimp farm in 2003 (Cherry Aung 2016). Therefore, the similar scenario was observed in the Ayeyarwaddy and Rakhine region while the southern mangroves forests in Tanintharyi Region so far remained unaffected by aquaculture. While direct anthropogenic impacts including coastal development activities comprise the biggest threat to mangrove ecosystems at present, climate change is another factor for the changes in mangrove ecosystems (Gilman et al. 2008).

3.7 Mangrove Protection and Restoration Protected Areas

There is an urgent need to maintain the remaining mangrove forests resources of Myanmar with the increasing pressure on the remaining mangroves,. But, the little movement of the mangroves conservation in Myanmar are currently protected within the Meinmahla Kyun Reserve and in the Lampi Marine National Park covering a total of lower than one percentage of Myanmar's overall mangrove stands. The extensions are not planned at present (NBSAP 2015). A priority task should be expanded the existing protected area network strategy in Myanmar. Strengthening for the legislative framework applicable to protect the mangrove resources area management will enhance law enforcement and providing incentives for restoration of degraded mangrove lands.

3.8 Myanmar Reforestation and Rehabilitation Programme (MRRP) (2017-18 to 2026-27)

The forest resources cover in Myanmar is about 42.92%, the closed forest and opened forest are 21.56% and 21.36% of the country's total area respectively

according to FAO data (FAO 2015). The Deforestation of average annual rate is about 1.72% (1,348,620 acres) of the country's total area between 2010 and 2015. Therefore, degraded forests amounted to 22.29% (3,725,0000 acres) of the country's total area.

MRRP is a keypoint and significant initiative of the Government with various objectives as follows:

- To strengthen the investment of private sector in forest plantations
- To fulfill the demands on teak and other commercial timber species
- Formulation of Forest Plantation Policy
- In order to achieve the objectives, the following targets are set, and being
- To restore and rehabilitate the degraded forests for climate change mitigation and adaptation as well as to enhance ecosystem services
- To improve the livelihood and socioeconomic conditions of the rural people through increasing job opportunities and the community forestry implemented with great efforts:
 - establishment of 311,875 ha (770,332 Acres) of Community Forests
 - conservation of 202,429 ha (500,000 Acres) of remaining natural forests in Central Dry Zone
 - establishment of 115,427 ha (285,104 Acres) of private plantations
 - establishment of 148,627 ha (352,438 Acres) of state-owned forest plantations
 - encouraging and improving Assisted Natural Regeneration covering 331,392 ha (818,538 Acres) in the Production Forests
 - reservation of 1,610 square miles (6.195% of country area) to fulfill the national target of 30% of PFE in accordance with Myanmar Forest Policy 1995.
- formulation of forest plantation policies and strategies

CHAPTER IV

SUVERY ANALYSIS

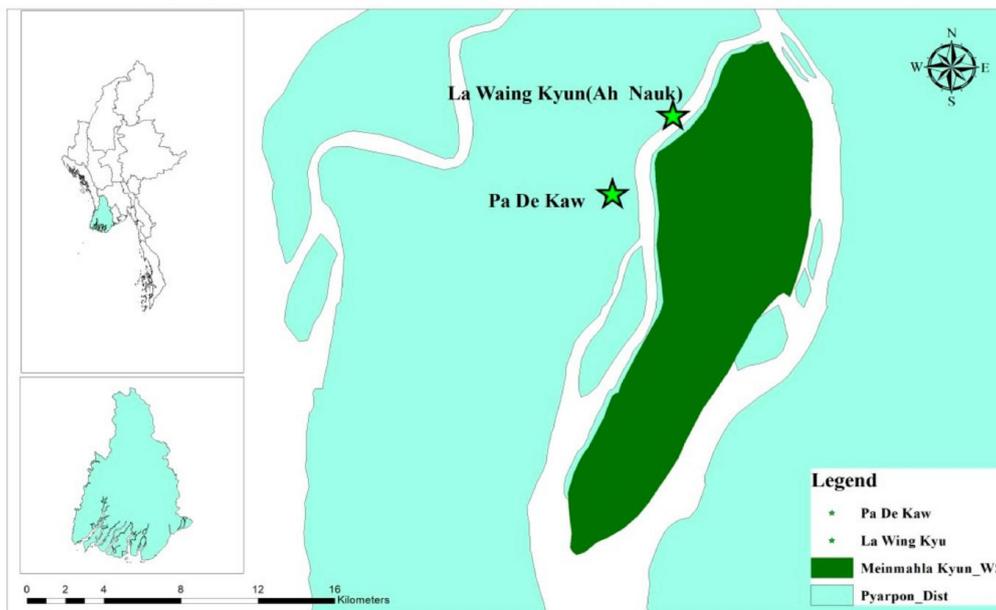
4.1 Survey Profile

The study area is Meinmahla Kyun Wildlife Sanctuary which is chosen and located in the western part of this Kyun as well as coastal wetland in the southern part of the Ayeyarwaddy Delta, located at 15_57.8220 N and 95_ 17.9880 E, Bogalay Township, Ayeyarwaddy Region of Myanmar. Meinmahla Kyun Wildlife Sanctuary is also the mangrove reserve and the area is 136.72 sq km and established in 1986. The Wildlife Sanctuary was designated as the third Ramsar site and also ASEAN Heritage Park of Myanmar in 2017. Although mangrove ecosystems have been declining due to activities including logging, charcoal and firewood production, fishing and development of shipping lanes, this Sanctuary is one of the largest remaining mangrove areas of the Delta Region. The mangrove date palm (*Phoenix paludosa* Roxb.) is planted and found the place where mangrove species are naturally occurred. It also supports globally threatened species such as mangrove terrapin (*Batagur basaka*), hawksbill turtle (*Eretmochelys imbricate*), green turtle (*Chelonia mydas*), the endangered great knot (*Calidris tenuirostris*), dhole (*Cuon alpinus*), Nordmann's greenshank (*Tringa guttifer*) and vulnerable species of fishing cat (*Prionailurus viverrinus*), the Pacific ridley turtle (*Lepidochelys olivacea*), the Irrawaddy dolphin (*Orcaella brevirostris*) and lesser adjutant (*Leptoptilos javanicus*). The site support for the saltwater crocodile (*Crocodylus porosus*) as the last estuarine habitat in Myanmar.

Padekaw village (15_ 59.2320 N and 95_ 15.7650 E) and Lawinekyun (A Nauk) (16_ 0.5860 N and 95_ 15.8660 E) were selected as field study areas to analyze the current situation of mangrove forest and the socio-economic conditions. These two villages were selected for accessibility, near the Wildlife Sanctuary reserve, and affected by cyclone Nargis in 2008.

