Capacity building for Moeyingyi wetland conservation in Myanmar in the context of climate change

Summary Report

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1. INTRODUCTION

Wetlands are important natural resources in Myanmar. They are natural heritages of the country and play a vital role in the economy of the country. In Myanmar, coastal and inland mangrove wetlands are of great value for nature conservation. Migratory birds are dependent upon these areas and hence, can be considered them as of international importance (CMS/CAF/Inf.14).

Wetlands also provide many valuable resources such as fishery, forest products and medicinal plants. Besides, they act as natural barriers against intrusion of sea water into the agricultural areas as well as prevent the costal land from erosion. The wetlands fed by groundwater discharge have a direct influence on stream flow. Fresh water fish from the inland wetland have been the major protein food source of the people of Myanmar. A network of freshwater wetlands, rivers and adjacent wetlands are very important for water supply, transport and habitats for freshwater fish. However, the natural characteristics and value of many inland lakes have been changed by human activities, thus reducing their natural values (CMS/CAF/Inf.14).

Climate change, once a topic of heated debate, is now a subject of near-unanimous agreement among scientists all over the world. Some forms of climate change we have been experiencing in recent years are more frequent floods, stronger hurricanes, typhoons and other storms, and more extended droughts and heat waves. Global climate change may alter hydrologic parameters upon which wetlands, and the species that inhabit on them, depend (IPCC, 1995). Hydrology is probably the most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes (Mitsch and Gosselink, 1986). Hydrologic conditions can directly modify or change chemical and physical properties, and modifications of the physicochemical environment have a direct impact on the biotic response in wetlands (Snidvongs et al., 2003). However, other aspects of climate change, such as longer and more frequent droughts, floods may most likely have negative effects on peat carbon balance. In addition, human activities such as agriculture and forestry will also continue to transform wetlands and reduce overall wetland area, potentially resulting in losses of stored carbon (Ramsar COP8 DOC11, 2002).

The present study was conducted in Myanmar's only Ramsar site, Moeyingyi Wetland Wildlife Sanctuary (MWWS). MWWS is a state-owned area comprising floodplain and a storage reservoir that is important for flood control. Some eight villages comprising about 1,117 households are located in the surrounding area and depend on the wetland for traditional fishing and water supply for paddy fields. A number of vulnerable and near-threatened bird species are supported by this wetland. Considering its significance at national and international level, it is of utmost importance to raise awareness on the conservation and management of this wetland. This study provides the projection of climate change up to 2050 and its impact on the water availability in the Bago River Basin and the Moeyingyi wetland. Capacity building and raising the awareness on the conservation and management of wetlands

to Government officials and other relevant stakeholders with active participation of the community will lead to the sustainability of wetlands.

2. STUDY AREA

The study area comprises of MWWS and nearby Bago River Basin. Figure 1 shows the overall study area with the location of hydro-meteorological stations. The total area is 3,170 km^2 with an average annual temperature of 26 °C. The average annual rainfall is about 3,000 mm and almost 85% of the rainfall occurs during the monsoon season (May to October).

MOEYINGYI WETLAND

Moeyingyi wetland lies in Bago and Waw township of Bago district. It is about 1.2 km from Yangon-Mandalay Road and covers an area of 103.6 km^2 (40 square miles). Moeyingyi wetland was constructed in 1978 and was originally built to supply water to Bago-Sittoung canal during the dry season and a reservoir for flood control. It now also serves as a resting place for migratory birds. The site was open in 1998 for the visitors by the Department of Forestry and was declared as a Ramsar site in 2005. Moeyingyi wetland is surrounded by embankment of an average height of 3.66 m (12 ft) with the total storage capacity of 173 million cubic meters (MCM) (140,000 ac-ft). There are three main sluice gates to supply water for irrigation: Moeyingyi (10 openings), Kapin (8 openings) and Zwebat (4 openings), which are controlled and managed by Irrigation Department of Bago district. Around 65 species of water birds, 60 species of terrestrial birds, 30 species of fishes and 29 species of reptiles and amphibians are found in the Moeyingyi wetland.

BAGO RIVER BASIN

Bago River Basin is shared between Bago Township of Bago Division and Yangon Division of Myanmar and lies west of Moeyingyi wetland (Figure 1). The northern part of the basin has higher altitude of up to 800 m AMSL whereas the lower southern part is relatively plain and fertile. The Bago River flows through Bago city and is flooded almost every year during the monsoon period. The average flow in the Bago River is 135 m^3/s which can increase up to 450 m^3/s during the rainy season. The Bago River supply water for irrigation and to maintain the water level of Moeyingyi wetland during the dry season. The intake of the irrigation canal lies between Zangtu and Bago stations.

