Field Survey report on the Assessment on Climate Change and its Impacts on Agriculture in Some Selected Villages in Ayeyarwady Division

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1. INTRODUCTION

Climate Change is a reality which is affecting everyone but poor communities will be affected the hardest and would have the least resilience to respond to it. Increasing temperatures, unpredictable weather conditions, decreasing and erratic rainfall patterns and rising sea levels are external manifestations that climate change is happening. On a global perspective, reports indicated that it is very likely that heat waves will become more frequent. There would also be an increase in hydrological disasters as future tropical cyclones (typhoons and hurricanes) will become more intense, with ongoing increases of tropical sea-surface temperatures[1]. Research has also estimated that a 1° increase in sea surface temperature would lead to a 31% increase in the global frequency of Category 4 and 5 cyclones per year[2]. Food security will be undermined as rising temperatures will hinder crop productivity. Climate change will bring in positives effects as well such as few deaths due to cold exposures and increase in food production in some areas but the positives effects will be outweighed by the negative effects

Southeast Asia comprises the 10 independent members of the Association of Southeast Asian Nations (ASEAN) and newly independent Timor-Leste. With a total land area of 4,330,079 square kilometers (3.3% of the world total) and mainly tropical climate, it has 563.1 million people (8.5% of the world population) and its population is rising almost 2% annually, compared with the global average of 1.4%[3]. The IPCC Fourth Assessment Report mentions that the South East region is particularly vulnerable to the impacts of climate change with its extensive, heavily populated coastlines, large agricultural sectors and large population. The region's contribution of Agriculture to the GDP is at 11% and employs more than 43 million people[4]. Due to climate change, it is expected that rice yield potential is likely to decline about 50% by 2100 from 1990 without adaptation or technical improvement. This would create serious implications of both the development of countries as well as poverty levels as the main staple food is rice and contributes to a substantial amount to the income of the region. In his speech at the 17th Session of the Commission on Sustainable Development, the UN Secretary-

1 Climate Change Synthesis Report: IPCC (2007)
2 Global Assessment Report on Disaster Risk Reduction: United Nations (2009)
3 World Bank's World Development Indicators online database
4 The Economics of Climate Change in Southeast Asia: A Regional Review: ABD (2009)

General called upon the world 'to revitalize agriculture and support the productivity and resilience of small farmers, in particular, to achieve food security for all'[5]. Population growth in the region is also a major issue for the food security. For example, Myanmar is projected to have a population of around 60 millions by 2020. This is an additional population of about 5 millions people for them the country has to produce more rice and more drinking water by 2020. Under the constraints posted by climate change in agriculture production, this could be a big challenge in Myanmar. Agriculture can be one of the contributors for climate change mitigation, but if left unchecked, climate change will affect agricultural production and exacerbate drought and desertification subsequently causing numerous problems.

To develop appropriate strategies that would assist farmers to adapt their farming methods and mitigate the impacts of climate change, it is necessary to understand the challenges and constraints they face. The report is an attempt to understand the impact of climate change of the Myanmar farmer in the cyclone affected area of the delta, the current adaptation practices and what are the possible interventions.

2. Climate change in Ayeyerwady Delta; People's experiences and farmers' responses

Overall purpose

(1) To explore people's experiences of climate change in the Ayeyerwaddy Delta and assess the impact of these on agricultural livelihoods. An alternative approach (bottom to top), based on the experiences of 6 billion stakeholders, will be practised aiming that a time and space tested adaptation and mitigation local methods can be collected. .
(2) To document the Myanmar Climate Change Performance Assessment Report (MCCPAR)
(3) To conduct training on Climate Change and Disaster Prevention
Target Groups- Students, Officials, Media people, and Community leaders

Background

Climate change is manifest in the form of increased frequency and intensity of weather related disasters such as floods and cyclones; climatic variability in terms of changes in temperature, predictability of rainfall and the onset of seasons. It is already established that climate change is having a huge impact on the agricultural sector in developing and least developed countries across Africa, Asia and Latin America and the relationship between climate change and food insecurity is becoming apparent. The crop loss to disasters and crop failure due to erratic weather pose a great threat to the food security of poor and marginalized communities.

[5] http://www.un.org/apps/news/infocus/sgspeeches/search_full.asp?statID=486

3. **Process for data collection on climate change study**

a. Areas for data collection – at least two villages per township

- Pyapon
- Labutta
- Bogale

b. Information is to be obtained in three ways

1. Focused Group discussion with men farmers
2. Trend analysis map with farming community
3. Focused Group discussion with women and farmers

c. Since the information to be collection is quite a lot – the exercise can be done with a village community over a period of a couple of days

d. Period of data collection: 1-2 weeks of July and August, and 1-2 weeks in September and October 2010

e. **Requirements**

- Information to the village head of the meeting
- Organizing two groups (men/women) about 10-20 participants
- Flip Charts
- Markers

f. Training of team who will be doing the exercise – 2nd week of June

g. Team composition and breakup

Questions to ask:

1. Has the farmers changed their livelihoods over time? What has been the pattern of this change? What are the changes related to?

Methodology: Focused group discussion
Tool: Trend Analysis focusing on livelihoods

- Have the farmers changed their livelihoods over a period of time?
  - Probe Indicators:
    - primary livelihood share decreasing over a period of time
    - supplementing their farming income with new livelihood options
    - presence of dual livelihoods
- How has their livelihood income from farming varied over time
  - Methodology: Trend analysis map
- Why has this happened? What are the reasons from this?

Possible reasons could be
- For productivity
  - Weather unpredictability – floods, cyclones
  - Loss of crops/harvest due to weather or insects
  - Market situations – rise in fertilizers, seeds, transportation, fuel
  - Government laws/policies
- For income
  - Productivity
  - Market situations

2. What kind of climatic changes (temperature, rainfall patterns, seasonal predictability ...) the community has witnessed in the last few decades?

Methodology: Trend analysis
Participants: Older people – also if they are farmers

- Indicators for the trend analysis
  - Occurrence of rainfall – start of the rain period – can be obtained through discussion
  - Amount of rainfall: indicator needs to be external manifestation
  - Temperature: indicator needs to be external manifestation
  - River/Sea level: indicator needs to be external manifestation

3. What are the impacts of climate change on people's life, what are the reasons for these impacts and how are they coping with these changes?

Methodology: Presentation of Trend Analysis tool leading to a focused group discussion
Participants: Women and men in separate groups

- Areas to explore
  - Work load on the woman/children – increased or decreased and how
  - Food intake – how the diet has changed (both in terms of quantity and variety)
  - Migration to other areas to work
  - Supplementing by working as laborers
  - Spending patterns of the family: which is receiving the least
  - Education – have the children dropping out of school due to work load or unable to spend for transportation
  - Water availability for various purposes – look at stress created by limited water resources
  - Selling off their assets for money

4. What has been the direct impact of climate change on crop production? (Various factors may impact crop production e.g. insects damage which may or may not be related to climate change (more favorable breeding conditions for insects etc ... so this needs to be considered.)

   Methodology: Presentation of Trend Analysis tool leading to a focused group discussion
   Participants: Farmers

   - Question to ask
     - Is it common to have crop/seed failure?
     - Has the farmers getting low output on their harvest
     - Has the farmers been delaying / preponing their sowing period?
     - Have they been changing the varieties of seeds
     - Are they using various additional inputs (fertilizers/water) to increase/improve crop productivity?

5. How farmers have been adapting on their own to improve their agricultural production?
   Methodology: focused group discussion
   Participants: Farmers

   - Some of the possible things they could be doing – to be used a guide for discussions
     - Raising of sowing beds
     - Changing their crop pattern – sowing with the changing weather conditions
     - Changing variety of seeds
     - Harvesting water
     - Mulching
     - Increasing organic matter into the soil to increase productivity as fertilizers
     - Taking loans from money lenders
     - Multiple cropping – more than one crop per season
     - Crop rotation – harvesting different crops throughout the year
     - Changing types of crops they are growing – maybe in vegetables (since rice conditions are more or less
     - Are they taking up other livelihood options (this question is throughout the study)

6. What changes do communities want to support their adaptation initiatives?
   Methodology: focused group discussion
   Participants: Farmers

   Ideas from them

A: Samples for Work schedule:

Sample 1: farmers (day 1)

Sample 2: with older people (day 1)

Sample 3: two groups: men and women separately (day 2)

Sample 4; to be done at one group (farmers) (day 3)

4. Social Impacts of Climate Change:

4.1 Education

According to the 2005 Human Development Report, Myanmar scored 0.76, just below the world average (0.77), on its Education Index. The Education For All (EFA) Mid Decade Assessment 2007 reported 2005/06 net enrollment levels at 82 percent for primary education and 34 percent for secondary education. These figures are roughly congruent with the Integrated Household Living Conditions (IHLC) survey 2004 that places primary net enrolment rate at 85 percent. These aggregate figures mask significant variations across income levels. According to the 2000 Multiple-Indicator Cluster Survey (MICS), almost 20 percent of children from the poorest quintile never enroll in school, compared to less than 5 percent of their wealthier counterparts who do not enroll. By the age of 11, approximately 60 percent of students in the richest quintile transferred to middle school, while only 10 percent of students in the poorest quintile continued to middle school.

Cyclone Nargis had a significant impact on the education sector. An estimated 50 to 60 percent of public schools, including monastic ones, were destroyed or damaged. This information is drawn from Government administrative data, UN agencies, and the VTA survey. Administrative data show a range of 43-48 percent schools totally or severely damaged; the VTA shows 63 percent but focused on the 30 most severely affected townships. The total damage and losses in education are estimated at about K 116 billion, including K 25 billion from the damage to educational materials.

Damage and Loss Estimates in the Education Sector in Yangon and Ayeyarwady Divisions (Kyats million)

Damage	115,300
Losses	1,023
Total	**116,323**

Source: PONJA Team estimates

In addition to the many casualties and trauma suffered by children, the use of schools as emergency shelter sites (if not damaged) further strained limited educational resources. Restored school facilities are helping children to return to class, and contributing to overcome trauma by providing child-friendly spaces to meet peers. Government, private sector organizations, NGOs and international donors have provided funding estimated at close to K 5 billion for the repair of primary and secondary schools with damaged roofs.2 The Ministry of Education has delivered textbooks and some educational materials to schools in affected areas,

while NGOs and international partners supported government efforts to reopen educational establishments or set up temporary learning spaces with a minimum set of educational inputs.

Since school children have to help their parents in field works, most of the have to drop-out from school in 2009. Daily foods are rationalized among family members. Housewives became wagers. Some have to borrow money with interest on daily basis so that they can sell snacks and local delicacies around the village and sometimes to the neighboring villages. In 2008, government waived taxing on fishing at Inn(special lakes for fishing). However, in 2009 government restarted taxing again and therefore villagers found themselves in a more difficult situation in payment and daily expenses in their lives. At present the family situation is in such a way that most children are staying at home for home daily works, and housewives are accompanying their men to fields and fishing for works.

4.2 Donation – social events

Religious Infrastructure

The Delta, like the rest of Myanmar, is home to a large number of monasteries, pagodas, churches, and mosques. These buildings play an important part in the life of the communities. The religious community has been at the forefront of efforts to bring assistance to cyclone survivors during May and June and has provided aid to all faiths on an equitable basis. The damage to religious buildings amounts to around K 150 billion. Most of these damages occurred in Ayeyarwady Division.

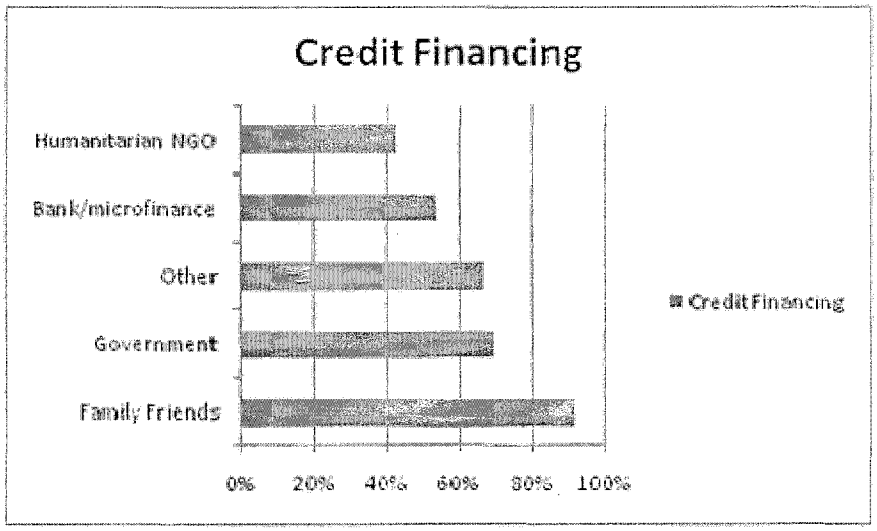
Majority of Myanmar people re Buddhists, who strongly believe in donations and charity. Myanmar family offer swan (food and curry) and water and flower to in memory of Lord Buddha and His sons the Buddhist Monks almost daily early in the morning. Moreover Myanmar people donate all necessary things to the Monasteries at times for the sustainability of Buddhism in the country. All Myanmar family are strongly believe in binding with obligations to put their children to monks and nuns when they are at the age of 6-12 at least once in their life to undertake Buddhist training at the monasteries. All farmers are working hard and save money for that special occasion, and normally they offer foods and delicacies to the entire village no matter whether they are affordable or not. It is therefore the celebration of these religious ceremonies is an indication how well they are beings in their livelihoods.

Over the Delta, due to declining in crop yields and reduction in prices, holding of such Ahlhu(special religious ceremony for children to become monks) are reduced and less pompous or magnificent due to reduction in family incomes. This is particularly true when Delta was hit by Cyclone Nargis.

In addition, every Buddhist community in the country holds religious festivals collectively. Since 2000 onwards, people in Delta are saying that these festivals are becoming less pompous and magnificent and sometimes failed to hold due to people unable to share their income in religious activities. The same, this becomes more visible after Nargis.

In rescuing and donations to the needy of Nargis victims, it is remarkable to witness that donations and charity from religious groups throughout the country are enormous compatible to other donors like Government, UN, and NGOs.

Main sources of credit financing as reported by households in the Delta



Under the category of other, majority are religious groups mostly headed by well-known Buddhist monks, and well wishers mostly because of their religious beliefs. This category may be unique for Myanmar, since Myanmar people are helpful even to strangers in nature because of tradition and culture, which were rooted in people hearts due to religious beliefs. Since people from throughout the country are participating, this sector is a remarkable force in donation during the time of Nargis recovery period.

The present survey groups to six villages tract reported that the people are admitting they tried to hold such religious ceremonies and festivals aw before, but at a mush lesser frequency and pompous. For example, the Nharnapauk village reported that they held their Phayapwe (Pagoda Festival) when they were supported a bag of rice for boiling and a pig for meat by a nearby village which was less affected by Nargis. This usually mounts a psychological pressure on the farmers when they find themselves unable to hold their usual religious activities.

The years 2005-2006 was a good year for farmers due good income from high price of rice and eggs. Prices of commodities were lowered. Moreover, farmers were not obliged to offer rice to the government starting from 2005.

As a result, most farmers donated more money in the constructions of religious buildings, in the maintenance of religious structures, in the holdings of religious ceremonies. Moreover, most family could hold the very special religious occasions for letting their children to become Buddhist monks and learned Buddhist basic literatures and teachings at the monasteries. Coincidently, however, during the same year farmers encountered with pests of black coloured, which were killed by insecticides later. The volume of insects were so huge that they were taken away from fields by using the shovels and even the ducks gave up eating them finally.

4.3 Business Extension
The Summer and Winter Crops and Fish Harvesting

Figure (3) shows the changes in people's livelihoods with the introduction of fishing in the TheeEinKyaungSu village starting from 1960-70. At first, fishing was meant as an alternative for extra-income and the size is small. Starting from 1980-1990, when the villagers started to face with the declination in summer paddy yields, then fishing became another alternative livelihood options for the local people. However, starting from 2000-2008, fish catch has been declining again for several reasons. The main reason is due to the rising sea water temperatures in the area. It leads to the fish to change their nests to cooler sea temperature areas to a deeper under water sea area. That makes the fish nests move to a deeper, and of course further from the coast, area to make the net fishers unable to catch the fish.

The second reason may be loosing of mangroves along the coast, which are normally used as the nests for fish(home of the fish). Thirdly, most fish-catchers especially those affordable ones are using modernized fish-catching equipments, which can catch all sizes of fish including fries for fish population growth.

In compliance with the declination in paddy yields. Apart from fishing other livelihoods such as husbandry, shop-owners, rice mills and local medium-size traders are also developed within the community as new livelihoods.

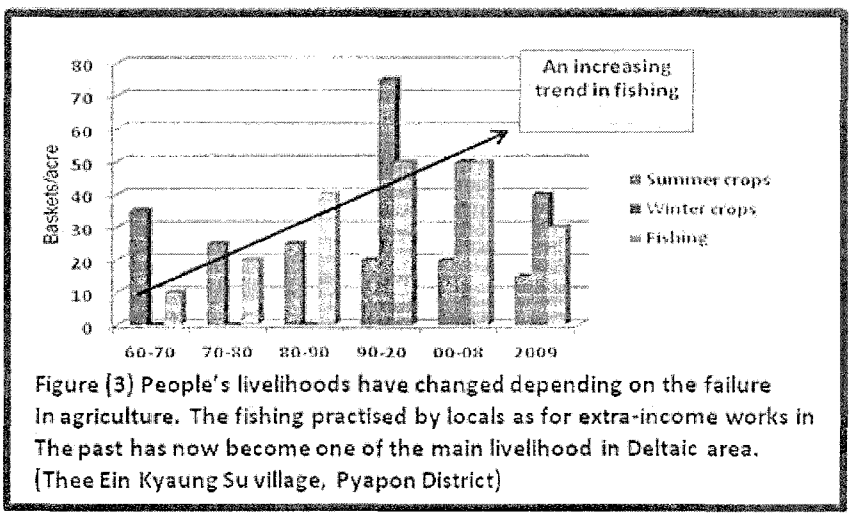
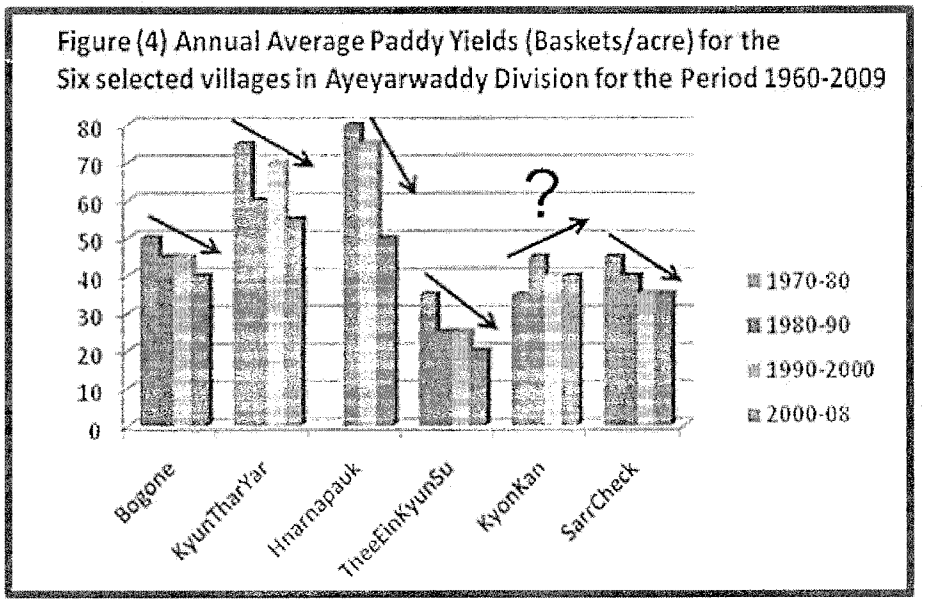


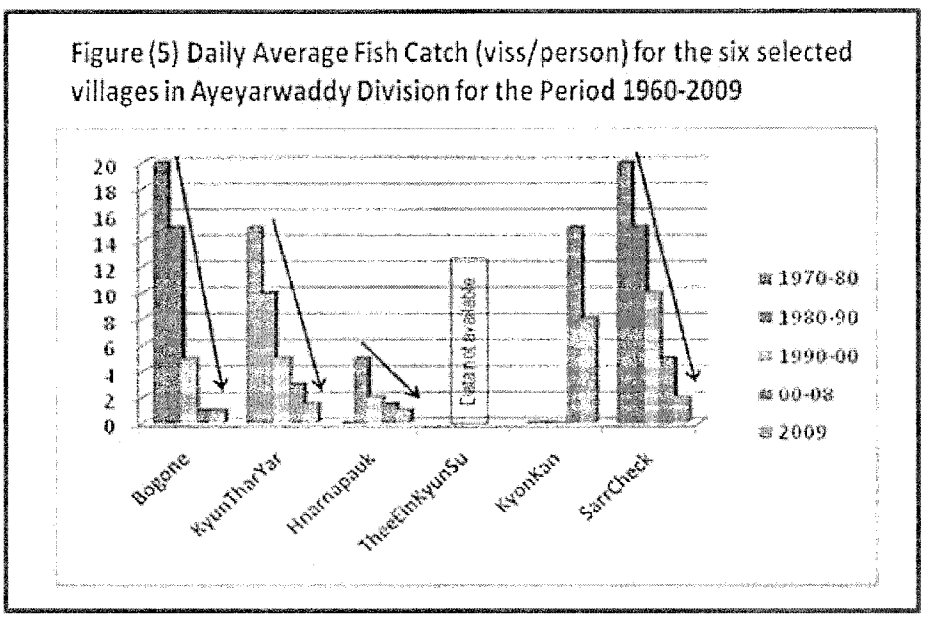
Figure (3) People's livelihoods have changed depending on the failure In agriculture. The fishing practised by locals as for extra-income works in The past has now become one of the main livelihood in Deltaic area. (Thee Ein Kyaung Su village, Pyapon District)

Thus the Livelihood-Climate Linkage Model of TheeKyunEinSu village demonstrates how the impact of climate change can have impacts on livelihood patterns and how local community are resilient to the climate change impacts by adapting them with alternative livelihoods.

Fish catching had declined since 1980s mainly due to over harvesting and shifting of fish nests away from the coast due to climate change. This was evident in all six villages under study. Another contributable cause might also be using of modernized fishing equipments which could caught fishes of all sizes regardless of ages. It was therefore fish breeding were also down.

In any case, farmers were facing with declining in agricultural yields and fish catches, which certainly had been a pressure in their livelihoods and also food security.





In order to compensate their daily life expenses for food and children education, people in the study villages started to work on alternate income rather than traditional agricultural works. The very first thing most farmers introduced another livelihoods was husbandry, especially chickens, ducks and pigs at their home. Initially, they started this business as just for an extra income. After they experienced declining in agricultural yields and fish catch mainly due to weather changes, these husbandry became one of the main livelihoods for most households.

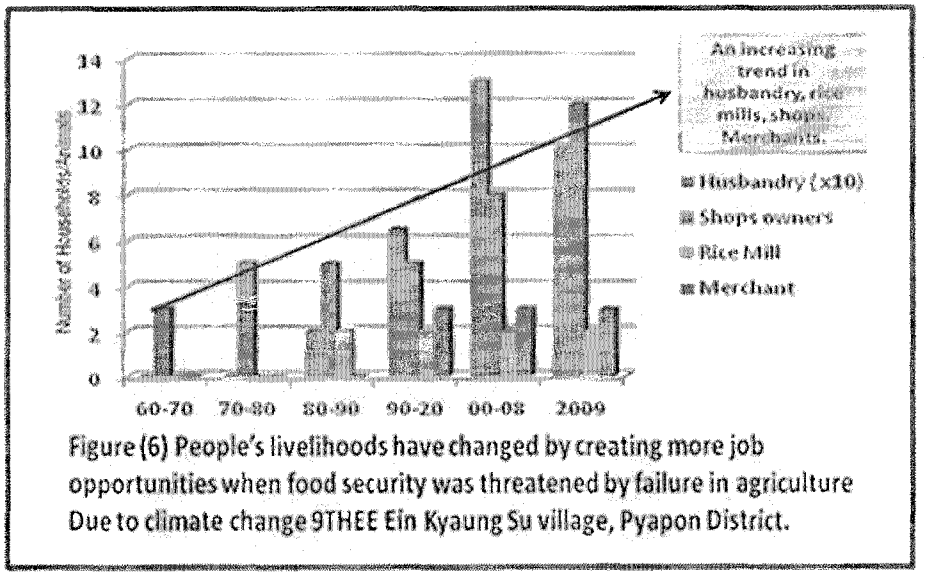


Figure (6) People's livelihoods have changed by creating more job opportunities when food security was threatened by failure in agriculture Due to climate change 9THEE Ein Kyaung Su village, Pyapon District.

Job losses are largely in the informal sector such as seasonal jobs in agriculture, people livelihoods in the six villages shifted to short-term jobs in community works, small-scale fishing, rice mills, fish processing, salt production, wood cutting, and other resource based economic activities, such as small shops, small video mini theatre, going-out for works at larger cities, etc.

4.4 Water

Water Supply and Sanitation

Prior to the cyclone, water supply for rural communities in the affected areas consisted primarily of household-level rain water harvesting tanks, communal rain water ponds, open wells, tube wells, and rivers. Most households had a roof-rainwater harvesting system that collected rainwater through a gutter into large earthen pots as the main source of water during the rainy season, while in the dry season communal ponds that collected rainwater served as the primary source of water, with most communities having at least one or two ponds. Only a small percentage of communities were connected to piped water supply networks. Ponds and household rainwater harvesting systems were most impacted by the disaster. The cyclone, and the flooding that followed, damaged close to 13 percent of ponds in Yangon and up to 43 percent of ponds in Ayeyarwady Division. The map 9 shows the extent of the salinity of pond water throughout the Delta.

This salinity led many households to shift water sources from ponds to rain water tanks. Sixty-three percent of people surveyed consider their current access to clean water to be inadequate, with approximately 1.8 million severely affected people in need of improved water supply. To reduce the risk of water-borne diseases among affected populations, relief interventions are focusing on the provision of an adequate supply of safe water, and on supporting hygiene and sanitation measures. Initial recovery activities will help families to reacquire earthen pots with which to harvest rainwater, the dominant source of clean drinking water. The damage and losses in the water sector resulting from Cyclone Nargis are estimated at around K 8.5 billion.

Sanitary facilities, including both pit and open or floating latrines, existed in most communities in both Yangon and Ayeyarwady Divisions. Most latrines that existed prior to the cyclone have collapsed or are now unsafe for use due to flooding. Open defecation has increased, and unsafe excreta disposal with direct drop latrines, without pits, is common. The proportion of households practicing unsanitary defecation – open defecation, floating latrines or trenches – almost doubled to 40 percent.

The proportion of households practicing unsanitary defecation, which includes open defecation, the use of floating latrines as well as trenches. The shift to unsanitary defecation practices is strong in the lower Delta area. In particular, the combination of households using river water as a source for drinking water and the rise in the use of floating latrines poses stark health risks in this area.

4.5 Coastal Flooding and Erosion

Coastal flooding and erosion in Southeast Asia have intensified in recent years due to the combined effect of extreme climatic and non-climatic events.

Mangrove forests play a critical role in the protection of coastlines in Myanmar. Many of the mangrove forests, however, have been converted into aquaculture and other related projects, and in some cases are converted into human settlements where gathering of mangrove trees for charcoal making and construction materials are practiced unsustainably. As a consequence, many areas have been exposed to tidal waves and coastal erosion. Coastal flooding and erosion have been accelerated by the destabilization of coastlines due to advancing sea levels and extreme events (such as La Niña and tropical cyclones), causing significant damage in many parts of the region. The tropical cyclones that hit Southeast Asia in recent years, together with storm surges, have accelerated the erosion of beaches, steep bluffs, deltas, and mangrove swamps. This has led to substantial economic losses, loss of lands, and even premature deaths of inhabitants.

Serious cases have been reported in the small coastal villages of Ayeyarwady Delta, in Ayeyarwady and Yangon Divisions south of Yangon. The people of the Bogale and Latbutta settlement previously enjoyed living in a diverse natural habitat with wetlands, mangrove swamps, and marshes that were home to a wide variety of flora and fauna. Due to coastal erosion and an advancing sea, most of these areas are now deforested, degraded, and devastated, and groundwater resources are already contaminated with seawater. Many families have been forced to abandon their coastal homes, as few people can afford to continue rebuilding houses washed away regularly by the sea and by the devastating cyclone Nargis's storm surges.

4.6 Rising Sea Level

Rising sea level has caused saltwater intrusion into both coastal freshwater and groundwater resources.

Rising sea levels have caused saltwater intrusion into coastal freshwater and groundwater resources in many areas of Myanmar, aggravating water shortages brought about by declining rainfall. Rising sea levels have also accelerated inundation and land subsidence in

coastal cities and communities, resulting in considerable losses to tourism and aquaculture industries.

Saltwater intrusion in the shallow and deep aquifers of Delta has reached inland up to 10–15 km from the coastline. The problem has been exacerbated by overexploitation of groundwater, which has caused land subsidence. Salinity intrusion has advanced in the country affecting the lives and livelihoods of the people living in the coastal areas.

Predicted sea level at 2100

By 2100, rising sea levels are predicted to severely affect millions of Southeast Asians.

Wassmann et al. (2004) and the Stern Report (Stern 2007) state that millions of people living in the low-lying areas of the People's Republic of China, Bangladesh, India, and Viet Nam will be affected by rising sea levels by the end of this century. Myanmar is not an exception. By 2100, under the most common predictions, global mean sea level is projected to increase by 40 cm, which could mean an increase in the average annual number of people flooded within coastal regions, or from 13 million to 94 million people worldwide. About 20% of hem will live in Southeast Asia, particularly Indonesia, Philippines, Thailand, Myanmar and Viet Nam.

4.7 Women and children issues

Vulnerable groups

Catastrophic events such as Cyclone Nargis can intensify the vulnerability of already marginalized members of the community, who are in normal times less likely to have access to services or control resources. These vulnerable groups are least likely to have the physical capabilities, social power or economic resources to anticipate, survive and recover from the effects of the disaster, or access services for recovery. As such, they depend on recovery programs that offer protection and address their needs.

Women face special vulnerabilities in the aftermath of the cyclone, as discussed in the next section. Other vulnerable groups include children, who are at greater risk of abuse, violence, exploitation and neglect and may face difficulties continuing their education as families struggle to rebuild livelihood; the landless, who are economically vulnerable; and the elderly or chronically sick or disabled, who may be less able to rebuild livelihoods on their own and may be dependent on support from families or the community. To address the needs of vulnerable groups, assistance programmes should involve community members in decision-making throughout the project cycle, with a focus on vulnerable groups. At the same time, a complementary system could be reinforced, with skilled social workers, community child protection and development workers, as well as functioning referral mechanisms.

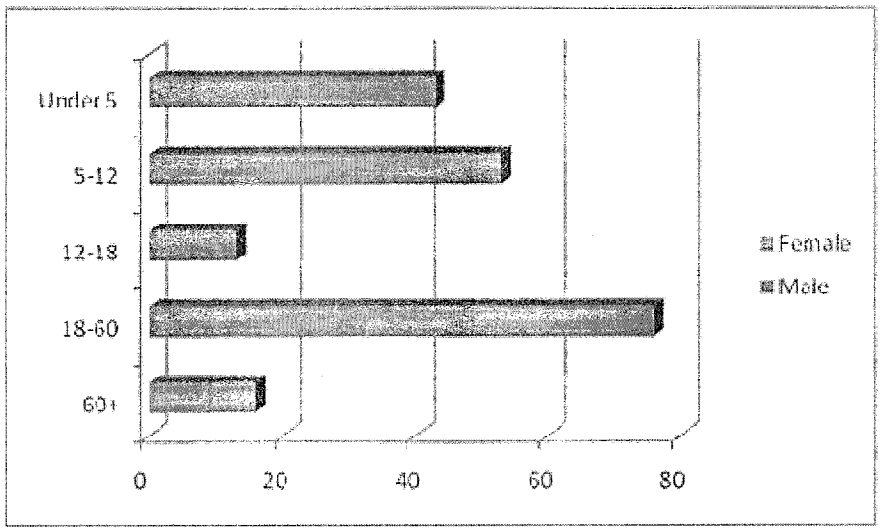
4.8 Gender

According to the assessment data, the majority of the cyclone's victims are female: 61 percent of those dead are female, with the number much higher in some villages. The disproportionate number of female victims is especially evident in the key productive and reproductive age group of 18-60.

This demographic change will have significant impacts on the roles of, and relationships between, different genders, and may cause social reverberations, including a spate of remarriage, or early marriage. There may be a need for men to go to other villages or towns to

find a wife, which could increase out-migration from severely affected areas or lead to more inter-village marriages.

Age-Sex ratio of the Deaths in 10 Selected Severely Affected Villages



The economic effects of the cyclone may cause younger unmarried women to leave the village to find work, especially as the labor of women in the Delta tended to be labor-based, compared to that of men, which tended to be land-based. Inexperienced in urban life, these young women are vulnerable to exploitation, forced labor, forced prostitution and trafficking. An influx of migrant populations increases vulnerabilities for women in the Delta. Data shows that while there is a balance between migration into and out of the Delta, the incoming migrant population is four times more likely to be male than female. This will further exacerbate the gender imbalance resulting from uneven mortality in some areas and increase the potential for exploitation and abuse, including gender-based violence. Careful monitoring and provision of advocacy and protection services for women and children will be important. These vulnerabilities highlight the need for relief and recovery strategies to incorporate an understanding of the social realities and impact of the cyclone, including the needs, experiences, and contributions of each gender to foster an environment promoting nondiscriminatory humanitarian assistance, through comprehensive and representative consultation with the affected population.

4.9 Migration

The change in livelihoods due to climate change also leads to changes in social lives. In 1950s, 1960s, 1970s and up to 1980s, many new settlers were migrated to the surveyed villages due to because of good income from farming. During those periods, the paddy fields were freshly graded and very fertile. It was therefore paddy yields were high. In addition, price of rice were also high during those time, therefore a lots of farmers had comfortable lives and good income. Many people from remote areas from northern and central parts of the country were migrated and settled in Delta area. After Nargis in 2008, the whole Delta lost in all farming equities- man power and machine power, and most importantly the investment in farming. A lots of farmers reported that they could not maintain their farming works due to lacking in

wagers, investment, farming machines and tools, bullocks, etc. As a result most daily wagers lost their jobs in their own villages. So they moved to other areas for new jobs for daily lives. In Bogone and Hnarnapauk villages, only 25% of the farmers left in the village for farming. Some were dead because of Nargis and some were already left for another places where they could find new jobs. In addition, those who were still staying in their own villages were facing with problems to restart their field works due to lacking of work forces (human wagers and animal buffaloes) and insufficiency of cash investment. Several family members of farmers, young and old, had moved to towns for works to bear their family expenses. Though the amount of movers in this component is not high, but it is increasing steadily. That again reduced the labour force in the villages and creating a shortage of wagers.

4.10 Overall Quality of life

Social Impact

Analyzing how Cylone Nargis has affected local patterns of life, social structures and institutions, and vulnerable groups is important in order to understand its impacts and to develop plans for effectively delivering post-disaster assistance.

Field visits during the PONJA observed a high level of unity and social cohesion among survivors, who have no doubt been brought together by their common efforts to survive and rebuild. Though no visible tensions between ethnic and religious groups have so far arisen, intergroup relations could potentially worsen due to possible inequities in aid provision, depending on the nature of the relief and recovery effort. Conversely, there is the potential for the post-cyclone response to improve relationships between religious and ethnic groups. Religious leaders, who provided early aid, have emphasized the non-sectarian nature of their assistance. This outpouring of assistance from all faiths to all faiths may be a unifying force. There is a risk of a redistribution of land away from small-scale farmers to those with larger holdings. Renewal of land user rights is contingent on productive use of land in the past year. This, along with a desperate need to ensure food security, appears to be a central reason why farmers were disproportionately likely to return to their villages soon after the cyclone, even to the most affected areas close to the coast. The loss of documentation recording land use history is problematic in this regard. There is a risk that loan-based responses further indebt affected villagers, increasing poverty in the medium to long run. Besides providing relief, the government response has focused on asset replacement, with implements and seeds being provided in the form of loans. Such a strategy works against aid dependency. At the same time, it assumes a relatively smooth return to land cultivation, which is not likely to occur evenly across the Delta. The policy of provision of loans rather than grants may, therefore, lock community members into a cycle of poverty and debt that could be hard to break.

The recovery effort, if it is sizeable, will constitute another great shock on the social fabric of life in the Delta. Villages in affected regions received relatively little aid from outside prior to the cyclone. Interaction with the state and civil bodies at higher levels was limited. With some exceptions, local cultures and practices changed relatively slowly in response to outside influences and pressures. The response to the cyclone has the potential to change life in Delta villages for the better. Yet it also has the potential to result in negative consequences. This indicates the need to build in measures to address low absorptive capacity, in particular

through community capacity building, as well as progress monitoring mechanisms. Many of the critical areas identified, which require attention if recovery is to be sustainable, cannot be addressed through projects alone; policy decisions, including reforms, will be necessary. Key issues where policy attention is needed include land use and resettlement. Good practice from ASEAN Member States and elsewhere in addressing these issues include: (i) ensuring that an open consultative process is in place to establish the wishes of affected families and communities with regard to return and resettlement, providing families with appropriate assistance depending on their aspirations; (ii) ensuring that due process is established to protect the access of survivors to their families' land and to settle any land claim issues; (iii) minimizing changes to settlement and land use patterns, in particular avoiding transfer of land away from smaller farmers, which would tend to be regressive in impact.

4.11 Community adaptation mechanisms:

(i) What are they doing?

Low-input and unsustainable farming practices

Although the Ayeyarwady Delta is known as the "rice bowl of Myanmar", rice yields have not improved significantly over the last decade, averaging around 3.1 to 3.3 tonnes per hectare. In the early 1990s, the main increase in rice production was due to the expansion of land under cultivation, which increased by about 25 percent between 1990 and 1994. Although the introduction of modern high-yielding varieties in the 1980s initially led to improved yields, crop production has stagnated in recent years, as technical inputs such as fertilizers and improved farming practices have failed to keep up. As reported by the International Rice Research Institute, "Modern varieties are cultivated widely with very little application of chemical fertilizers, contributing to a decline in soil fertility." Low-input agriculture is mainly a result of poverty. Farmers do not have the financial resources to acquire inputs (fertilizers and pesticides) needed to make the best use of modern rice varieties and sustain yields. In parts of the Ayeyarwady Delta, land degradation and declining soil fertility due to exploitative farming practices have also contributed to decreasing agricultural yields. As a result, in order to maintain agricultural incomes and food production, farmers have resorted to cultivating even more land. For instance, in coastal areas, converting mangroves areas to rice farms has resulted in seawater encroachment and salinisation of soils, providing a source of income for only a short period of time before yields drop below economic levels. In parts of the Labutta township, for example, farmers have abandoned paddy fields or converted land to salt farms.

(ii) Lack of awareness and knowledge

Communities lack awareness and knowledge about the importance of sound natural resource management practices, essential for ensuring the sustainability of their livelihoods. Prior to Cyclone Nargis, most communities in the Ayeyarwady Delta had little or no access to training or awareness-raising activities on sustainable resource management. Government extension services in forestry, agriculture and fisheries remained insufficient, as there was a serious lack of human and financial resources. The shortage of civil society organizations also meant that very few non-governmental organizations (NGOs) were available to fill the gap in capacity building needs.

Limited community awareness is compounded by poverty and the lack of alternative livelihoods, which are driving causes of the over-exploitation of forest resources, fisheries and agricultural land. One positive outcome of Cyclone Nargis is that NGOs now have access to donor funding and technical assistance that will enable them to provide capacity building activities to improve resource management practices

(iii) Uncertainty over land tenure or land use rights

In Myanmar, the government owns the land and leases it to individuals. In many cases, the initial lease is to wealthy individuals on a 99-year lease. They in turn sub-lease the land on a short-term basis (for a year up to a few years) to individual farmers who then grow crops such as rice. A similar situation applies in the fisheries sector. Fishing licenses are granted to wealthier individuals, who then sub-lease (frequently through several "layers" of sub-leases) to the individual fisher on short-term leases, which often run from season to season. One serious consequence of land tenure insecurity is that farmers and fishers have little motivation to think about long-term implications of how they manage their land or their fisheries. This uncertainty is a major disincentive to invest in more environmentally sustainable land use practices that may be costly and only yield benefits over an extended time period. It is also discourages enterprise investment, such as in the aquaculture sector. In addition to land tenure issues, there has been significant illegal encroachment on reserved forests and harvesting of mangroves for fuel wood and charcoal in protected areas. This has been due mainly to the common perception that protected areas belong to the government rather than to the community as a whole, thus leading to the lack of ownership by communities and to over-exploitation. By contrast, experiences of NGOs in community forestry demonstrate that communities are more likely to apply sustainable practices if they are given clear responsibility over forest management. For instance, the NGO FREDA has been able to employ the government's 1995 Forest Instructions and obtain long-term forest leases for communities for up to 30 years to rehabilitate mangroves in 23 villages. However, in general local communities as well as local administration personnel remain unaware of these opportunities. The government is beginning to recognize this problem. In its post- Nargis recovery plans, the government makes use of the Forestry Instructions for the rehabilitation of mangrove forests

(iv) What they are unable to do for adapting

Some farmers obtain good breeds from relatives in remote areas for sowing. Regular checking on the soil condition at the time of raining, and depending on the finding, then appropriate breeds and sowing-time schedule are chosen normally. Fish catch reduces during the breeding period due to heavy catching. Though authority warn the people not to catch fish during the breeding period, people just do not follow the orders and rules because food were not enough and therefore insecure for the family members daily meals.

Many wagers formerly depending on farm works are becoming fish catchers due to declining in agricultural products. After Nargis husbandry is introduced to villages due to well wishers' donation of household chickens and pigs. More people are working in husbandry when fish catching became reduced again due to several reasons. Firstly, because of increased population and declining in crop yields year after year, fish catching became over harvesting. So catching reduced dramatically. Secondly, catchers started to use modernized equipments and

better nets in fish catching. This allow them to catch more fish without leaving breeds for next generation, so fish population reduced. Farmers are helpless to stop those illegal acts.

Paddy yields were continued to decline due to degradation of soils, adverse weather, frequent encountering of pests, etc. Farmers then shifted to short-live termed paddy for breeding. Nargis was the most devastating storm that the Delta people ever faced in their whole lives. Almost all farmers were facing with difficulties in daily lives due to sever impacts on their livelihoods. Paddy yields were severely down. Fields were degraded in soils, covered with salt water, facing with adverse weather, no more house hold animals for cultivation, no more farming equipments, unable to hire the daily wagers due to lacking of reserved money.

Facing with field rats, facing with salinity, paddy crops were unable to sustain, and soils were extensively degraded. Only middle-term life span paddy were able to sustain and farmers were worried later that they might not be able to grow mid-term paddy in future.

After Nargis, fish harvesting was extensively reduced. Over a period of five months time after Nargis, fish catchers were almost unable to find fish. Even after that fish catch were reduced substantially. It was contributable to the fact that Nargis had spoiled all the bushes and small trees along the banks which were normally used as the home of the fishes.

Fish catchers were spending five hours time for catching fishes which were supposed not more than one hour in the past. Due to the warmer sea conditions and the changes in currents, many fishes had shifted to colder sea areas, which made the fish nests shifted to further and deeper areas from the sea shore. It is therefore normal fish catchers were unable to reach the fish nests. Catchers at present were adjusting the rise and fall of sea water so that they can be able to catch.

Farmers were facing with field rats which were hazardous to paddy fields. The problem became more serious since the rats were growing not only in sizes but also in numbers The outnumbered rats were probably due to the fact that most fields were unable to plough in 2008 and 2009 due to a big reduction in working forces. In addition, farmers were unable to hire wagers as well. So the fields became bushy and more rats were breeding. In addition, there were several rat catchers in the fields like snakes, birds, etc., by which several rats were cleared up. After Nargis those rat catchers were gone with the strong wind and waves of Nargis.

2008-2009 was the worst year in terms of livelihood income and people were facing with hard times to bear the cost of family daily expenses for basic needs such as food and housing. Most farmers and their grown-up family members became wagers and depending on any available jobs for daily income. Most students in the family dropped-out from school due to economic crisis in the family.

There were several causes for the downing of fish catch; firstly, fish caught diseases due to warming of water and high temperatures. Secondly, most farmers used insecticides in water and this killed most fishes. Thirdly, due to intrusion of salt water into fresh water fresh water fish died.

The whole village grow seasonal plantation, mainly as summer cropping. After Nargis, no buffaloes were available in fields during the sowing period in peak season month of September. Due to failure in obtaining sprouts, seeds scattering may be repeated triple for the assurance of sprouting. Though longer-term paddy seeds can offer yields, shorter-term paddy seeds are chosen for growing due to unpredictability in weather especially in post monsoon season. Mid-term paddy seeds are grown in areas where water is available at all time, and

shorter-term paddy seeds are grown on higher grounds. Traditionally longer-term paddy seeds are better quality, bigger plant, larger seeds, higher yields. Salt water start to intrudes soon after the rain decreases or stops.

To prevent from intrusion of sea water into paddy fields, dykes and small dams are constructed for years. Those dykes and small dams can assist in keeping the rain water for good farming; now these dykes and small dams are not under good maintenance and most need to strengthen by heightening the heights. In 2009 paddy fields are infested with worms, especially at nodes, and decomposed, rotten, be putrid but farmers are afraid of affecting people by using insecticide without having basic proper knowledge on the use of insecticides. The paddy breeds are provided by the authority, most of them fail to grow. 400-500 buffaloes are used in fields in the past, and nothing is left at present because of devastating Cyclone Nargis. Due to reduction in work forces in both human and animals working power, many fields are unable to plough and grow paddy; so many fields are covered now with thick grass. So the fields are much harder in ploughing, but growing bananas and brinjals are good productive especially after Nargis. Only the old breeds which were left-over after Nargis were used for seeding in 2008 and 2009. Some farmers obtain good breeds from relatives in remote areas for sowing. Regular checking on the soil condition at the time of raining, and depending on the finding, then appropriate breeds and sowing-time schedule are chosen normally. Fish catch reduces during the breeding period due to heavy catching. Though authority warn the people not to catch fish during the breeding period, people just do not follow the orders and rules because food were not enough and therefore insecure for the family members daily meals.

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Growth in population was witnessed at the village. More dwellers came and stayed. Fish catch reduced due to increase in catchers. Fish got some diseases due to changes in their ecosystem. Crop yield decreased due to breakage of embankments and polders in fields. Use of unlawful means in fish and shrimp catch caused damage in embankments. Rain became more irregular and decreased in obtaining fresh water from rivers for paddy farms.

Local farmers made their own weather forecasts by looking at the fruits of fig trees. If fruits were gathering at the middle of the tree, then good peak rain year will come; if fruits are gathering at the lower part of the tree, then good early rain; and if fruits are gathering at the upper part of the tree, then late rain will be good; and if fruits are seen everywhere (good weather year) then a good rain year for the whole season. Another commonly used prediction method is by checking the black marking of frog's thigh- at upper joint means good early rain, at middle of thigh means good peak rain, at the lower joint means good late rain. Moreover, predictions are also made by checking the behavior of the red ants; when red ant makes early nesting means early rain, red ant makes nest at lower level means strong winds. Farmers expressed to have trainings to understand more on the weather forecasts and bulletins issued

by the government. After Nargis, many farmers are using small battery radios to listen to weather news, especially about the storm news. However, most of them barely understand the terms and usages properly.

5. Conclusion

5.1 Projected Impacts of Climate Change should be implemented

At present, the literature on the impact of climate change on Myanmar is limited. However, there appear to be some emerging climate change trends that have been researched by Myanmar's Department of Meteorology and Hydrology (DMH). These were published in the UNESCAP monthly Journal .and were also presented in the form of initial research findings by DMH at the recent Monsoon Forum, and include observations of a gradual warming, over the last 40 years, in the Bay of Bengal region close to the Ayeyarwady Delta, as well as a gradual southward movement of the monsoon trough that forms around the onset of the monsoon in the Bay of Bengal, from 20 degree N to 10 degree N near the Ayeyarwady Delta coast. Within the context of a broader analysis of climate related hazards outlined above, there is a need to undertake a scientific diagnostic of Cyclone Nargis, which differed from historical cyclone tracks in the Bay of Bengal.

Moreover, the present investigation in the six selected villages by the MCCW team clearly found that the climate had changed over the delta area at least since 1980. Judging from the declining in crop yields and the experiencing of more adverse weather in the area are contributable to two main pressure- population growth and loss of tress. The team also had verified that this had been a high impact on the livelihoods of Delta people. The team also confirmed that the livelihoods income is also indirectly reliant on the environment as it relies on servicing those households whose livelihoods are resource-dependent. It is therefore environmental degradation is a serious threat to the livelihoods and food security of the Delta area.

In addition, it is important to highlight that delta regions all over the world face special vulnerabilities to the impacts of climate change. This is an opportune time for dialogue between Myanmar and other countries that are contending with possible impacts of climate change in their delta regions. Such a dialogue can help exchange methodologies for assessing vulnerabilities and explore adaptation and risk management solutions that may be applicable in the Myanmar context

5.2 Managing Disaster Risk: Key Priorities in DRR

Cyclone Nargis highlighted Myanmar's vulnerability to high-impact, low-frequency natural hazards, and also the need for the country to undertake a range of actions for reducing, mitigating and managing disaster risks in the future to avoid similar catastrophes. These actions would have to be carried out in the short, medium and longer terms, depending on the needs and priorities identified through a participatory and consultative process that involves a range of national, local, regional and international entities. Priorities for improved disaster risk management and reduction over the short, medium and long terms, can be distributed across the following five pillars: (a) risk identification and assessment; (b) strengthening and enhancing

emergency preparedness; (c) institutional capacity building; (d) risk mitigation investments, and; (e) risk financing and transfer mechanisms. The core underlying principle, however, remains that both loss of life and the economic impact of disasters can be reduced through advance planning and investment.

5.3 Country environmental analysis should be realised

Country Environmental Analysis (CEA) is a relatively new analytical tool that a number of multilateral and bilateral development organizations are beginning to apply, in particular to inform overall country programming CEA provides systematic analysis of key environmental issues most critical to the sustained development of a country and the achievement of the Millennium Development Goals and opportunities for overcoming constraints; of the environmental implications of key development policies; and of a country's environmental management capacity and performance. The tool was developed in response to increasing focus on mainstreaming environmental issues into development policies and planning.

5.4 DRR in CEA (Country Environmental Analysis)

Some development organisations use the term strategic environmental assessment (SEA) rather than CEA to describe environmental analysis undertaken to inform programming of country assistance. CEA provides an important opportunity to highlight disaster risks, where significant, and helps ensure that they are adequately addressed. The Asian Development Bank's CEA for Tajikistan, for instance, identifies natural hazards, including drought, landslides and earthquakes, as one of the country's key environmental problems and highlights a related reduction in vulnerability as a major element in promoting environmental interventions to reduce poverty. In order to enhance resilience, it recommends support for activities that contribute to greater physical stability (e.g., prevention of soil erosion); the exploitation of opportunities for simultaneously reducing vulnerability and supporting livelihoods (e.g., drainage of lands prone to mudslides and use of the water collected for irrigation); careful attention to zoning of economic activities; and, more generally, a policy that favours risk reduction over emergency response and reconstruction. All CEAs should include collation of basic hazard data and background information on past disaster losses to give a preliminary overview of the significance of disaster risk in a country and to provide information that can be drawn upon both in undertaking environmental assessment of individual projects and in country programming. United Nations Development Programme (UNDP) environmental guidelines, for instance, already indicate that country environmental reviews should include baseline data on rainfall, climate, temperatures, seismic faults, cyclones and droughts.

5.5 Holding of workshops for Public Risk Knowledge and Climate Change

Workshops on TARNS (Tsunami Alert Rapid Notification System) and CONOPS (Concept of Operations), ICS (Incident Command System), and CCR (Coastal Community Resilience) and Monsoon Forum should be held regularly so that the existing gap between the coastal community and science agencies including disaster management concepts can be narrowed.

6. Acknowledgement

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Lastly, not the least, the author would like to thank to US Embassy in Myanamr for their funding supports in this BIG mini project, and EcoDev for their suggestions and invaluable discussions. It is advisable to keep the momentum up for more investigation by expanding the sample size of the villages in the Deltaic area in the coming years.

Table(1) List of incidences of extreme weather at selected six villages during the period 1968 to 2008

		1968-78	1978-88	1988-98	1998-08	2009
SanChec	Storm	1975 storm	No	No	Nargis	No
	Tornado	No	No	No	No	No
	Thunderstrike	No	No	No	No	No
TheeEinKyaungSu	Storm	No	No	No	Nargis	No
	Tornado	No	No	No	Yes	Yes
	Thunderstrike	No	No	No	Yes	Yes
Kyonkon	Storm	No	No	No	Nargis	No
	Tornado	Yes	No	No	No	No
	Thunderstrike	Yes	No	No	No	No
HnamaPauk	Storm	No	No	No	Nargis	No
	Tornado	Yes	No	No	No	Np
	Thunderstrike	Yes	No	No	No	No
KyunTharyar	Storm	No	No	No	Nargis	No
	Tornado	Yes	No	No	Yes	No
	Thunderstrike	Yes	No	No	Yes	No
Bogohn	Storm	No	No	No	Nargis	No
	Tornado	No	Np	Yes	Yes	No
	Thunderstrike	No	No	Yes	Yes	Yes

Table(2). The Climatic Atlas (Rainfall) in Six selected villages of Ayeyarwaddy Division for the Period 1968-2009