The general information of the two villages as shown in Table 4.1. Local people living in the area survive by working fisheries and cultivation of paddy fields. Their income can get from selling firewood, making and selling charcoal and illegal logging and extraction for building for local uses. Agriculture products and home gardens and aquaculture products are also their income. Mostly, the economic activities in the study area are the subsistence level. Most men in the areas are fishermen while women and children are collectors of prawns, fish and inter-tidal. These products are important source of income to both fishermen and in processing and trading. The Delta region has challenges such as capacity development and better education and healthcare and infrastructure for hygienic drinking water. Almost of the households use firewood as fuel energy for the cooking and heating. Access the studied area to the other villages was difficult because of poor transport infrastructure and few all-season roads that travel between villages. Therefore, villages are often conducted by boat. Households in the studied areas villages use rainwater for drinking and cooking. But, sometime they cannot collect enough rainwater. The location of the study area as shown Figure 4.1.

Figure (4.1) Location Map of the study area



Source: Forest Department

Table (4.1) Genera information of the two villages

Sr	Village Name	Township Name	Total Households
1	Lawinekyun(A Nauk)	Bogalay	115
2	Padekyaw	Bogalay	230
	Total		345

4.2 Survey Design

The total household of the studied two villages is 345. (confidence interval=95%, marginal error=5%). According to Taro Yamane Formula, the sample size is chosen 185 households.

$$n = \frac{N}{(1 + Ne^2)}$$

where n = sample size; N = total population of household; e = allowable error (5% = 0.05).

In the study area, method of simple random sampling survey was used by formulated and prepared questionnaires during the October 2022. From two villages of Bogalay Township, Patheingyi District, Ayeyarwaddy Region, the sample of 185 households were interviewed Table 4.1. It expresses a descriptive analysis method of household respondents.

This study depend on primary survey data and data collection method is interviewing of face to face. The local people depending and living directly and indirectly on products from mangrove forest for their livelihood were selected as respondents for the interview survey. For the interview, the simple random sampling method was used. According to Scirbbr website, a simple random sample is a randomly selected subset of a population. In this sampling method, each member of the population has an exactly equal chance of being selected. The income sources mangrove forest product, agriculture and non-farm activities are the main sources of income. Mangrove forest products (fish, firewood, shrimp, and crab) was gathered from the questionnaire.

4.3 Survey Results

This chapter shows survey analysis result of mangrove forest conservations in Bogalay Township, Patheingyi District, Ayeyarwaddy Region.

4.3.1 Social Economic background of respondents

Primary data for this research was collected from 185 respondents, regarding analysis shown in table 4.2.

Table (4.2) Demographic characteristics of respondents

Sr	Description	Category	Number of respondents	Percentages
1	Gender	Male	89	48
		Female	96	52
		Total	185	100
2	Age	Under 20	2	1
		20-29	36	20
		30-39	50	27
		40-49	47	25
		Over 49	50	27
		Total	185	100
3	Religion	Buddhism	184	99
		Hindusim	0	0
		Christian	1	1
		Islam	0	0
		Total	185	100
4	Education	Graduate	1	1
		High School	5	3
		Secondary School	41	22
		Primary School	56	30
		Monastic Education	82	44
		Total	185	100

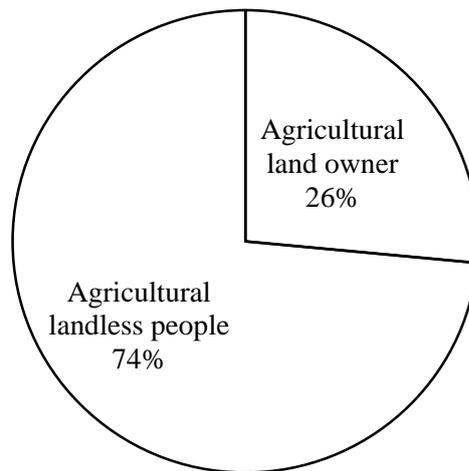
Sr	Description	Category	Number of respondents	Percentages
5	Occupation	Farmer	43	23
		Non-farm activity	44	24
		Collection of mangrove based product	98	53
		Total	185	100
6	Agricultural land	Yes	49	26
		No	136	74
		Total	185	100

Source: survey data (2022)

Primary data for this research was collected from 185 respondents were interviewed from study area, regarding analysis shown in table 4.2. The household head distribution of the study is 89 respondents are male (48%) and 96 are female (52%). Just two respondent is under 19 years (1%), 36 respondents are between 20 to 29 years (19%), the 50 respondents are between 30-39 years (27 %), 47 respondents are between 40 to 49 years (25 %) and the 50 respondents are over 49 years (27 %). In religion, the 184 respondents are Buddhist (99 %) and only 1 respondent is Christian (1 %). Family size varied from 1 to 10 members.

For the education level, one respondent is graduate, 5 respondents are high school, 41 respondents are middle school, 56 respondents are primary school and 82 respondents are monastic education. Therefore most respondents did not educated from formal school, just from traditional monastic education. For our Country, Myanmar, Paddy rice cultivation is tradition and Ayeyarwaddy region is famous for “rice bowl of Myanmar and it is also import for livelihood.

Figure (4.2) Ownership of Agricultural Land



Source: survey data (2022)

For agricultural land holding sizes respondents, minimum is 0 and maximum is 100 acres. The 49 (26%) respondents have their agricultural land but 136 (74%) respondents have not agricultural land.

In the study area, the respondents' income get from various sources such as wage labor in mangrove forest plantations, casual and seasonal labor in agriculture, small scale trade, shop keeping, fish proceeding and crafts and collection of firewood. The respondent' houses was used with timber flooring and metal roofing is 17%, wood, brick and concrete, metal roofing is 8%, timber and bamboo flooring and Nypa roof is 74% and the remaining 1% stay on a boat.

From the mangrove forest, some respondents used for houses construction. The mainly construction material of mangrove forest are timber and nipa palms (*Nypa fruticans*). The non-farm activities and collection of mangrove forest products and farm activities are the source of income. According to survey, the 24% occupation from non-farm activities, 53% get their occupation by the mangrove forest products collection and 23% occupation from agriculture. The income such seasonal and casual labor in agriculture, wage labor in mangrove forest rehabilitation activities, shop keeping, fish proceeding, collection of firewood and crafts made 77% of households income.

