



Norwegian University
of Life Sciences

Master's Thesis 2016 60 ECTS
Faculty of Veterinary Medicine and Biosciences
Department of Plant Science

**Restoring Myanmar's Mangrove Forests and
Coastal Communities' Socioeconomic Stability with
Community Based Mangrove Management**

Jonathan Grevstad Lindholt
Agroecology

Preface

This thesis marks the conclusion of my five years at The Norwegian University of Life Sciences. I am forever grateful for the personal and academic development I have been allowed to achieve. My studies have focused on the challenges in International Environment and Development, and later on the many opportunities in Agroecology. This research therefore also represents my provisional contribution to bridge the gap between these fields of study, to reconnect man and nature.

Through this research I have been able to visit Myanmar, the Real Land of Smiles. Myanmar showed me what the world looked like without the luxuries I often take for granted, and gave me an improved perspective of life. I have seen the dramatic consequences of the destruction of mangrove forests, and developed an even deeper determination to solve such problems.

My highest gratitude and sincere appreciation goes to the many people that have made this paper possible by providing valuable insights, time and resources. Special thanks go to Arne Fjørtoft, U Win Maung, Win Sein Naigh, Htei Lin, Joacim Kontny and Htoo Lwin Aung, but also to everyone I encountered from the teams in Worldview International Foundation, Mangrove Service Network and Mangrove Action Project. I also wish to extend a sincere appreciation to the people that met me with warm welcomes and hospitality when visiting Shwethaunyan, Bogale, Myan Aung, Labutta, Gawdu, Tangida, Haing Gyi Tan, Kyeintali and Poelaung. In all fairness I thank people in Myanmar as a whole for the amazing kindness I received during my research.

Lastly, but certainly not least, I would like to thank my girlfriend for unconditional love, my fellow students for kind encouragements, and my supervisors Charles “Chuck” Francis and Anna Marie Nicolaysen for their constructive critique and priceless counsel through this process.

Jonathan Grevstad Lindholt

Norwegian University of Life Sciences

Ås, May 2016

Abstract

Mangrove forests have a significant capacity to provide ecosystem services. However, deforestation from land use changes has led to widespread degradation of these services and consequently jeopardizes coastal populations. Reforestation projects and attempts to develop sustainable management procedures are widely attempted worldwide. However, these projects often have sustainable rural livelihood improvements as a complementary goal. Integrated approaches such as Community Based Mangrove Management (CBMM) are emerging to bridge the gap between ecological restoration, community participation and livelihood improvements. CBMM has been applied in several projects in Myanmar with mostly positive impacts on sustainable rural livelihoods. This research shows that an active inclusion of local communities in planning and implementation of restoration projects could lead to a more sustainable management of the mangrove forests, and ensure livelihood improvements for coastal communities.

Table of Contents

1. Introduction	1
1.1. Research question.....	4
1.2. Scope of thesis	4
2. Theoretical framework	5
2.1. Governing common resources	5
2.2. Mangrove Reforestation.....	5
2.3. Community Based Mangrove Management	6
2.4. Sustainable Rural Livelihoods framework	7
2.5. Agroecology and systems perspective.....	8
3. Methods	9
3.1. Study area.....	9
3.2. Choice of Method	10
3.3. Conducting and analyzing interviews.....	10
3.4 Constraints of method.....	11
4. Results	12
4.1. Community Forests.....	12
4.2. Community supported forest reserve	12
4.3. Results from Community-supported forest reserve.....	13
4.3.1. Results from interviews with Worldview International Foundation	13
4.3.4. Results from interviews with villagers in community supported forest reserve.....	16
4.4. Result from Community forests	20
4.4.1. Results from interviews with NGOs – Community Forests.....	20
4.4.2. Results from interviews with community forest members	21
4.5. Results from interviews with Forest Department	27
4.6. Summary of results	28
5. Discussion	29
5.1. What are the most critical driving forces to prevent mangrove forest deforestation?.....	29
5.2. How do reforestation projects alter the ecological understanding of people?	30
5.3. What kinds of livelihood improvements are integral to the protection of mangroves?	30
5.4. How important is the overall question of involving people in the restoration?	31
5.5. What kind of governance is best for long-term sustainability of the projects?.....	31
5.6. Sustainable Rural Livelihood improvements.....	32
6. Conclusion	36

1. Introduction

Mangroves are a collection of 18 families of salt tolerant and woody that have uniquely adapted to coastal conditions to provide extraordinary ecosystem services (UNEP, 2014). Mangroves were predominantly utilized for their timber and firewood quality and increasingly removed to make room for other land uses such as aquaculture and paddy fields (Blasco et al., 2001; UNEP, 2014). It is estimated that more than 35% of the mangrove forests globally were deforested in the last two decades, and that the trend is continuing by 1-8% per year (Valiela et al., 2001). The consequences of diminishing mangrove forests are the loss of biodiversity and ecosystem services, and a further marginalization of some of the poorest populations on the planet (Walters et al., 2008). A report by the United Nations Environment Program (UNEP) calls mangroves “one of the most threatened ecosystems in the world” and highlights the importance of sustainable management and restoration efforts in order to mitigate the ongoing situation (UNEP, 2014 p. 4). Recently mangroves have received much attention for their role in supporting aquatic life, providing benefits for millions of people and sequestering substantial amounts of carbon (Alexandris et al., 2013; Dobson et al., 2006; UNEP, 2014).

Mangrove forest ecosystems make up a transitional zone between land and sea and have a vital role in supporting aquatic life (Alexandris et al., 2013; Bosire et al., 2008; Siikamäki et al., 2012). Mangrove trees create a multitude of roots that acts as important habitat for aquatic life and it is estimated that around 80% of global fish species directly or indirectly depend on this habitat (Bosire et al., 2008; Polidoro et al., 2010). Studies show that fisheries experience a rapid decline in areas where the structure of mangrove ecosystems had been disturbed (Sasekumar et al., 1992). Mangroves thusly support a stable food supply for coastal communities, and also act as protection against weather.

Located along the shoreline, mangroves protect coastal communities by acting as natural barriers and significantly reducing the impacts from wind and waves (Bosire et al., 2008). Research by Hiraishi and Harada (2003) show that 30 trees per 100 meters² reduces the onshore wind and wave impact by more than 90%. Furthermore, recent finding show that areas with intact mangrove forests have notably less casualties after storms than areas where deforestation had occurred (Sandilyan & Kathiresan, 2015). It is estimated that over 100 million people receive benefits from mangrove forests through resources and protection, while also contributing greatly to global carbon sequestration (Sandilyan & Kathiresan, 2015; UNEP, 2014). Research suggest that mangrove trees can sequester more than three times the

amount of carbon found in terrestrial forests and thusly have an important role in climate change (Siikamäki et al., 2012; UNEP, 2014). Based on these results it is estimated that mangroves provide effective ecosystem services valued at US\$33-57 thousand per hectare annually (UNEP, 2014). Direct payment for ecosystem services and carbon sequestration have been initiated to provide support for sustainable resource management in developing countries, but not adequately implemented to benefit mangrove areas (Siikamäki et al., 2012). This is especially relevant in developing countries with large areas of forests, limited resources for monitoring and rural populations that depend on resources from the forest ecosystem services, such as Myanmar.

Myanmar is a developing country with the world's seventh largest mangrove forests (UNEP, 2014). Myanmar is located in South East Asia, bordering to India and Bangladesh in the West, China in the North, Laos and Thailand in the East, and is one of the countries that are most impacted by the loss of mangrove forests (Oo, 2002). The country has experienced rapid urban and economic growth resulting in increasing need for natural resources such as rice, charcoal and onshore fisheries (Lin, 2004). Rice is a staple crop in Myanmar and research suggests that conversion of land to paddy fields are responsible for up to 85% of Myanmar's mangrove deforestation (Webb et al., 2014). Charcoal made from mangrove trees contributes to deforestation as it is a necessary source for energy and firewood in rural areas and Myanmar's increasingly large cities (Zöckler et al., 2013). Construction of aquaculture ponds is an increasing threat to mangroves in Myanmar (Zöckler et al., 2013). Shrimp ponds can lead to rapid economic gains, but extensive use of chemical inputs such as copper and chlorine limit the productive time to 5-10 years as the ponds get to acidic for further production (Gräslund & Bengtsson, 2001; Zöckler et al., 2013). The limited productive time of shrimp ponds forces the producers to move their operations, thereby deforesting new areas (Zöckler et al., 2013). Rapid expansions of agricultural land, extensive charcoal production and onshore aquaculture have caused substantial degradation of the mangrove forests in Myanmar.

Deforestation of mangrove forests in Myanmar has resulted in more than 80% reduction of forest cover in the last century (Leimgruber et al., 2005; Myint Aung, 2007). Especially forest reserves and common land have been subject to illegal deforestation in favor of rice paddy fields and aquaculture (Tint, 2011). Loss of mangrove forests in Myanmar has devastating impact on both nature and society, as fish stocks are reduced, agricultural land lost and coastal communities are left prone to damages by storms (Leimgruber et al., 2005). The increasing

deforestation rate and a heightened understanding of mangrove forest importance has resulted in a range of reforestation measures.

The Myanmar Ministry of Environment and non-governmental organizations (NGOs) have initiated numerous restoration projects of the mangrove forests (Macqueen, 2012). In spite of extensive efforts, there is a common challenge among the mangrove restoration projects to sufficiently integrate local communities and livelihood needs, resulting in further unsustainable land uses (Biswas et al., 2009; Oo, 2002). Community participation and livelihood improvements could be seen as clearly integral to the accomplishment of reforestation and sustainable management of mangrove forests, but adequate implementation has been absent (Datta et al., 2012). A concept of Community Based Mangrove Management (CBMM) has emerged to strengthen the connection between restoration efforts and livelihood improvements in order to maintain long-term sustainable management (Datta et al., 2012).

A CBMM approach was central in creation of the Myanmar Forest Law signed in 1992 and the Community Forest Policy that was initiated in 1995 (Lin, 2004). The community forest initiative has resulted in the establishment of more than 250 community forests (Tint, 2011), and recently an experimental form of community-supported forest reserves (Macqueen, 2012). Community forests are based on the notion that allowing communities control over the reforestation and harvest process will lead to sustainable management (Tint, 2011). Conversely, community-supported forest reserves actively involve local populations in the restoration work, but exclude them from actively harvesting the forest and rather provide livelihood benefits from paid work and infrastructure improvements. Both methods of reforestation are based on a CBMM method by actively engaging the local population in order to increase their livelihood situation and rehabilitate the ecosystem of mangrove forests.