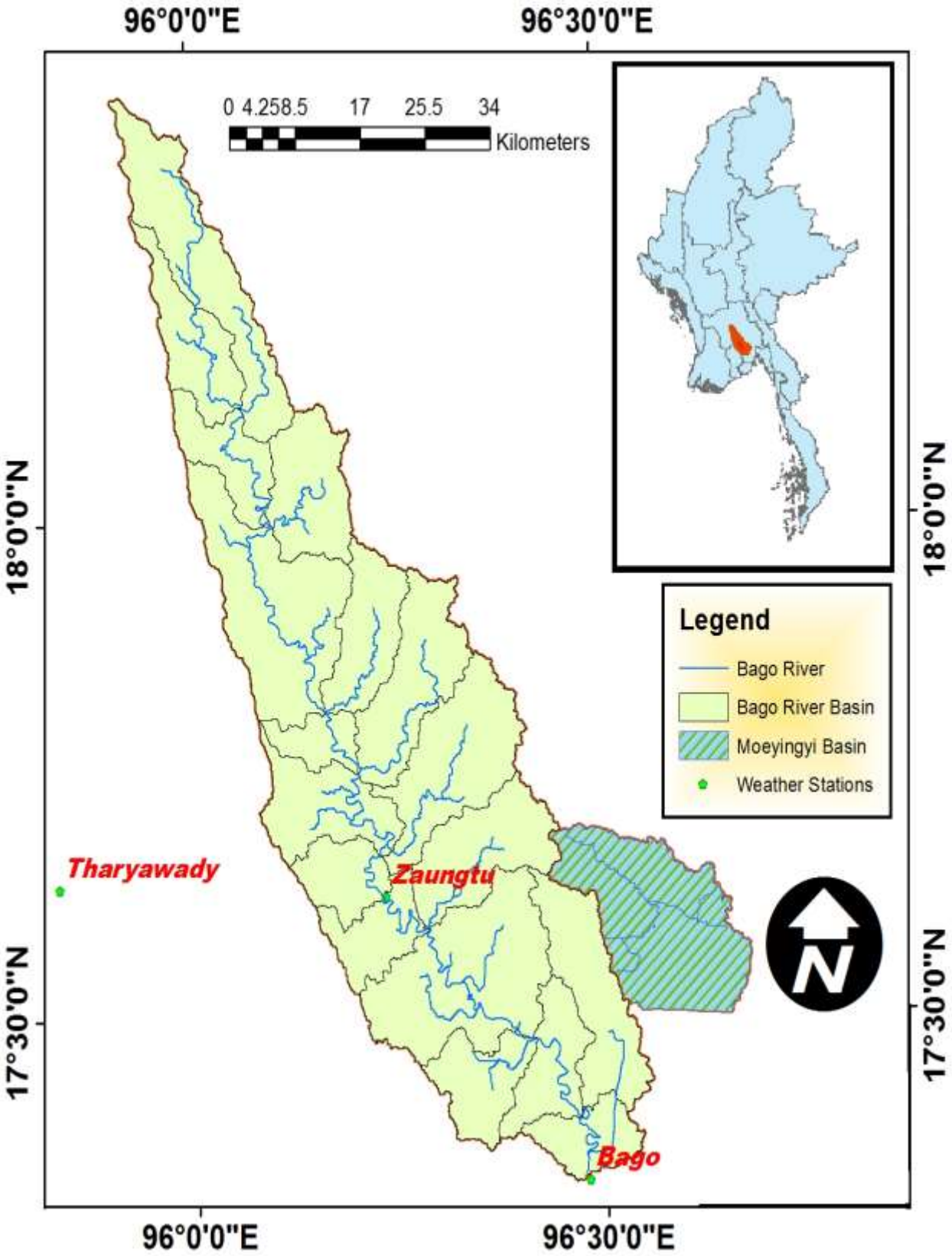

Figure 1: Location map of Bago River Basin and Moeyingyi wetland

3. CLIMATE AND CLIMATE CHANGE

VULNERABILITY TO CLIMATE CHANGE

According to the Department of Meteorology and Hydrology of Myanmar, over the last decade, Myanmar is experiencing an increase in temperature and a change in precipitation patterns. Myanmar ranks one of the top countries vulnerable to the effect of climate change (Wang et al., 2013). The vulnerability is of particular concern because about 32.7% of the total population (54.6 million) lives under the poverty line.

Climate change can have a serious impact on the livelihoods of poor farmers that rely directly on agriculture. Approximately 70% of the labor population depends on the agriculture, livestock and fisheries sectors for their livelihoods. Myanmar is a developing country with a GDP annual growth rate of 6.5%. Agriculture and fisheries constitute the second largest contribution to the economy. In 2013, agriculture contributed ~38%, services ~41.7% and industry ~20.3% of total GDP.

Around 80% of total populations from Moeyingyi are engaged in agriculture and fishery. The daily income of 26% of people is less than USD 2.9 (3000 MMK). Similarly, the main income source of people from Bago is timber and agriculture. The major crop in the region is rice, which occupies two-thirds of the available agricultural area. Other major crops include betel nut, sugarcane, maize, sunflower, etc.

Climate change adaptation is necessary in Myanmar as even with significant reductions in carbon emissions, the impacts of climate change cannot be stopped. The need for adaptation is compounded by the growing populations and economies in Myanmar's most vulnerable areas (NAPA, 2012).