Table (4.3) Average annual household income

Types of Income	Average Income Per Year (Kyats/year/household)	Income Share (%)
Mangrove Forest Income	2093000	42
Agricultural Income	1264467	26
Non-Farm Income	1599000	32
Total Income	4956467	100

Source: survey data (2022)

According to the survey results, mangrove forest income is 42% that included both subsistence and cash income. Income from agricultural is 26% and from non-farm income makes up 32%. In Bogalay Township, forest cover is around 11% of the township area. Therefore, Forest income is second place although most of households are landless people.

4.3.2 Environmental Status

According to the survey interview, the monsoon duration at present is shorter than in the past and temperature at present is higher than in the past. The rainy season is shorter and flooding occurrences time is higher. Population pressure effects mangrove forest degrading and deforestation. But the establishment of mangrove forest planation is implemented and community forestry is introduced. Therefore, Forest cover in Bogalay Township is slightly decline.

Table (4.4) Environmental and weather Status

Sr	Environmental Status	Total	Percentage
1	Rainfall is less than five years ago	96	52
	Rainfall is more than five year ago	62	34
	Rainfall is the same during five year	10	5
	No Response	17	9
2	Temperature is less than five years ago	23	13
	Temperature is more than five years ago	149	80
	Temperature is the same during five year	5	3
	No Response	8	4
3	Mangrove forest is less than five years ago	118	64
	Mangrove forest is more than five years ago	50	27

Sr	Environmental Status	Total	Percentage
	Mangrove forest is the same during five year	5	3
	No Response	12	6
4	Sea level is less than five years ago	22	12
	Sea level is more than five years ago	118	64
	Sea level is the same during five year	32	17
	No Response	13	7
5	Drinking water is enough	80	43
	Drinking water is not enough	95	51
	No Response	10	6

Source: survey data (2022)

Regarding to primary data, table 4.4, the 96 respondents (52 %) answered the rainfall is less than five years ago, the 62 respondents (34 %) answered the rainfall is more than five years ago, the 10 (5 %) household answer the rainfall is the same and the left 17(9%) respondents have no idea for rainfall.

The 23 respondents (13 %) answered the temperature is less than five years ago and the 149 respondents (80 %) answered the temperature is more than five years ago, the 5 respondents (3 %) answered the temperature is the same and the left 8 respondents (4%) respondents have no idea for temperature condition.

The 118 respondents (64 %) answered the mangrove forest less than five years ago and the 50 respondents (27%) answered the mangrove forest more than five years ago, the 5 respondents (3 %) answered the mangrove forest condition is the same during five years ago and the 12 respondents (6 %) answered they have no idea for mangrove forest condition during five years ago.

The 22 respondents (12%) answered sea level less than five years ago and 118 respondents (64%) sea level more than five years ago, the 32 respondents (17%) answered sea level is the same during five years ago and the 13 respondents (7%) did not answer for the sea level during five years ago.

The 80 respondents (43 %) answered they are enough drinking water and the 95 respondents (51%) are not enough drinking water and the 10 respondents (6 %) answered they have no idea for drinking water.

Mangrove are unique intertidal ecosystems that occur primarily in tropical regions of the world. They support diverse community of terrestrial and aquatic fauna

and flora, and their ecosystems are direct and indirect environmental, economic and social values to human societies throughout the world. Sustainable development of mangrove ecosystem implies the maintenance and use of natural resources to ensure ecological resilience and economic opportunities for present and future generations. Since the recent decades, new findings have shown that the mangrove ecosystems are recorded as sinks for climate change mitigation initiatives and high carbon sequestration. Mangroves serve as protection function from waves and storms. In Myanmar, Cyclone Nargis highlight the role and value of mangrove forest that save many people in Ayeyarwaddy Delta. Forest Department shared the mangrove forest knowledge to the local community. According to the most of the respondents mangrove forests provide many fish, prawn, crab, fire wood, nipa palm and it can protect from environmental disaster.

4.3.3 Dependency of Mangrove Forest

Firewood, construction material, other mangrove products are used directly or indirectly for their livelihoods in study area. Some use for commercial benefits and mostly households for subsistence.

Table (4.5) Go to mangrove forest in Survey Area

Sr	Related of mangrove forest	Total	Percentage
1	Sometimes	74	40
2	Daily	92	50
3	Weekly	19	10
Total		185	100

Source: survey data (2022)

Regarding survey data, the respondents 74 (40 %) sometimes use mangroves forest, the 92 respondents (50%) daily use mangroves forest and only 19 respondents (10%) weekly use.

Moreover, there are many forest products in study area. Among them, they said nine types of mangrove products are useful for their daily lives.

Table (4.6) The Most Useful Mangrove Forest Product

Sr.	Mangrove Forest Product	Total	Percentage
1	Fish	91	50
2	Crab	8	4
3	Prawn	5	3

Sr.	Mangrove Forest Product	Total	Percentage
4	Wood	19	10
5	Bark	0	0
6	Wood pillar	18	10
7	Honey	6	3
8	Firewood	19	10
9	Charcoal	19	10
	Total	185	100

Source: survey data (2022)

The respondents of 91(50 %) answered the most useable mangrove forest product is fish, the 8 respondents (4 %) for the most useable product is crab, the 5 (3%) is prawn, the 19 respondents (10%) is wood, nobody response for bark, the 18 respondents (10%) is wood pillar, the 6 respondents (3%) is honey, the 19 respondents (10%) is firewood and 19 respondents (10%) is charcoals.

In study area, there are only seven mangrove products are useful for income generating.

Table (4.7) Most Favorable income for respondent of mangrove forest product

Sr	Mangrove Forest Product	Total	Percentage
1	Fish	117	64
2	Crab	13	7
3	Prawn	13	7
4	Wood	2	1
5	Wood pillar	2	1
6	Firewood	19	10
7	Charcoal	19	10
	Total	185	100

Source: survey data (2022)

Regarding the research data, see table 4.7, the respondent 117 (64%) are use fish, the second useable mangrove forest product is firewood and charcoal, the 38 (20%) respondents response for these two products, the third usable mangrove forest product is crab and prawn, 26 (14%) respondents answered these two products and the last is wood and wood pillar, only 4 (2%) respondents responded for their commercial products.

In the study area, most of the people depend on mangrove products for their livelihood. Therefore they directly use the mangrove products and some use the mangrove products for trade.

Table (4.8) Access to mangrove products

1	Access to mangrove products	Directly	123	67
		Indirectly	60	32
		No response	2	1
		Total	185	100

Source: survey data (2022)

According the survey data (table 4.8), regarding of 123 respondents (67 %) get mangrove forest product directly and the 60 respondents (32 %) get indirectly and the left 2(1%) did not response.