This research focuses on analyzing the community involvement, ecological improvements and livelihood impacts made by restoration efforts in Myanmar, and assesses them based on their impact on sustainable livelihoods. It is comprised of a theoretical review, where the importance of cooperative resource management and key concepts are explained; a methodology part, in which the processes used for interviews and observations are explained; a results part, in which findings are elaborated on; a discussion on relevant findings; and a conclusion that summarizes results and recommendations.

1.1. Research question

Based on the information I present in the introduction, my research question is formulated as:

How can community participation in coastal communities be encouraged and livelihood improvements secured by sustainably reforesting mangroves in Myanmar?

Underlying questions that support the primary research question are:

- What are the most critical driving forces to prevent mangrove forest deforestation?
- How are reforestation affected by the ecological understanding of people?
- What kinds of livelihood improvements are integral to the protection of mangroves?
- What are reasons for and impacts of involving local people in planning & restoration?
- How does governance structure contribute to long-term sustainability of projects?

1.2. Scope of thesis

Coastal communities' livelihoods are an essential part of the CBMM approaches in Myanmar. The aim of the research is therefore to investigate what impacts CBMM has on coastal communities' livelihoods, and which factors contribute to sustainable management. By dedicating my analysis to coastal communities and their livelihoods I will also look at the surrounding institutions that influence the projects. However, topics regarding national energy strategy, economics and politics are beyond the scope of this thesis. Furthermore, due to time constraints it was not possible to perform quantitative assessment of forest structure or long-term measurement of the study areas. In the same regard I have not focused extensively on the role of private sector and commodity chains. Instead the basis for assessment was through literature, participant observations and personal statements from the interviews I conducted during my ten weeks in the field.

2. Theoretical framework

2.1. Governing common resources

Managing common resources has been a widely debated issue throughout the last century. Hardin (1968) proposed in the theory *tragedy of the commons* thesis: that common resources managed by individuals would inevitably be overharvested as people lack a fundamental understanding of sustainably managing such resources to benefit the community, not only individuals. Hardin believed that “freedom in a commons brings ruin to us all” and that everyone is destined to maximize their own benefit without regard for the community at large (Hardin, 1968 p. 1244). Hardin’s theory set the tone for the discourse debating privately and governmentally run resource management and has been subject to debate ever since (Feeny et al., 1990).

On the other side of the argument is the notion that collective action can manage a common resource without direct state intervention. Ostrom challenges Hardin’s theory by examining and effectively demonstrating alternative solutions in governing commons (Dietz et al., 2003; Ostrom, 2015). Ostrom (2015) presents empirical evidence which show that people are capable of letting go of the instant reward in favor of a long-term collective benefit if they are confident that others do the same. Examples of successful community management include fishermen in Canada that cooperate by designating individual areas for catchment (Dietz et al., 2003), and forest dwellers in the Philippines that collectively decide on harvest amounts and management procedures (Ostrom, 2005). Cooperative management of common resources has thusly become increasingly relevant for projects aimed at restoring and rehabilitating ecosystems such as mangroves through sustainable management.

2.2. Mangrove Reforestation

A recurring issue in mangrove restoration projects is the lack of understanding prior to initiation. Ecological restoration is said to be one of the most challenging aspects of ecology, and restoration of mangrove forest is among the most difficult ecosystems to restore, as it is dealing with an especially fragile, complex and dynamic ecosystem (Biswas et al., 2009). Although ecological knowledge on restoration methods have gained momentum research

indicates that restoration projects often fail to incorporate local populations that are affected by the project (Biswas et al., 2009; Field, 1998). When initiating a project it is therefore essential to integrate local communities in such a manner that participation, welfare and livelihood improvements are expected to continue indefinitely (Datta et al., 2012). Datta et al. (2012) also show that lack of income generating activities is the main reason for local communities to engage in unsustainable land use, therefore it is argued that focus should be on creating a system that is both economically and ecologically sustainable in the long run. These notions are central elements in Community Based Natural Resource Management (CBNRM) that is based on a decentralization of rights and responsibilities, to provide rural communities with better control of their resources. CBNRM has increasingly been implemented throughout the last decades and has influenced mangrove management as the more specific Community Based Mangrove Management.

2.3. Community Based Mangrove Management

CBMM is centered on the idea that if the wellbeing of local communities is secured, then a sustainable management of their surrounding mangrove area will follow (Datta et al., 2012). CBMM also involves the notion that community participation is incentivized by knowledge of the benefits they are able to retrieve by sustainable management (Datta et al., 2012). A community based management of mangroves is widely discussed in developing countries and some skepticism is registered among authorities who argue that the tragedy of the commons is inevitable (Sudtongkong & Webb, 2008). Regardless, researchers indicate that community based management often leads to better forest structure and ecological sustainability than governmentally run areas (Kalonga et al., 2015; Sudtongkong & Webb, 2008). This is rationalized by communities' close connection to the forests and understanding of the benefits they receive from a sustainable management plan, with a clear incentive which governmental authorities may not have (Lin, 2004). Successful CBMM projects are registered in large parts of Asia, particularly in India, Indonesia, Pakistan, Philippines, Thailand and Vietnam. Some implementation has also been recorded in African and South-American Countries (Datta et al., 2012).

There are, however, still some issues regarding the economic framework of a CBMM approach. According to Datta et al. (2012) some CBMM projects fail either because local governance structures do not ensure that the benefits are shared among the communities, or that the communities fail to maintain the initial methods of progression. In order to make a successful CBMM project there must be in place a system that balances the need for economic benefits and conservation of biodiversity (Duane, 1997). Field (1999) states that all CBMM projects need a financial basis, but that the most important element is that the project encourage a self-supporting economic system that allow it to sustainably maintain livelihoods and ecosystem services. There must be a structured plan for multiple uses of the available resources that do not compromise the integrity of the ecosystem services. Examples of such integration are use of small-scale and mangrove friendly aquaculture, sustainable harvest of medicinal mangrove products such as leaves and bark, and eco-tourism operations (Datta et al., 2012). A sustainable livelihood approach can then be applied to determine if the CBMM strategy are improving rural communities' livelihoods.

2.4. Sustainable Rural Livelihoods framework

A livelihood is what makes up the basis for living. It comprises the activities, capabilities and assets, both material and social, that make it possible to maintain an acceptable level of nutrition and income to sustain a viable living situation (Scoones, 1998). A sustainable livelihood is thusly a livelihood that can cope with stresses such as economic fluctuations and environmental disasters without diminishing the natural resources it depends on (Scoones, 1998). According to Scoones (1998) there are key elements to ensure that sustainable livelihoods derive from a new strategy. The strategy has to create working days and income for the population that reduces poverty and increase their well-being, and it must also provide possible livelihood adaption through natural resource sustainability (Scoones, 1998). The sustainable livelihood approach is framed to understand, measure and analyze the underlying factors for poverty reduction. It differs from other poverty reduction programs that mainly focus on levels of income, by also measuring development based on availability to different kinds of capital (Adato & Meinzen-Dick, 2002). These capital assets are natural, human, social, financial and physical (Scoones, 1998). Natural capital is defined as the natural resources and environmental services they provide. Human capital is the skills, knowledge and availability of people to perform the livelihood strategy. Social capital is comprised of

social resources such as friends, cooperatives, associations and a community in which livelihood strategies can be based on. Financial capital is availability of money, in terms of cash, savings and pension. The physical capital includes the infrastructure available for the community, such as roads, housing, technology and sanitation (Adato & Meinzen-Dick, 2002; Scoones, 1998). Sustainability of a new project implemented to a community is therefore based on the availability and ability to increase these capital assets and their resilience to external stress factors such as weather impacts.

2.5. Agroecology and systems perspective

This study is conducted with a special notion of an agroecological approach. Agroecology is the study of food systems, namely the agricultural systems, the ecology that surrounds them, the economy that drives them and the society that depends on them (Francis et al., 2003). Agroecology proposes a holistic view that encompasses social, economic and environmental concerns in order to create a food system that are sustainable. In this regard sustainability implies that a system is designed to maintain form and function for a prolonged time. In regard to agroecological forest restoration, sustainability means that the project initiated and the society that depends on it will be able to sustain itself without further external influence or inputs.

A systems perspective to mangrove reforestation based on agroecological principles provides a holistic view of a situation. Mangrove ecosystems are a common resource that has for many years been exploited by a myriad of factors, and consequently led to a reduction of livelihood sources that the Myanmar people depend on. The situation is in desperate need of bridging the different aspects in the Myanmar society to promote sustainable solutions, by looking at causes, consequences and solutions. Questions that raise concern is whether or not there is adequate governing systems in rural Myanmar, and whether the ecological importance of mangroves are commonly known. Further questions to explore is whether or not the widespread deforestation results from a lack of an alternative income source, and what solutions could be implemented to change that.

3. Methods

3.1. Study area

I conducted this study in and around 10 villages on the South West coast of Myanmar. The villages were chosen by the snowball method (Biernacki & Waldorf, 1981). I started my research in Shwethaunyan and gradually acquired new information on additional projects. All villages apart from Shwethaunyan had established or were in the process of establishing community forests. Shwethaunyan (marked with a square on the map) had an experimental form of governance, which in this paper is identified as community supported forest reserve. In addition to visits and interviewing in the villages I made observations and took part in discussions regarding the open access mangrove areas en-route to the study areas. The villages I visited can be seen in Figure 1, and are identified by the following numbers:

1. Shwethaunyan, 2. Bogale, 3. Oakpo, 4. Myan Aung, 5. Labutta, 6. Gawdu, 7. Tangida, 8. Haing Gyi Tan, 9. Kyeintali, 10. Poelaung.

