

The Republic of the Union of Myanmar
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Forest Department



**Climate Change Adaptation on Water Resource Management:
a case study of Pakokku Township, Magway Region, Myanmar**

Khin Maung Soe
Sangchan Limjirakan
Environmental Conservation Department, Ministry of Natural Resources and
Environmental Conservation,

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မြန်မာနိုင်ငံ၊ မကွေးတိုင်းဒေသကြီး၊ ပခုက္ကူမြို့နယ်တွင် ရာသီဥတုပြောင်းလဲမှုကို
လိုက်လျောညီထွေနေထိုင်ခြင်းအား ရေအရင်းအမြစ်စီမံခန့်ခွဲမှုအပေါ်လေ့လာခြင်း

ခင်မောင်စိုး၊ ဦးစီးအရာရှိ၊ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ သယံဇာတနှင့်
သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန။

ဒေါက်တာ ဆန်ချန်လင်ဂျီရာခန့် - သုတေသနအကြံပေးပုဂ္ဂိုလ်၊ ပတ်ဝန်းကျင်ဆိုင်ရာသုတေသနဌာန၊
ချူလာလောင်ကွန်းတက္ကသိုလ်၊ ထိုင်းနိုင်ငံ၊ ဘန်ကောက်မြို့။

စာတမ်းအကျဉ်း

ရာသီဥတုပြောင်းလဲမှုကြောင့် လွန်ခဲ့သည့်ဆယ်စုနှစ် အနည်းငယ်အတွင်း ကမ္ဘာ့အပူ
ချိန်သည် သိသာမြင့်တက်လာလျက်ရှိပါသည်။ ၂၀ ရာစု၏ အလယ်ခန့်မှစတင်၍ သဘာဝစနစ်
များအပေါ် ရာသီဥတုပြောင်းလဲမှု၏ ဆိုးကျိုးသက်ရောက်မှုများသည် ပိုမိုသိသာထင်ရှား လာ
ခဲ့သည်။ ၎င်းသက်ရောက်မှုများအနက် ရေသယံဇာတအပေါ် သက်ရောက်မှုသည် အဓိက
ကဏ္ဍမှ ပါဝင်လာခဲ့သည်။ ထို့အတူ မြန်မာနိုင်ငံအလယ်ပိုင်းတွင် ရာသီဥတု ပြောင်းလဲမှုများ
ကြောင့် ရေပြတ်လပ်ရှားပါးမှုများ ပိုမိုကြုံတွေ့လာရသည်။ ဤသုတေသန၏ ရည်ရွယ်ချက်မှာ
ရေသယံဇာတစီမံအုပ်ချုပ်မှုတွင် ရာသီဥတုပြောင်းလဲမှုကို လိုက်လျောညီ ထွေစွာနေထိုင်
ခြင်းအကြောင်းအား လေ့လာရန်ဖြစ်ပါသည်။ သုတေသနလေ့လာမှုဧရိယာ အဖြစ်မြန်မာနိုင်ငံ၊
မကွေးတိုင်းဒေသကြီး၊ ပခုက္ကူမြို့နယ်တွင် လေ့လာခဲ့ပါသည်။ ပခုက္ကူမြို့နယ် အတွင်းရှိ ရှင်မ
ကန်ကျေးရွာ၊ ပန်းတိုင်းခြံကျေးရွာ၊ ပေါင်လောင်ကန်ကျေးရွာနှင့် ကြီးစံကျေးရွာများသို့
သွားရောက် လေ့လာခဲ့ပါသည်။ သုတေသနအတွက် မေးခွန်းလွှာကို မေးမြန်းခြင်းတွင် စုစု
ပေါင်း ဖြေကြားသူအရေအတွက်မှာ ၆၁ ယောက်ဖြစ်ပြီး အစိုးရဌာနဆိုင်ရာ အရာရှိများ၊ အစိုးရ
မဟုတ်သောအဖွဲ့အစည်းများမှ ဝန်ထမ်းများ၊ ဒေသခံပုဂ္ဂိုလ်များအား သွားရောက် မေးမြန်း
ခဲ့ပါသည်။ ၎င်းပုဂ္ဂိုလ်များအား **Purposive sampling method** အသုံးပြု၍ ရွေးချယ်ခဲ့ပါသည်။
လေ့လာမှုဧရိယာအတွင်းမှ သုတေသနအတွက် လိုအပ်သော သတင်း အချက်အလက်များနှင့်
Data များအား ရရှိနိုင်ရန်အတွက် **Semi-structured questionnaire** တည်ဆောက်၍ **in-**
depth interview method ဖြင့် မေးခွန်းများကို မေးမြန်း ခဲ့ပါသည်။ ရရှိလာသော သတင်း
အချက်အလက်နှင့် **data** များအား **Descriptive and Content Analysis** နည်းများ အသုံးပြု၍
ခွဲခြမ်းစိတ်ဖြာပြီး သုတေသနစာတမ်းတွင် ရေးသား တင်ပြခဲ့ပါသည်။ သုတေသန၏ အဓိက
တွေ့ရှိချက်များမှာ ဖြေကြားသူ အားလုံး၏ ၉၈ ရာခိုင်နှုန်းသည် ရာသီဥတု ပြောင်းလဲမှုအား
သိရှိနှင့်ပြီးဖြစ်ကြပါသည်။ ထို့အပြင် ၁၀၀ ရာခိုင်နှုန်းသော ဖြေကြားသူများသည် ရေချို့