	Rainfall					
SanCheck	1968-1968 Normal	1968-1978 Normal	1978-1988 Normal	1988-1998 Normal	1998-2008 Normal but more unsettle weather prevails	2009 Increase of rain due to prolonged rainy season especially in post monsoon with frequent unsettle weather conditions..
TheeEinKyaungSu	Normal	Normal	Normal	Normal	Increase of post monsoon rain due to longer duration of post-monsoon season. More intense rain and unsettle weather prevails during the rainy season.	Increase of rain especially in post monsoon rain due to longer duration of post-monsoon season. More intense rain and infrequent unsettle weather prevails.
Kyonkan	Normal	normal	normal	Normal	Increase of post monsoon rain due to longer duration of post-monsoon season. More intense rain and unsettle weather prevails during the rainy season	Increase of rain especially in post monsoon rain due to longer period of post monsoon season. More intense rain and infrequent unsettle weather prevails.
Hnamepauk	Normal	Normal	Normal	Slight Decrease of rain	Increase of post rain with more frequent unsettle weather.	Increase of rain especially in post monsoon rain, with longer period of post monsoon rain
Kyunthatyar	Normal	Normal	Normal	Slight Decrease of rain	Increase of post rain with more frequent unsettle weather.	Increase of rain especially in post monsoon rain, with longer period of post season..
Bogone	Normal	Normal	Normal	Less rain Unsteady rain	Increase of post rain with more frequent unsettle weather.	Increase of rain especially in post monsoon rain with longer priod of post season

Table(3). The Climatic Atlas (Temperature) in Six selected villages of Ayeyarwady Division for the Period 1968-2009

Temperature						
	1958-1968	1968-1978	1978-1988	1988-1998	1998-2008	2009
SarCheck	Normal	Normal	Normal	Slight Increase	Slightly increase	Markedly Increase
TheeEinKyaung Su	Normal	Normal	Normal	Increase	Markedly Increase	Markedly Increase
Kyonkan	Normal	normal	normal	Increase	Markedly Increase	
Hnamepauk	Normal	Normal	Slightly Increase	Markedly Increase	Hottest Years	Hot Year
Kyunthatyar	Normal	Normal	Normal	Slight Increase	Markedly Increase	Hot Year
Bogone	Normal	Normal	Normal	Slight Increase	Markedly Increase	Hot Year

Table (4) The Forest Cover Change in Six selected villages of Ayeyarwady Division for the Period 1968-2009

Forest Cover						
	1958-1968	1968-1978	1978-1988	1988-1998	1998-2008	2009
SarCheck	Normal	Normal	Loss of forest started	Heavy loss of forests	Total loss of kanazo forest	Total loss of forests
TheeEinKyaung Su	Normal	Normal	Loss of forest started	Slightly loss of forests	Markedly loss of forest	loss of forests continue
Kyonkan	Normal	normal	Loss of forest started	Heavy loss of forests	Total loss of forest	Total loss of forests
Hnamepauk	Normal	Normal	Loss of forest started	Increase loss of forests	Loss of forest continue and mounting in pressure	ILoss of forests continue
Kyunthatyar	Normal	Normal	Loss of forest started	Markedly loss of forests	Total loss of forest	Total Loss
Bogone	Normal	Normal	Loss of forest started	Loss of forests continue	Heavy loss of forest	Heavy Loss continue

Table (5) The Forest Cover Change in Six selected villages of Ayeyarwady Division for the Period 1968-2009

	Rainfall					
	1958-1968	1968-1978	1978-1988	1988-1998	1998-2008	2009
SanCheck	Normal	Normal	Normal	Normal	Normal but more unsettle weather prevails	Increase of rain due to prolonged rainy season especially in post monsoon with frequent unsettle weather conditions..
TheeEinKyaungSu	Normal	Normal	Normal	Normal	Increase of post monsoon rain due to longer duration of post-monsoon season. More intense rain and unsettle weather prevails during the rainy season.	Increase of rain especially in post monsoon rain due to longer duration of post-monsoon season. More intense rain and infrequent unsettle weather prevails.
Kyonkan	Normal	normal	normal	Normal	Increase of post monsoon rain due to longer duration of post-monsoon season. More intense rain and unsettle weather prevails during the rainy season	Increase of rain especially in post monsoon rain due to longer period of post monsoon season. More intense rain and infrequent unsettle weather prevails.
Hnamepauk	Normal	Normal	Normal	Slight Decrease of rain	Increase of post rain with more frequent unsettle weather.	Increase of rain especially in post monsoon rain, with longer period of post monsoon rain
Kyunthatyar	Normal	Normal	Normal	Slight Decrease of rain	Increase of post rain with more frequent unsettle weather.	Increase of rain especially in post monsoon rain, with longer period of post season..
Bogone	Normal	Normal	Normal	Less rain Unsteady rain	Increase of post rain with more frequent unsettle weather.	Increase of rain especially in post monsoon rain with longer priod of post season

Table (6) The Storms and the Extreme Weather Events Change in Six selected villages of Ayeyarwady Division for the Period 1968-2009

		1968-78	1978-88	1988-98	1998-08	2009
SanCheck	Storm	1975 storm	No	No	Nargis	No
	Tornado	No	No	No	No	No
	Thunderstrike	No	No	No	No	No
TheeEinKyaungSu	Storm	No	No	No	Nargis	No
	Tornado	No	No	No	Yes	Yes
	Thunderstrike	No	No	No	Yes	Yes
Kyonkan	Storm	No	No	No	Nargis	No
	Tornado	Yes	No	No	No	No
	Thunderstrike	Yes	No	No	No	No
Hnamepauk	Storm	No	No	No	Nargis	No
	Tornado	Yes	No	No	No	Np
	Thunderstrike	Yes	No	No	No	No
Kyunthatyar	Storm	No	No	No	Nargis	No
	Tornado	Yes	No	No	Yes	No
	Thunderstrike	Yes	No	No	Yes	No
Bogone	Storm	No	No	No	Nargis	No
	Tornado	No	Np	Yes	Yes	No
	Thunderstrike	No	No	Yes	Yes	Yes

Table (7) The Adaptation Measures and the existing Activities

Current Adaptation Measure and Existing Activities	Constraints and Gaps	Potential Opportunity Plans
Firewood and Fuelwood	Inappropriate law enforcement	Process opportunities to conserve
Charcoal Production	Insufficient concern	Awareness raising and Advocacy
Shelter (directly and indirectly)	Mass production for fuel for business concern	Capacity buildings
Food Security	Over fishing	Support
Fish and crabs catching	Linkage between Climate Change and environmental Degradation	Networking with media
Prawning	Technical Competent	Collaboration with different common interest groups
	Funding Flow Unbalance	Academic assessments on current status of mangrove Ecosystems
	Lack of systematic knowledge	Concrete data collection and distribution
	Media (information access Unequal access to mangrove services)	
	Lack of Interests in multi-stakeholders	
	Fishery declining	

Table (7) The Adaptation Measures and the existing Activities (Continued)

Current Adaptation Measure and Existing Activities	Constraints and Gaps	Potential Opportunity Plans
Deforestation in mangrove	Less knowledgeable	Fuel efficient stove technology
Less catching in Fish and Prawn	Rules and regulations not strong enough	Community owned forests establishment
Elephant population declines	Less Capacity building initiatives	More Training on awareness and need for technical support
More coastal erosion and displacement of villages	Mangrove forests diminished	Need for process on monitoring and evaluation
River channel changes due to high sedimentation	Less cooperation by stakeholders	Need for funding
Adverse weather	Need more social enterprises	Need for capacity building
Size of Fuelwood getting smaller		Income generating promoting
Livelihood of villagers deteriorate		More flexibility in livelihoods rather than environmental basics
Saltwater intrusion		
Mangrove plantation activities by NGOs insufficient		

Table (7) The Adaptation Measures and the existing Activities (Continued)

Current Adaptation Measure and Existing Activities	Constraints and Gaps	Potential Opportunity Plans
More vulnerable to disasters due to deforestation in mangroves	Less awareness, need more public education	Need mobile education programmes
Less resources in fishery	Less cooperation and coordination	Create more alternative livelihoods
Less opportunity for more jobs	More controlled by big pockets	More programmes on the conservation of current mangrove forests
More hardship in economic situations	Mono-culture	Need Policy on Advocacy
More migrants	Less abidance by the laws	Need community capacity building
More human trafficking	Less knowledge on the impacts of mangrove deforestation	Promoting community participation
		Promote indigenous knowledge