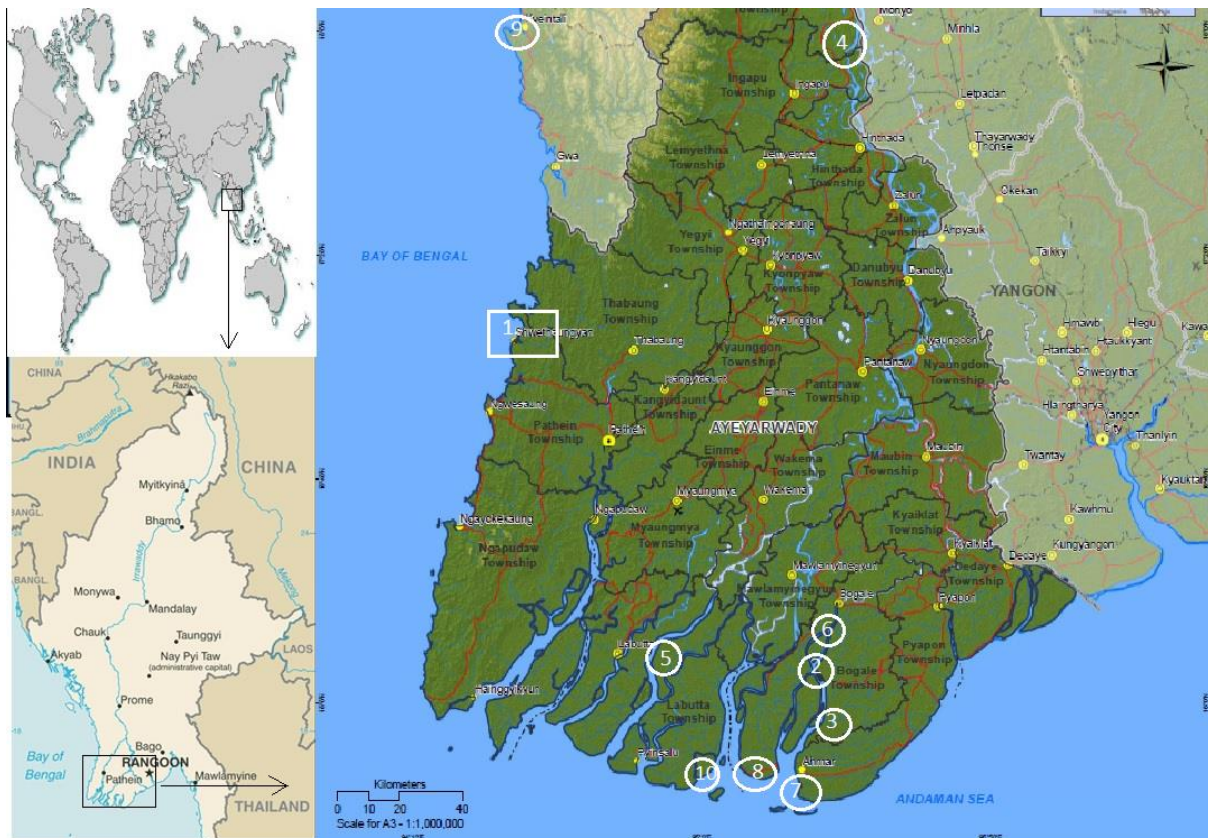


Figure 1: Map of study area. South West Myanmar (MIMY, 2015) 1 Shwethaunyan (17° 4' 26.07" N 94° 28' 0.174" E), 2 Bogale (16° 16' 12.288" N 95° 23' 36.0348" E), 3 Oakpo (15° 43' 22.944" N 95° 21' 51.9444" E), 4 Myan Aung (18° 16' 14.6964" N 95° 19' 14.5452" E), 5 Labutta (16° 7' 38.2548" N 94° 45' 49.3452" E), 6 Gawdu (16° 13' 27.3792" N 95° 17' 27.726" E), 7 Tangida (15° 46' 0.768" N 95° 20' 21.678" E), 8 Haing Gyi Tan (15° 49' 22.4724" N 95° 7' 40.3284" E), 9 Kyeintali (18° 0' 39.7224" N 94° 29' 15.7272" E) 10 Poelaung (15° 50' 53.3148" N 95° 2' 53.5848" E)

3.2. Choice of Method

In order to answer the research question I chose a qualitative method, further explained as a case study, in the terms developed by Robert Yin (2013). I chose this approach to provide a broad overview of attitudes and perceptions from a range of people of different occupations. A case study should be undertaken when trying to understand contemporary phenomena that are observable and interview subjects are available, and is appropriate when the researcher is going to answer “why” and “how” questions (Yin, 2013). Furthermore, this research is comprised of a compilation of interviews, observations and archival data. The research question focuses on how community participation in restoration projects can lead to livelihood improvements, and thusly I required a broad view of opinions on different reforestation projects, the level of community participation, and experiences of enhancing livelihoods through restoration efforts. I undertook an exploratory style research as is appropriate in order to get a holistic view of the situation where the wanted goal is not clear (Yin, 2013). Furthermore, this research investigates the situation of several mangrove restoration projects in Myanmar, and therefore characterized as a multiple case study (Yin, 2013).

3.3. Conducting and analyzing interviews

Prior to traveling to the villages and interviewing local people there a series of information-gathering interviews were conducted in Yangon (previously known as Rangoon). That gave me an overview of different mangrove projects, and a deeper understanding of the complexity of restoring mangroves in Myanmar. The information I obtained during these interviews helped me to identify two main types of restoration projects, namely *community-supported forest reserves* and *community forests*.

I began my fieldwork in ten project areas on the South West coast of Myanmar in October and completed by mid-December 2015. I conducted interviews with nine NGO employees, two Forest Rangers and 97 people from local communities, and did participant observation in their villages. I chose the participants via a snowball method (Biernacki & Waldorf, 1981), starting with the village leader in each village. After the initial interview I asked to be referred to a person of interest who would be a good source of further information. The next person would also be asked to refer me further, and so forth.

The interviews lasted between 15 minutes and 1.5 hours and were based on open-ended questions, in order to get a qualitative and in-depth understanding of people's perceptions. Questions were in most cases asked in Burmese via a translator, or in English when possible. All interviews were taped on a voice recorder, and later transcribed and translated. The transcribed results have been analyzed according to Yin's method of systematically categorizing the results to look for patterns of attitudes and opinions (Yin, 2013).

The questions I asked regarded whether or not people see benefits or problems from the reforestation projects, what kind of livelihood improvements they have noticed, and what happens after NGOs leave the project area. I also asked questions regarding governance, ownership, income sources and ecosystem services deriving from the reforestation projects. The full list of interview questions is in appendixes i, ii, iii.

All participants were given information regarding the study through a written statement according to the Norwegian Social Science Data Services' rules for data collection. The statement was presented in both English and Burmese and is attached in appendix iv. All participants signed the statement with consent that their quotes could be used for the research and informed that personal information would be kept anonymous. Quotes used in the results are therefore incognito except in cases where I was given explicit permission.

3.4 Constraints of method

I have conducted a qualitative case study aimed at communities in coastal areas, limited by the scope of the research. I was therefore careful to work in a structured and unbiased way with my participants, but I would like to discuss briefly some challenges I encountered.

The language barrier was a problem, as the general population speaks little to no English. Most interviews with villagers were conducted through a translator, and this barrier may have caused confusion regarding the questions and answers. Also, many of the individual interviews became more like focus-group interviews, as they attracted other people in the village. It is possible that this experience affected how they answered my questions. Finally, as I was introduced to the villagers as a concerned scientist, it could be assumed that not all interviewees answered completely honest on questions regarding the use of mangrove forests as fuel wood, for example, and also their view on the presence of NGO's and the future prospects.

4. Results

4.1. Community Forests

Through the initial interviews in Yangon I learned that Community Forests were initiated as the Forest Departments way of enabling a community-based approach to the restoration efforts. Community forests are communally managed forest that are sustainably harvested as needed. These forests are established on government owned land after communities show interest in creating such a forest. As stated by the Community Forest instructions in the forest policy statement, land under planning of a community forest should be analyzed as to what possibilities it possesses and then a management plan, containing detailed descriptions on methods of planting, harvesting and timeframe, should be developed. Most communities get advice from NGOs as this is a complicated process. A community forest concession is granted for a period of 30 years after sufficiently completing a management plan. The concession is given with a possibility of further 30 year extension if the rules and regulations have been followed adequately. In the case of a misconduct of contract there will be termination of the agreement and the land will be returned to control of the Forestry Department. The Forestry Department has stated obligations to provide tools and educational knowledge for one year in order to initiate a project. NGOs also provide support before and after implementation of a management plan.

4.2. Community supported forest reserve

An alternative method of reforestation and resource management was identified as community supported forest reserve. It is based on planting trees with the support of local communities but where there is not legal to harvest timber. These projects are primarily initiated to restore ecosystem services, improve biological diversity and sequester carbon, but also implement sustainable livelihood development through involvement of local communities and by distributing benefits to the communities. There were one active community supported forest reserve identified, and one in an early establishing phase.

According to the information I gathered both community supported reserves and community forests could be identified as utilizing CBMM methods to improve sustainable livelihoods. In both types of projects there are a multitude of involved NGOs, the Myanmar Forest Department and local population that work together towards reforestation, and a part of the

population that capitalizes from the extraction of timber. I was informed about a wide array of projects and decided to identify and interview representatives from nine community forests and the active community supported forest reserves.

The following sections present the projects, starting with the community supported forest reserve, and I have organized interviews according to whether the participants were part of NGOs, village community or Forest Department. Furthermore, the interview results have been analyzed and sorted into categories of community participation, community awareness, livelihood improvements and challenges.

4.3. Results from Community-supported forest reserve

The village of Shwethaunyan is located on the West coast of Myanmar. The expedition from Yangon is between a six and twelve hour drive, depending on weather and transportation. As I visited the area three times I got to experience flooded roads, motorcycling in mud, and twelve hour bus-rides to get back to Yangon. Upon first arrival I was situated in a modest abode, and quickly learnt that Shwethaunyan is a small village that lacked infrastructure such as electricity and consistent water supply. The villagers, comprised of around 1200 households, are mostly fishermen, small-scale business owners and farmers. The area surrounding the village was seemingly a paradise, comprised of coconut palms, fruit trees and near pristine beaches. However, the sight of a degraded mangrove forest and severe erosion of the shoreline made me realize the importance of my research. As I further investigated the area I made acquaintances with villagers, the village leader and the NGO: Worldview.

4.3.1. Results from interviews with Worldview International Foundation

Worldview International Foundation (WIF) is an NGO with broad experience supporting sustainable human development. WIF has a long history of supporting democracy and development in Myanmar with a wide range of projects, and has in recent years focused greatly on mangrove forest restoration. WIF Myanmar is comprised of a strong workforce, with experts on forestry, marine biology and renewable energy. Patheingyi University (PU) who formally owns the mangrove forest in Shwethaunyan to be used as a research site contacted WIF, and they have together initiated the experimental form of mangrove restoration.

Through interviews with WIFs manager Win Maung I was informed that the area surrounding the village until 20 years ago was the habitat of healthy, 30-meter tall mangrove forests, but that the rapid deforestation by charcoal burners had tormented the area during a few years. I also received a detailed report about the procedures that had recently taken place. Since January 2012 there has been an active effort to restore the forest, improve livelihoods, and educate the community about the importance of a healthy mangrove forest. The project has a goal of restoring 1800 acres of mangrove forest, by planting and managing 2 million trees in order to rehabilitate the ecosystem and sequester carbon. PU has estimated that the potential carbon offset in the reserve at 210,000 tons of CO₂ per year, while additional ecosystem services are valued at US\$40 million. WIF and PU have high hopes that potential payment for ecosystem services from socially responsible governments and companies will finance this and future restoration projects in Myanmar.