The mangrove ecosystem is one of the productive ecosystem. It helps maintain the nursery ground and food-chain in the aquatic environments, moderates salinity, protects the soil and provides timber, fuelwood, charcoal and arrange of non-forest products. Therefore, conservation and protection of mangrove is essential for sustainable food security of study communities.

Table (4.9) Mangrove forest is important for aquacultures species

1	Mangrove forest for aquaculture species	Agree	173	93
		May be	7	4
		Don't think so	3	2
		No response	2	1
		Total	185	100

Source: survey data (2022)

The 173 respondents (93%) are agree the mangrove forest is important for aquaculture, 7 respondents (4%) are think so for this question and 3 respondents (2%) answered don't think that mangrove forest is important for aqua creatures. And the 2 respondents did not answer for this question.

4.3.4. Income sharing among different income levels

The households were separated based on their total income as; high, medium and low income to differentiate households level in the form of wellbeing. In the study site, poor people are landless and they do not get the regular work and have the regular income. Therefore, according to the income amount, income level is divided

into three types: low level (less than 2600000Kyats per year), medium level (between 2600000Kyats and 4420000 Kyats per year) and the high level (more than 4420000 Kyats per year).

Table (4.10) Mangrove Forest Income among Different Income Level

Income Source	High Income (n = 56)		Medium Income (n = 65)		Low Income (n = 64)	
	Income	%	Income	%	Income	%
Mangrove Forest Income	3260400	32.8	1744600	52.8	1274000	79.3
Agricultural Income	3312400	33.3	309400	9.4	171600	10.7
Non-Farm Income	3377400	33.9	1248000	37.8	161200	10.0

Source: survey data (2022)

According to the above Table, we can clearly note that higher income from the mangrove products is seen at the middle level and the lower level.

Income from mangrove product in the high level, medium level and low level are 32.8%, 52.8% and 79.3% respectively according to survey result. The landless people in the study sites are households of low-income level and the middle-income level so that they mainly dependent on the resources of mangrove forest for their livelihood activities. For Agricultural Income, the low-income level is 10.7% and the middle-income level is 9.4% and the high-income level is 33.3% according to the above table. For Non-Farm Income, the low-income level is 10% and the middle-income level is 37.8% and the high-income level is 33.9%. It is clearly seen that if there are alternative livelihood activities, the dependency of mangrove forest resources will reduce.

4.3.5 Conservation Practices

Local people activities in study area have led the destruction of the mangrove forests. They cut down for use as firewood or for clearing the way for agricultural land as farming rice, palm oil, or aquacultures practices shrimp. The mangrove forest destruction and deforestation has devastated the carbon ecosystem and has destroyed the very resource that nourishes and protects communities. To restore those mangrove forests that have immense benefits, stabilize the coastline, reduce erosion,

provide protection from storms, and are home to fish, birds and plants. Mangroves store as much as four times the carbon stored in inland forests, mangrove forest conservation is important.

Table (4.11) Conservation Practices

Sr	Conservation Practices	Total	Percentage
1	Benefit from Mangrove Forest Protection		
	Agree	185	100
	Disagree	0	0
	Total	185	100
2	Have you attended in Knowledge sharing Activities		
	Agree	111	60
	Disagree	74	40
	Total		
	Mangrove Conservation is important		
	Agree	185	100
	Disagree	0	0
	Total	185	100
3	Aware of Mangrove Forest Conservation activities		
	Agree	185	100
	Disagree	0	0
	Total	185	100
4	Involve mangrove forest rehabilitation		
	Have no desire	1	1
	Desire but busy	70	38
	Have desire	114	61
	Total	185	100

Source: survey data (2022)

All respondents (100%) know, aware and agree to mangrove forest protection and conservation is important and to improve their livelihood. All respondents are aware mangrove conservation is important for not only their area but also environmental care, related of mangrove forest and eco system. They already known government mangrove forest conservation activities integrated with local NGO.

But, the 111 respondents (60 %) attend the knowledge sharing activities and the left 74 (40%) respondents did not attend for their personal activities and some people have less time to attend this sharing .

The 114 respondents (60 %) have desire to involve mangrove forest conservation activates, 70 respondents (40 %) want to involve that activities, but they are poor and have no extra time. The local people involve in mangrove reforestation and rehabilitations process as a worker.

4.3.6 Natural Diaster and Fuel for Daily Cooking

Mangrove forest conservation and rehabilitation is one method to mitigate risks of natural disasters. Mangroves provide an essential source of protection against the effects of natural hazards and erosions because they serve as a buffer against storm surges, strong winds and tsunamis. Mangroves forest in study area have been cut down for fuel-wood for cooking and heating.

Table (4.12) Natural Disaster and Fuel Use for Daily Cooking

Sr	Name	Total	Percentage
1	Experiences about Natural Disasters		
	Yes, Serious	169	91
	Yes, no serious	5	3
	No experience	8	4
	No response	3	2
	Total	185	100
2	Mangrove for protection Natural Disaster		
	TRUE	171	92
	Might Be	6	3
	Don't think so	7	4
	No response	1	1
	Total	185	100
3	Energy use for cooking		
	Fuelwood	185	100
	Charcoal	0	0
	Total	185	100
	Total	185	100

Source: survey data (2022)

The regarding of 8 respondents (4 %) are no experience of natural disaster, the 5 respondents (3%) are experience of natural disaster bur not too bad, the 169 respondents (91 %) are big experience of natural disaster. The left 3 respondents (2%) did not answered for this issue.

The 171 respondents (92 %) agree that mangrove forests protect them from natural disaster the 6 respondents (3 %) think like that, the 7 respondents (4%) don't think like that and the only one respondent did not answered not only may be but also think so for this question.

All respondents (100%) use fuel wood for daily cooking.

4.3.8 Myanmar Reforestation and Rehabilitation Programme Activities in Bogalay Township

In order to restore the degraded and deforested forests area, Forest Department launched Myanmar Reforestation and Rehabilitation Programme (MRRP) (2017-18 to 2026-27) in 2017. According to MRRP, Dry Zone Greening Department is also cooperating with Forest Department in implementing MRRP. MRRP has being implemented in all 15 States and Regions (i.e., 68 Districts) of the country. According to the formulation and implementation of MRRP, forest operations have been implemented.

4.3.8.1 Forest Cover in Bogalay Township

Land cover provides a means to examine landscape characteristics and patterns, which are important in understanding. The condition, extent and availability of lands. Land cover shows the physical land type such as forest or wooded land or water whereas land use documents how people are using the land. Land Cover of an area support information to help users to understand landscape.