To better understand the impact of climate change, three climate change models MIROC 5, CSIRO and ECHAM with two emission scenarios of AR5, RCP 4.5 and RCP 8.5 were used to project the future climate change scenarios in the project area. The RCP 4.5 represents the medium emission whereas RCP 8.5 represents the high emission of GHGs. The study used multiple climate models and scenarios to address the uncertainties associated with climate change projections. The future period was divided into three time periods: 2020s (2021-2030), 2030s (2031-2040) and 2040s (2041-2050).

OBSERVED CHANGES IN CLIMATE IN MYANMAR

High emission of GHGs is bringing a lot of changes in climate across the globe. Myanmar in the past decades has experienced the following changes in its climate:

- increase in temperatures across the country (~0.08°C per decade), most notably in the northern and central regions
- increase in total rainfall over most regions, however, with notable decreases occurring in certain areas (e.g., Bago Region)
- a decrease in the duration of the south-west monsoon season as a result of a late onset and early departure times
- increase in the occurrence and severity of extreme weather events, including cyclones/strong winds, flood/storm surges, intense rains, extreme high temperatures and drought

Source: NAPA, 2012

CHANGE IN TEMPERATURE

The average temperature of Moeyingyi wetland is about 26°C, and the hottest and the coldest months are April and January with an average temperature of 30.5°C and 23°C, respectively. With the climate change, the annual average temperature is expected to increase continuously. Under the RCP 4.5 scenario, the temperature is expected to increase by 1.7°C whereas under the RCP 8.5 scenario the temperature can increase by 1.8°C. This indicates that the evapotranspiration in the future will increase, thus increasing the water demand of crops.

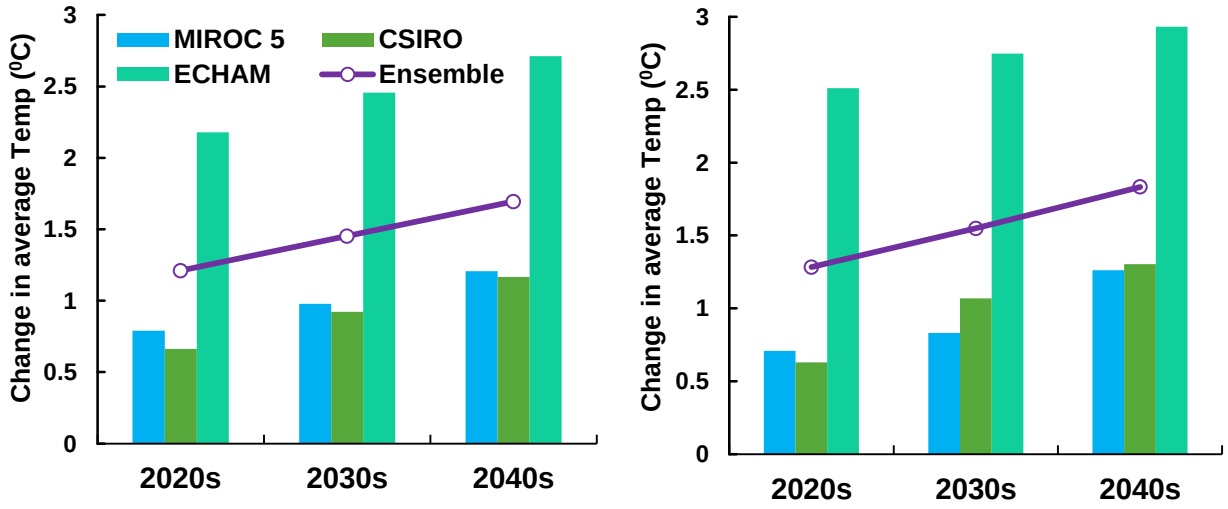

Figure 2: Relative change in average temperature for different future periods under (a) RCP 4.5 and (b) RCP 8.5.

PRECIPITATION CHANGES

There is already a high variation of rainfall bringing both localized flooding and drought. Almost 85% of the total annual rainfall occurs in the month from May to October. The projection of climate change suggests that the total annual rainfall will decrease during 2020s whereas it will increase gradually towards the later period of study. Similarly, a large variation in seasonal rainfall can be expected in the future. Overall, rainfall will decrease in the wet season except during the month of July where the rainfall can increase by 10% compared with the base period. The largest decrease of 40% can be seen during the month of May for all time periods.

Moeyingyi and Bago city endures regular flooding during the monsoon season. The floods of 1994, 1997, 2007 and 2011 were the worst natural disaster ever recorded. The flood of 2011 inundated areas of up to 1.5 m displacing over 5,000 people. With the changing climate and expected increase in precipitation the flooding events can get even worse in the future.