WIF established a base in Shwethaunyan and a mangrove nursery to start producing seedlings. Given the size of the area it was decided to approach the local villagers with the offer of seasonal work planting mangroves. The villagers received education on planting, propagating and maintaining mangrove forests, and were given a wage slightly above the average daily income of roughly US\$5. This resulted in 100 villagers working seasonally on planting seedling, as mangroves cannot be planted during the monsoon season in May-September.

Interviewing WIF's permanent staff was an informative way to get to know the projects and their views on governance, sustainability and livelihood improvements. During the interviews it became apparent that NGO workers often have more concern regarding mangroves than national foresters. In fact, many of the NGO workers that I interviewed had quit their job at the Forestry Department because they felt there were too many restrictions, and also corruption, in the forestry department, leaving them compromised in being able of making a positive impact. Furthermore, my impression is that the Myanmar Forest Department has not nearly enough resources to control this situation. One WIF employee, who previously worked in the Forest Department, told me that "They (the Forest Department) don't have control and there is too much corruption". Similar statements were recurring from several of WIFs employees and reflect a situation in which the people themselves have to take action to save their environment.

All staff from WIF expressed passion for reforestation work and a desire for a position in which they could actually protect and preserve the natural environment. A statement from one

of them exemplifies their motivation towards a more community based mangrove restoration: “Mangrove forests will continue to be degraded without a proper plan for the future. In order to fix this problem it is very important to educate the population and initiate proper management systems”. WIF and the staff clearly intend to maintain their projects for long term sustainability by educating and involving the community, improve their basis for livelihoods, and expanding the areas of restoration.

Furthermore, the chairman of WIF, Arne Fjørtoft, tells me that the plans are to rapidly expand their operations. He told me “Worldview acts as a catalyst for communities that wish to bring improvements to their life and surrounding ecosystems”. Through visits to nearby villages I was informed that WIF already have been a catalyst. Information on the potential benefits from the project were gaining positive reputations, and there were several requests to help others construct reserves and maintaining their mangrove forests.

4.3.1.1. Community participation and awareness

Community participation is a central element in WIF’s projects. WIFs manager in Shwethaunyan, Win Maung, tells me that he has “hope that a sense of community ownership will emerge” by engaging the communities and allowing them to take part in the restoration effort. A male 73-year-old WIF employee, stating, “People didn’t feel ownership before, underlined the dire need for a cooperative community. They just took whatever they wanted”. WIF has worked to change this attitude by actively engaging people. Providing seasonal work and educational workshops about attributes and importance of mangroves has resulted in a change in attitude from the villagers. This is exemplified by Win Maung who told me that “The reforestation work has made the villagers understand that the use of mangroves as firewood is more damaging than rewarding. Instead there is now a larger use of driftwood, dead branches and coconut husks”. And according to him there was also a change in the attitude of large parts of the local community. He stated, “60-70% of the people now understand the importance of mangrove forests, but they all need firewood and food. The easiest way to get that is by felling trees”. It was therefore important for WIF to improve the livelihood basis and introduce alternate income sources.

4.3.1.2. Sustainable livelihood improvements

Creating a society that does not rely on profits from timber resources is important to a long-term sustainability of the mangroves, and WIF has made substantial impacts in that regard. Based on past experiences and, as WIFs chairman told me, a determination to “help the villagers help themselves” there has been initiated several alternative income opportunities that could alleviate the need to harvest the forest. I am told that measures implemented were introducing efficient stoves, establishing Nypa-palm syrup production, suggesting agricultural improvements, such as composting systems and irrigation methods, and facilitating infrastructure developments such as improvement of roads, wells and dams. These improvements seemed encouraging, but I had to investigate whether or not this was actually improving the livelihoods of the local community.

4.3.4. Results from interviews with villagers in community supported forest reserve

Through interviews with 29 villagers I learned that restoring mangroves in the area was desperately needed and to some extent already successful. Everyone interviewed in proximity to the forest reserve was over 18 years old and had lived in the area for more than 5 years. They told me about the changes they had witnessed during their life, and especially people that had lived there for more than 20 years had dramatic stories to tell.

I asked a series of questions about the history of the area in order to get an understanding of the extensive changes that had occurred during the last couple of decades. Especially one 83-year-old lady that had lived in Shwethaunyan her whole life had a vivid recollection of the past: “There was an abundance before, of both fish and fruits. We did not even need a market because everyone was sharing with each other and we all had enough. Now there are no forest or fish, higher prices and a lot of trouble”.

The dramatic change had particular relevance for the fishermen of Shwethaunyan. I interviewed 19 of them, and asked what changes they have noticed in the fish, octopus and crustaceans catch rate during the last 10-20 years (depending on how long they have been fishing). Everyone said that the catch rate of seafood had steadily declined following the deforestation. One 45-year-old fisherman was quoted saying “Before I could catch up to 20kg a day. Now I am lucky if I get more than 1kg”. All 19 fishermen gave similar statements, but

only 10 of them answered that the reason was because of the mangrove deforestation. I was told that the connection between deforestation and decline of aquatic life was only recently pointed out to the population by WIF's awareness campaign, and one 27 year old fisherman told me that "I did not know about the connection between mangroves and fish before. Now I know the importance of the mangroves and I want to help the forest grow back." Such statements were recurring among the villagers I interviewed.

4.3.4.1. Community awareness

Improving the ecological understanding and sense of community ownership of the mangrove forest was a central topic in WIFs work. Through interviews it became apparent that the general community achieved a new perspective on mangroves through town meetings with educational sessions and by working with the foresters. I asked questions regarding the participants' opinion on the importance of mangroves and was told by a 37 year old lady shopkeeper that "A healthy forest leads to a healthy society", a 32 year old fisherman that "Mangroves are very important for the fish", and another fisherman said that "Mangroves protect us from wind and waves". Resulting from the awareness campaign there was also a change in the use of firewood, and an increased use of alternative sources. One 49-year-old female fisherman told me "Before I used mangrove trees and branches, now I collect coconut husks and driftwood." Most of the interviewed participants gave mangroves similar positive attributes in their answers, while two people said they did not know of any importance of the mangroves other than source for firewood.

The ecological knowledge has spread throughout the village and almost everyone can now see the connection between healthy forests and a healthy population. During a visit to the local elementary school I was provided further evidence that the presence and active work of WIF have an impact on the society. All students in the area, roughly 300, were educated on the importance of mangroves and methods of preserving them. During the visit I approached the principal of the school and was told that they also would like to participate in the mangrove restoration, and I was later informed that they were in the process of doing just that.

4.3.4.2. Community participation

Interviewing villagers showed me the importance of community participation for the restoration work. The 49 year old female fisherman was among those who helped plant seedlings, and she told me that “Participating in the reforestation is very good because I get knowledge on the importance of mangroves and I learned how to plant trees.” Another woman who told me “It was a very good experience, I felt like a responsible person, not as a worker”, supplements her statement. All 15 participants interviewed that had contributed in the seasonal work told me that it was positive to work on restoring the mangrove forest, however, some of them also pointed out that this work only gave income for some months and that they would like to have more steady income to support their livelihoods.

4.3.4.3. Livelihood improvements

The work WIF has done has also focused on livelihood improvements. I am told about income sources that are already implemented with great success, and several others in planning phases. One income source already implemented is teaching ladies to sow clothes and dye them with bark from the mangrove branches. Two ladies that now sold clothes in and outside the village showed this new activity to me. One of the ladies told me “I have learned how to make and color clothing. I sell them to the market and make good money”.

Another improvement made by WIF is the introduction of efficient stoves. The stove replaces the traditional “three stone fireplace” in which a kettle or pan is placed on three stones over the fire. The efficient stove is made of clay and has a circular design to use at least 40% less firewood than before, and reduces harmful emissions. The new stove was widely accepted by the residents as exemplified by two farmers that said “Efficient stoves are very good! They make cooking easier and we use less firewood” and “I never thought about using less wood”. In addition to a changed mindset WIF has made sure that efficient stoves will be widely available by teaching people how to make them. Manufacturing and selling stoves thusly both resulted in new income generating activities and reduced the need for firewood.

In addition to new income sources there was also made infrastructure improvements by WIF. When I asked the participants what changes they have seen since the NGO started their work I was told that the deforestation had stopped, that the infrastructure was better and that they had

better hopes for the future. The lady shopkeeper stated that “It is very good now”, and supplemented with “We got a new road and salary from WIF”. A 35-year-old fisherman agreed and stated “Worldview has increased our knowledge and given employment. This will lead to development and more tourists”. I followed up his statement by asking whether increased tourism will be good, and he answered that “Yes, it is good. Because tourists bring money, and that will create more jobs and more protection of the forest”.

Prolonged protection of the forests is definitely the biggest issue in Shwethaunyan. Through interviews I became aware of some confusion regarding how the forests could be protected in the long term, and some challenges that were registered in that regard.

4.3.4.4. Challenges

In contrast to the positive statements regarding community supported forest reserves there are challenges to be aware of. Most notable is that not all people feel like the forest is theirs anymore. This attitude is reflected in interviews when asked what they think will happen after the NGOs leave the area. One fisherman said that “We will probably chop it all down to sell the timber” and added that, “If I don’t have money, and don’t catch fish, I have to cut and sell mangroves to support my family”. Another fisherman stated, “I don’t believe people change. More trees lead to more logging for charcoal.” Such attitudes were only openly expressed by two out of the 29 interviewed people, but there were notably some negative opinions regarding the ban from harvesting timber for firewood and construction materials. This issue might be mitigated if a community forest is established in the area complimentary to the forest reserve. I went on to ask the villagers of Shwethaunyan about their knowledge and opinions about community forests. 15 of the participants had knowledge about it, and the village leader, a 45-year-old man, said, “We would like to establish a community forest to protect our forest and village”. Similar statements were recorded from the other participants, exemplified by the 32-year-old fisherman stating “This (a community forest) could be very positive because the whole society could benefit from the resources”.

The benefits a community forest can bring were investigated through research in several villages where this procedure had been operational for many years. The following section presents results from the NGOs and users of community forests.