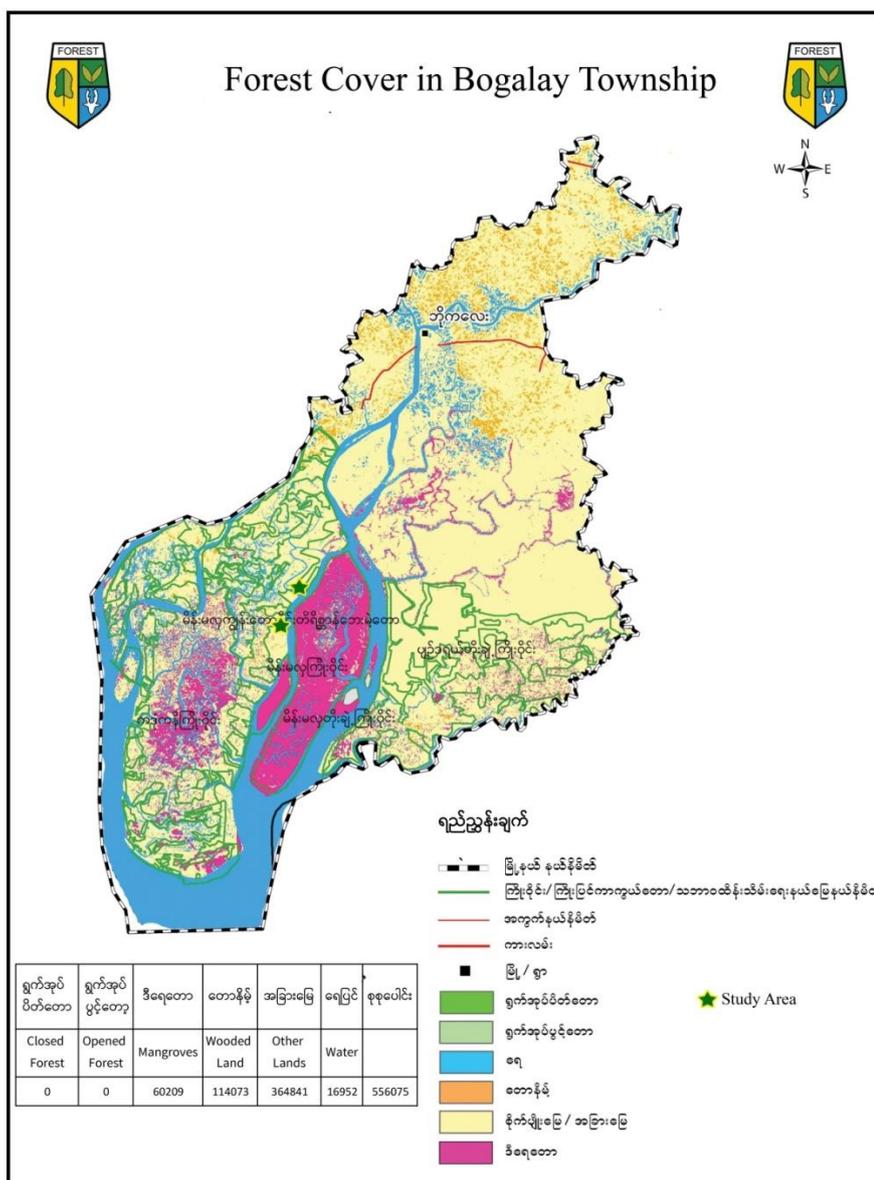
Forest cover is The amount of forest that covers a particular area of land is the foret cover that refers to the whole area more than 1 hectare in area, existing tree canopy density of more than 10%. Forest cover can be determined as absolute (in square kilometres/square miles) or relative (in percent). It is used for assesing the forest cover or growing stock of a particular ecosystem or a country and classifying forests based on type, form, composition, latitude, altitude etc.

Table (4.13) Forest Cover in Bogalay Township

Sr	Type of Land cover	FRA 2015 (%)	FRA 2015 (Acre)	FRA 2020 (%)	FRA 2020 (Acre)	Difference
1	Forest	11.01	61241	10.82	60209	(-) 1032
2	Wooded land	3.36	18717	20.51	114073	(+) 95356
3	Other	75.58	420320	65.61	364841	(-)55479
4	Water	10.05	55797	3.06	16952	(-)38845
Total		100	556075	100	556075	

Source: Forest Department, Bogalay Township

Figure 4.3 Forest Cover in Bogalay Township



Source: Forest Department, Bogalay Township

In Bogalay Township, according to Forest Resource Assessment forest cover is 11.01%(61241 acres) in 2015 and 10.82% (60209 acres) in 2020. Therefore mangrove forest decline 1023 acres from 2015 to 2020. Similarly, other (except forest, wooded land and water) and water are 75.58%(420320 acres) and 10.05%(55797 acres) relatively in 2015 and 65.61% (364841 acres) and 3.06% (16952 acres) in 2020. But, wooded land is 3.36% (18717 acres) in 2015 and 20.51% (114073 acres) in 2020. The above table 4.13 shows mangrove forest is declined from 2015 to 2020 due to landless people but mangrove forest conservation activities and community forestry process is well operated in Bogalay Township. So, wooded land area is increased from 2015 to 2020.

4.3.8.2 Plantation Establishment in Bogalay Township

The mangrove plantations establishment is a method that reduce loss in mangrove cover and enhance carbon sequestration that contributes to climate change mitigation and to additional ecosystem services

Table (4. 14) Plantation Establishment in Bogalay Township

Sr.	Established Year	Area (AC)
1	2017	1400
2	2018	1355
3	2019	1400
4	2020	1400
5	2021	1400
6	2022	1400
Total		8355

Source: Forest Department, Bogalay Township

According to Bogalay Township, Forest Department Data, Mangrove Plantation have been establishing. Mangrove plantation of 1400 acres in 2017, 1355 acres in 2018, 1400 acres in 2019, 1400 acres in 2020, 1400 acres in 2021 and 1400 acres in 2022 in Bogalay Township. There are mangrove plantation 8355 acres in Bogalay Township from 2017 to 2022. The operation area is decided by MRRP from head office, Forest Department.

4.3.8.3 Natural Regeneration in Bogalay Township

Natural regeneration is the process by which forests are restocked by plants that develop from seeds that fall and germinate. Restocked and created forests by using transplants grown in forest nurseries. This regeneration of mangrove forests, will support more effective management measures, particularly for the conservation of this mangrove ecosystem.

Table (4.15) Natural Regeneration in Bogalay Township

Sr.	Year	Area (AC)
1	2017	1300
2	2018	1000
3	2019	1300
4	2020	1300
5	2021	500
6	2022	450
Total		5850

Source: Forest Department, Bogalay Township

One of the MRRP activities is Natural Regeneration. In Bogalay township, there are natural regeneration area of 5850 acres, 1300 acres in 2017, 1300 acres in 2018, 1300 acres in 2019, 1300 acres in 2020, 500 acres in 2021 and 450 acres in 2022. The operation area is decided by MRRP from head office, Forest Department.

4.3.8.3 Community Forestry in Bogalay Township

Nowadays, community forestry had become a well-established and integral part of the framework for management and use of forest resources. Community forestry remains a potentially powerful driver of positive change within the forestry sector.

The specific objectives and definitions for community forestry were clearly defined, the types of land that can establish CF were increased (for example, CF is allowable in the buffer zone of the protected area), and the production from CF was considered not only for the subsistence needs of local people but also for the small scale to commercial scale enterprises. The Community Forestry Instruction(CFI) issuing 2019 gives a significant development in the aspects of partnership,

participation and decentralization. The local communities are granted trees and forest land tenure rights for an initial 30-year period, which is extendable. The Forest Department provides the technical assistance and plays the leadership role in the exercise of community forestry and the development of CF based enterprises.

There are ten steps in community forestry establishment process. These steps are:

1. To nominate the staff of forest department, township for community forestry establishment process
2. Extension and awareness sharing for community forestry establishment process
3. Choosing of Community Forestry User Group of community forestry
4. Choosing of Management Committee of Community Forestry User Group
5. To examine the land for community forestry
6. To submit community forestry application form to Staff Officer, Township
7. To admit the applied land for community forestry
8. Formulation of management plan of community Forestry
9. Issuing the Community Forestry Certificate
10. Activities implementation accordance with management plan of community Forestry

Table (4.17) Community Forestry in Bogalay Township (MRRP)

Sr	Village Name	Established Year	Permitted Area (AC)	Member	Certificate Issue
1	Shwe Pyi Thar	2011	50	106	31.7.2012
2	Mingalar Kyaw	2017	20	7	6.7.2017
3	Htaw Paing	2018	15	10	10.8.2018
4	Kwe Pone	2021	219	19	28.3.2022
5	Padekyaw		7	23	Now step 8

Source: Forest Department, Bogalay Township

Four Community Forestry with getting Community Forestry Certificates are found in Bogalay Township and plus one of the study areas (Padekyaw) is trying to get the Community Forestry Certificate. Now they reach eight step of ten steps. Interviewing with the community forest user group, most of them are very satisfy to get the opportunity community forestry enterprise because the CFI issuing 2019 gives to conduct livelihood development activities and more than subsistence development. They have the chances to implement cooperation and coordination with NGOs and INGOs and getting financial support from donor.

According to Staff Officer, Forest Department, Bogalay Township, the following activities should be implement to support rural communities' development.

- Establishment of self-established forest plantations (establishment of private plantations)
- Establishment of community forestry (available for your own use, you can earn money by selling surplus)
- Mixed crop and forest cultivation;
- Engaging in government and private forest plantations
- Production of timber and non-timber forest products from natural forests; Private extraction;
- Involvement in wood-based industries and value-added products;
- Manufacture of basic forest products

CHAPTER V

CONCLUSION

5.1 Findings

This thesis is resulting the mangrove ecosystem usefulness to the local community and environmental conservations of not only Ayeyarwaddy Region but also of the country, Myanmar. The management and conservation practices of mangrove forest of local people are technically not operating very well. INGOs and local NGOs are operating implement the mangrove reforestation, rehabilitation and management, with increased potential between and among the key stakeholders and communities.

In the study area, the most of the people's livelihoods are at subsistence level. For their livelihoods, they depended on natural resources heavily. The activities of major livelihood in the study area are mangrove forest product collection, agriculture and non-farm activities. Among them, the major income source is mangrove forest resources and most of the delta communities depend on them. The main provisioning ecosystem services of mangroves forest are woody products such as timber, post and pole, firewood and charcoal as energy sources, fodder, shelter, medicines and a fishery which is important for landless people, subsistence, livelihood and commercial fisheries for all households living in coastal and delta areas. By selling forest products collected from the mangrove forest such as fishes, crabs and prawn, they create their income (42% to total household income). As they are poor and predominantly live in the delta region, half of the respondents engaged in mangrove based occupations. The average annual household income from mangrove forest products per year was Kyats 2,093,000. The mangrove economic value is Kyats 3,893,760 in Dr. Tin Tin Wai's research of "Economic Dependency of Local Communities on Mangroves: A Case Study in Bogalay, Myanmar". Therefore, the mangrove forests economic value is gradually reducing due to degrading of mangrove forest and the deforestation. In this study, agricultural income estimated about 26% of total income as well as non-farm incomes accounted 32% of total household income. The wage labor in mangrove

forest plantation, casual and seasonal labor in agriculture, salary, private shop, etc., were the major non-farm activities. Furthermore, the dependent of mangrove forest vary among different income levels. According to the survey result, the middle-income and low-income levels of the respondents depend on forest resources with 52.8% and 79.3% of total household income. The landless households are the middle income and low income level households and do not get the other alternative opportunity for income activities. Therefore, the lower income level households are more dependent for the forest incomes than the level of better off households.

The dependence level is 42% in the study sites on average. Therefore, local community in the studied sites is majority dependency on the mangrove forest resources for their livelihood activities. In this study, the characteristics of socio-economic that influenced forest dependency were also explained. Agricultural land size is related with mangrove forest income. In parts of the Ayeyarwaddy Delta, according to the farming practices, land degradation and declining soil fertility led to decreasing agricultural yields. In the Delta areas, converting mangrove areas to rice paddy farms became in seawater encroachment and soils salinization. Household size is related dependency on mangrove forest to get income. According to the survey result, the respondents produced mangrove forest products directly and indirectly as 67% and 32% respectively. Education level in this study is not effected on mangrove forest dependence for less access to alternative income sources. In this research, the mangrove forest is mainly depended by the regardless of the gender of the head of the household. The households of dependency on mangrove forest will decrease if they get the chance for other alternative livelihood sources.

Income that is generated from agricultural income, mangrove forest products and non-farm income are the sources of local community to fulfill their subsistence needs. However, the local people who are living nearby the forest reserve depend mainly on mangrove forest because the accessibility of the mangrove forest products is easily to generate their livelihood income. The main livelihood income is from the products of the mangrove resource and 42% of the total income of the household income. Therefore, the households are mainly dependent on the products of mangrove. The low-income level households have neither regular off-farm employment nor agricultural land to generate their income. So, They significantly depend on the mangrove forest resources like fish, prawn, crab and firewood for their subsistence. Some household collect the firewood for economic purpose and The

firewood is the main energy source for cooking in this study area. The non-farm income is the second largest income source. It accounts for 32% of total income. The agricultural income is 26% of total income. In the study sites of the livelihood of local community, the mangrove forest resource is mainly income although some get the activities of other alternative livelihood like employment of agriculture and non-farm employment.

Social economic background of local people plays important role and considerable point in the conservation and management of mangrove forest. The mangrove forest protect floods, damaging storm, wind and waves and support and provide the basic need of local people and maintain water quality and clarity, trapping sediment from inland and pollutants filtering.

The activities of mangrove forest conservation such as mangrove plantations, natural regeneration and establishment of community forestry, etc., are successful implemented in Ayeyarwaddy Region. Forest Department (FD) has announced the Myanmar Forest Policy and is trying to stop illegally extraction and use community monitoring and reporting system to manage and conserve the mangrove resource. Although Forest Department(FD) attempt to rehabilitate, manage and conserve mangrove resource, there are still weakness in management and conservation in mangrove forests. Currently, management and conservation project in Ayeyarwaddy Region are being implement in cooperation and collaboration with international organizations and local organization to restore and rehabilitate the mangrove resources.

5.2 Recommendation

For the sustainable livelihood, the livelihood strategies of households should be diversified and created job opportunity. To get the sustainable forest management and conservation, the local people' dependency on mangrove forest resource should reduce. The alternative income generation activities should be implement and create in the management and conservation of forest resource for protection of mangrove resources utilization and conservation. Mangrove forest resources support important contribution to local livelihood, therefore issues on the dependency of forest resource and of rural livelihood subsistence level is not be neglected in the decision making process. The improvement of mangrove forest will support and provide tangible and intangible benefits and sustainable management of forest resources.

All households need to get alternative and electricity support for daily cooking, local people need to reduce the extraction of firewood from mangrove forest. The distribution of required amounts of fuel efficiency cook stove is provided by Forest Department and FD should encourage for the production and using fuel efficiency cook stove. Local authorities should fully participate and lead these kinds of activities; Forest Department should focus on illegal deforesting activities and to rehabilitate and restore the degraded forests for enhancing ecosystem services.

Weak community participation can be found in community forestry. Communities are unlikely to participate in CF activities because the lack of economic and social incentives. Thus, they have their awareness raised for the concept of CF enterprises, stabilize the environment, and improve the incomes and living standard. The communities trust is important. Land tenure and land-use right should be secure. The successful story for community forestry should be established. The community forestry enterprises are economically viable and potentially improvement for their livelihood. Forest Department should provide the awareness-raising, sustainable livelihood framework concept and community enterprise training to develop the community forestry. The sustainable conservation and management should be implemented through directly and indirectly management and conservation method. Sustainable mangrove forest management and conservation means that people can have the right to use resources without important degradation, deforestation and depletion to the mangroves.

The staff working management and conservation activities should know the concept of forest management with community participation approach, private-public-partnerships approaches and green economy green growth and blue economy. The staff should be conduct to get the achievement and willingness in both environmental management and conservation.

Mangrove forest management and conservation practices should be adjusted regarding to local people lifestyle, job opportunity, infrastructure development, market condition, tourism, fisheries, reliability on mangrove, etc.

Policies, laws, rules and regulation for sustainable mangrove management and conservation should be reasonable and applicable, and dynamic between among people, authority, and concerned department and ministry. Better protection and income collection should listed systematically by mangrove forest products including aquatic animals in the water area.

Forest Department in Myanmar should mainly focus on prevention and finding the suitable ways to minimize land violations. Revenue can be increased by getting more products from natural ways regarding to improvement in mangrove forest situation in Myanmar.

REFERENCES

- Alongi, D.M. (2009) Paradigm shifts in mangrove biology. In: Perillo GME, Wolanski E, Cahoon DR, Brinson MM (eds) Coastal Wetlands—an integrated ecosystem approach. *Elsevier*, New York, pp 615–640.
- Answer (2012, March). *Natural resource management*. Retrieved 2012, fromn Answers: <http://www.answers.com/topic/natural-resource-management>
- Bangkok: 1. Department of Marine and Coastal Resources (DMCR), 2. Kasetsart University Faculty of Forestry (KUFF).
- Cha, Seong-Min. (2017). The Here and Hereafter of Myanmar Telecommunications Sector. *International Journal of Control and Automation*, Vol.10, No.4 (2017), pp.159-168.
- Cherry Aung (1999) Study on some ecology of mangrove at Setse, Mon State. Unpublished Master thesis submitted to Mawlamayne University.
- Cowardin, L.M., Carter, V., Golet, P.C., LaRoe, E.T. (1979) Classification of wetlands and deepwater habitats of the United States. United States Fish and Wildlife Service, Washington, DC.
- Costanza, R., Pérez-Maqueo, O., Martinez, M., Sutton, P., Anderson, S., Mulder K. (2008) The value of coastal wetlands for hurricane protection. *Ambio* 37(4):241–248.
- Department for Environment. (2012, 10 15). *defra*. Retrieved 10 13, 2011, from
- DFID. (1999), Sustainable livelihoods guidance sheets
- FAO (1952) Tropical silviculture, vol 1. FAO, Rome
- FAO (1994) Mangrove forest management guidelines. Forestry Paper 117, FAO Forestry Department, Rome.
- FAO (2010) The world’s mangroves 1980–2005, FAO forestry paper 153. Forest Resources Division, FAO. The Food and Agriculture Organisation of the United Nations, Rome, 77 pp.
- Forest Department (FAO) (2015). *Global Forest Resources Assessment 2010 country report, Myanmar*. Rome: FAO.

- FREDA & ACTMANG (2012) Ten years in Pyindaye-Yangon. Thin Publishing House. 164 pp.
- Gopal, B., Kvet, J., Löffler, H., Masing, V. & Patten, B.C. (1990) Definition and classification. In: Patten BC, Jorgensen SE, Dumont HJ, Gopal B, Koryavov P, Kvet J, Löffler H, Sverizhev Y, Tundisi JG (eds) Wetlands and shallow continental water bodies. *Natural and Human Relationships*, vol 1. SPB Academic Publishing, The Hague, pp 9–16.
- Greenstein and Spiller (1995). *Industrial and Corporate Change*, vol.4, 647-6.
- Gruber H., Koutroumpis P. (2010), Mobile communications: Diffusion facts and prospects. *Communications and Strategies*; 77(1): 133–145.
- Gruber H., Verboven F. (2001), The evolution of markets under entry and standards regulation—the case of global mobile telecommunications. *International Journal of Industrial Organisation*; 19: 1189–1212.
- Govindasamy, C., Kannan, R. (2012) Pharmacognosy of mangrove plants in the system of unani medicine. *Asian Pac J Trop Dis*:S38–S41.
- Gilman, E., Ellison, J., Duke, N., Field, C. (2008) Threats to mangroves from climate change and adaptation options: a review. *Aquat Bot*; 89(2):237–250.
- Hardy (1980). The role of the telephone in economic development, *Telecommunications Policy*, vol. 4, no. 4, pp. 278– 286, Dec. 1980.
- ICRA Learning Resources. (2012). *Livelihoods*. Retrieved from Livelihoods – Key Concepts: www.icra-edu.org/objects/anglolearn/ACFtTAGCm.pdf
- International Finance Corporation, (2014). *Sizing the Opportunity: Green Telecoms in Myanmar-Green Power for Mobile Market Analysis*.
- Jacqueline Pee Gyaw(EMPA 6th batch) analysis “ A study on the status of mangrove timbers in the Ayeyarwady Delta(1990 – 2008)
- Kathiresan, K., Bingham, B.L. (2001) Biology of mangroves and mangrove ecosystems. *Adv Mar Biol* 40:81–251.
- Keddy PA (2010) *Wetland ecology: principles and conservation*, 2nd edn. Cambridge University Press, Cambridge.

- Kee-Yung Nam, Maria Rowena Cham, and Paulo Rodelio Halili, (2015). Developing Myanmar's Information and Communication Technology Sector Toward Inclusive Growth. *ADB Economics Working Paper Series*.
- Khizindar, Tariq., M. (2015). An Empirical Study of Factors Affecting Customer Loyalty of Telecommunication Industry in the Kingdom of Saudi Arabia *.British Journal of Marketing Studies*, Vol.3, No.5, pp.98.
- Kjerfve, B. (1990) Manual for investigation of hydrological processes in mangrove ecosystems. UNESCO/UNDP. New Delhi, India, p 79.
- Kjerfve B, Drude de Lacerda L, Rezende CE, Coelho-Ovalle AR (1999) Hydrological and hydrogeochemical variations in mangrove ecosystems. In: Yáez–Arancibia A, Lara–Domínquez AL (eds) *Ecosistemas de Manglar en América Tropical*. Instituto de Ecología A.C., México, UICN/ORMA, Costa Rica, NOAA/NMFS, Silver Spring, MD, USA, pp 71–82.
- Kofi Ampomah, Yirenkyi (2012). “Factors Affecting Customer Satisfaction and Preference in the Telecommunications Industry”: A Case Study of MTN Ghana., Kwame Nkrumah University of Science and Technology.
- Lin, Junqi. (2012). “The Factors Affecting Customer Satisfaction and Behavioral Intentions in Using Mobile Telecommunications Service in Bangkok”, Thailand. University of the Thai Chamber of Commerce.
- Maburuka, I.R. (2016). “Determinants of Customers Choice of Service Provider in the Mobile Industry in Kenya”, Strathmore University.
- Melana, D.M., Atchue, J. III, Yao, C.E., Edwards, R., Melana, E.E., Gonzales, H.I. (2000) *Mangrove management handbook*. Department of Environment and Natural Resources, Manila, Philippines, pp 96.
- Myint-Pe (2002) National Report of Myanmar- on the sustainable management of the Bay of Bengal Large Marine Ecosystem (BOBLME) GCP/RAS/179/WBG
- Nellemann, C., Corcoran, E., Duarte, C.M., Valdés, L., DeYoung, C, Fonseca L. Grimsditch, G. (eds) (2009) *Blue carbon: a rapid response assessment*. United Nations Environment Programme, GRID-Arendal.

- Rahul and Zhu, Xue. (2012). An analysis of Factors Influencing the Telecommunication Industry Growth: A Case Study of China and India, Bleking Institute of Technology.
- Shakerdargah. (2008). Mangrove and Wetland Ecosystems(vol 6:). In B. T. Kasatsart University, *Tropical Forestry Change in a Changing World* (p. 236).
- Spalding M, Kainuma M, Collins L (2010) World atlas of mangroves. Earthscan Publishing, London Richards DR, Friess DA (2016) Rates and drivers of mangrove deforestation in Southeast Asia, 200-2012. PNAS 113(2):344–349.
- Tutorvista.com. (2011). *Environment and environmental problems*. Retrieved from Conservation and Protection of the Environment: <http://www.tutorvista.com/content/biology/biology-ii/environment-andenvironmental-problems/protection-environment.php>
- VDB Loi. (2017). Telecommunications, Media and Technology Myanmar Update Venkatram,
- Vora, Lopa, J. (2015). Evolution of Mobile Generation Technology: 1G to 5G and Review of Upcoming Wireless Technology 5G. *International Journal of Modern Trends in Engineering and Research (IJMTER)* Volume 02, Issue 10, [October – 2015] ISSN (Online):2349–9745; ISSN (Print):2393-8161.
- Waverman, L., Meschi, M., & Fuss, M. (2005). The Impact of Telecoms on Economic Growth in Developing Countries. The Vodafone Policy Paper Series, 2, 10-24.
- Wikipedia. (2012b). *Livelihood*. Retrieved June 30, 2012, from Wikipedia, The Free Encyclopedia: <http://en.wikipedia.org/wiki/Livelihood>
- Wai, T.T. Economic Dependency of Local Communities on Mangroves: A Case Study in Bogalay, Myanmar.Available online: <http://www.eepseapartners.org/economic-dependency-local-communities-mangrovescase-study-bogalay-myanmar>
- Webb EL, Jachowski NRA, Phelps J, Fries DA, Than MM, Ziegler AD (2014) Deforestation in the Ayeyarwady Delta and the conservation implications of an internationally-engaged Myanmar.Glob Environ Chang.

- Yong JWH (2016) An ecological and plant biodiversity assessment of the Meinmahla Kyun Wildlife Sanctuary (MKWS) in relation to biodiversity conservation and restoration, and human livelihood. FFI report. 37 pp.
- Zöckler C (2016a) Bird survey and training report Ayeyarwady Delta, Myanmar. Unpublished report for Fauna & Flora International
- Zöckler C (2016b) The bird and mangrove survey of the inner Myeik Archipelago March 2016. Unpublished report for Fauna & Flora International.
- Zöckler C, Delany S, Barber J. (2013) Sustainable coastal zone management in Myanmar. ArcCona Ecological Consultants and Flora Fauna International. Cambridge, p 60.

Websites

<https://www.sciencedirect.com/science/article/abs/pii/S0378112705004834>

<http://www.defra.gov.uk/environment/natural/ecosystems-services/>