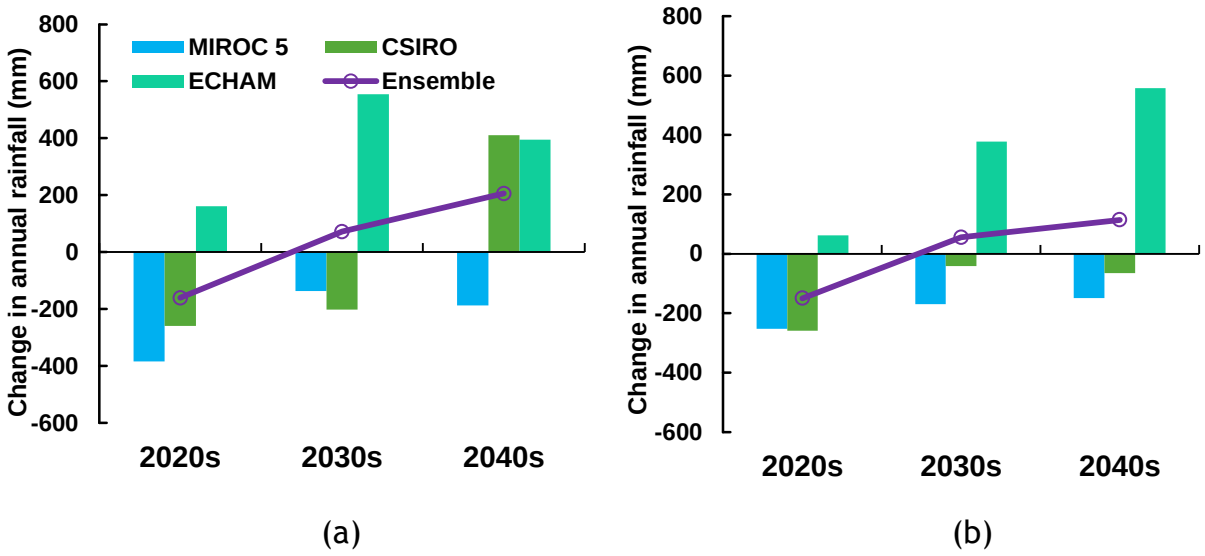

Figure 3: Relative change in annual rainfall for different future periods under (a) RCP 4.5 and (b) RCP 8.5.

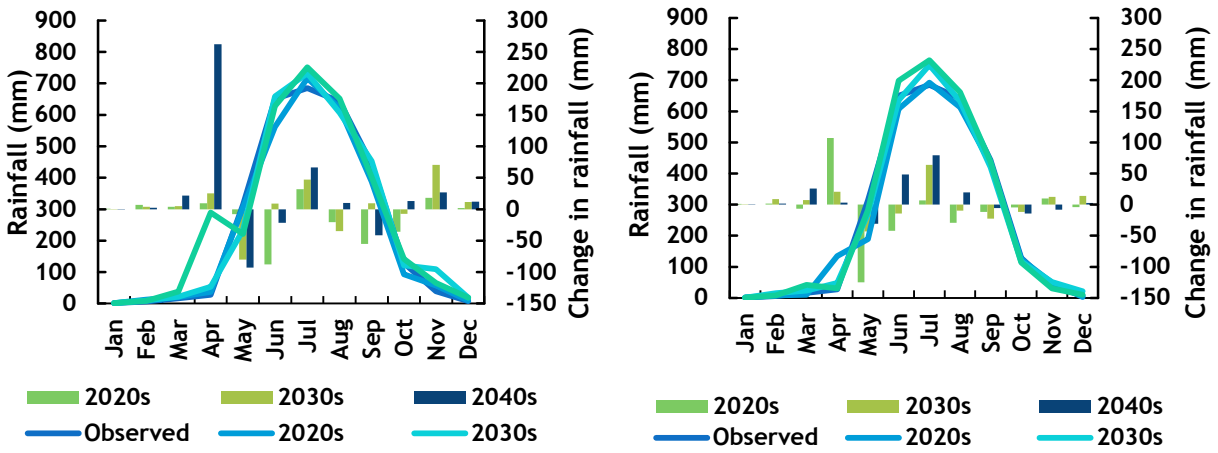

Figure 4: Relative change in monthly rainfall for different future periods under (a) RCP 4.5 and (b) RCP 8.5.

4. IMPACT ON WATER RESOURCES

BAGO RIVER BASIN

There were around 5.3 million people residing in Bago River Basin in 2010. Most of the local people have poor living standards and rely heavily on economic income related to utilization of water resources in the watershed. Around 40% of the total population is farmers and 30% rely on fisheries. Bago River is also one of the important sources of water to Moeyingyi wetland. Water form Bago River is diverted to Moeyingyi wetland from Zangtu weir (Figure 1). Around 8.5m^3/s of water is diverted to Moeyingyi wetland during the dry season.

Climate change impact study at Bago River suggests a decrease in River discharge compared with the base period of 1994-2008. The analysis shows that under the RCP 4.5 scenario the discharge in the River decreases throughout the study period. Under the RCP 8.5 scenario, the discharge will increase for the period of 2040s. The projected change in the discharge is about -7% (-38 to 29%), -7% (-32 to 42%) and -1% (-29 to 126%) in the 2020s, 2030s and 2040s, respectively, for Zangtu station. Similarly, the average change in discharge of -6% (-45 to 62%), -5% (-36% to 61%) and 0.1% (-31 to 166%) in the 2020s, 2030s and 2040s, respectively, is observed for Bago station.