4.4. Result from Community forests

Resulting from initial interviews I had a clear notion of the multitude of community forests in Myanmar. I wanted to visit a variety of the projects and made a map of possible areas to visit. Given time constraints I was not able to visit the remotest areas, but nevertheless was able to visit nine villages widely dispersed throughout the country. In order to get to the villages containing community forests I were accompanied by a translator at all times. He helped me buy bus tickets, hire boats, cars and motorcycles, and navigate through the wide array of villages, rivers and forests. I had not made contact with all NGO's and villages before travelling from Yangon, and that resulted in surprisingly warm welcomes and new acquaintances. During the expedition we lived in local guesthouses, hammocks and floors, and I learned to live, eat and talk like the locals.

The following results is a compilation of interviews and observations in nine community forests, namely Bogale, Oakpo, Myan Aung, Labutta, Gawdu, Tangida, Haing Gyi Tan, Kyeintali, and Poelaung. They are all spread across the western coast of Myanmar, except from number 4, Myan Aung, which is located in the central part of Ayeyarwady region and does not involve mangrove forest, but a community forest with terrestrial trees. The community forests were initiated by different NGO's identified as: Forest Resource Environment Development and Conservation Association (FREDA), Mangrove Service Network (MSN), Coastal Livelihood and Environmental Assets Restoration in Rakhine (CLEARR) and Mangrove Action Project (MAP), except Myan Aung which had a governing system made by the villagers themselves.

4.4.1. Results from interviews with NGOs – Community Forests

Through interviews with staff from the different NGOs I learned much about the motivations to create community forests and the procedures they followed. I learned that the NGO's helped create community forests because "it is the most effective way to stop deforestation and improve livelihoods" as one worker from MSN said. I also learned that the Forest Department did not adequately deliver the support to communities stated in their Policy papers. A worker from FREDA was quoted saying that the "Forest Department does not understand the concept of community forests, but we are slowly convincing them that it is beneficial". The NGOs see community forests as an opportunity to create the sustainable rural

livelihood improvements that are so desperately needed. Another worker from MSN, Htei Lin told me “A Community Forest would give the community a source of income that could provide benefits in the long term”. Similar opinions were shared by all of the nine NGO workers I interviewed.

Furthermore, I became aware that the NGO workers that had been doing this for many years had developed very clear opinions on what it takes to develop and maintain a successful community forest. “First of all” MSNs chairman Win Seigh Nigh told me, “is the need for clear ownership and boundaries of which the community forest will be located.... Secondly, the people need to understand the benefits that will arise from the community forest”. It became clear that educating people of the mangroves functions was essential and that some community forests had failed because of mismanagement by some members. The NGOs have therefore started educating the villagers in the initial phases of community forests, prior to creation of a management plan. Another worker from MSN tells me “The management plan must be written with the help of NGOs, but by the villagers, in order to establish an understanding that this project is by the villagers, for the villagers.” The management plan lays the foundation for further work on the community forest. I am told that this provides a detailed plan on responsibilities for the members as well as to what extent the benefits will be shared. The NGOs later provide seedlings if needed, tools and continuous advice to the community groups.

4.4.2. Results from interviews with community forest members

All community forests investigated were established in areas that were severely affected by mangrove deforestation. There was observable deforestation and erosion in most areas, but the areas with community forests had notably better forest cover than surrounding areas. I was told by my translator, Htoo Lwin Aung that “People have more respect for private land and community forests than the common land and forest reserves”. The community forests was obviously working to some extent, but I was curious to investigate how these areas were managed. The following results are derived from interviews in the villages, through ten personal interviews and seven group interviews with 10-25 members of community forests present.

4.4.2.1. Before community forests

Eight of the nine villages had experienced drastic reduction in their surrounding mangrove forests prior to the projects. They explained that their surrounding forest was deforested as they were converted to shrimp ponds or paddy fields, and through charcoal production. The consequences I noted was that the population had to struggle to make sufficient income and livelihood basis. One member from Tangida village told me extensively about the situation prior to their community forest establishment in 2007. He said, “We had big problems. The forest was gone, there was very little fish and our paddy fields were damaged by salt intrusion, giving low yields”. A similar story had unfolded in Gawdu, in which I was told that “The forest was very healthy and good, but the illegal shrimp farmers destroyed almost all the mangrove forest, and then they abandoned them”. Similar stories were recorded in all villages, except Myan Aung that had a system in which the local Monk was the caretaker of the forest. The Monk in Myan Aung told me that “the Buddhist way is to respect nature” and that people “ask for permission if they need resources”. The forest surrounding Myan Aung was healthy and flourishing, clearly maintained sustainably. This way of thinking and governing the resources was not apparent in the other villages, but the increased interest for community forests led me to think that a similar mentality might develop.

4.4.2.2. Community awareness and participation

The community forest members in Oakpo told me that community forests became a viable option when they were “informed that they could get temporary ownership and be able to perform as caretakers of the forests”. The community received thorough information from the Forest Department and NGO’s regarding the expected long-term benefits prior to project initiation, and I was told, “We did not know the value of mangrove forests before”. A similar statement was recorded in Tangida when the village leader said, “We wanted to protect our environment so that we are protected against storms. FREDA informed us about the possibilities and taught us how to make a community forest”. They went on to form a community forest group and created a management with the help of FREDA.

All NGO’s invited the community forest members to workshops in which the members received education on mangrove management. The workshops also resulted in election of community forest committees that could take managerial decisions. The committee was

integral in administering planting of seedlings, and facilitate management of the forests. Some communities had agreed to harvest only when desperately needed, while others set a timeframe between 5-10 years for selective harvest to take place. The selective harvest was based on thinning the forest to maintain forest structure. This is exemplified by the village leader in Poelaung who said “We have learned to harvest sustainably by harvesting branches and only felling a few trees per year. We also plant new trees every year, and expect to export some timber in 5-10 years“. In most cases this process was successful as they followed clear guidelines as stated in their management plans. This resulted in a clear strategy for further work as most villages had agreed upon responsibilities for all community members.

In most communities there was a structured management of the shared resources. Three of the communities had divided both work and benefits equally among the members, as exemplified by a male member from the community forest in Tangida that said, “We have divided the work through the whole community. The men are thinning unwanted trees and branches while the women are preparing seedlings” and a female member from Poelaung that said, “We have divided the area in 5 separate sections. 20 people manage each section”. The other five communities interviewed, excluding Myan Aung, had divided the community forests so that each member had particular responsibilities over certain areas. For example, a member from Gawdu said, “We manage five acres each, but help each other if needed”. There was, however, a commonality among the community forests that a part of income made through timber sales should go to community development. Through the interviews I learn that distribution of benefits, stated in their Management Plans, were 25% to further community forest development, 25% to village development and 50% to personal livelihood improvements. This structure functioned in seven of the communities, but one community noted some issues in the equitable sharing of benefits.

4.4.2.4. Livelihood improvements

The community forests have, according to the interviews, established a new foundation for community development. I was told that infrastructure improvements in the villages were previously performed sporadically, resulting in poor management of roads, bridges and wells, and that benefits from community forests had provided a new possibility to choose what improvements are needed and implement them. A villager in Tangida told me “We have improved our Pagoda (Buddhists place of worship), our roads and telephone line with the

money from our community forest.” In Gawdu I was told “We have now a steady source of firewood, food and medicine”. And in Poelaung I was happy to hear that they “have built a new school with the communal benefits, there are more opportunities and less people move away”. In addition to material improvements there are also a notable increase in the agricultural yields from paddy fields, the daily catch of aquatic food and more sustainable solutions. In Tangida, where there were problems with salt intrusion prior to community forest establishment reported that the “agricultural fields now have a healthy forest to cover and now there are less salt intrusion and better yields“. There were also substantially more income sources available, as aquatic life had started to reestablish in the areas surrounding the forest. “It is much more fish and crabs now” said one of the fishermen in Tangida. In Gawdu they had learned how to take advantage of the abandoned shrimp ponds as one fisherman said “We have started making mangrove friendly aquaculture”. I was shown the mangrove friendly aquaculture, which involves planting of mangrove trees in the ponds, in which shrimp and crabs was steadily returning.

Another good example of the benefits from the community forests is registered in the village Haing Gyi Tan. The village is located on the riverbank with large rice fields dominating the inland. The only protection from storms and floods is an island 50 meters offshore. This island was chosen as one of the first community forests in Myanmar. The idea was that this island was so important for the security of the community that if logged would leave the village unprotected. 20 years later it is clear that this was a success. The island had, at the time of my visit, a flourishing mangrove forest and biodiversity. I was also told that the cyclone ‘Nargis’ dramatically proved that they were utterly dependent on this island for protection. A 19-year-old man told me that “the cyclone killed many people in nearby towns, but very few in this town because the mangroves protected us” and “some people saved their lives by climbing in mangrove trees”. I investigated the success further and was told by 37 year old fisherman that “The community forest is so good because our village leader arrests people if they cut down any trees”. Upon interviewing the village leader I was told “People are respecting the forest now. We only harvest trees when we really need it”. I was also made aware that the community had started planting mangroves along their paddy fields to protect against salt intrusion.

Beneficial attributes from rehabilitated mangrove forests were also observed in Poelaung. The village is situated close to the shoreline and receives heavy impacts from waves and winds. Erosion of landmasses was clearly visible in the large areas without mangrove forest. The

erosion problems prior to community forest establishment was so severe that the village had to be relocated five times during the last ten years. A woman bluntly stating: “*Our land was washed to the sea*”, illustrated the harsh reality, but the mangrove forest in Poelaung was at the time of this research in the process of growing back to preserve the village. Establishing a community forest and enforcing strict laws regarding harvest had provided the community with a possible sustainable future. Through interviewing people in Poelaung I also learned that another aspect of the NGO involvement in the area included creation of an investment procedure called revolving funds.

4.4.2.5. Revolving fund

Establishing revolving funds was the NGOs method of introducing a savings system to the rural communities. These funds act as a small bank for the community, which they can use for further community improvements. NGOs donated a sum of money to the community with an agreement that the money should be lent out to entrepreneurs that seek to establish or improve their business. I was told that all members of the community could apply for these funds, and that they were functioning. One 29-year-old entrepreneur illustrated the success by telling me “I have bought a new engine for my boat so I can catch more fish” while the village leader of Poelaung said that “Our members have made a lot of money. Some improve their agriculture by improving their agricultural equipment, others buy boats or livestock.” The entrepreneurs invest the money and make an agreement to pay it back with interest within a certain time period. The interests are then used to improve their infrastructure such as roads, bridges, solar panels, electricity and water wells. I became curious about this arrangement and asked what they would need to totally stop selling mangrove timber from their community forests. The answer from two village leaders was that “If the revolving fund gets big enough we don’t need to sell timber from our forest” and “We would sign a contract prohibiting us from cutting the forest if we receive payments”. The revolving funds and community forests had obviously made impact on the development of the villages, but there are still some unresolved challenges to be aware of.