ပြတ်တောက်မှု၊ အပူလှိုင်းများနှင့် စိုက်ပျိုးရေး အထွတ်နှုန်းများကျဆင်းမှု အစ ရှိသော ရာသီဥတုပြောင်းလဲမှု၏ ဆိုးကျိုးများကို ဖော်ပြပြောဆိုခဲ့ကြသည်။ ရာသီဥတု ပြောင်းလဲမှုအား လိုက်လျောညီထွေစွာနေထိုင်ခြင်းအကြောင်း မေးခွန်းများကိုမေးမြန်းရာတွင် အစိုးရအရာရှိ ၁၀၀ ရာခိုင်နှုန်းက စိုက်ပျိုးရေးကဏ္ဍ၌ ရာသီဥတုပြောင်းလဲမှုဒဏ်ကို ခံနိုင်ရည်ရှိသော မျိုးစေ့ များကို အသုံးပြုရန်ဖော်ပြခဲ့ကြပါသည်။ ၎င်းတို့၏ ၈၉ ရာခိုင်နှုန်းမှာ စိုက်ပျိုး ရေးလုပ်ငန်းများတွင် ရေအကုန်အကျသက်သာစေသော ရေပေးဝေမှုစနစ်ကို အသုံးပြုရန်နှင့် စိုက်ကွင်းများတွင် အစိုဓာတ်ထိန်းသိမ်းရန်အတွက် ထွန်/ထယ်ရေးကောင်းမွန်စွာ ထွန်ယက်ရန် ကို ဖော်ပြခဲ့ကြသည်။ မေးခွန်းဖြေကြားသူ တောင်သူများ၏ ၉၀ ရာခိုင်နှုန်းက ထူးခြားသော မိုးလေဝသ၊ ရာသီဥတု အခြေအနေများတွင် သင့်တင့်လျောက်ပတ်စွာနေထိုင်ခြင်း အကြောင်း ကိုဖော်ပြခဲ့ပြီး၊ ၎င်းတို့၏ ၈၈ ရာခိုင်နှုန်းက စိုက်ပျိုးရေးကဏ္ဍတွင် ရာသီဥတုပြောင်းလဲမှု ဒဏ်ခံ နိုင်သော မျိုးစိတ်မျိုးကွဲများကို အသုံးပြုရန်ကို ဖော်ပြခဲ့ကြပါသည်။ မေးခွန်းဖြေကြားခဲ့သည့် မွေးမြူရေး လုပ်ငန်းလုပ်ကိုင်သူများ၏ ၁၀၀ ရာခိုင်နှုန်းက မုတ်သုန်မဝင်မီကာလတွင် ကြိုတင်၍ ထွန်ယက် ခြင်းနှင့် ထယ်ထိုးခြင်း များကိုပြုလုပ်ခြင်း၊ သီးနှံစိုက်ပျိုးခြင်းအတွက် စိုက်ပျိုးချိန် ပြောင်းရွှေ့ခြင်း စသည်တို့ကို ဖော်ပြခဲ့ကြပါသည်။ ရာသီဥတုပြောင်းလဲမှုကို လိုက်လျော ညီထွေစွာ နေထိုင်ရန်အတွက် ရေအရင်းအမြစ်စီမံခန့်ခွဲမှု