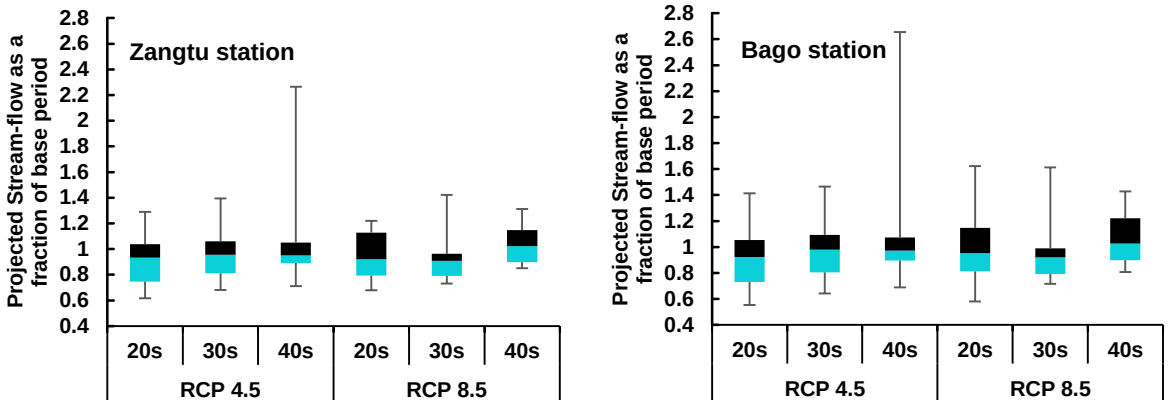

Figure 5: Box and whisker plots of projected stream-flow under the RCP 4.5 and the RCP 8.5 scenarios as a fraction of streamflow of the base period

Seasonal analysis suggests that the discharge at Zangtu station is likely to decrease during the monsoon seasons with the highest decrease of up to 88 m^3/s in the month of August under the RCP 4.5. Similarly, the discharge is expected to decrease during the dry seasons which can have a negative impact on diversion of water from Bago River to Moeyingyi wetland. On the other hand, the discharge is likely to increase during the month of July at Bago city and can further worsen the recurring floods.

MOEYINGYI WETLAND

A warming in air temperature can directly raise the wetland temperatures, which can adversely affect aquatic life. Additionally, warmer water can increase the range of non-native fish species. The population of native fish species often decreases as non-native fish prey on and out-compete them for food.

Climate change impact analysis shows a decrease in inflow at Moeyingyi wetland in future periods. Inflow at the wetland can decrease as high as 23% for the period of 2020s compared with the base period of 2007-2011. This can have serious consequences for both agriculture and wetland biodiversity. The inflow is expected to decrease during the dry season and increase during the wet seasons. The highest decrease in the inflow can be observed during the month of May and October whereas the inflow will increase for the months of June and July.

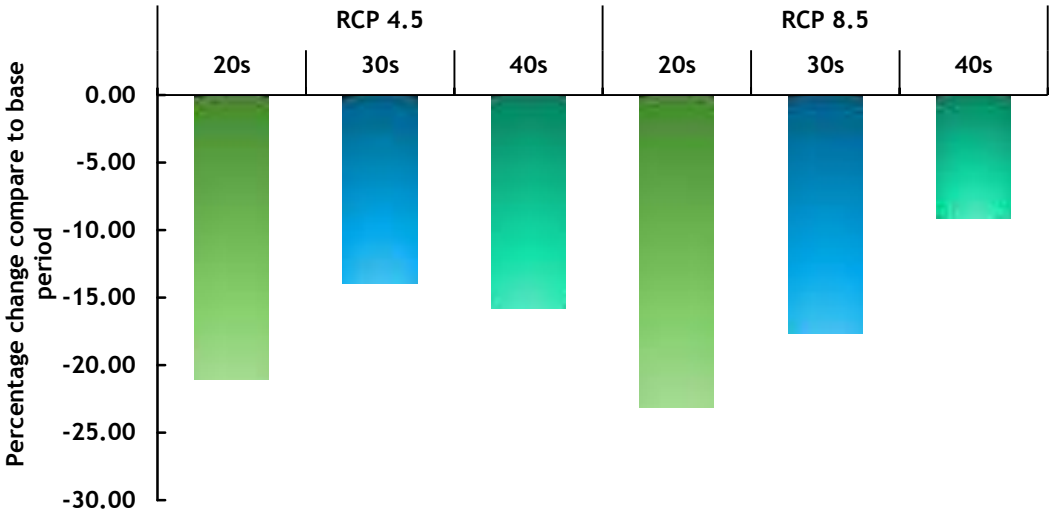

Figure 6: Change in percentage of inflow at Moeyingyi wetland

Moeyingyi wetland is under the supervision of Forestry Department, Ministry of Environmental Conservation and Forestry whereas the sluice gates are controlled by the Irrigation Department, Ministry of Agriculture and Irrigation. A constant conflict arises between the Forestry Department and the Irrigation Department regarding maintaining the water level of Moeyingyi wetland. The Forestry Department wants to maintain the water level to at least 23 ft AMSL during the months of March and April whereas the Irrigation Department faces high water demand during these seasons and are compelled to supply water for irrigation which results in a decrease in water level to less than 21 ft AMSL.

In future the precipitation is expected to increase, indicating increase of water availability in Moeyingyi wetland. If the water level in the Moeyingyi wetland is maintained as in present condition, the outflow from Moeyingyi wetland during the monsoon season will decrease whereas more water will be available during the dry season. This indicates an increase in water availability for irrigation use in downstream. However, this increase in water availability will not be enough to maintain the water level in the Moeyingyi wetland.

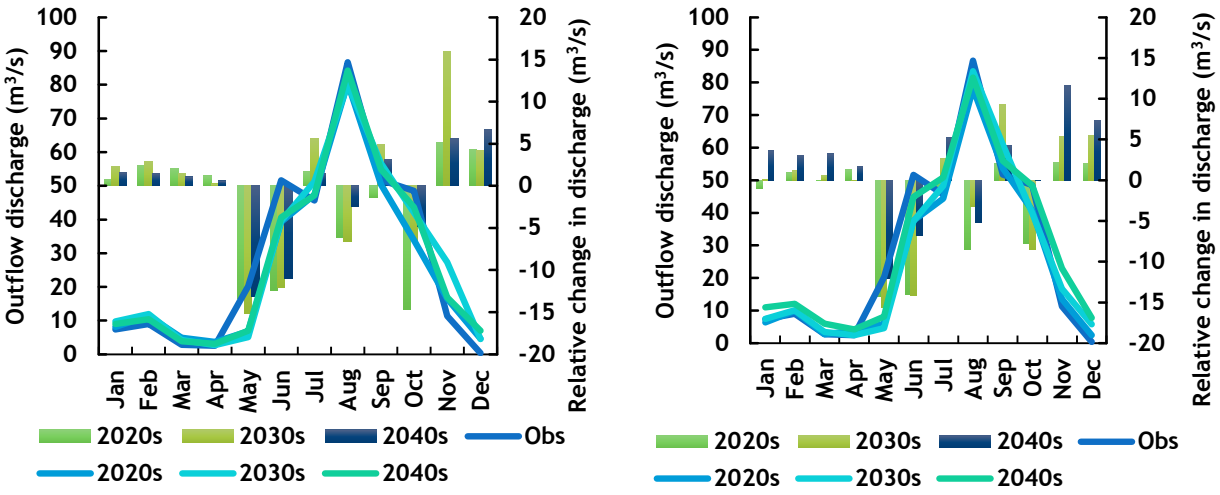

Figure 7: Relative change in monthly outflow discharge from Moeyingyi wetland for different future periods under (a) RCP 4.5 and (b) RCP 8.5.

5. ADAPTATION

Changing precipitation patterns, increasing temperature and decreasing water availability is likely to have short-term crop failure as well as long-term production decline. The change in CO_2 concentration and temperature will threaten agricultural productivity, stressing crops and reducing yields of major cereals like rice. Furthermore, climate change can change or shift the patterns of migratory birds and exacerbate flooding or drought causing massive damage to lives and properties.

Moeyingyi being a rural area and with around 80% of the population directly depending on the wetland, is highly vulnerable to climate change. The area is constantly devastated by floods and water scarcity and with global warming and climate change these events can be further aggravated. Moeyingyi wetland is an important asset for Myanmar. Different Government agencies and the relevant stakeholders should prepare an action plan for the sustainable development addressing environmental, social and economic aspects.

The impact of climate change is inexorable and preparedness and adaptation will be a key elements. Adaptation means planning in advance to minimize the damage or take advantages of opportunities that arises due to climate change. Preparing in advance or proper adaptation strategies will not only save properties and lives but also will harness the advantage of changing climate.

Following adaptation strategies are recommended to offset the negative impacts of climate change and for the sustainable development of Moeyingyi wetland.

SOCIO- ECONOMIC SECTOR

People from Moeyingyi wetland are vulnerable to climate change for the following reasons:

- Around 77% of the population living on the vicinity directly depends on Moeyingyi wetland for their livelihoods.
- Incomes of the people are directly dependent on climate sensitive sectors like agriculture, fishery and forestry.
- High poverty levels affecting the capacity to respond to climate change impacts.
- Lack of knowledge and awareness to adapt against changing environment.
- Limited technology to prepare against the impact of climate change related events.

Agriculture is the most vulnerable sector due to the impact of climate change. The expected rise of temperature and changing pattern of precipitation will have a negative impact on the agriculture production and food security. An increase in temperature and a decrease in precipitation will result in an increase in water demand for crops, which will have a severe impact in rain-fed agricultural areas. On a contrary, an increase in intense rainfall and floods will result in loss of yields from crop damage. This decline in crop production will result in an increase in price of crops, which particularly affect the low income rural population and can result in malnutrition.

To cope with the changing environment, farmers should focus on climate resilient crops using different varieties of rice. New varieties of climate resilient rice can tolerate drought, heat and have early maturation to shorten the growing season and reduce the crops exposure to extreme events. The government should focus on reducing climate change vulnerability of rural farmers through locally relevant technologies. In this context, decision makers and institutes has to play a major role at multiple levels from initiation to transfer of technologies to the farmers.

Production techniques can also play as important role in climate change adaption. One of such techniques is reduced or minimum tillage agriculture. In this technique, seeds are inserted using seed drills to a certain depth without disturbing the soil structure. This helps build up organic matter in the soil improving the soil moisture capacity and ultimately increase the water use efficiency.

With the changing climate, history becomes less reliable guide to the farmers. Sharing information and forecasted weather patterns can help farmer response by planting more appropriate crops. In addition, providing insurance may aid farmers during the natural disaster and to adapt to climate change.

Similarly, to reduce the vulnerability and dependency of local people to Moeyingyi wetland, alternate sources of income should be encouraged and promoted. Moeyingyi wetland is a natural heritage of the world and is listed as Ramsar site. Moeyingyi wetland has high potential for tourism. This site should be endorsed to attract more tourists, hence creating tourism-based industries.

Executing Agencies

The Ministry of Agriculture and Irrigation is responsible for providing training on harvesting and land preparation, production and distribution of machineries and insurance against crop damages. The International Rice Research Institute (IRRI) has already identified and released various climate resilient rice verities. In collaboration with IRRI, the Ministry of Agriculture and Irrigation, Universities and Research

institutes should focus on developing and identifying early maturing and heat tolerant breeds of rice suitable for Moeyingyi area.

The Department of Meteorology and Hydrology should establish a network of weather stations so that timely forecasted data can efficiently be disseminated to a greater section of farmers.

Agencies	Responsibility
Ministry of Agriculture and Irrigation	Promote diversification and climate resilient crops
	Enhance rice production through farm mechanism and breeding new variety of rice
	Insurance scheme to farmers
Universities and Research Institutes	Develop and identifying early maturing and heat tolerant breeds of rice suitable for Moeyingyi area
Ministry of Hotels and Tourism	Promote Moeyingyi wetland and create alternate sources of income for people
Department of Meteorology and Hydrology, Ministry of Transport	Establish a network of weather stations so that timely forecasted data can be efficiently disseminated to farmers

ENVIRONMENT AND BIODIVERSITY

Other form of threats the wetland is facing is the loss of habitats through over fishing, hunting and illegal trade of species. Around 49% of the population is engaged in fishing activities. The fishes are consumed locally as well as supplied to nearby Bago city. Around 18% of the total fishery household practices electric shock fishing (BANCA, 2014). This can be a serious threat on the aquatic resources. Also, new species of fish are being introduced by farmers to increase the yield. This introduction of new species can have a negative impact on the native species and is a matter of research.

Similarly, bird hunting and illegal trading of species like turtles and snakes are driving the species to extinction. There is a huge demand of birds as a delicacy, which has resulted in an increase in bird hunting. Villagers are using nets and even chemical like potassium cyanide for hunting, which can even have an adverse effect on water birds and fish resources. Besides bird hunting, illegal trading of turtles and snakes, especially Yellow-banded Krait, Monocellate Cobra and Russell's Vipers are forcing the species to extinction. Moreover, snakes that are caught in the fishing nets are consumed as foods as well as are used as animal feeds for domestic pigs.

Figure 8: Snakes caught in fishing net

Source: BANCA

The upstream of the wetland is an agricultural area where people use extensive amount of chemical fertilizers and pesticides, which finally pollute the wetland. This pollution if not properly controlled can create huge problem of water contamination and for the biodiversity that depends on the wetland. Similarly, there is no provision of monitoring water quality and very less research has been conducted on the water quantity and quality of the wetland. Furthermore, the farmers normally utilize the land for agricultural use during the dry season when the water level in the wetland decreases.

To solve these issues, the Forestry Department should enforce strict laws and regulation for the protection of wild animals and stop illegal activities including electric shock fishing as well as overharvesting of fish stocks. Similarly, bird hunting and illegal trade of species should not be allowed in the MWWS. Land encroachment and pollution is getting increasingly a serious problem in Moeyingyi wetland. The wetland should be fenced properly and the water level should be maintaind at 23 ft R.L. to conserve the sanctuary area. If possible farmers should be encouraged to use organic fertilizer and focus should be diverted to increase yield per unit area than to extend horizontally.

Executing Agencies

Agencies	Responsibility
Forestry Department, Ministry of Environmental Conservation and Forestry.	Electric shock fishing should not be allowed in the Moeyingyi wetland area
	Strict laws should be enforced against bird hunting and illegal trading of species
Universities and Research Institutes	Research on long-term effect on the native fish due to introduction of new species
Irrigation Department, Ministry of Agriculture and Irrigation	Reduce the use of chemical fertilizer and pesticides at the upstream with regular water quality control and examination
	Maintain the water level at 23 ft and construct fencing to prevent land encroachment

EARLY WARNING SYSTEM

Moeyingyi wetland is frequently exposed to meteorological hazards like floods and droughts. However, currently there are no weather stations to measure the rainfall and temperature. The nearest weather station is the Zangtu station which lies about 40 km west of Moeyingyi wetland. This station cannot properly represent the actual weather of the wetland. Hence, a permanent weather station should be established and early warning system should be developed which can provide data and information for reducing the vulnerability of local communities.

Executing Agencies

Agencies	Responsibility
Department of Meteorology and Hydrology, Ministry of Transport	Installation of weather station near Moeyingyi wetland
	Installation of flood early warning system for reducing the vulnerability of local communities
	Installation of gauging station at upstream of Moeyingyi wetland
	Proper data entry system

WATER SUPPLY AND HAZARDS

Climate change analysis shows that the annual average rainfall will decrease in the future, thus decreasing the water flow to Moeyingyi wetland. An increase in discharge can be observed during the monsoon season suggesting an increasing risk of flooding. Currently, Moeyingyi wetland is serving 125 km^2 of agricultural area and the government has a future plan to irrigate an area of 200 km^2.

A total of five dams including Zangtu, Kodukwe, Salu, Shwe Laung and recently Wagadok dam are feeding the Moeyingyi wetland during the dry seasons. Even with five dams supplying water, it is still difficult to maintain the water level and to supply water for irrigation at the same time. To keep up with the increase in water demand (160%), an additional storage should be constructed upstream of Moeyingyi wetland. Similarly, the current embankment of Moeyingyi wetland should be increased and this can help store water as well as protect downstream from the monsoon floods.

Another major problem Moeyingyi wetland is facing is the sediment deposition. Huge amount of sediment during the rainy season is being deposited in the wetland decreasing the water storage capacity. There have not been any study for sediment deposition nor have any recorded data for sedimentation. Dredging the canals and wetland regularly, construction of sand traps and upstream afforestation can be a solution for the sediment problem.

Executing Agencies

Agencies	Responsibility
Irrigation department, Ministry of Agriculture and Irrigation	Construction of new dams upstream of Moeyingyi wetland over Bago tributaries to store water for dry seasons
	Increase the embankment of the Moeyingyi wetland to collect more water
	Construction of sand traps upstream to prevent sediment deposition
	Dredging regularly the sediment from Moeyingyi wetland
	Better management and efficient use of water
Forestry Department, Ministry of Environmental Conservation and Forestry	Afforestation upstream can prevent sediment transportation to wetland

6. CONCLUSION

Moeyingyi wetland is one of the valuable assets of Myanmar, which plays multiple roles such as flood control, irrigation as well as provides habitat for wildlife. However, change in climate and weather conditions can have serious impact on Moegyingyi wetland. People living around Moeyingyi wetland are vulnerable to the impact of climate change as around 77% population is directly depended on the wetland for their livelihoods. Climate change is one of the major challenges to water availability in the next several decades. Agriculture is among the sectors most exposed to global climate change and its impacts. Similarly, climate change can have an adverse effect on the biodiversity. Hence, adaptation is the key element for the sustainable management of wetland. Adaptation measures not only help minimize vulnerability but also harnesses the opportunities. The main objective of this project was thus to assess the impacts of and response options to climate change for the MWWS conservation and other sectors which are dependent on the water from this wetland. A list of adaptation options are identified which can offset the negative impacts of climate change in the Bago River Basin and Moeyingi wetland and these are summarized in a table below:

Table: Summary of adaptation strategies for conservation of Moeyingyi wetland

Sector	Adaptation strategies	Executing agencies
Socio-economic	Promote diversification and climate resilient crops, crop varieties	Ministry of Agriculture and Irrigation, Universities and Research Institutes
	Enhance rice production through farm mechanism and breeding new variety of rice	
	Insurance scheme to farmers	
	Raise awareness about the importance of wetland and its sustainable development	Forestry Department, Ministry of Environmental Conservation and Forestry, NGOs
	Create alternate sources of income for local people and decrease dependency on	Ministry of Hotels

	Moeyingyi wetland	and Tourism
	Promote Moeyingyi wetland to attract more tourists and investments to boost local economy	
	Sharing information and forecasted weather to farmers	Department of Meteorology and Hydrology, Ministry of Transport
Environmental and biodiversity	Electric shock fishing should not be allowed in the Moeyingyi wetland area	Forestry Department, Ministry of Environmental Conservation and Forestry, Universities and Research Institutes
	Harsh punishment should be enforced against bird hunting and illegal trading of species	
	Introduction of new species can have a long-term effect on the native fish. Research on this topic is recommended	
	Reduce the use of chemical fertilizers and pesticides at the upstream with regular water quality monitoring	Irrigation department, Ministry of Agriculture and Irrigation
	Maintain the water level at 23 ft and construct fencing to prevent land encroachment	
Early warning system	Installation of weather station near Moeyingyi wetland	Department of Meteorology and Hydrology, Ministry of Transport
	Developing flood early warning system for reducing the vulnerability of local communities	
	Installation of gauging station at upstream of Moeyingyi wetland	
	Proper data entry and management system	
Water supply and hazards	Construction of new dams upstream of Moeyingyi wetland over Bago tributaries to store water for dry seasons	Irrigation department, Ministry of Agriculture and
	Increase the embankment of the Moeyingyi	

	wetland to collect more water	Irrigation
	Construction of sand traps upstream to prevent sediment deposition	
	Dredging regularly the sediment from Moeyingyi wetland	
	Better management and efficient use of water	
	Afforestation upstream can prevent sediment transportation to wetland	Forestry Department, Ministry of Environmental Conservation and Forestry

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