4.4.2.6. Challenges with community forests

Community forests seem to benefit most of the people in the long run, however some communities do not see the same successful results. Poor management and illegal loggings are presented as the main problems for long-term management of the community forests. I asked a community forest member in Gawdu about the illegal loggings, who said that “When the trees were large enough illegal loggers cut down the forest during a few nights in 2014. We did not have guards, and the forestry department don’t have capacity”. As he previously had stated that community forests were good for the community I asked him if he and the community would continue with community forests. He then replied that “Yes. It was working very well, and if we start having guards at night it will work. It is important that we protect for future generations.” The problem of illegal logging is recurrent across four of the community forests. When asked what could be done about it, the recurring answer is that there are no resources to monitor the forest. As the Forest Department has handed over responsibility to the communities it is to some extent the responsibility of the communities to take matters in their own hands. This has resulted in some unorthodox solutions such as the village leader in Haing Gyi Tan who “arrested” people. He said “We caught the people that were illegally logging and made them sign a paper, promising never to cut here again”.

Other communities state that a main problem is a lack of understanding between members and the responsibility they have. This is recurring in three of the community forests, and is explained by a lack of commitment throughout the community. One member from Kyentali stated that there is a challenge when “some members don’t participate, so the benefits cannot be divided equally”. These issues show that there are still some challenges in the structuring of the community forest in a way that benefits them all.

4.5. Results from interviews with Forest Department

In Poelaung I was able to interview two Forest Department officials. When asked what kind of support they were providing the community forest members they said that “providing seedlings and training in the first year” was their main task, and then some “advices throughout the coming years”. I asked the Foresters how they encouraged community forests and was replied, “People did not understand the concept of community forests before, then we explained about the benefits, and now, after some years, everyone wants to be a part of it. There was, for example, one group that did not want to participate because there was so many rules, but after we held a presentation about benefits they wanted to join.” Both Foresters agreed that the community forest projects were a good way of maintaining a sustainable and stable management of the mangrove forests. Their main concern however, was that some illegal loggers were hampering the sustainable management. They told me that had also been some incidents in which “illegal loggers had been fined for encroaching on community forest areas”. However, none of them had any solution to this other than handing out fines.

4.6. Summary of results

Empirical results from the field research have investigated the state of mangrove forests before and after CBMM project implementations. Through interviews with villagers and NGOs we have seen that the reforestation projects and community management are actively being initiated and that sustainable management is viable when livelihood needs are being met. The following Table 1. Show a systematic summary of the results found.

Table 1: Summary of main findings

Domain	Main findings from community supported forest reserve	Main findings from Community Forests.
Before project	Landscape degraded from dense forest to shrubs: <i>“Not beautiful here anymore”</i>	Illegal charcoal burners had deforested most of the surrounding forest.
Livelihood consequences of deforestation	Reduced availability of construction materials and firewood: <i>“Need to buy from others”</i> Lack storm protection:	Reduced income from fishing. <i>“Before I could catch up to 20kg a day. Now I am lucky if I get 1kg.”</i>
Livelihood benefits from reforestation	Paid work: <i>“We get salary from WIF”</i> Educational improvements. Infrastructure: <i>“got new road and electricity”</i>	Income source, food security, storm protection, construction materials. Infrastructure development.
Ecological benefits from reforestation	Consistent reforestation. Improved stock of aquatic life.	Improved stock of aquatic life. Erosion control
Agricultural improvements	Erosion control Windbreak.	Erosion control, and reduce salt intrusion to paddy fields.
Role of NGO in maintenance process	Complete control over the management and monitoring.	Establishing revolving fund. Managerial advices. Infrequent monitoring.
Role of Forest Department	Consider forest reserve private land, and does not interfere with process.	Provides support Grants concession for 30 years. Infrequent monitoring.
Role of NGO in restoration process	Provide seedlings, tools, training, education, paid work, distribute benefits,	Provide seedlings, training, education, some paid work, technical support
Challenges	Lack sense of ownership/ understanding: <i>“We will probably chop it all down to sell the timber” (Tragedy of the Commons)</i>	Insufficient monitoring: <i>“Difficult to stop illegal loggers”</i> Some lack of involvement.
Long term viability	NGO will continue funding through carbon markets. Provide infrastructure improvements as needed. The project may integrate a CF project to help the sustainability of the community.	Depending on level of monitoring there are reasons to believe that CFs can provide long-term income, infrastructure development and ecosystem services

5. Discussion

This thesis is based on fieldwork in ten villages in Myanmar, where I have used a qualitative research to investigate the methods of reforestation projects and impacts on livelihoods. The study has been conducted in order to answer the research question: *How can community participation in coastal communities be encouraged and livelihood improvements secured by sustainably reforest mangroves in Myanmar?* The following discussion will generate some more widely applicable concepts, based on empirical data and theory, in order to improve further implementations of CBMM and provide guidelines for sustainable reforestation and management of mangrove forests. This may not be applicable to a global scale, but nonetheless will provide some useful insights from the Myanmar case study that can inform practice in other developing countries. The next sections will discuss the supporting research questions and analyze the projects based on the Sustainable Livelihood approach in order to discuss the main research question.

5.1. What are the most critical driving forces to prevent mangrove forest deforestation?

It became evident throughout this research that the problems surrounding mangrove forests are complex and complicated. Especially the paddy fields, shrimp pond constructions and charcoal burning have left Myanmar deforested on a large scale. The rural populations are seldom a part of the large-scale deforestation, but they all require food, money and firewood, and thusly harvest the forests. Adjusting their habits towards more sustainable consumption, i.e. using alternative firewood sources and mangrove friendly aquaculture may have a substantial impact. The matter of illegal deforestation may be considered the main issue and harsher penalties such as the ones implemented by the village leader in Haing Gyi Tan seemed efficient in that regard. Increased implementations of community forests might also mitigate this problem, as most of the illegal loggers was identified as poor residents from nearby villages. In regards to the community-supported forest reserve in Shwethaunyan there was some people who indicated that they would harvest mangrove timber when the trees had grown sufficiently. This issue may also be mitigated if a community forest is established in the area complimentary to the forest reserve, giving the community a steady source of firewood and construction material.

5.2. How do reforestation projects alter the ecological understanding of people?

Through observations and interviews it is made clear that the rural populations of Myanmar have started to develop a sense of ecological understanding. They have received this through educational workshops, tree planting and village meetings. The interviews show that people now understand that there is a vital importance of the mangroves and that the future of their society relies on a sustainable management of their natural resources. It is evident that the general attitude of the local communities did change significantly during their involvement with NGOs. However, this does not mean that they will continue to maintain this attitude in the long-term, but experience from the community forests and the implementation of mangrove education in schools indicate that it is possible to maintain a governing structure as long as there are communal benefits to be gained.

Knowledge regarding mangroves and the vulnerable ecosystem services are very high in the villages that have been cooperating with NGO's. The direct contact with NGO's has taught the population that a healthy mangrove forest is synergetic with a prosperous future. In interviews it becomes apparent that the cooperation with national and international organizations has given them a new view of their surroundings. There is a clear difference in attitude between villages that have been educated by NGO's and those that have not, showing that the impact made by NGOs could be improved to include more villagers.

5.3. What kinds of livelihood improvements are integral to the protection of mangroves?

Creating new sources of income and infrastructure improvements could reduce the need for unsustainable impacts on the forest. I have shown that there are numerous methods to improve livelihoods in rural parts of Myanmar. Most notably is mitigation of the widespread use of charcoal by introducing effective alternatives and substitutions. It seems that the work performed by NGOs has been effective in this regard. The communities seem to have an improved lifestyle after receiving infrastructural improvements, paid labor and alternate income sources. Through interviews I have learned that the community forests and the community supported forest reserve are rehabilitating the mangrove forests and that this leads to better availability of food sources. The reforestation methods investigated through this research have given the villagers a chance to re-establish the resources they depend on. Improving the livelihood basis for the communities through alternative income sources,

infrastructure development and implementing methods for sustainable harvest of the forests are integral to maintain the protection. It also became apparent that the revolving fund provided valuable benefits for the community members. It provided a level of security for them by having a “bank” in which they could borrow from, and a steady flow of communal interests that would be used for development.

5.4. How important is the overall question of involving people in the restoration?

The interviews and observations shown in this research suggest that active community participation is essential in reforestation methods. Active involvement provides communities with a sense of ownership and basis for cooperation towards sustainable management. This supports Ostrom’s theory that collective resource management is a viable alternative to governmentally managed areas (2005). Conversely, the consistent rate of illegal deforestation shows that sustainability issues persist in instances where cooperation are not yet established, supporting Hardin’s tragedy of the commons (1968). There is notably more involvement in the community forest method, but there are signs that the reforestation through forest reserve may be more effective in regards to long-term protection of the forests and the villagers interviewed at both projects show an enthusiasm to continue the work. Most people say that they have learned why and how to protect their resources, and this indicates that participation may continue in the long run.

5.5. What kind of governance is best for long-term sustainability of the projects?

One main challenge in Myanmar is the capacity of authorities to maintain their resources. The lack of law-enforcement visible in rural areas has led to unsustainable extraction of resources and general confusion as to what rules are enforced. It seems like the forest department has been a large part of the main problem as they have for many years allowed logging and “illegal” land use change. Improved law enforcement and a stricter top-down enforcement of illegalities may be required to control the situation. The recent change of government in Myanmar has indicated stricter environmental governance, and could lead to better management of the mangroves. However, incentivizing community forests and establishing clear rules for mangrove management are the most immediate mitigation measure available.

It seems like community forests would be the most appropriate way for management. It is especially suitable towards long-term sustainability in small scale, as it allows the community to take control over both management and distribution of benefits. On the other hand, a community supported forest reserve may be better in larger scales. In which an NGO or local authorities have more control of the process and distributes benefits. A combination of the two approaches could however lead to a more optimal solution. A forest reserve that maintains the biodiversity and ecosystem services coupled with a nearby community forest that provides a basis for livelihoods. The NGO's have realized this and there are prospects involving a combination of the two projects.