အလေ့အကျင့်များအတွက် မေးခွန်း များကို မေးမြန်းရာတွင် ဖြေကြား သူများအားလုံး၏ ၉၂ ရာခိုင်နှုန်းက ရေကိုအကျိုးရှိစွာ အသုံးပြုခြင်း၊ ၎င်းတို့၏ ၈၈ ရာခိုင်နှုန်းက ရေကိုချွေတာ အသုံးပြုခြင်းနှင့် ၎င်းတို့၏ ၈၄ ရာခိုင် နှုန်း က ရေယိုစိမ့်မှုကို လျော့ချခြင်း စသည် တို့ကို ဖော်ပြခဲ့ကြပါသည်။ ရာသီဥတုပြောင်းလဲမှုကို လိုက်လျောညီထွေစွာနေထိုင် ခြင်းနှင့် သက်ဆိုင်သော မူဝါဒများ ကဏ္ဍတွင် ၁၀၀ ရာခိုင် နှုန်းသော ဖြေကြားသူများက အစိုးရမှ အကောင်အထည်ဖော်ဆောင်ရွက်လျက်ရှိသည့် ရာသီဥတု ပြောင်းလဲမှုကို လိုက်လျော ညီထွေစွာ နေထိုင်ခြင်းမူဝါဒများမရှိပါဟု ပြောကြားခဲ့ သည်။ သို့သော် Myanmar's NAPA၊ မြန်မာနိုင်ငံ အမျိုးသားရေမူဝါဒနှင့် ကျေးလက်ဦးစီးဌာန၏ ရေကဏ္ဍနှင့် ဆက်စပ်လျက်ရှိသော မူဝါဒများက ရေအရင်းအမြစ်စီမံခန့်ခွဲမှုကဏ္ဍတွင် ရာသီဥတုပြောင်းလဲမှုကို လိုက်လျောညီထွေစွာနေထိုင်ခြင်းနှင့် သက်ဆိုင်လျက်ရှိကြောင်း တွေ့ရှိရပါသည်။ ဥပမာ အားဖြင့် ရာသီဥတုနှင့် လိုက်လျော ညီထွေဖြစ်သော စိုက်ပျိုးရေး လုပ်ကိုင်မှုနှင့် ရေအကုန်အကျ သက်သာစေသော ရေပေးဝေမှု စနစ်များက တိုက်ရိုက်သက်ဆိုင် လျက်ရှိကြောင်း တွေ့ရှိရပါသည်။ သုတေသနရလဒ်များအရ ရာသီဥတုပြောင်းလဲမှု၏ ဆိုးကျိုး သက်ရောက်မှုများကို လျော့ချရန်နှင့် ထိခိုက် ခံစားရသူများ အားလုံး၏ လိုက်လျော ညီထွေစွာ နေထိုင်နိုင်မှုစွမ်းရည် မြှင့်တက်လာစေရန်အတွက် Disaster risk reduction, preparedness, relief and

rehabilitation ကဲ့သို့သော လုပ်ငန်းစီမံချက်များကို ထိရောက်စွာ အကောင်အထည်ဖော် ဆောင်ရွက် ရမည်ဖြစ်သည်။

Climate Change Adaptation on Water Resource Management: a case study of Pakokku Township, Magway Region, Myanmar

Khin Maung Soe¹, Sangchan Limjirakan²

¹Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation, Myanmar

²Environmental Research Institute, Chulalongkorn University, Bangkok, 10330, Thailand

* Corresponding author, e-mail address: khinmaungsoe.ecd@gmail.com

Abstract

The Earth's temperature has increased in recent decades leading to changing of climate. The adverse effects of climate change on natural systems have also become evident since the mid of the twentieth century. Water resources are mainly affected by climate change, particularly in the central part of Myanmar that faced with water shortage. The objective of the research is to study climate change adaptation on water resource management at the Pakokku Township, Magway Region, Myanmar. The four villages, namely Shin Ma Kan, Pan Tine Chone, Paung Laung Kan and Kyee were selected as the study areas because of their strong drought and water shortage in the dry season for decades. The 61 respondents were selected by using a purposive sampling method. An in-depth interview using a set of semi-structured questionnaires was conducted to obtain relevant data. Data obtained were analyzed using descriptive and content analysis. The study found that 98% of the respondents knew about changing of climate. Regarding climate change adaptation, 100% of government officers mentioned changing seed varieties resisting to climate change in agriculture sector. Considering water resource management practices adapting to climate change, 92% of respondents mentioned using water efficiently and 86% of them mentioned water saving. All respondents (100%) mentioned that there was no policy on climate change adaptation that being implemented by the government in the study area. However, the Myanmar's National Adaptation Programme of Action, Myanmar National Water Policy and the water-related policy of Department of Rural Development would relate to climate change adaptation on water resource management. For examples, climate-smart agriculture and water-saving irrigation techniques. The study would recommend that climate change adaptation plans should be properly conducted on disaster risk reduction, preparedness, relief and rehabilitation on water resource to reduce impacts and to enhance the capacities of all stakeholders to combat climate change.

Keywords: Climate change adaptation; Water resource management; Pakokku Township; Myanmar

Climate Change Adaptation on Water Resource Management: a case study of Pakokku Township, Magway Region, Myanmar

1. Introduction

Climate change has impacted on human and natural systems. Its effects include alteration in precipitation patterns, sea level rise, heat extremes, drought, storm, monsoon cycles, ocean currents, sea surface temperature, and river flows (Horton et al., 2017). According to the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2013), the Earth's temperature has increased in recent decades. In the Southeast Asia region, temperatures have also increased at a range of 0.14°C to 0.20°C per decade since the 1960s. Regarding the global and regional temperature trends, Myanmar has noticed nationwide warming since the 1950s. Climate change has adversely affected Myanmar's natural resources and livelihoods (Kreft, Eckstein, Dorsch, & Fischer, 2016). The increasing temperature, variable precipitation, rising sea level, droughts, floods, and extreme storms, have already affected all aspects of lives in Myanmar (Slagle, 2014). According to the Global Climate Risk Index 2015, Myanmar ranked the second most vulnerable country affected by climate change in the world calculated based on the recent 20 years (Kreft, Eckstein, Junghans, Kerestan, & Hagen, 2015). Recent extreme weather events such as Cyclone Nargis in 2008, extreme heat waves in 2010, and flash floods in 2015, impacted on society, ecology and economy of Myanmar (MOECA, 2015). Regarding the Myanmar's National Adaptation Programme of Action (NAPA) report (NAPA, 2012), the temperature in Myanmar has increased at an average of 0.08°C per decade over the last six decades. Myanmar's income relies heavily on the agricultural sector. The central part of Myanmar is the most water-stressed region of the country. Seasonal water scarcity is very common in this area (MNPED & MOH, 2011). The temperature is in the range of 40 to 43°C. The mean annual rainfall is quite low of about 500-1000 mm per year (Egashira & Than, 2006). Therefore, water scarcity always turns into a serious issue in this area. Water resources in the central part of Myanmar need to be managed necessarily for both domestic use and agricultural use purposes. The proper practices of water resource management in the context of climate change adaptation would need to be considered.

The study area composed of the four villages, namely Shin Ma Kan, Pan Tine Chone, Paung Laung Kan and Kyee in the Pakokku Township, Magway Region, Myanmar. It is a dry area with few natural resources due to the geographical condition (Department of Population, 2015). Pakokku Township is located in the latitude between 20° 54' 45" N and 21° 29' 40" N and the longitude between 95° 14' 00" E and 95° 10' 21" E with the altitude of 64.52 m above the mean sea level. The land area of the Pakokku Township is 1258.3 km². Agriculture in Pakokku is highly climate-sensitive (Fee et al., 2017).

In Pakokku Township, the highest temperature recorded was 45.10°C and the lowest temperature recorded was 8.90°C between 1987 and 2016. The average mean temperature was 27.81°C. The highest average temperature was 35.87°C and the lowest average temperature was 19.68°C. The annual average rainfall was 631.66 mm (Department of Meteorology and Hydrology, 2018). The study area is shown in Figure 1.

2. Objective

The objective of the research is to study climate change adaptation on water resource management at the Pakokku Township, Magway Region, Myanmar.

3. Methodology

The study areas were drought and faced with water shortage in the dry season. The respondents of the study were selected by using a purposive sampling method, which concentrates on people with particular characteristics who will better be able to assist with the relevant research (Bernard, Wutich, & Ryan, 2016). The total respondents were 61 including governmental officers, non-governmental organizations (NGOs) officers, and local peoples who are farmers, village heads, teachers, traders and employees. An in-depth interview was conducted between December 2018 and January 2019 by using a set of semi-structured questionnaire to obtain relevant data. The questionnaire was composed of three parts, including general information of respondents, climate change adaptation, and water resource management. Data obtained were analyzed using descriptive and content analyses.

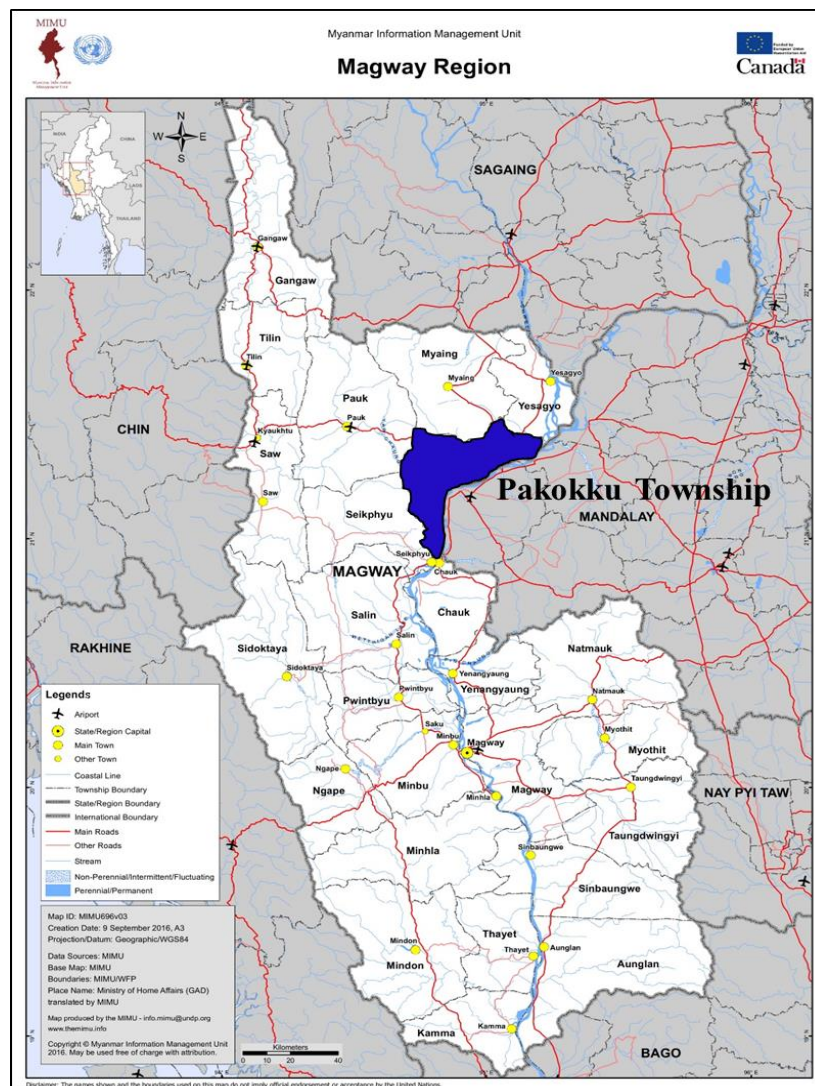


Figure 1. The study area; Pakokku Township (blue colour shaded), Myanmar (Myanmar Information Management Unit, 2018).

4. Results and discussions

4.1 Demographics of Respondents

The majority of respondents were male of 92% and female of 8%. The ages of the respondents were divided into five groups. 30% of respondents were in the age range of 51-60 years old, 26% in the age range of 61 years old and above. 25% of them were in the age range of 41-50 years old and 16% of them were in the age range of 31-40 years old. Only 3% of them were in the age range of 18-30 years old. In terms of education, 30% of respondents graduated from a secondary school, while 26% graduated from a primary school. The number of respondents who obtained a bachelor degree presented 20%, a high school 11% and did not go to school 10%. The occupations of the respondents were farmers (67%), government officers (15%) and the rest were teachers, employees, livestock husbandries, traders, and non-governmental organization officers.

4.2 Climate Change Adaptation

According to collected data on climate change adaptation, the study found that 98% of respondents knew about changing of climate. 100% of government officers mentioned that temperature has increased, rainfall patterns have changed, late onset and early withdrawal of monsoon have occurred in Myanmar, while 93% of farmers mentioned that they were getting more hotter days. 100% of respondents including teachers, employees, and non-governmental organization officers mentioned temperature increasing and sea level rising. In terms of the climate change impacts, 100% of respondents knew the impacts such as freshwater shortage, heat waves, crop production decreasing. 100% of non-governmental organizations officers mentioned that climate change impacts were heat waves and freshwater shortage. To adapt to those kinds of climate change impacts, 100% of government officers adapted to climate by living properly in extreme weather conditions, 95% of the farmers adapted to climate change by changing seed varieties resisting to climate change. Regarding the effects of climate change in the villages, 96% of the farmers mentioned heat waves and less water retained ponds in summer. The major impacts that are affecting in their villages were also heat waves and rainfall variation.

Regarding climate change adaptation, government officers mentioned changing seed varieties resisting to climate change, water-saving irrigation in agriculture and making good tillage in farms to maintain soil moisture content. While farmers mentioned living properly in extreme weather conditions, changing seed varieties resisting to climate change impacts as well. All respondents who work in livestock husbandries, traders and NGOs officers mentioned harrowing and ploughing before monsoon coming, changing seed varieties resisting to climate change impacts, changing sowing dates of crop plantation, and staying properly in extreme weather conditions. By altering planting dates and choosing seed varieties with different growth duration, farmers can adapt to climate change to some extent (Zou, Li, Gao, & Wan, 2012). Changing planting dates would be a practical adaptation to drought and water scarcity causing from changing of climate (Swe, Shrestha, Ebberts, & Jourdain, 2015). In semi-arid and arid regions, introducing new seed varieties would be made farmers' livelihoods better with more food security under climate change situation (2013).

Stakeholders participation in climate response actions are very crucial in conducting adaptation strategies to climate change (Manyani & Bob, 2018).

It can be concluded that climate change impacts in the study area were temperature increasing, rainfall patterns changing, people migrations, flash floods, storm frequency increasing, droughts, rainfall variability, late onset and early withdrawal of monsoon. However, the respondents did not know governmental policy to reduce climate change impacts. They need some researches on climate change, climate change awareness, and stakeholder participation in climate change response actions.

4.3 Water Resource Management

The study found that 100% of respondents used water from rainwater, pond water, deep tube well water, and water from river pumping project for their consumption. The ways to manage water resource in their villages were using water efficiently, reducing water leakage and water saving. 100% of respondents have faced with water resource problems such as less water retained ponds in summer and distances to water sources. In order to solve such problems, they took water from other villages and renovated village water ponds in summer by local government offices.

The United States Environmental Protection Agency (USEPA) stated that using water efficiently would benefit on environmental, health, and economy benefits (USEPA, 2000). Moreover, it would help to improve water quality, conserve aquatic ecosystems, and control drinking water resources. Using water efficiently, through behavior, if practiced broadly, would reduce effects of drought. The water metering system and piping networks have an advantage to encouraging water conservation, enhancing allocatively efficient distribution, and reducing water leakage.

4.4 Policy on Climate Change Adaptation on Water Resource Management

The study found that policies related to climate change adaptation is Myanmar's National Adaptation Programme of Action (2012). All respondents mentioned that there was no policy on climate change adaptation that being implemented by the government. However, the study found that the Department of Rural Development implemented its policy by digging deep tube wells to reduce water shortage for domestic water use conducted in Shin Ma Kan and Pan Tine Chone in 2017. Myanmar's National Adaptation Programme of Action, Myanmar National Water Policy (2014), and the policy of the Department of Rural Development (2017) would relate to climate change adaptation on water resource management in the study area. Myanmar Climate Change Policy (2019), Myanmar Climate Change Strategy (2018-2030), and Myanmar Climate Change Master Plan (2018-2030) have been launched in June 2019.

5. Conclusion

Myanmar has already affected by climate change impacts. Presently, the study area has no direct policy related to climate change adaptation on water resource management implemented. Climate change adaptation on water resource management includes climate-smart agriculture practices and water-saving irrigation techniques. The study would recommend that the action plans on disaster risk reduction, preparedness, relief and rehabilitation on water resource management should be properly conducted to reduce impacts occurred and to enhance the capacities of all stakeholders to combat climate change.

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