Even though the initiated projects are not flawless, they both help local communities manage their surrounding resources. Establishing community forests and community reserves evidently provides the people power to maintain the forests and distribute the benefits in their community, which governmental institutions has failed to do, while also preserving biodiversity and ecosystem services. However, the most effective method of governing a common resource seemed to be religious protection. In Myan Aung there was a completely different mentality regarding resource governance as a result of the strong presence of the Monk. This area was, however, are inland forest and with a wide range of other income sources such as agriculture and animal husbandry.

5.6. Sustainable Rural Livelihood improvements

Improving livelihoods in a sustainable manner has been instrumental in creating both community forests and community-supported forest reserves. We have seen that infrastructure development, agricultural methods and alternate income sources has resulted from these projects. However, to critically asses the projects the following sections undertake a further investigation regarding the sustainability of the projects by analyzing the capital assets fluctuations and the sustainable rural livelihood impacts (Scoones, 1998).

5.6.1. Improved capital assets

By applying the asset based evaluation on the CBMM projects we can further identify the improvements provided by the projects. Table 2. show that there are substantial increases in all capital assets, enforcing the theory that CBMM projects such as community forests and community supported forest reserves provide sustainable livelihoods.

Table 2. Asset fluctuations

Capital	Change since CBMM	Asset
Natural	Increased	Mangrove trees, retention of soil, quality of crops, availability of aquatic food, flood and storm protection
	Decreased	Mangroves for firewood.
Social	Increased	Cooperation in and among communities. Increased communication with Forest Department and NGOs
	Decreased	Migration to cities
Human	Increased	Knowledge, skills, education.
	Decreased	
Physical	Increased	Quality of roads, bridges, solar panels, phone lines, efficient stoves
	Decreased	
Financial	Increased	Income, savings
	Decreased	Income from charcoal

5.6.2. Creation of working days

Both projects analyzed create additional working days for the local population. The forest reserve method provides workers with a daily wage for the time they spend planting and managing the forests, albeit only seasonal. This results in an increased annual wage for the limited number of people participating, but does not provide any working days for other people. Conversely, the community forest projects provide year around working days for all members participating, albeit no daily wage. They do, however, have the possibility of

managing their own resource and in that way make more money in the long run than people working at the forest reserve.

5.6.3. Poverty Reduction

Both projects provide to some extent incentives for poverty reduction among the communities. The forest reserve is possibly able to provide a more substantial economic development as it aims to collect carbon quotas based on the mangroves carbon sequestration ability. Conversely, community forests will not have this same carbon sequestration option as it will be subject to harvest irregularly, and therefore probably not of interest for carbon quota schemes. However, the local communities actively involved in the community forests have to some extent the ability to choose their level of income, and consequently are empowered in terms of poverty reduction.

5.6.4. Increased Well-being

Mangroves are important as a source of food, shelter and resources for Myanmar's coastal communities. There is a multitude of fruits and medicinal plants that grow in these forests along with a wide variety of birds, insects and animals that reside in them. Protecting these resources are key to local communities' well-being. We have seen that the presence of healthy mangrove forests leads to a substantial reduction in coastal related risks and that sustainable management of the forest combined with an equitable distribution of benefits can thusly lead to substantial benefits for the rural communities.

5.6.5. Livelihood adaption

Livelihood adaption refers to the key ability a livelihood has to cope with stresses and shocks (Scoones, 1998). This is especially vital as coastal communities in Myanmar are regularly exposed to heavy storms. Mitigating the impacts of these storms are therefore extremely relevant for the well-being and maintenance of coastal communities' livelihoods. Both methods presented in this research has shown that a successful implementation of mangrove restoration leads to significantly improved storm protection. There is also a common

characteristic that the projects lead to a more stable source of aquatic life, and coupled with more sustainable methods of catching, supports livelihoods greatly.

5.6.6. Natural Resource sustainability

We have seen that some of the community forests have been operational and sustainably managed for 20 years. This is a good indication of the long-term viability of the project, and act as an indicator that communities can overcome the tragedy of the commons without continuous government control. This is also a signal that communal management may be ideal for protecting forests and ensuring livelihood benefits. The community protects the forest and vice versa if there is a fundamental understanding of the importance of sustainable management. Indeed there are some projects that show signs of failure, but that is mostly due to lack of monitoring or poor planning by the communities.

Availability of firewood is of special importance. There is no stable electricity resource available in most rural villages and in large parts of the urban areas, leaving them reliant on either firewood or gas based stoves. Improving the availability of gas based stoves and electricity should be of concern in order to reduce the pressure on mangrove forests, but would also lead to additional CO₂ emission. We have seen that some of the communal interests go towards improving the solar powered electricity grid, however this is not adequate in terms of replacing firewood as of cooking food.

6. Conclusion

This study has shown that the chances of successful long-term management of mangroves are improved when it leads to livelihood improvements. Community based mangrove management that effectively includes the local communities' leads, more often than not, to a sustainable management of mangrove forests. Applying CBMM by establishing community forests or similar can help marginalized people benefit from the resources available, and can provide long-term income generating activities. It becomes evident through this research that in order to ensure sustainable management it is vital to educate and incorporate the local communities in the whole process of management of their resources, from planning to sustainable harvests. Furthermore, this research demonstrate that the best way of ensuring community participation is by conveying the ecological ramifications of sustainable management and what livelihood benefits that can derived from it.

The implementation of community forests is one step towards mitigating large-scale deforestation of mangroves for firewood, improving livelihoods and restore ecosystem functions in Myanmar. Coastal communities now have a means of maintaining management of their resources in a sustainable manner, harvesting only what they need and upholding a sense of ownership over the forested area that can overcome a tragedy of the commons.

Further research is needed to project how financing of CBMM projects can be improved. Carbon offsetting schemes and payment for ecosystem are two possible sources for a wider development of these methods. It would be valuable to investigate how such markets can be linked to sustainable livelihood improvements and may be useful in order to assess future applications of CBMM. Using mangroves as a part of the market for carbon quotas could potentially be a salvation for coastal forests and be of support to the livelihood structure of coastal communities that depend on sustainability. It would also be relevant to investigate better methods of monitoring and safeguarding the natural resources in such rural areas. Finally, it would be of utmost importance to research how CBMM methods could be applied on an even larger scale. Establishing a system that sustainably manage mangrove forests is one step on the way to mitigate ongoing ecological catastrophes. We are in dire need of better global systems if the human population continues its exponential growth and subsequent need for resources. As technological advances are leading to a global community we must reconsider how we organize our Global Community Based Resource Management.

References:

- Adato, M. & Meinzen-Dick, R. (2002). Assessing the impact of agricultural research on poverty using the sustainable livelihoods framework.
- Alexandris, N., Chatenoux, B., Harriman, L., Lopez Torres, L. & Peduzzi, P. (2013). Monitoring Mangroves Restoration from Space.
- Biernacki, P. & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological methods & research*, 10 (2): 141-163.
- Biswas, S. R., Mallik, A. U., Choudhury, J. K. & Nishat, A. (2009). A unified framework for the restoration of Southeast Asian mangroves—bridging ecology, society and economics. *Wetlands Ecology and Management*, 17 (4): 365-383.
- Blasco, F., Aizpuru, M. & Gers, C. (2001). Depletion of the mangroves of Continental Asia. *Wetlands Ecology and Management*, 9 (3): 255-266.
- Bosire, J. O., Dahdouh-Guebas, F., Walton, M., Crona, B., Lewis, R., Field, C., Kairo, J. G. & Koedam, N. (2008). Functionality of restored mangroves: a review. *Aquatic Botany*, 89 (2): 251-259.
- Datta, D., Chattopadhyay, R. & Guha, P. (2012). Community based mangrove management: A review on status and sustainability. *Journal of environmental management*, 107: 84-95.
- Dietz, T., Ostrom, E. & Stern, P. C. (2003). The struggle to govern the commons. *science*, 302 (5652): 1907-1912.
- Dobson, A., Lodge, D., Alder, J., Cumming, G. S., Keymer, J., McGlade, J., Mooney, H., Rusak, J. A., Sala, O. & Wolters, V. (2006). Habitat loss, trophic collapse, and the decline of ecosystem services. *Ecology*, 87 (8): 1915-1924.
- Duane, T. P. (1997). Community participation in ecosystem management. *Ecology LQ*, 24: 771.
- Feeny, D., Berkes, F., McCay, B. J. & Acheson, J. M. (1990). The tragedy of the commons: twenty-two years later. *Human ecology*, 18 (1): 1-19.
- Field, C. (1998). Rationales and practices of mangrove afforestation. *Marine and Freshwater Research*, 49 (4): 353-358.
- Field, C. (1999). Rehabilitation of mangrove ecosystems: an overview. *Marine Pollution Bulletin*, 37 (8): 383-392.
- Francis, C., Lieblein, G., Gliessman, S., Breland, T., Creamer, N., Harwood, R., Salomonsson, L., Helenius, J., Rickerl, D. & Salvador, R. (2003). Agroecology: the ecology of food systems. *Journal of sustainable agriculture*, 22 (3): 99-118.
- Gräslund, S. & Bengtsson, B.-E. (2001). Chemicals and biological products used in south-east Asian shrimp farming, and their potential impact on the environment—a review. *Science of the Total Environment*, 280 (1): 93-131.
- Hardin, G. (1968). The tragedy of the commons. *science*, 162 (3859): 1243-1248.
- Hiraishi, T. & Harada, K. (2003). Greenbelt tsunami prevention in South-Pacific region. *Report of the Port and Airport Research Institute*, 42 (2): 1-23.
- Kalonga, S., Midtgaard, F. & Eid, T. (2015). Does forest certification enhance forest structure? Empirical evidence from certified community-based forest management in Kilwa District, Tanzania. *International Forestry Review*, 17 (2): 182-194.
- Leimgruber, P., Kelly, D. S., Steininger, M. K., Brunner, J., Müller, T. & Songer, M. (2005). Forest cover change patterns in Myanmar (Burma) 1990–2000. *Environmental Conservation*, 32 (04): 356-364.
- Lin, H. (2004). Community forestry initiatives in Myanmar: an analysis from a social perspective. *International Forestry Review*, 6 (2): 79-88.

- Macqueen, D. (2012). Recommendations for a market-led approach to community forestry in Myanmar. *Report of an Advisory Mission*: 3-16.
- MIMY. (2015). *AYEYARWADY REGION - MYANMAR*, 07.02.2015.
<http://www.theminmu.info>: Myanmar Information Management Unit (MIMY).
- Myint Aung, U. (2007). Policy and practice in Myanmar's protected area system. *Journal of Environmental Management*, 84 (2): 188-203.
- Oo, N. (2002). Present state and problems of mangrove management in Myanmar. *Trees-Structure and Function*, 16 (2): 218-223.
- Ostrom, E. (2005). Self-governance and forest resources. *Terracotta reader: a market approach to the environment*. Academic Foundation, New Delhi: 131-155.
- Ostrom, E. (2015). *Governing the commons*: Cambridge university press.
- Polidoro, B. A., Carpenter, K. E., Collins, L., Duke, N. C., Ellison, A. M., Ellison, J. C., Farnsworth, E. J., Fernando, E. S., Kathiresan, K. & Koedam, N. E. (2010). The loss of species: mangrove extinction risk and geographic areas of global concern. *PLoS one*, 5 (4): e10095.
- Sandilyan, S. & Kathiresan, K. (2015). Mangroves as bioshield: An undisputable fact. *Ocean & Coastal Management*, 103: 94-96.
- Sasekumar, A., Chong, V., Leh, M. & D'cruz, R. (1992). Mangroves as a habitat for fish and prawns. *Hydrobiologia*, 247 (1-3): 195-207.
- Scoones, I. (1998). Sustainable rural livelihoods: a framework for analysis.
- Siikamäki, J., Sanchirico, J. N. & Jardine, S. L. (2012). Global economic potential for reducing carbon dioxide emissions from mangrove loss. *Proceedings of the National Academy of Sciences*, 109 (36): 14369-14374.
- Sudtongkong, C. & Webb, E. L. (2008). Outcomes of state-vs. community-based mangrove management in southern Thailand. *Ecology and Society*, 13 (2): 27.
- Tint, K., Springate-Baginski, Oliver Gyi, Mehm Ko Ko. (2011). Community Forestry in Myanmar: Progress and Potentials. *Yangon: ECCDI*.
- UNEP, v. B., J., Sullivan, E., Nakamura, T. (Eds). (2014). The Importance of Mangroves to People: A Call to Action. Cambridge.: United Nations Environment Programme World Conservation Monitoring Centre. 128 pp.
- Valiela, I., Bowen, J. L. & York, J. K. (2001). Mangrove Forests: One of the World's Threatened Major Tropical Environments At least 35% of the area of mangrove forests has been lost in the past two decades, losses that exceed those for tropical rain forests and coral reefs, two other well-known threatened environments. *Bioscience*, 51 (10): 807-815.
- Walters, B. B., Rönnbäck, P., Kovacs, J. M., Crona, B., Hussain, S. A., Badola, R., Primavera, J. H., Barbier, E. & Dahdouh-Guebas, F. (2008). Ethnobiology, socio-economics and management of mangrove forests: a review. *Aquatic Botany*, 89 (2): 220-236.
- Webb, E. L., Jachowski, N. R., Phelps, J., Friess, D. A., Than, M. M. & Ziegler, A. D. (2014). Deforestation in the Ayeyarwady Delta and the conservation implications of an internationally-engaged Myanmar. *Global Environmental Change*, 24: 321-333.
- Yin, R. K. (2013). *Case study research: Design and methods*: Sage publications.
- Zöckler, C., Delany, S. & Barber, J. (2013). Sustainable Coastal Zone Management in Myanmar. *ArcCona Ecological Consultants and Flora Fauna International*. Cambridge, UK. 60pp *Stilt*, 66 (2014): 37-51.

Appendix:

i. List of interview question for villagers:

1. Gender & Age
2. How long have you lived here?
3. What is your main source of income?
4. For farmers: What kind of food crops? What kind of changes has happened in your farming the last decade?
5. For fishermen: What kind of change have you noticed in the fish population during the last 10-20 years?
6. For charcoal burners: How much coal do you sell and produce a month?
7. What do you use for firewood?
8. How much coal/firewood do you buy a month?
9. Which alternatives are available other than firewood/coal?
10. What kind of changes in the natural environment have you seen over the last 10-20 years? Mangroves, aquatic life, terrestrial life, weather etc.
11. What kind of changes in the social environment have you seen over the last 10-20 years? (Population growth, political?)
12. What is your relationship with the mangrove forest?
13. Have you participated in mangrove restoration?
 13. B. Yes: What did you learn from that?
 13. C. No: What do you think of the restoration projects?
14. Have you heard of Community forests or similar? What do you think about that?
15. a. how important are the mangrove forests for income sources?
15. b. how important are the mangrove forests for ecosystem services (E.g. Fish, crustaceans, crabs, flood protection, oxygen production, (carbon))?
15. c. how important are the mangrove forests for the future?

Why is the mangrove forests chopped down? Firewood – Building material – agriculture – Shrimp farming – infrastructure development, others
16. Do you think the mangroves should be protected? If yes, how? If no, why not?
17. On a scale from 1-10, how well are the mangroves protected now? Specify.
18. What other income / food sources are possible in the forest other than firewood?
19. What is needed in this society to protect the mangroves from being replaced by shrimp farms and coal production?
20. What is the best method to preserve the mangrove ecosystem? Community forest, forest reserve or private forests?
21. How can the protection of forests continue after NGOs leave the area?
22. What do you think of local and international organizations that come here and try to restore the forests?
23. Do you have any other thoughts about the mangrove forest and society?

ii. Interview questions for NGOs:

1. What is your job?
2. What was your previous job?
3. What do you do to reduce deforestation?
4. What do you do for reforestation?
5. How does the population/ villagers benefit from these projects?
6. What happens after a project is finished?
7. How does a successful project work?
8. Why does an unsuccessful project not work?
9. How could prolonged community participation be maintained in order to help reduce deforestation and aid in mangrove reforestation in Myanmar?

iii. Questions for Community Forest (CF) members

1. When did CF start?
2. How did CF start?
3. What has changed since CF was established? Environment, society, benefits, etc.
4. How many participants/members?
5. How is it managed? People, land rights, benefit.
6. What support do you get from NGOs?
7. What happened after NGO work was finished?
8. What happened in area outside CF?
9. How do you protect from encroachment?
10. What made this CF a success or failure?
11. How can we make it better in order to protect and manage for the future?

iv. Information letter for interview subjects in English

Request of participation in a research project

Project name: Mapping people's attitudes to mangrove forests, the need for reforestation and alternatives to coal production.

A student at the Norwegian University of Life Sciences performs this interview as a part of his master thesis in Agro ecology. The aim of the project is to investigate people's perception of mangrove forests in Myanmar in order to find solutions towards stopping the deforestation. Mangrove forests are a vital part of the ecosystem; as it provides shelter for many species, flood protection, carbon sequestration and many more. However, these forests are rapidly being deforested. This also happens in Myanmar as the forests are sold as coal and replaced with other production.

Persons interviewed in this project will be anonymous, thus not recorded with name and personal information. The people interviewed in this project are selected on the basis of availability and connection to mangrove forests.

What does it mean to be a part of this project?

This interview will be centered on questions regarding attitude to mangrove forests and what alternatives there are and could be to sell the forests as coal. The interview will take about 15 minutes and will be recorded with an audio recorder.

What happens with the information that is given?

All personal information will be randomized and kept confidentially. It is only the student and his supervisor that will handle the material. When the project is published it will not be possible to identify the interviewed subjects.

This project will be finished recording information at 14th of December 2015, and the finished report will be published May 15th 2016. All information will be kept anonymous.

Participation is voluntarily

This is a voluntary study and you are free to withdraw your consent at any time. Your information will then be terminated

If you wish to participate or have any questions regarding the study, please take contact with the student by email: jonathan.lindholt@nmbu.no or his supervisor: anna.marie.nicolaysen@nmbu.no

Consent to participate in the study

I have received information about the study and I accept to participate:

(Signed by participant, date)

v. Personal Reflections

This research started out with a personal interest in regenerating degraded ecosystems using agroecological approaches. I wrote my bachelor thesis on agroforestry methods Tanzania as a means to restore food security and ecological stability and my interest grew for this field of research. I therefore started researching possible solutions when I heard about the ongoing ecological catastrophe of mangrove deforestation in Myanmar immediately.

In 2014 I received information about a Norwegian that had initiated several projects for mangrove restoration in Myanmar. Arne Fjørtoft, a previous political leader and journalist, had been instrumental in the Democratic Voice of Burma, and had for many years worked on creating democracy and socioeconomic stability in the country now known as Myanmar. Mr. Fjørtoft's accomplishments and projects on mangroves led me to contact him and his Worldview International Foundation (WIF). Through this connection I was able to get firsthand knowledge on the political and ecological situation in Myanmar, and we started discussing the way forward.

In August 2015 I travelled to WIF's headquarters in Yangon in order to initiate the field research. WIF has a team of helpful employees that assisted my work through large parts of the study. I got to travel along the coast of a remarkably scenic country and know the rural people. This was a remarkable experience that introduced me to new cultures, religions and customs. I stayed in local houses, hammocks and floors, sang traditional songs and ate freshly harvested foods. The experience made me realize how amazing a life without modern luxuries could be, however I was not always happy and positive.

My fieldtrip also showed me the harsh reality of what poorer people has to endure. Most significantly were the catastrophic results of the mangrove deforestation. Time and time again I listened to stories about how beautiful the coastline once was, that people now don't have enough food to make a stable living and that they probably have to move to the cities to find jobs. The ever-increasing need for charcoal was identified as the main reason for deforestation, as no proper alternatives were widely available. I knew about this issue prior to my visit, but seeing it and listening to the stories of despair made it all very real. My concern was slightly relieved after learning about the oil reserves in Myanmar that potentially could lead to an electrical revolution, but I also learned that this oil is sold overseas and little concern is on local populations needs. Charcoal is the main source of energy and the country

suffers from it. The new government that has promised to make drastic reforms could however gradually mitigate the energy issue. In the meantime the focus is on making sure that the remaining mangrove forests are sustainably managed and reforestation efforts are supported.

Visiting villages with functioning community forest gave me the sense of hope that I desperately needed. I observed and listened to people talking about how great this arrangement was and the benefits it brought. Some villages had never functioned as a democratic society before NGO's taught them how to cooperate in managing a common resource. The community forests thus constructed a basis in which the communities could help each other and their environment, sustainably and beneficial for everyone.

Writing this thesis has been a mental challenge. I felt isolated and frustrated when, after spending months in the tropical jungles of Myanmar, I found myself constantly in front of the computer. I realize that this is a normal sensation, but nevertheless a personal struggle. However, I found my motivation and feel satisfied with the finished paper.

This has been an amazing adventure that has taught me more about the world and myself than ever before. I will never forget or regret my travel to "The smiling country" of Myanmar and I am already thinking about what more I can do to help the country and its mangroves develop sustainably.



Norges miljø- og biovitenskapelig universitet
Noregs miljø- og biovitenskapelige universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway