

**POLICY GUIDELINE ON DISASTER RISK REDUCTION
FOR CLIMATE CHANGE ADAPTATION : A CASE OF
KLONG YAN WATERSHED RESOURCE CONSERVATION
AND REHABILITATION NETWORK, SURATTHANI**

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**A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts in Environment, Development and
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แนวทงนโยบยการลคกัยพิบัติเพื่การปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศ : กรณิลุ่มน้ำ
คลองย่น จ้งหวัดสุราษฎร์ธานี



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ศิวพร พรหมแดน : แนวทางนโยบายการลดภัยพิบัติเพื่อการปรับตัวต่อการเปลี่ยนแปลงสภาพ
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ประเทศไทยเป็นหนึ่งในประเทศภูมิภาคเอเชียตะวันออกเฉียงใต้ที่ได้รับผลกระทบดังกล่าวในแง่ของภัยพิบัติ ซึ่งผลกระทบเหล่านี้ได้สร้างความสูญเสียต่อชีวิตและทรัพย์สินของประชาชนเป็นอย่างมาก ดังนั้น ในกรณีปัญหาดังกล่าว การจัดการน้ำภายใต้การปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศจะเป็นแนวทางนโยบายที่จะช่วยลดความเสี่ยงผลกระทบจากภัยพิบัติ จุดประสงค์ในการศึกษานี้ คือ เพื่อศึกษาแนวทางนโยบายการลดภัยพิบัติเพื่อการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศ ในลุ่มน้ำคลองยัน จังหวัดสุราษฎร์ธานี พื้นที่ศึกษาได้แก่ อำเภอวิภาวดีและอำเภอกีรีรัฐนิคม เนื่องจากพื้นที่ดังกล่าวได้รับความเสียหายจากน้ำท่วมมากที่สุดในช่วง 10 ปีที่ผ่านมา การศึกษานี้มีผู้ใช้ข้อมูลปฐมภูมิที่ได้จากการเก็บแบบสอบถามและการสัมภาษณ์เชิงลึกกับผู้มีส่วนได้ส่วนเสียจำนวน 29 คน ประกอบไปด้วย เจ้าหน้าที่ของรัฐ ผู้นำชุมชน ประชาชนชาวบ้าน เครือข่ายลุ่มน้ำ และองค์กรไม่แสวงหากำไร ด้วยการเลือกกลุ่มตัวอย่างแบบเจาะจงในการเลือกกลุ่มเป้าหมายในการศึกษา แบบสอบถามใช้แผนการป้องกันและบรรเทาสาธารณภัยแห่งชาติ พ.ศ. 2558 แผนแม่บทรองรับการเปลี่ยนแปลงสภาพภูมิอากาศ พ.ศ. 2558-2593 และแผนยุทธศาสตร์การบริหารจัดการน้ำ พ.ศ. 2558 เป็นแนวทางนโยบายในการวิเคราะห์ข้อมูลในด้านปฐมภูมิ และข้อมูลทุติยภูมิที่ได้จากการทบทวนวรรณกรรมซึ่งข้อมูลที่ได้จะถูกนำมาวิเคราะห์ผ่านรูปแบบสถิติเชิงพรรณนาและนำเสนอในเชิงร้อยละ

จากการศึกษาพบว่า 31% รู้จักแผนแม่บทการป้องกันและบรรเทาสาธารณภัยแห่งชาติ 2558 แต่อย่างไรก็ตาม 69% ไม่รู้จักแผนฯ ดังกล่าว จากประสบการณ์ของผู้ตอบแบบสอบถามได้แสดงความคิดเห็นถึงแนวทางนโยบายการลดความเสี่ยงภัยพิบัติในชุมชน คือ การสร้างความรู้ การเพิ่มความตระหนัก การมีระบบสื่อสารและระบบการเตือนภัย รวมถึงการสร้างกลุ่มเครือข่ายผ่านกิจกรรมของชุมชน นอกจากนี้ ในด้านแนวทางนโยบายสำหรับการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศในด้านการจัดการน้ำ ผลการศึกษพบว่า 24% รู้จักแผนแม่บทการเปลี่ยนแปลงสภาพภูมิอากาศของประเทศไทย 2015-2050 ในขณะที่ 75% ไม่รู้จักแผนฯ ดังกล่าว จากประสบการณ์ของผู้ตอบแบบสอบถามได้แสดงความคิดเห็นถึงแนวทางนโยบายที่สามารถนำไปใช้ในการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศในการจัดการน้ำในชุมชน คือ การเพิ่มความรู้และความเข้าใจ การฟื้นฟูป่าต้นน้ำ การสร้างกลุ่มเครือข่ายการอนุรักษ์และฟื้นฟูทรัพยากรธรรมชาติ นอกจากนี้ ในแง่ของแนวทางนโยบายการจัดการทรัพยากรน้ำ ผลการศึกษพบว่า 48.27% รู้จักแผนยุทธศาสตร์การจัดการทรัพยากรน้ำ 2558 แต่อย่างไรก็ตาม 72% ไม่รู้จักแผนฯ ดังกล่าว จากประสบการณ์ของผู้ตอบแบบสอบถามได้แสดงความคิดเห็นถึงแนวทางนโยบายที่สามารถนำไปใช้ในการจัดการทรัพยากรน้ำในชุมชน คือ การสนับสนุนความรู้การเพิ่มความตระหนัก การสร้างระบบบำบัดน้ำเสีย การสร้างฝายชะลอน้ำ การปรับปรุงระบบระบายน้ำ ดังนั้น ควรมีการเพิ่มความรู้และเสริมสร้างความตระหนักในการจัดการทรัพยากรน้ำเพื่อที่จะนำไปใช้เป็นแนวทางนโยบายการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศในการจัดการทรัพยากรน้ำต่อไป

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Siwaporn Promdaen : POLICY GUIDELINE ON DISASTER RISK REDUCTION FOR CLIMATE CHANGE ADAPTATION : A CASE OF KLONG YAN WATERSHED RESOURCE CONSERVATION AND REHABILITATION NETWORK, SURATTHANI. Advisor: SANGCHAN LIMJIRAKAN, D.Tech.Sc.

Thailand is one of South-east Asian countries that have been suffered from extreme events resulting from the impacts of climate change. One consequence of changes is the severity and frequency of extreme events leading to disasters in all regions of Thailand. These effects provided losses and damages at all levels. To solve such problems, water resource management under climate change adaptation has been set up under policy guidelines to reducing the disaster risk from the climate change. The objective of this study is to study the policy guidelines on disaster risk reduction for climate change adaptation on water resource management in Klong Yan Sub-Watershed, Surat Thani Province. Vibhavadee District and Kirirat Nikom District were the study areas because these areas suffered from severe floods for the past decade. Respondents of the study were applied by the purposive sampling method in order to select stakeholder's involvement. The number of respondents were 29 including governmental officials, local leader, local wisdom scholars, the network of watershed groups and non-profit organization. Data collection used in this study including desk study of secondary data and in-depth interviews of primary data by using a set of questionnaires. A set of questionnaires based on the National Disaster Prevention and Mitigation Plan 2015, Thailand Climate Change Master Plan 2015-2050 and the strategic plan on water resource management 2015. Descriptive research method was used for data analysis which presented in terms of percentage results.

The research found that only 31 % of the respondents were familiar with the National Disaster Prevention and Mitigation Plan 2015. However, about 69 % of the respondents were not familiar with this plan. They noted that effective policy implementation requires knowledge training, awareness raising, building communication systems and early warning systems and the creation of the network groups through local activities. In terms of policy guidelines for climate change adaptation on water resources, the study found that only 24.13% of the respondents knew Thailand Climate Change Master Plan 2015-2050. While, about 75 % of respondents did not familiar with this plan. They viewed that effective policy guidelines require increased knowledge and perception, restoring the watershed-forest, networking the conservation and rehabilitation of natural environment. Regarding the policy guidelines on water resource management, 48.27% of the respondents knew about the strategic plan on water resource management 2015. However, 51.72% of the respondents did not familiar with this plan. They noted that the policy implement requires encouraging knowledge and raising awareness, building the waste water treatment systems, building check dams, improving the waterway and drainage systems. Therefore, knowledge and raising awareness on water resource management should be enhanced on the policy guidelines for climate change adaptation on water resources.

Field of Study:	Environment, Development and Sustainability	Student's Signature
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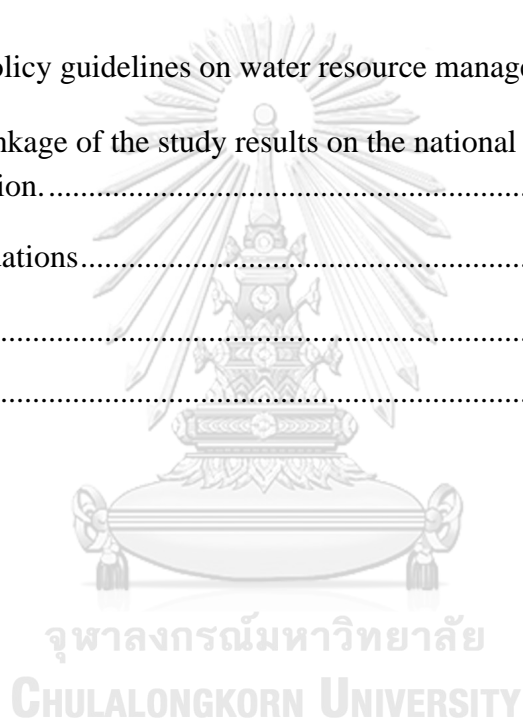
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LIST OF ABBREVIATIONS

BAU	Business-as-usual
DRR	Disaster Risk Reduction
ENSO	El Nino
ESCAP	Economic and Social Commission for Asia and the Pacific
GAP	Good Agricultural Practice
GCMs	General Circulation Models
FAO	Food and Agriculture Organization of the United Nations
HFA	Hyogo Framework for Action
IPCC	Intergovernmental Panel on climate change
IWRM	Integrated Water Resource Management
TDRI	Thailand Development Research Institute
NOAA	National Oceanic and Atmosphere Administration
SDGs	Sustainable Development Goals
UN	United Nations
UNISDR	United Nations Office for Disaster Risk Reduction
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
WSSD	World Summit on Sustainable Development

CHAPTER I

INTRODUCTION

1.1 Background of the study

Based on the Intergovernmental Panel on Climate Change AR4 reported to that the average surface warming, owing to increasing greenhouse emission at the atmosphere (IPCC AR5, 2014). It is likely projected to be increase in the range from 2⁰ C to 4.5⁰ C over the next 100 years. This phenomenon led to change on the earth environments. Water resources are essential factors for human life and are vulnerable resources on the of climate variability (IPCC AR4, 2007). The evidences from the IPCC AR 4 reported that global warming contributed to change the hydrological cycle through impact on the form, timing, quantity, intensity of precipitation pattern and temperature. Additionally, the IPCC AR5 pointed out that anthropogenic activities have also motivated the aggravated impact of fresh water, including land-use change, extending urbanization and overpopulation. Therefore, increased effects of climate change on water resources are composed of human activities and non-human activities. These affect the world change the hydrological system in terms of intensity, frequency, timing and quality.

According to the IPCC AR4, effects on intensive precipitation are expected to the risks of extreme events on water resources. The most well-known from these events is heavy flooding and prolong drought. This phenomenon would have consequent effects on traffic congestion, mudslides and landslides. In addition, human activities include human intrusion and economic development, would lead to increase losses and damages from extreme events (IPCC AR5, 2014). Conversely, some parts of regions, the precipitation rate would be decreased and temperature could be increased, owing the effect of climate change provided to shift the system of hydrological cycle and temperature. Because of rising temperature provided to increase vapors and reduce soil moisture as a result in the risk of water shortages. Groundwater is another resources on water recharge effected from flooding the climate-related variability (IPCC AR4, 2007). This event provided to the risk of low water level, leading lack of quality of groundwater in the future. Thus, the effect of climate change contributed to change the system of hydrological cycle as a result in the water-related problems.

In addition, the IPCC AR4 suggested that effects of climate variability contributed to changes in rainfall pattern both increases and decreases, leading to change on the runoff stream flow and volume. If the runoff seasons were shorter or early runoff, effecting a variability of socio-economic development and ecosystem. Furthermore, it effects the operation of exiting water infrastructure, including irrigation systems, reservoirs, flood-related structures, structural drainages (IPCC AR4, 2007). This aggravated impact led to the stresses on the way of life for people

who are rely on natural water to livelihood. Meanwhile, cropping producers are projected to reduce due to deficit on water irrigations, in particular during the dry season. This negative effect causes the slowdown of economic development. Next, the IPCC AR 5 also found that effects of climate change contributed to change on water raw, providing water qualities problems. Because of increased temperature on river stream by decomposition, organic production, nutrient cycling on river will impact water more nutrition and chemical as a result of risks of available water. Thereby, the effect of unusual climate on freshwater resources, leading adverse effects of development both water supply, human health and ecosystem.

In South-East Asia region, it found that the climate variability namely the variability of temperature and precipitations involved in ENSO phenomenon (Loo YY, et. al. 2015). This event caused to increase temperature, in particular during the dry season as a result of water shortages in some areas where are inefficient water demand. Conversely, El Niño, owing to more frequent precipitation has effected on variability of rainfall rates, causing flooding, landslides, and mudslides. Thereby, the effects of climate change contributed to change on precipitation trend and temperature, effecting the variability of natural disaster such as flooding and drought.

For Thailand, freshwater resources are essential resources because it is the main factor to moving forward the socio-economic country, including domestic use, agricultural productivities, transportation, tourism sectors, energy sectors (The policy committee for water resources management, 2015). At the same time, these resources are the most vulnerable resources to climate variability (IPCC AR4, 2007). In fact, changes on the reliability of water cycle effects on precipitation pattern, temperature and evaporation, causing the risk of extreme events such as flood events, severe drought. In 2011, Thailand faced the effect of climate change, causing heavy rainwater in the northern Thailand. The worse flooding flowed from the north to the central of Thailand, which is downstream led to flood inundation in all regions. These aggressive events affected on the overall of sectors, in particular agriculture products. As a result, decreasing productivities and economic losses from the report showed that the country suffered devastating flood around 14 million people were affected, hundreds of lives were lost and agriculture damages amounted to around US\$ 44 billion (ESCAP, 2012). Moreover, in a next few year, the country is expected to suffer the intensive drought that occurred an off-season drought in many areas due to the increased climate variability. Rainfall was further delay, particularly the area of downstream. These extreme events occurred in the middle of the rainy season as a result of average of the rainfall was lower than normal. The major dam decreases lower from the average of reservoir capacity and also lead to the water shortage crisis stems for the low level of water in reservoirs (The Department of Disaster Prevention and Mitigation, 2015).

Therefore, reducing exposure and vulnerability, leading to decrease disaster risk from the effect of climate change are necessary at all of levels. Disaster risk reduction is a crucial role to address risk driver, effecting all of development. And climate change adaptation associated with actions to decrease the climate change impacts in the long term. Thus, disaster risk reduction is action to reduce the exposure and vulnerability of climate extreme. And the same, increasing adaptive capacity will advocate the effective development in the long term. This research will provide the study current policy on water resources management to the effect of climate change, leading to disaster risk reduction for climate change adaptation.

1.2 Research objective

- To study the policy guideline of water management on disaster risk reduction for climate change adaptation in Klong Yan watershed resource conservation and rehabilitation network, Surat Thani.

1.3 Research questions

- How policy guideline on disaster risk reduction are.
- How to implement climate change adaptation.

1.4 Scope of the study

- The content of study will focus on policy guideline of water management to climate change.
- The study will highlight on disaster risk reduction for climate change adaptation.
- Data collection will be used from desk study and in-depth interview using questionnaires. The questionnaire used for the survey and in-depth interview.
- The target stakeholder with in-depth interview will involve in such as local leaders and households.
- Description method will be used for data analysis.
- Report writing.

1.5 Expected outcome

The expected outcomes of a study would be:

- Policy guideline on disaster risk reduction for climate change at the study area.
- Adaptive capacity on water management to climate change would be useful for further local communities in the future.

CHAPTER II

LITERATURE REVIEW

2.1 National Policy

2.1.1 National policy on disaster risk reduction

1) Hyogo Framework for Action (HFA) 2005 – 2015

The Hyogo Framework was the first plan as the policy framework on disaster risk reduction. The HFA aimed to building the resilience of nations and communities to disasters adopted by the world conference on disaster reduction at Hyogo, Japan. Therefore, this framework was the tools on prevention, mitigation, preparedness and vulnerability reduction including preparedness, response and recovery action at a cross of levels. The HFA composed 5 priority actions, including (UNISDR, 2018).

Priorities 1: making disaster risk reduction (DRR). This action implemented under mechanisms aiming a national and a local priority by undertaking. The action included (i) promotion of institutional mechanisms, (ii) development of polices and planning, (iii) community-based participation, (iv) decentralization of responsibilities and resources, (v) the assessment of human resources and capacities and (vi) supporting polices commitment and promotion of community participation.

Priorities 2: improving risk information and early warning. This action provided the risk reduction and the promotion of disaster resilience based on the knowledge of disaster and identification of disaster risk. The action included (i) developing information systems of risk assessment, (ii) developing indicator systems of vulnerability, (iii) the improvement of statistical information, (iv) supporting the early warning systems, and (v) integrated between governmental agency and decision-making at both the national and the local level.

Priorities 3: using knowledge, innovation and education to build a culture of safety and resilience. The supporting knowledge, innovation and education can create prevention and capacities from the impact of disaster. The action included (i) developing technical and scientific knowledge, (ii) studying assessment of vulnerability and impact disaster, (iii) promotion of the application of technology and (iv) supporting technology and innovation for guideline.

Priorities 4: reducing the risks in key sectors. Disaster risk factors associated with changing social event, natural phenomenal, economic condition. Therefore, reduced risks will help to resilience disasters. The action included (i) the promoting financial support, (ii) the strengthening social mechanisms, (iii) the integrated action and (iv) risk assessment.

Priorities 5: strengthening preparedness for effective response at all levels. The severity and frequency of disaster can be reduce by well preparedness with knowledge and the capacity building on disaster management. The action included (i) conducting innovative technology and knowledge, (ii) supporting the exchange information and collaboration, (iii) revising the policy and plans, (iv) supporting the emergency funds and (v) engagement of the participatory process.

2) Sendai framework for Disaster Risk Reduction (2015 – 2030)

The Sendai framework used as guidelines of disaster risk reduction. This framework was adopted on March 18, 2015 at the Third UN World Conference in Sendai, Japan due to the Hyogo Framework for Action 2005 – 2015. The Goal of Sendai Framework focused on protecting new risk, reducing existing risk and enhancing resilience through the implementation of integrated measures, including preparedness, response and recovery. Therefore, the Sendai framework has as the guidelines to prevent and reduce disaster risk with across sectors which can be summaries as follows: (UNISDR, 2018).

Priorities 1: understanding disaster risk. Disaster risk management have to be an understanding disaster risk with all dimensions of vulnerability, exposure, capacity, disaster characteristics. Clearing disaster will help to reduce the impact of disaster. The priority action on an understanding disaster risk included (i) the promotion of knowledge, (ii) the assessment of vulnerability, exposure and capacity and hazard types, (iii) the expansion of cooperation between local and scientific knowledge, (iv) supporting the partnership of disaster risk knowledge, (v) the awareness of disaster risk and (vi) supporting information and mapping technology.

Priorities 2: strengthening disaster risk governance to manage disaster risk. Disaster risk governance is a crucial role for prevention, mitigation, preparation, response, recovery. It supports collaboration and partnership in cross sectors through participation-relevant stakeholders. Therefore, the priority action on disaster risk government included (i) adopting laws and regulations, (ii) integrated laws with other sectors, (iii) supporting the participatory process, (iv) supporting the empowerment of local communities and (v) the promotion of budget allocation, (vi) the building role of community.

Priorities 3: investing in disaster risk reduction for resilience. The investment on reduction and prevention through structural and non-structural measure is important in order to increase the capacity of resilience. This action will reduce losses and damages from disasters. Thereby, the priority action on investment included (i) supporting the financial resources, (ii) allowing insurance systems, (iii) promoting infrastructure investment, (iv) strengthening the integrated planning and management of natural resources, (v) supporting land-use polices development and (vi) strengthening the disaster risk management.

Priorities 4: enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction. The increased preparedness is an essential part to recovery in the disaster risk. This action will help to rehabilitate through effective measures. Thereby, the priority action on disaster preparedness included (i) revising policies and plans, (ii) investing technological warning system, (iii) building community centers, (iv) supporting the role and mechanism of community, (v) training the voluntary groups, (vi) supporting the cooperation between multi-stakeholders and other related sectors and (vii) improving methods of preparedness and (viii) revising the international law and collaboration.

2.1.2 National policy on water resources management

From past to present, Thailand has used the national economic and social development plan in order to move forward the country’s development. The purpose of national plan is the guideline of nation’s development on economy, society and environment under security, prosperity and sustainability in the long term. This national plan included development strategies in terms of economic development, public administration, national security, technology and innovation, human resource, environmental issues and international cooperation.

Water management is one of the national development strategies under the environmental-friendly growth issuers. Thailand’s water policy aims to respond the water demand in the country’s development in all sectors. The national policy on water management can be summarized as follows:

The First National development plan (1961-1966) focused on investment-priority because the country’s need to improve and develop the facilities along with other developed counties. Therefore, the development highlighted the high rate of economic growth and investment infrastructure, namely industry projects, mining sectors, transportation developments, irrigation projects and other facilities. As a result, these development led to increase in Gross Domestic Product (GDP) of the value of goods and services in the county. (The National Economic and Social Development Plan, 1961-1966)

In terms of water management took into account the development of agricultural sectors because the government needs to improve agricultural products and to support employment-related agriculture. Therefore, water resource management was preparing for development of economy particularly agricultural sector and industrial sectors. The irrigation projects, namely Mae Klong, Cho Phraya Dam and Bhumibol Dam used for generate hydropower. In addition, the government began the expansion of irrigation schemes to other region such as in the North, the Northeast and the South respectively (Sethaputra et. al, 2001).

The Second Plan (1967-1971) remained to develop economic systems as first plan, in particular economic sectors. However, the development in this plan emphasized to distribute the project of agriculture at the remote area. The law also was improved for the country’s development. Therefore, the top-down authority was still the development strategy (The National Economic and Social Development Plan (1967 -1971)).

In context of water resources management was implemented under agricultural development. Land-use extension was urgently reformed due to water-demand sides in both agricultural products and industry sectors. Therefore, there were new projects to expend irrigation plans. Such the Sirikit Dem was initiated for developing the hydropower and consumption (Sethaputra et. al, 2001).

The Third Plan (1972-1976) continually extended to support the development of social and economic dimensions as a respond for changing projects. However, the economic growth was slowed due to aggressive-demand sides. Therefore, in order to maintain the balance of public expenditures with stability of the country, the government provided the national strategies, including (i) supporting economic stabilities and economic growth, (ii) reforming the social justice, (iii) creating employments, (iv)promoting the economic growth in particular the local region. Therefore, this plan mainly supported the labor force and also to create employments in the society and economic structure (The National Economic and Social Development Plan, 1972-1976).

For water resource management under the development of producing growth aimed to increase agricultural products for foreign market and to maintain the economic stability. Water resources were developed through the irrigation projects in order to increased water demand approach. In addition, budgetary distribution on irrigation development was prepared for new schemes in the future such as the Upper Cho Phraya project. Thus, water management was still developed by strategies emphasizing agricultural sectors and irrigation projects (Sethaputra et. al, 2001).

The Forth National Plan (1977-1981) due to emphasize on economic growth from first plan to third plan provided the problems in the country, namely unemployment, natural degradation, income disparity. Thus, the strategy of this plan remain focused on management and rehabilitation, including economic recovery, reducing the gap between income and disparities, improving quality of life, restoring environmental resources and natural management (The National Economic and Social Development Plan,1977-1981).

Based on rapid development, it directly affected on water resources in terms of deterioration. Water resource plans were management and rehabilitation on natural resources. Besides, the master plan on water resource management was used during that time. Therefore, water resource management in this plan not only focused on supply management but also on water resource rehabilitation (Sethaputra et. al, 2001).

The Fifth National Plan (1982-1986) aimed to export the economic growth with the new inspiration of semi-industry country; people-center development was mentioned in this plan. The economic development was pushed by money institution such as banks, co-operatives. At the same time, in terms of developmental society, there was the measure for the increased income distribution in the local regions (The National Economic and Social Development Plan, 1982-1986).

However, the problems on water shortage took placed because of increased consumption of water supply. Furthermore, many irrigation projects, namely small, medium and large scales took place for water supply in order to increase the standard of living in particular rural areas. During that time, there were many agencies to

implement on water resource management, namely Royal Irrigation Department (RID), the Electricity Generating Authority of Thailand (EGAT), the ministries of the Interior and others. In fact, there was no master plan for water management (Sethaputra et. al, 2001).

The Sixth National Plan (1987-1991) was still the productive-based development and marketing goals due to the potential competition in the international market. Such improving the capacity building in terms of human resources, science and technology, environmental resources, public administration, economic growth and private enterprises contributed to increase the production in the international market. At the same time, there was enhancing the market-based structures and products, the allocation of income and stability in particular provincial regions and rural areas. Thus, this plan still highlighted the production and market competition, leading the country's development at the international level (The National Economic and Social Development Plan, 1987-1991).

Regarding water management, there were the policy guidelines on water resource management at the watershed level. Many water-related projects used for development through governmental agencies. In addition, there were roadmaps for planning water management, supporting participatory process, developing information systems. However, the policy guidelines on water resource management was not achieved due to lacks of cooperation among water-related organizations (Sethaputra et. al, 2001).

The Seventh National Plan (1992-1996) aimed to promote the prosperity of economic growth, income distribution, human resources, increased standard of living and environment resource management under sustainable development Therefore, this plan focused the creation of balance in all dimensions of development, namely economic growth stability, the income of distribution and the developmental capacity in regard of human resources, quality of life and environmental management (The National Economic and Social Development Plan, 1992-1996).

In terms of water resource management, there were the policy guidelines on water management at the 25 basins. This guideline also led to improve the effective water management for irrigation and agriculture sectors. Besides, there were implemented on water resource development by governmental agencies such as water-pumping projects. Therefore, water supply can access as free resources during that time because its plan did not to restrict water consumption yet (Sethaputra et. al, 2001).

The Eight National Plan (1997-2001) significantly shifted in the country's development due to the global changes. The main context of this plan associated with enhancing provincial and rural development, strengthening for the quality of life, improving participation of community. Therefore, this plan highlights the paradigm of "people-center development" (The National Economic and Social Development Plan, 1997-2001).

In terms of water management, enhancing the distribution and allocation of water system were used for irrigation areas and domestic consumption in order to reduce wastage of water supply. Furthermore, there were encouraging the campaigns

for effective water uses or water-saving. In addition, raw water from industrial sectors and agriculture consumption were used for charging the real cost. Besides, the integrated between all organizations and agencies was developed at the both national levels in order to ensure in the work-related mechanism on water management resource. However, due to the rapid urbanization provided to increase the over-demands on water supply in many sectors, leading the water-related problems. Besides, lacks of coordination between organization and related-agencies contributed to problems the policy implementation on water management. Accordingly, the policy guidelines on water management did not achieved during that period (Sethaputra et. al, 2001).

The Nine Plan (2002-2006) remained to move forward the concept of sufficiency economy philosophy. It contributed to enhance development in the community areas leading to more income, occupations and the role of local communities (The National Economic and Social Development Plan, 2002-2006).

Regarding water resource management, there were integrated the organization-related water, applying innovation and technology, cost-recovery mechanisms and changing water supply. Therefore, this plan focuses the policy frameworks on water management in order to push its implementation to stakeholders, especially local community (Sethaputra et. al, 2001).

The Ten Plan (2007-2011) applied the Philosophy of Sufficiency Economy based on the sustainable development concept. This plan was not only due to increase the quality of life for resolving economic and social problems, but also to create social harmony lead to “the Green and Happiness Society” in the country. Therefore, this plan composed of 5 strategies that can be conclude as follows; (i) strengthening social and human development, (ii) building strong communities, (iii) improving production methods, (iv) co-existing between people and environment, and (v) supporting good governance. From water resource management under the strategy of environmental issues. The plan highlighted the integrated water resource management at all of river basins for both quantity and quality of water resource in order to respond the needs for a better quality of life. This national plan can be summarized (The National Economic and Social Development Plan, 2007-2011).

First of all, restoring and conserving watershed forest by supporting reforestation where is the upstream and cultivation such as vetiver grass on steep slopes. Second, there had monkey sheet in prevention and mitigation of flood events and improving preventing system and water draining in the city areas. This reason led to control waste water by restore and building capacity of wastewater treatment in the big city. In addition, creating mandatory law and regulation with effective water treatment from households and industry and charging fee of water treatment were policies to water management. Furthermore, setting warning systems and forecasting systems for disaster risk reduction created the effective water management. In addition, integrated the cooperation between central and local agencies with building knowledge of water management were the other way for water management. In addition, developing water resources for cleaning water at all of community such as

building capacity of retention areas, rehabilitating natural water resources and ponds were the example of water management in during that time.

The eleven Plan (2012-2016) was a part of Thailand 's long term vision (2027) that aimed to develop country's (i) to support the fairness of the society, (ii) to develop center-people approach, (iii) enhance the sustainable economy, (iv) to preserve natural and environmental system. The main context of this plan was applied to the Philosophy of Sufficiency Economy from the Eighth to the Tenth Plans. Thus, development strategies for national plan comprised of creating the fairness and quality, developing the knowledge, building the economic sustainability, supporting the potential agriculture sector, managing natural environment. Therefore, the key of developmental strategies consisted of creting human resource and social quality, economic restructuring and management of sustainable environment (The National Economic and Social Development Plan, 2012-2016).

In terms of water resource was a part form of natural management, including improving and restoring water resource throughout integrated water management. Another policy was increasing capacity of community in terms of climate-resilient society will be enhanced to cope with the impacts of climate change. This also includes increasing knowledge and management that will help local people to prepare the climate-related impacts.

The twelve of National Economic and Social Development Plan (2017-2021) has set up 10 strategies that reflect under the long-term goal of 20-year national strategic plan in order to move forwards for prosperity and sustainability. The first 6 strategies of the 6 policies consist of (1) developing human development, (2) setting fairness and reducing social inequality, (3) strengthening economy and increasing sustainable competitiveness, (4) promoting environmentally-friendly growth for sustainable development, (5) supporting national security for prosperity and sustainability, (6) increasing public management and good government. This plan corresponds with Majesty the King's Philosophy of Sufficiency Economy to ensure in terms of moderate, rational, and self-immune based on the Middle Pathway and people's centeredness. In addition, 12th plan has corresponded the principle of sustainable development that is undertaken in UN Sustainable Development Goals (SDGs) under "2030 Agenda for Sustainable Development" (The National Economic and Social Development Plan, 2017-2021).

In terms of water resource management are under the 4 strategy on environmentally-friendly growth for sustainable development. The context of water resource management in the 12 national plan can be summarized as follows:

- Accelerating the announcement of the draft water act to serve as strategy for national water management by reviewing plans or projects that associated with governmental policy, local administration, the committee of river basins. This included the strategy plan for development and national water management, the national water crisis (flood, drought, and waste water). Setting up data center for national water, the budget policy on integrated water plan.

- Accelerating the integrated water basin plan at all of 25 basins by the national committee for water resource management to drive the framework of water management and development, reviewing plan or projects to both normal and crisis plan, building networks and corporation with public sectors, private sectors, non-government organization, local community, local public administration and government agency.
- Driving Strategic Environment Assessment (SEA) to respond making decision at policies, plans and projects for appropriated areas .This is to be done for development at basin scales to consider sustainability and capacity of ecosystem and the way of life in community.
- Enhancing water uses and allocation at in-irrigation areas and out-irrigation areas in order to build high values (i) changing types, patterns, methods of cultivation to fit for water capacity, characteristic areas, zoning, (ii) supporting new theory agriculture, (iii) conducting water treatment and recycle water at industry areas.
- Increasing the effective storage of water budget and the distribution by developing small and medium ponds (i) take prior to local communities where are still lack of water supply by using water surface, groundwater and local irrigation in order to reduce water shortage, (ii) studying the economic possibility for water diversion between the national basin and international basin under considering balance, stability and participation at all levels.

2.2 Climate change

2.2.1 Background of climate change

The United Nations Framework Convention on Climate Change (UNFCCC) defined climate change as “a change of climate, which is attributed directly to human activities that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UN, 2017).

According to the Intergovernmental Panel on Climate Change AR 4 (IPCC AR4, 2007) found that the average of global warming is likely to be increase from 2 °C to 4.5 °C. This information used to support other scientific issues. For example, the National Oceanic and Atmosphere Administration (NOAA) expected that the year-to-date globally averaged land surface temperature was 12.7 °C (54.9 °F) above the 20th century average (NOAA, 2017). In addition, (Koontanakulvong et. al, 2013) also pointed that the global average temperature to climate variability has increasingly considered since the end of nineteenth regions. They used to general circulation models(GCMs)that predicted in the next 2050 at Asia countries found that temperature, precipitation and runoff has switched on the range of + 1.0 to + 4.5, -

10% to +20 % and -5 % to + 30%. Thereby, there was many evidents from scientific community that are confirmed the global temperature has likely increased since the last nineteen centuries and will be sharply expected in the next twenty centuries. The IPCC AR5 (2014) has continually study evidences to support that climate-related impacts are likely to be intensified with direct and indirect to human beings and result in risks across sector and regions, namely risk of death, severe sickness, extreme events, mortality and morbidity, food security, water resources, losses of livelihood and income, losses of marine system. Koontanakulvong, et. al. (2013) also confirmed that increase temperature has led to more vulnerable to climate change. These changes have contributed to extreme events, namely heavy floods, prolong droughts in many areas and due to dramatic damage to human life and property. Therefore, most of information is projected that global temperature have warmed result from greenhouse-gases emission contributed to the effects of all of system both losses and damage. Such natural disaster included floods, droughts and landslide, due to loss and damage into life and assets. In addition, the extreme weather that is small changes in average conditions can have big influence on extreme events. This event effects in the short-term in terms of condition can link with global atmospheric and oceanic circulation features such as the El Nino/ Southern Oscillation (ENSO) phenomenon. And in the long term, they are the effects between sea surface temperature and rainfall pattern that suggested as a possible cause of long, dry regimes (Ramamasy and Baas, 2007).

2.2.2 Climate change in Thailand.

Climate change has dramatically affected to different countries all around the world and Thailand is one of South-east Asian countries that have been faced with the multiple impacts of climate change. Marks (2011) examined the result of the study based on climate simulation in the next 2050 years in Thailand. He found that the average of daily maximum temperature will be increased around 1.2 °C to 1.9 °C. In addition, Chinvanno, et.al. (2009) also developed local models by using SRES A2 and B2 scenarios on climate projections in the next 2010-2100 years. They found that Thailand and surrounding countries are likely expected to change temperature, precipitation rate and sea level rise, especially in the central and lower North-eastern region. The local temperature has rising between 0.4 °C and 4.0 °C in the next 100 years. Besides, they also noted that the average temperature will be increased between 33 °C - 35 °C in the early 21 centuries.

Marks (2011) reported that the pattern of precipitation rate in Thailand will likely to be changed as a result in the frequency and severity of disasters. In addition, Limsakul, et.al. (2016) used GCM-GFDL-ESM2M GCM-MPI-ESM-LR and GCM-Had GEM2-ES Models to analyze the annual rainfall in South-east counties in the next 2006-2100 years. They found that annual precipitation in Thailand are likely to be change. While, total precipitation rate during on November to April likely increased in across country.

Maijandee (2013) examined the changes of precipitation and temperature in Thailand in the next 2020 – 2029 years by using MM5-RCM models. The result of scenarios found that in the rainy and summer season are expected to change the increased temperature and decreased precipitation rate at the North, West and Northeast region of Thailand. Meanwhile, Central and Eastern of Thailand are projected that precipitation are less than other region during in the rainy season.

2.2.3 The effects of climate change.

i. Agricultural production.

Thailand is one of South-east Asian counties that agriculture sectors is an important role for economic sectors and 32 % of Thai's population depends on agricultural productions for livelihoods. However, the effects of climate change creates the damages on economy sectors (The Strategic Plan on Thailand Water Resource Management, 2015)

Attavanich (2013) reported the effects of climate change on agricultural sectors in Thailand. He found that the summer season will be early period meanwhile winter season will be the late month. This event lead to negative effects to farmers and their agricultural yields. He also expected that many provinces in Thailand, namely Surat Thani, Chiang Mai, Chumphon, Rayong, Chachoengsao, Songkhla, Chanthburi, Nakhon Si Thammarat, Trang and Suphanburi will be experienced from the worst affected of climate change.

Marks (2011) reported the effects of climate change due to change EL-Nino and La-Nina phenomenon in Thailand which will be increased intensity and frequency every four to ten years, leading crop damages. Rice products are likely projected to be faced by change of precipitation pattern and temperature, leading new-born diseases with agricultural yield. Hence, the effect of climate change on agricultural production put Thailand's crops at risk of economy and livelihood.

ii. Water resources

The ESCAP (2012) reported that water resources are the primary component in the climate system because they are the main factor to link with other systems such as atmosphere, biosphere, cryosphere and hydrosphere. However, only 2.5% of water is available for supply uses. Brekke et al (2009) stated that climate-related change on water resources associates with various sectors, leading positive or negative impacts. Moreover, IPCC AR4 (2007) refer that climate change is expected to change on the timing and patterns of precipitation, temperature and evaporation. These impacts will influence water cycles in global environment throughout change in runoff, groundwater, and water supply.

The IPCC AR2 (1996) reported that change on precipitation is likely to increase in higher latitudes resulting in more annual runoff. In contrast, some lower latitude areas may face reduction and shortage in runoff. On the other hand, IPCC AR4 (2007) suggested that the projection of climate change in the future on precipitation pattern, runoff, and water level has continued uncertain.

The ESCAP (2012) pointed that counties in Asia-Pacific regions have been likely influenced on uncertainty of unusual climate contributes to environmental system and people through water resources.

The Policy Committee for Water Resources Management (2015) reported that Thailand has been continually suffered from water-related problems since 1967. This event still occurs in every year and expects to increase in a severity in some areas. The worst effect of climate change on water resource, for example, is water shortages in 2013. It found that around 7,490 out of 70,372 of the villages did not have enough for water supply during that period. In addition, a change in precipitation pattern are likely due to flood events. Additional effect of climate change on water resources lead to agricultural damages, considering approximately 17,000 per year (MOAC, 2012).

Peng, et.al. (2004) confirmed that the impact of climate change provides to water shortage, leading to the problem of water management in irrigation system and agricultural sectors. The Policy Committee for Water Resources Management (2015) reported that during in 2008-2013, Thailand faced with more the severity of drought. The total area suffered from severe water shortage more than 6 time in 10 years.

Arnell (1999) used climate and hydro simulations as HadCM2 and HadCM3 scenarios to projection in the next 2025-2050 years. He found that rising temperature relates to climate change leading change of precipitation, duration of snow covers. The result of the scenarios showed that the average annual runoff will enhance in the high latitudes counties such as Africa, Asia, and Southeast Asia regions. Conversely, the annual runoff will decrease in mid-latitudes and Subtropical areas.

Koontanakulvong, et.al.(2013) used the MRI-GCM model to predict the future climate and evaluating the impacts of irrigation projects .The found that rainfall pattern has continually changed. These effects lead to decrease the water level on dams and water user in the dry season. Such Yom, Nan and Chao Phraya Basin would be also effected on climate change. Therefore, effect of climate change on water resources will occur through inter-like factors in terms of inadequate water supply or excessive resource, leading water-related problems.

iii. Human Health

Marks (2011) reported that impacts of climate change on health are another health-related risk. He examined that rising temperatures in Thailand provide stress, leading injuries and sicknesses. He also found that in 2008 Thai's people faced to illnesses from water-related shortages, casing the impact of climate change. In addition, Langkulsen, et. al. (2010) explored the impact of climate change on health problem that the increased temperature in Thailand causes health-related exposure, leading to chronic-health diseases such as cardiovascular and heart failure. They found that people are work in outdoor places during the noon o'clock at around 34.6 °C are likely to heat exhaustion, leading heatstroke. Thus, rising temperature are likely supposed to health-related risks, particularly heat stress, high pressure, and new-borne diseases.

iv. Natural Disaster Risks

Limsakul and Singhruck (2016) reported that the effect of climate change in Thailand will increase in a frequency and severity, leading disaster risk. They studied the impact of natural disaster by using the total data of precipitation rate during 1955-2014 and found that amounts of precipitation were less frequent many regions of the country. However, the study also found that their extreme events will occur more intense during the rainy season. Kure and Tebakari (2012) studied the impact of climate change on hydrological cycle in the Chao Phraya River Basin, Thailand. They found that increased global temperature will become to change on temperature level and precipitation pattern. He used climate models to predict the climatic system in the future. As a result of model found that rainfall rates at Chao Phraya River Basin will likely to be increased. The change in the pattern of season and precipitation is likely expected water quality problem.

Marks (2011) reported that a change on precipitation rate provided to sea-level rise. He suggested that Thailand was the risk of sea-level rise around 12-22 cm .in particular the area near the ocean. In addition, rising sea level also reduce the water quality in the coastal community. He confirmed that saline intrusion from the sea will contaminate underground water at Thailand. Therefore, the impact of climate change on water quality will increase the salinity of coastal area, casing saltwater intrusion, moving saline water into freshwater resources.

2.2.4 Climate change adaptation

Adaptation associated with the action of the unavoidable impacts to climate variability. There are measures or methods to adjust activities, in particular vulnerable sectors in order to reduce the vulnerability and to increase capacity. (ESCAP, 2012) pointed that the adaptation actions are activities or operation of adjustment to natural disaster, leading strategies. These strategies highlight to reduce vulnerability and exposure on impacts of climate change. Similarly, Ford et al. (2011) provided the definition of adaptation is an implement of strategies to handle the results of the climate variability. This activity of adaptive capacity includes increasing awareness, promoting research, enhancing partnership, supporting risk reduction, strengthening monitor and promoting institutions.

The IPCC AR4 (2007) and Burton, et.al. (2002) defined adaptive capacity as “the ability of a system to adjust to climate change, variability and extreme events to moderate potential damages, to take advantage of opportunities, or to cope with the consequence”. Armitage (2005) provided the same definition of adaptive capacity in terms of community management as “a crucial aspect of resource management that reflects learning and ability to experiment and foster innovative solutions in complex social and ecological circumstance”.

Bennett, et. al. (2014) defined social adaptation as “measures of social resilience and the means to reduce the vulnerability of social institutions, communities, groups, or individuals to environmental, social, political, or economic

changes, shocks, stresses, or trends. The IPCC AR4 (2007) suggested that effective adaptation of strategies is depend on different situation such as location, environment, geography, economic factors and climate risk.

In addition, Adger, et. al. (2005) state that adaptation measures are both preparation and responsibility for risk events. This action is capacity building that provides to adapt in terms of ability of individuals, communities, nations. In addition, Smit and Pilifosova (2003) also suggested that adaptive capacity is an important action in order to reduce the vulnerability and to increase the ability in a long term. Consequently, the context of adaptation has associated with the process or actions to adjust in social, economic and environmental dimension to climate change.

i. Planning adaptation

The ESCAP (2012) suggested that plans and policies is the framework to reduce the adverse impacts of climate change through methods or action strategies. Smit and Pilosofova (2001) stated that the planning adaptation should consider action through laws and regulations. Burton and Development Programme United Nations (2005) described planning adaptation as follows:

- The plan has to point on the current need, vulnerabilities and climate change risks.
- The planning adaptation should consider more efficient and less expensive than design plans.
- The planning development not just consider climate change, but also handle vulnerability and expose of climate events.

Adaptation Policy Assessment

Adaptation policy in the context of climate refers to activity by governmental agencies to order or mandate for reducing vulnerability of climate change .This action includes law, regulation, legislation and incentives (Burton, 2002).

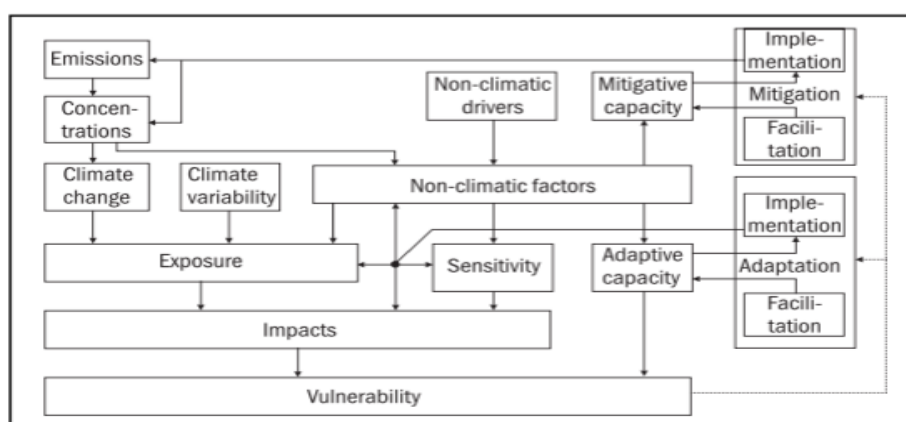


Figure 1 Adaptation in climate change issues.

Sources: Smit and Pilifosova, 2003.

This framework is divided many conceptual elements and each component has linked to backward and forward process. Adaptation Policy framework can be concluded as follows:

The beginning of concept starts from scenarios of carbon emissions and became the GHG concentrations in the atmosphere. This process provides climate change and climate variability in terms of spatial and temporal impacts. In addition, their exposure of a function to climate depends on location and level of climate variability. The sensitive of a function displays climate impacts and relationship that is contributes to exposure and sensitivity. Moreover, non-climate factors namely social, economic, environmental, and political and technology are impacts by vulnerability to climate change.

Therefore, two strategies of responsibilities for climate change are adaptive capacity and mitigate capacity (Burton et. al, 2002). Adaptive capacity refers that adaptive capacity is the ability of a community, region and system to adjust the effects of climate variability (Smit and Pilifosova, 2003). This use of definition has contributed to capacity to cope with climate change, namely extreme and uncertain events. Hence, the way led to reduce variability's and support sustainable development. The IPCC AR5 (2014) and Burton, et. al. (2002) refer mitigation to measures or strategies for reducing GHG emission in the atmosphere. Therefore, this policy is similarly the IPCC AR4 (2007) that confirmed the strategies of adaptation and mitigation can reduce the climate risks. This measure includes development of technology, study research that can cooperate at all of level with polices and action plans from the public citizen through governmental, national, international level. In addition, Burton, et. al. (2002) supported the conceptual adaptation to climate change by referencing the United Nations Framework Convention on Climate Change (UNFCCC) that is two strategies to respond for climate change. The first is mitigation method. This action is the reducing greenhouse gas of emission in the atmosphere. And another measure is adaptation. This action is reduction of vulnerability to climate variability. Therefore, adaptive policies assessment is used to mitigation and adaptation in the context of climate change can be concluded as follows:

- Combining strategies that decreased climate change and the vulnerability of systems.
- The conceptual framework associated with stakeholders to adjust and mitigate behavior under vulnerability to climate change.

The UNFCCC (2005) defined adaptation in terms of technology as “the application of technology to reduce the vulnerability, or enhance the resilience, of a natural or human system to the impacts of climate change”. Modern technology can help to increase the capacity building on impacts of climate change. The UNFCCC (2006) divided technology on adaptation into two-forms. Soft technology includes insurance measures. Hard technology includes irrigation systems, early warning system. Smit and Pilifosova (2003) suggested that technology on adaptation has a crucial role to respond capacity building to climate change because they directly and

indirectly provide abilities to reduce and manage severe impacts of climate variability. These technology include early warning systems, irrigation systems, mapping hazard, flood control measures. Consequently, the development of technology can reduce their impacts of climate change, leading potential adaptation in the long term.

Few, et. al. (2007) defined participatory process as the activities deals with stakeholder engagement in terms of decision-making and action. This process is a crucial role in order to cope with uncertain climate at all of levels in the society. The stakeholders' participation composed discuss, meeting, asking, and planning actions to express their points in the forum.

Armitage (2005) described adaptation actions under the community management as follows:

- providing knowledge and lessen learn to cope with climate variability and extreme event.
- developing or support different diversity.
- gathering knowledge both international and local subjects.
- maintaining a change for your system in the way of sustainability.

The IPCC AR5 (2014) reported that economic factors can support adaptative capacity to the impact of climate change. This measure included financial supports, funding, investment, private sectors, partnership of finance, loans, subsidies, payment for environment services, enhancing resource pricing. The FAO (2014) also support revenue factors that can help households more income, leading disaster risk reduction in the future.

The UNISDR (2007) stated that knowledge and eduction will help to build a culture of safety and resilience at all levels. Knowledge used for building perception and understands in risk management through training. Elias, et. al. (2009) noted that the local knowledge will help commnunities to manage natural hazard such as prediction of storms from the observations in the sky, wind or sea. In addition, the IPCC AR5 (2014) highlighted that knowledge is one of the most adaptation measures to cope with climate change impacts.

2.3 Water resources management.

2.3.1 The background and concept.

Over the past several decades, the concept of the Intergrated Water Resource Management originated and more attention at the International Water Conference. In the 1940s, an early concept of IWRM occurred when the Tennessee Valley Authority began to expand the water resources in the region. After that in 1977, the UN Conference on Water was adopted in Mar Del Plate. This conference highlighted to water supply and sanitation. In 1987, the Brundtland Report of the World Commission on Environment and Development stated the paradigm of “water” in terms of pollution and water supply. Fifteen years after the Mar del Plate conference, water issue was back on the International conference on Water and the Environment

(ICWE) in 1992, Dublin. The meetings pointed out the action at local, national and international levels under the following four principles (Savenije and Van der Zaag, 2008).

The Dublin Principles with the Mar del Plata Action Plan were led to basis in Rio de Janeiro at the UN Conference on Environment and Development in 1992 under the concept of integrated water resources development and management. This conference highlighted that water resource should be addressed in a basin-related context, considering the fundament of good governance and public participation. UN Water (2017) in 2015, the form of sustainable development adopted in the context of the Sustainable Development Goals (SDGs). The mission of water-related SDG target included (i) to support and strengthen the participation of local communities in improving water and sanitation management, (ii) to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes, (iii) to implement integrated water resources management at all levels, including through trans-boundary cooperation as appropriate and (iv) equitable access to safe and affordable drinking water. Therefore, since the UN Conference on Water in Mar Del Plata the global community's increased the water-related concern. This phenomenal provides the challenges of water resources management under the sustainable development in order to solve water crisis.

Rahaman and Varis (2005) defined the Technical Advisory committee of the Global Water Partnership at the Johannesburg World Summit on Sustainable Development (WSSD) Intergrated Water Resource Management (IWRM) as “a process which promotes the coordinated development and management of water, land and related resource, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and environment”. Thomas and Durham (2003) defined the IWRM as “a sustainable approach of the water management that recognizes its multidiscipline character-time, space, multidiscipline (science/technology) and stakeholders (regulators / users/ providers/neighbors) and the necessity to address, embrace and relate these dimensions holistically so then sustainable solutions can be brought about”. In addition, Setegn (2015) defined integrated water resources management as “the process of promoting the coordinated development and management of water, land, and related resources, to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. Therefore, the context of water management refers that the participatory planning and management based on stakeholder's decision to maintain and improve, an environmental resources and socioeconomic development.

The ESCAP (2012) offered the strategies on water management, including structure and non-structure methods. Non-structure refer to policy guidelines and good-government, water frameworks, regulations, laws, incentives, community empowerment, local knowledge, use-pay system and insurance. Conversely, structure methods refer to the water-related structure such as river channels, roof-water harvesting system, conservation ponds, catchment conservation, and reinforcement of

dams. This method will help to control, maintain, and allocate water flow for water consumption.

2.3.2 Water-related policies

The ESCAP (2012) pointed that the water resource management need policy approach to stakeholder in order to ensure for sustainable water development. In addition, Wouters, et. al. (2004) proposed that water resources management need to laws and policies in order to ensure a sustainable development. Furthermore, (Savenije and Van der Zaag, 2008) suggested that water management required the policy measure under integrated waterway. They pointed that the key policy toward the integrated water management. Therefore, policy option will help to push the integrated water management through accountability, government planning and management under the distribution of water resources efficiently.

Serageldin (1995) provided policies on water management in terms of “pollution fee” or the polluter-pays principle. Due to economic growth contributed to scarcity of water supply thus changing from water as a free to its economic value as a resulting this revenue are reflecting to support technical experts, water-related investment that will be ensured the water supply for future generation. The ESCAP (2012) confirmed that user-pay system will be reduced the stress on water resources by a high price on water. This action provides minimized impact on poor communities. Batchelor (2007) concluded the principle of water governance that can be summarized as follows:

- Openness and transparency : water organization and water policy should base on the transparent manner, particularly in terms of financial-related water comprehensive communication.
- Public participation should be relied on the water policy, including conception of implement and evaluation on water management.
- Water policies and activities must be coherent with political leader and stakeholders to work together.
- Equitable and ethic: accessing water resource between stakeholders and economic sector should be observed under the policy implement and development process.

Wouters, et. al. (2004) proposed the guidelines on water resources management as follows:

- The distribution or allocation of water for conservation of ecosystem, including rehabilitation of degraded river basins.
- The allocation of water from marginal boundaries to urban area.
- The capacity of innovative and technology that deals with allocation of water supply, namely water banks.
- The protection of water loss from overconsumption by trans-basin diversions measures .

- The protection of minority group or indigenous people who have value tradition to save water basins.
- The holistic water quality and quality regulation.
- The strategy and cooperation of adaptation to climate change .
- The adaptive capacity, transparency, accountability with the decision-making implement.

Loucks (2000) proposed the principle of water management, including (i) cooperated and collaborating actions with all of stakeholders, (ii) supporting the restoration and conservation of environmental ability, (iii) promoting the collaboration and actions with multidisciplinary groups, (iv) recognizing the economic, social and environmental dimension, (v) integrating and improving science-based knowledge and research study into decision- making and (vi) developing monitor and evaluation into decision.

Gourbesville (2008) apply the conception of water management in a study of the World Bank (2004) that can conclude as follows:

- The institutional framework refers to the level from local institution to international agencies, responding laws, regulations, human rights, standards on water resource for the maintenance, the conservation, conservation and management.
- The management means include laws, regulations, plan, financial support, methods standards, knowledge, information systems that provide the effective water distribution, use and maintenance for effective participation of stakeholder groups on water resource management. The development of infrastructure benefits for reducing extreme events such as floods and droughts, for various water supply, for water resource quality and hydrological resource conservation.
- The policy economy and reform on water management highlights on the allocation of costs and benefits on encouragement with resource and sustainability.

2.3.3 Public participation

Public participatory process is another method on water resources management under the stakeholder's involvement with all sectors. Sucharidtham and Sriwichailamphan (2015) define the definition of participation as "an individual of each level practice by participating in the planning, organizing, directing and controlling the performance of each part". Thus, the participatory implement is the way that stakeholders work together as a consequence in experience, capacity, knowledge, the implementation of administration, development.

Sucharidtham and Sriwichailamphan (2015) proposed the water resource management in terms of participatory process by planning, organizing, directing and controlling, resulting stakeholders work together effectively. They found that the local participation provided the social network between the leader and stakeholders, which led to cooperation, communication, the exchange of information and knowledge with

all of sectors. In additions, they also confirmed that decentralization and stakeholder participation are vital for water resources management. They suggested that stakeholder participation led to generate ownership, maintenance, corporation between local knowledge and situation on water resources as a result in building capacity, transparency, accountability and institution in the community. He provided an example of participatory process in river basin through “water committee”. This activity contributed to the role and responsibility in your basin.

Pahl-Wostl, et. al. (2007) found that the concept of social learning provided as communities practice”. They recommended that the social learning and local knowledge are crucial role on water resources management through participation process. This method led to attitudinal and behavioral changes in personal performance as a result in the learning together to manage together in communities. In the context of water management, social learning contributed to the disciplinary collaboration between stakeholders and water resource management. Moreover, (Al Radif, 1999) suggested the measure of water resource management under sustainable development which was demand-driven approach. The main of this management is to set up multiple-disciplinary method with all of levels to communicate on water resource, including consensus on the maintenance of ecosystem and preservation of water resource. This method leads to agreement in different prospective with water-related issuers and that contributed to integrate from views of user groups to policy-maker.

Cosgrove and Rijsberman (2000) reported that water management into our vision for water and life in 2025 was forward by the empowering stakeholder in communities, namely man and woman to determine the level of way for water-use activities.

Sucharidtham and Sriwichailamphan (2015) purposed the measure of the integrated water resource management on participatory process known as “POSDCORB” which can be applied on water management as follows:

- Planning (P) is the activity to direct the operational plan or framework forward the goal.
- Organizing (O) define as the structure of organization that have different position to work together.
- Staffing (S) is the person who manage natural resources, including stakeholder groups, leader, and organization.
- Direction (D) is to the way of command, control, order and operation.
- Coordination (Co) is the cooperation between personal performance and other stakeholders as a result in activities in the communities and leads to the mission.
- Responding (R) refer the performance report at the different department or organization to perform information to the member.
- Budget (B) is the management of financial budget and cost expense on water resources.

Thereby, participatory process is essential for stakeholders, resulting cooperate with multiple water uses, to ensure a fairness and sustainable allocation of fresh water. Cooperation among political leaders, decision-makings, conservation groups, scientists, economists, academic institution, media networks and general public will participate in order to ensure the accessibility of water resources.

2.3.4 Demand management

Managing demand on water management includes water-efficient technology, water knowledge management, adopting cost recovery polices. Loucks (2000) suggested that water sustainable management need to consider the other factors due to a various economy, ecosystem, social respond and physical objectives, water management cannot avoid the effects of this factors.

Loucks (2000) provided the management of water resources in terms of modern technology, including computer-based information, simulation, models and specific programs on water management used for analysis current situation in order to predict future impacts of water policy and planning in the next future. This innovative technology contributed to the graphic-related framework, resulting output of these analyses that were used for integrated visions between concerned and interested stakeholders and leads to the decision-making discussion. This study supported water management in terms of science and innovative measure to support technologies, methods, and experience for water-related management. Therefore, innovation in terms of scientific and modern technology will contribute analysis to problem-based solution on water resource (Cosgrove and Rijsberman, 2000).

Loucks (2000) found that training and education is a key action on sustainable water management in a long-term. Because of planning and managing water resource need to develop expertise and water resource management need to knowledge as capacity-building management. Therefore, knowledge and education will help the stakeholders to create the ideal on water management, including adaptive capacity to the effects of extreme events.

2.3.5 Managing water resources at the watershed scale

Managing water resources at physical scale is another strategy that the integrated land, water, upstream, downstream or river basins because change in a part of areas can have effecting on stockholders and environmental circumstances as well. Therefore, managing water resources need to identify the multiple dimension in order to sustainable water management. Thomas and Durham (2003) refer time and space dimension that used for water resource management in the unit as river basins or watersheds. The both of multidiscipline dimension considers a various factor to be used for decision making process, including the socio-economic parameters, an impact of environment, law and regulation, health problems, science and technology and political issue. The stakeholders dimension mentions the people who are involved decision process. Besides, Savenije and Van der Zaag (2008) suggested

water management in holistic method that need to consider from the many different perspectives and the context of dimensions under effective decision and management. They provided the measure on water resource management into four dimension as follows:

- The water resource or natural resource dimension refers to all forms of water-related body, including the process-related water, water pattern, water quantity and water quality such as rivers, groundwater, lakes, sea.
- The water users or human dimension mentions all economic activities and stakeholders who are users of water, including production.
- The spatial scale account for the allocated area of water resource and stakeholder. In this issues will be occurred at different level, including international level, national level, and province level as well as local level.
- The hydrological boundary is used for water management, considering river basins, sub-watershed, and catchments.
- The temporal scale refers to the water resource and users are change pattern such as flooding, drought events or even the concrete structures were used for water management.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Conceptual framework.

The research aims to study the policy guideline of water management on disaster risk reduction for climate change adaptation in Klong Yan watershed resource conservation and rehabilitation network, Surat Thani. The conceptual framework is shown in Figure 2. The study will be started from collecting data both the effect of climate change on water resources and the current policy of water management. These data will be analyzed through action of disaster risk reduction as a result of adaptive capacity. Data from effect of climate change such as the IPCC reports and other relevant research papers publish will be used as secondary data. And the data from current water policy and climate change adaptation will be used as both primary data from international through national documents. Those data will be used to analyze by using descriptive analysis method in order to look insight the policy guideline on disaster risk reduction for climate change adaptation.

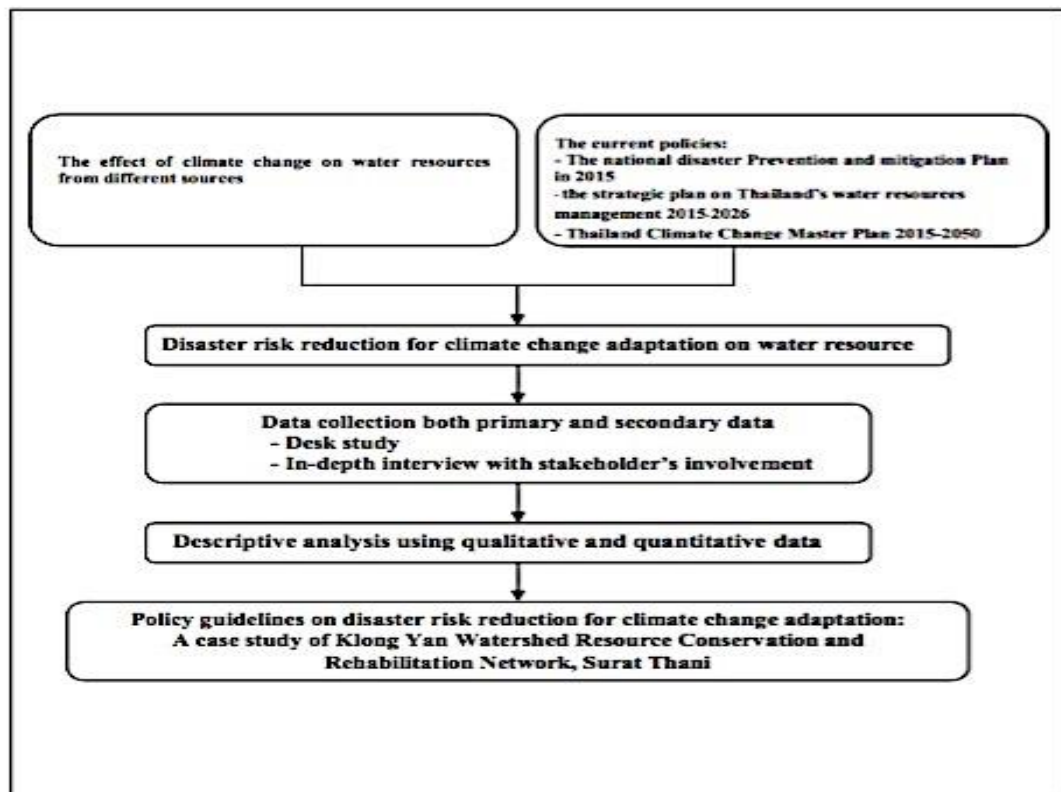


Figure 2 Methodology and research design.

3.2 Study area.

The study area is Klong Yan Sub-Watershed at Suratthant Province. Klong Yan Watershed (Figure 3) is a tributary of the Tapi River located in the South of Thailand. The topography of this Klong Yan watershed is a complex of two parallel mountains in the north and south. In the western side of the area, it is 200 to 800 meters above mean sea level. And in the east side of the land is around 100 - 200 meters from the mean sea level. Klong Yan watershed has originated the main river in Kaengkrachan National Park and Klong Yan Wildlife Sanctuary.

The climate in the Southern of Thailand is different from other parts due to topography. Generally, more rain occurred both the southwest and northeast monsoon. During on September is much rain due to the southwest monsoon in West Coast of Thailand. Conversely, in the Southern East of Thailand receives more rain on from November to January that is the beginning of the northeast monsoon. The average temperature is around 27.5°C. The annual average rainfall is 178 mm. calculated for a period of 1980-2010 year. The highest rainfall was recorded 1,840 mm. The annual average relative humidity is 80% (Thai Meteorological Department, 2017).

The land area of Klong Yan watershed resources is covered 1,136 km², including Suratthant Province and Ranong Province. This local community located at Suratthant Province, including Khiri Rat Nikhom District, ThaChang Distrcit and Vibhavadi District and have a number of population of 15,201. Most of them live in the Khiri Rat Nikhom District. The population is distributed in Tambon Tha Kham, Tha Kham, Nam Nao, and Ban Yang in Vibhavadi District. The communities earn a living in agricultural products and livestock. The land use of Klong Yan watershed resources included perennials and fruit trees such as rubber, palm oil, coffee, durian, sorghum, rambutan, mangosteen, longkong and cocoa.

SURATTHANI MAP

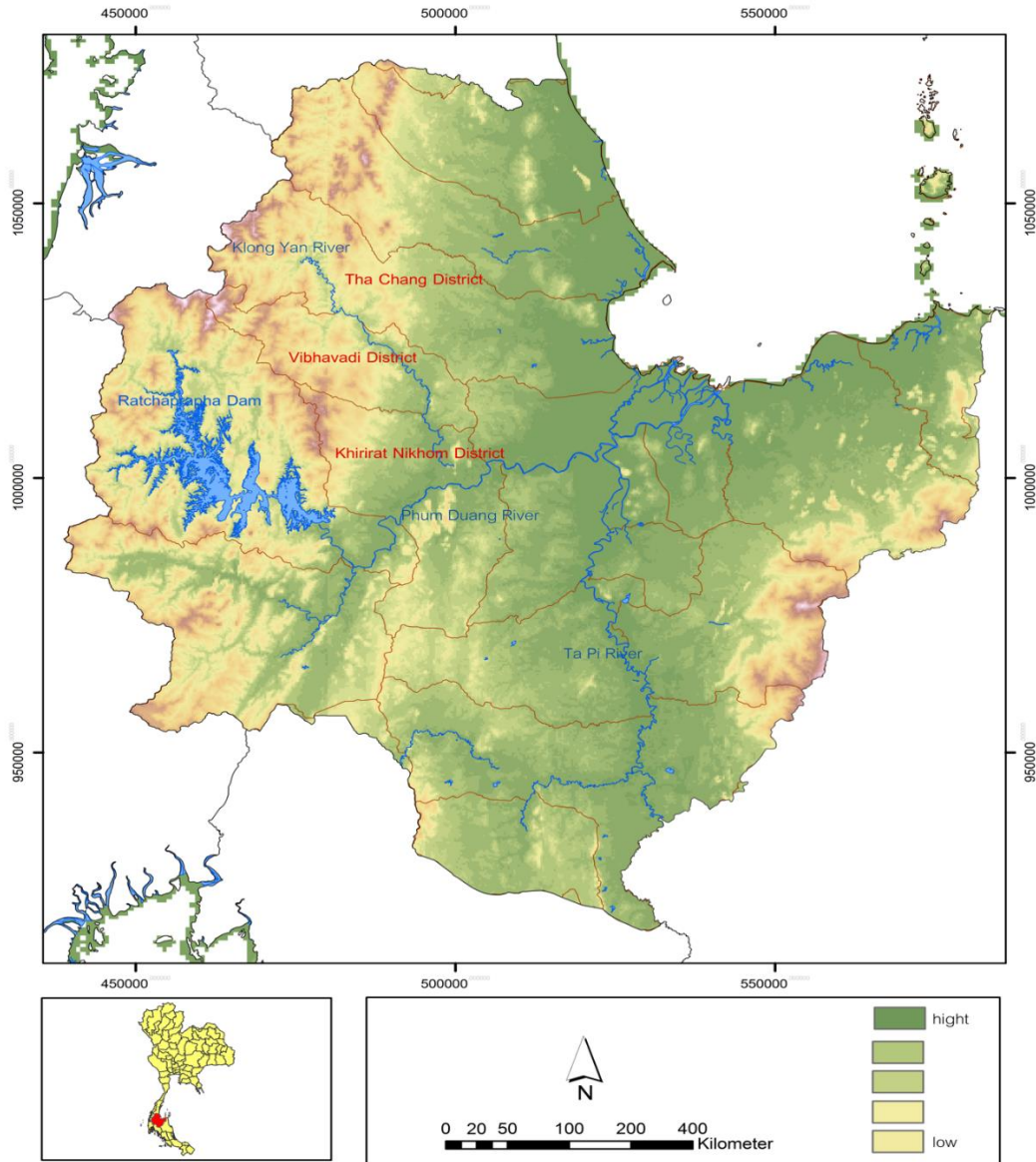


Figure 3 Surat Thani Map.
Source: The Royal Thai Survey Department, 2015.

3.3 Data collection

This research will use descriptive analysis process in both qualitative and quantitative method to synthesis and analysis policy guideline on disaster risk reduction for climate change adaptation at the Klong Yan Watershed in Surat Thani province. These data will be used as follows:

i. Desk study.

Many literature sources will be used as analyzing information at the Klong Yan Watershed. This includes the effect of climate change, reducing disaster risk as well as climate change adaptation will be given in primary data. Moreover, documents from Thailand's policies on water management includes the past effect of climate change, current policies on water resources management, flood event, drought, water demand, the strategic plan on Thailand's water resources management will be given in secondary data. In addition, review from international and national journal articles, academic reports, edited books, and researches will be used as referring researches.

ii. Direct observation.

Field visit is another method to identify the total information at the area. The objective of this process is to assess data and the study in order to support for this research toward understand of the study area. Field visit will be conducted at the Klong Yan Watershed.

iii. In-depth interview.

This study will use semi-structure in-depth interview process. The purposive sampling method will be used to select the informants for the in-depth interview. The informants will be local leaders, local officers and other stakeholders involved at the Klong Yan Watershed.

3.4 Data analysis

From the conceptual research framework shown in Figure 3.1, data analysis will be conducted for as follows:

- i. The effect of climate change will be used as secondary data both international and national documents.
- ii. The current policies of water resources will be used both primary and secondary data.
- iii. Those data will be analyzed through disaster risk reduction process and climate change adaptation by using descriptive analysis method.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 The study area

In 2017, the Department of Disaster Prevention and Mitigation reported the number of losses and damages in Surat Thani Province due to floods, especially in social and economic sectors. There were approximately 80,267 affected households. Economic damage was around 900 million Baht (Incident Action Plan of Flood, Storm and Landslide of Surat Thani Province, 2018). One of the affected areas was the Klong Yan Sub-Watershed which is under Tapee Watershed at Surat Thani province. (The Department of Disaster Prevention and Mitigation, 2018).

Klong Yan Sub-Watershed is located in Surat Thani and Ranong Provinces covering 6 districts, including Kirirat Nikom District, Vibhavadee District, Ta Chang District, Ban Ta Khun District, Kaper District and Chai Ya District. In this research, the study was Vibhavadee District and Kirirat Nikom District because these areas were the most affected areas from flood in Klong Yan Sub-Watershed.

Vibhavadee District is located in the mid-area of the Klong Yan Sub-Watershed at the latitude 90 14'20" N and the longitude 98 58' 44" E. This district is covered 5435.30 square kilometer and comprising of 2 sub-district, namely Takuk Nuea and Takuk Yai while Kirirat Nikom District is also located in the downstream of the Klong Yan Sub-Watershed at the latitude 90 1'48" N and the longitudes 98 57' 12" E. The area is totally 13473.70 square kilometer. There are composed of 8 sub-district, including Tha Khoanon, Ban Yong, Nam Hak, Kapao, Tha Kradan, Yan Yoo, Tham Singkhon and Ban Thamniap (Department of Provincial Administration, 2015). The topography of Vibhavadee District and Kirirat Nikom District is high plains and isolated hills (Figure 4). There is the Klong Yai River flowing from the north to the south. It joins with the Phum Duang River and then flows to the sea at the Pak Nam Tapee.

The meteorological data were collected by the meteorological station of Surat Thani Province. These data were recorded under a period of 1988-2017 year. The study found that the area is influenced by southwest and northeast monsoons. The first period is influenced by the southwest monsoon in West Coast of Thailand between May and October. Another period is influenced by the northeast monsoon that passes the Gulf of Thailand. The annual average rainfall is 329.9 mm. (Figure 5). The highest rainfall was recorded 1783.8 mm. (Figure 6) (The Hydro and Agro Informatics Institute, 2018). The summer season started from February to April. The average mean temperature was 26.8 °C with the lowest average temperature is 22.7 °C and the highest average temperature is up to 41.4 °C in April, respectively. (Figure 7) (Thai Meteorological Department, 2018).

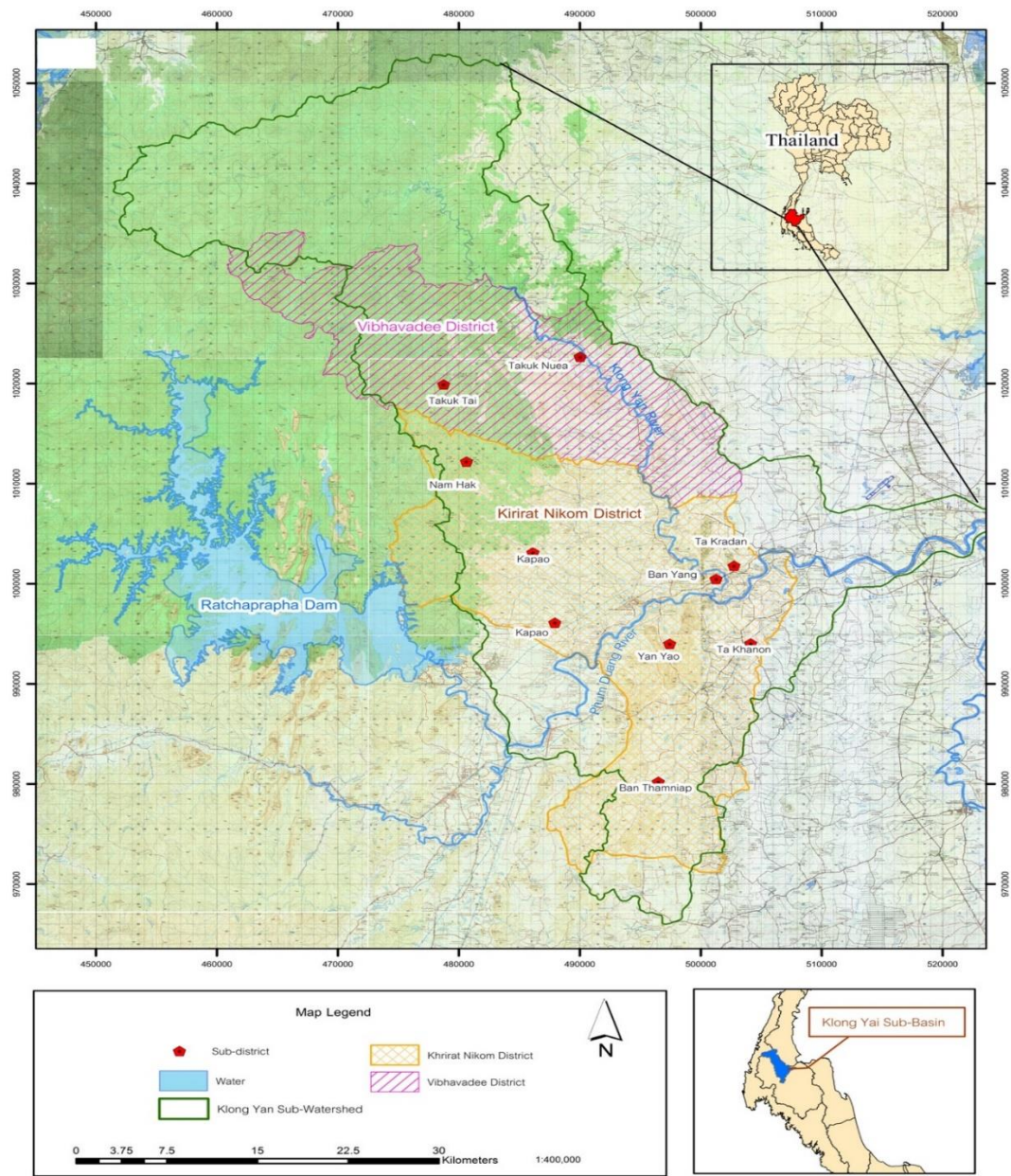


Figure 4 Map of geography at Kirirat Nikom and Vibhavadee Districts.
 Source: The Royal Thai Survey Department, 2015.

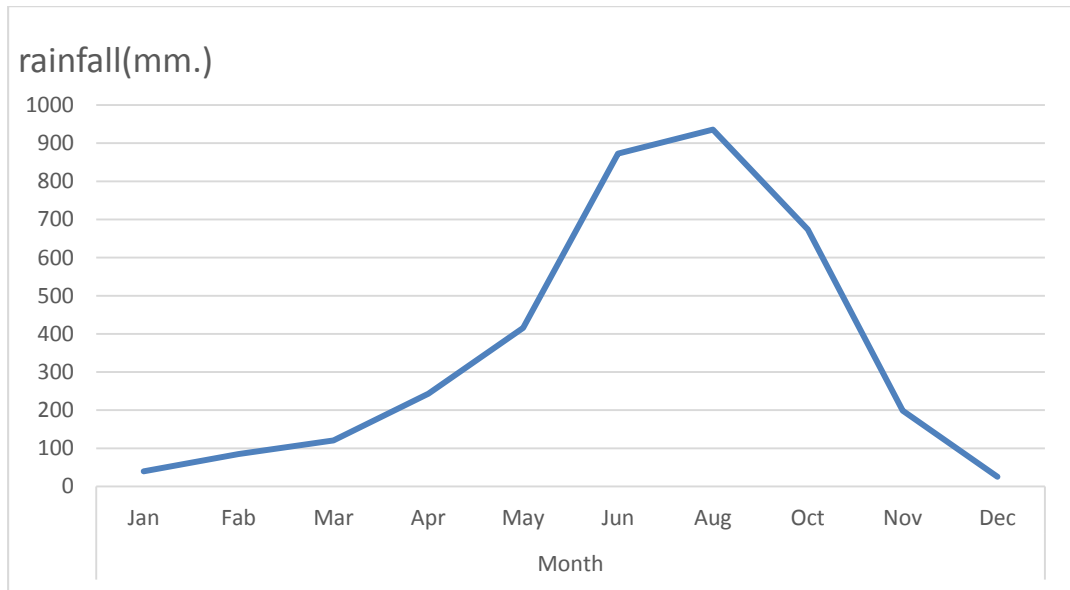


Figure 5 Average annual rainfall (mm.) during 1988-2017 at the Surat Thani Station.
Source: The Thai Meteorological Department, 2018.

Average annual maximum rainfall (mm.) during 2013-2018 at Vibhavadee Station.
(in 2016 no data monitored).

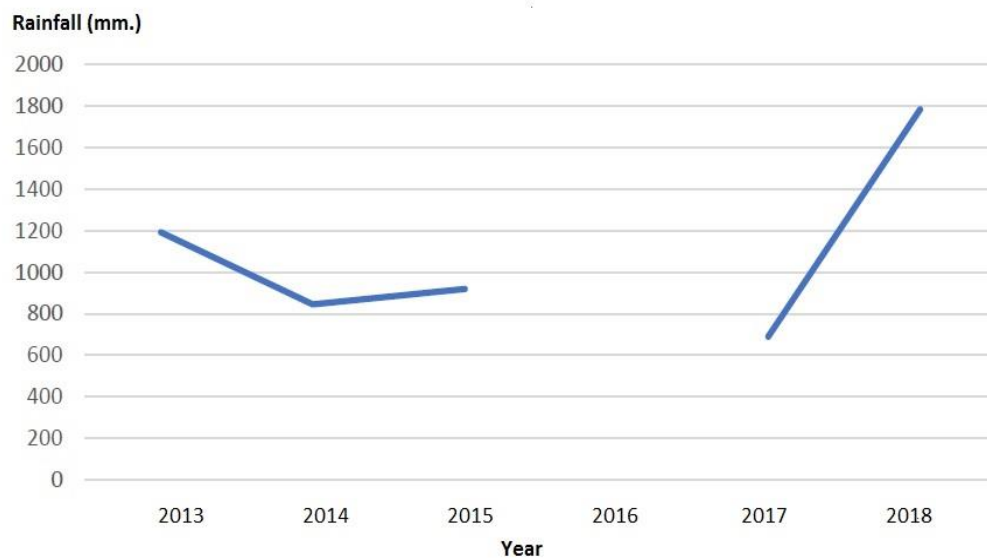


Figure 6 Average annual maximum rainfall (mm.) during 2013-2018 at Vibhavadee Station.
Source: The Hydro and Agro Informatics Institute, 2018.

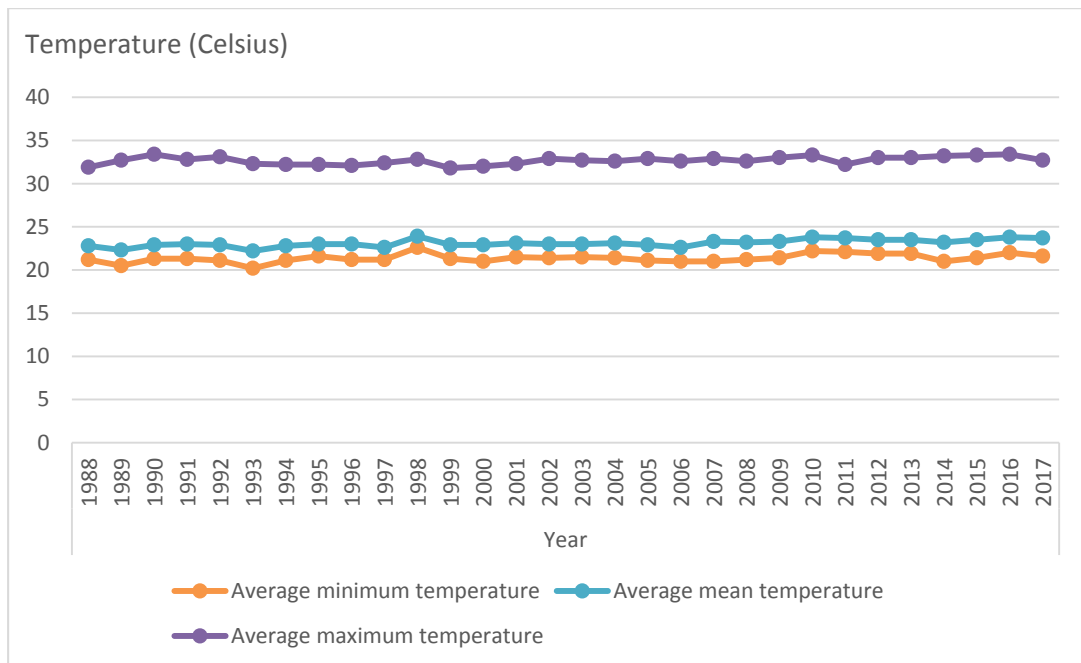


Figure 7 Average maximum, minimum and mean temperature ($^{\circ}\text{C}$) during 1988-2017 at Surat Thani Station.

Source: The Thai Meteorological Department, 2018.

In terms of land use area, it can be divided into five types, including agricultural areas, forest lands, urban, water sources and miscellaneous area. Mostly, the land in the study area composed of agricultural activities, namely para rubber, oil palm, mix orchard (durian, mangosteen, rambutan, landsat, coconut, coffee and rice). Forest areas, due to the geographic location and climate condition provided forest land covering tropical rain forest. Generally, there are forest plantation and evergreen. Urban area composes of village, school, hospital, governmental agencies. Water sources consist of natural pond, reservoir, river canal, lake, farm pond (Figure 8).

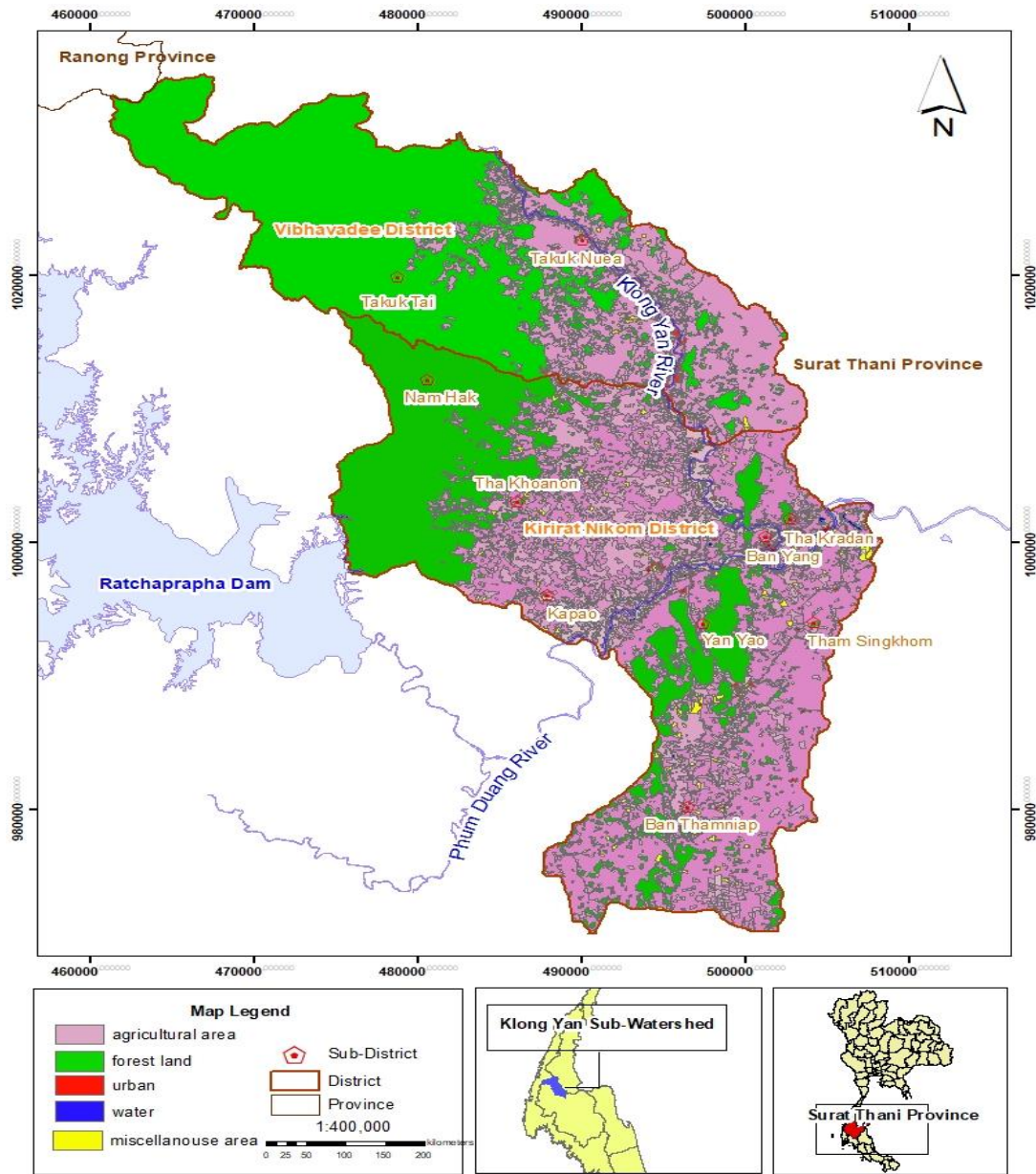


Figure 8 Map of land use at Kirirat Nikom and Vibhavadee Districts.
 Source: The Land Development Department, 2015.

In addition, studies areas covered with Kaeng Krung National Park, Klong Saeng Wildlife Sanctuary, Klong Naka Wildlife Sanctuary and Klong Yan Wildlife Sanctuary respectively. Areas in Vibhavadee District cover Kaeng Krung National Park, Klong Yan Wildlife Sanctuary, Klong Saeng Wildlife Sanctuary. Kirirat Nikom District also covers Klong Yan Wildlife Sanctuary (Figure 9).

In accordance with information on watershed classification from Department of National Parks, Wildlife and Plant Conservation (2015) the study found that there are 4 watershed class in their areas, including 1A, 1AR, 1BR, 2,3,4 as well as 5 respectively. Vibhavadee District composed of class 1A, 1AR and 1BR while Kirirat Nikom District comprised of 1AR, 1BR, 2,3,4,5. Therefore, study areas are still high natural ecosystem and potential feature within a watershed. However, there are some areas to use for agricultural purpose such as para plantation, fruited orchard as class 2, 3 and 4. The more information shown as in Table 1.

Table 1 Watershed classification at Vibhavadee and Kirirat Nikom District.

Watershed class	Characteristics
Class 1	<p>The area as head watershed due to a variation of important features and the level of significant ecosystem. Watershed class 1 was divided into 2 subclasses, including 1AR and 1BR.</p> <ul style="list-style-type: none"> - 1AR refer the area as forest cover that has not faced disturbance. - 1BR refer the area as forest cover that has been cleared and the land was altered from land-use agriculture such as rubble plantation.
Class 2	<p>The area is as second level from head watershed. This area can be some activities such as the land use of agricultural activities.</p>
Class 3	<p>The area is in the upland. This area can use the land for forestry, agricultural such as fruit tree however the governmental office has to control the land use and water conservation.</p>
Class 4	<p>The area is at foothill along stream or river. This area can use for agriculture and other activities.</p>

Source: The National Parks, Wildlife and Plant Conservation Department, 2015.

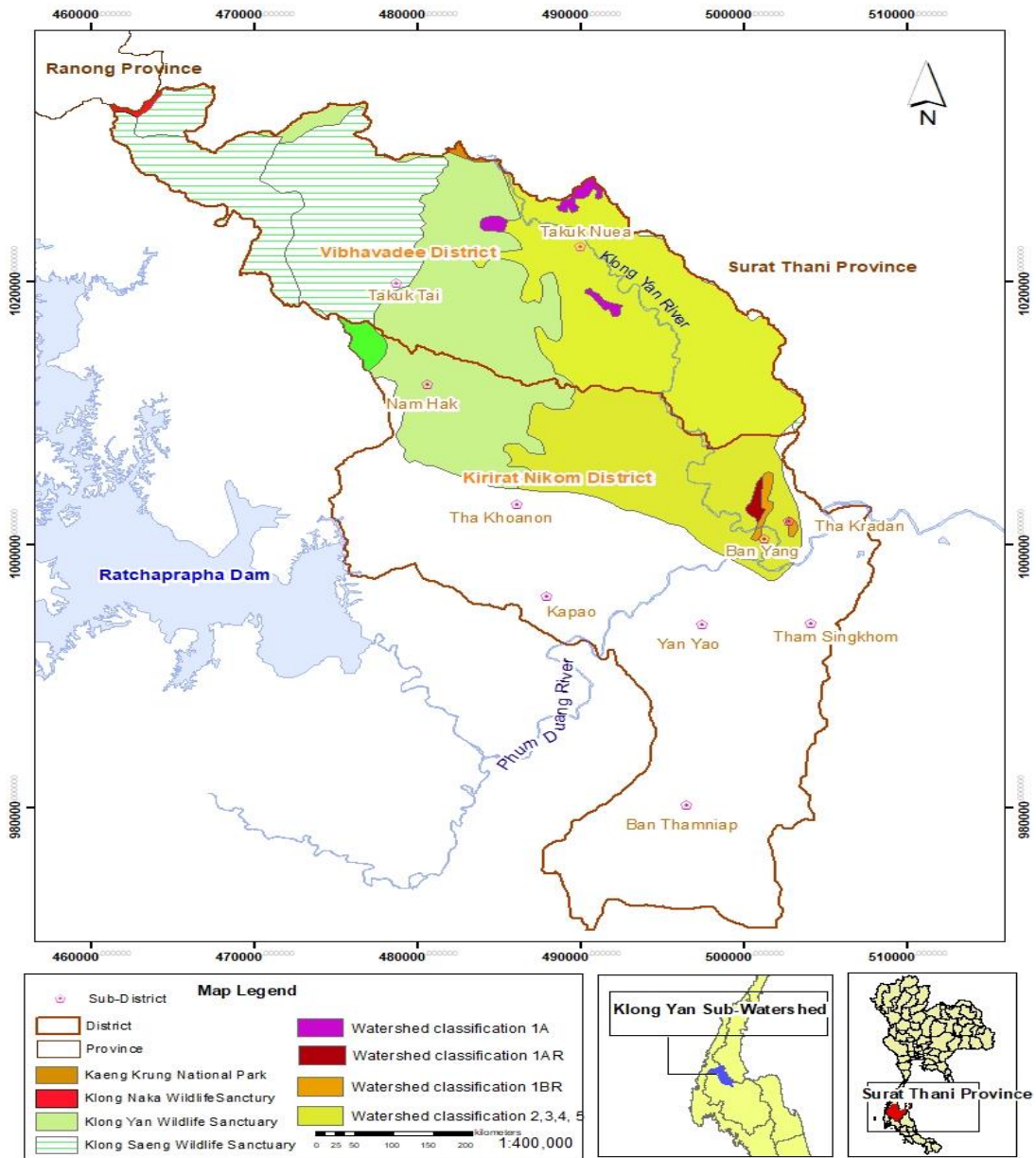


Figure 9 Map of forest area and watershed classification at Kirirat Nikom and Vibhavadee District. Source: The National Park, Wildlife and Plant Conservation Department, 2015.

According to information on soil types from Land Development Department (2015), the study found that most of soil types are clay, clay loam, sandy soil as well as clay sand due to alluvial soil and deposition of sediment along the river. Therefore, the study area found 4 types of soil, including land units 6, Land Unit 9, Land Unit 11 as well as Land Unit 24, respectively. Vibhavadee District composed of land Unit 9, land Unit 11 and Land Unit 24, including clay sand, clay soil and sandy soil while Kirirat Nikom District comprised of Land Unit 6, Land Unit 9, Land Unit 24 including clay soil, clay loam, clay sand and sandy soil . More details are as shown in Table 2 and Figure 10.

Table 2 Land classification at Vibhavadee District and Kirirat Nikom District.

Land classification	Characteristics
Land units 6	clay soil or clay loam
Land unit 9	clay sand
Land unit 11	clay soil, sandy loam
Land unit 24	sandy soil

Source: The Land Development Department (2015).

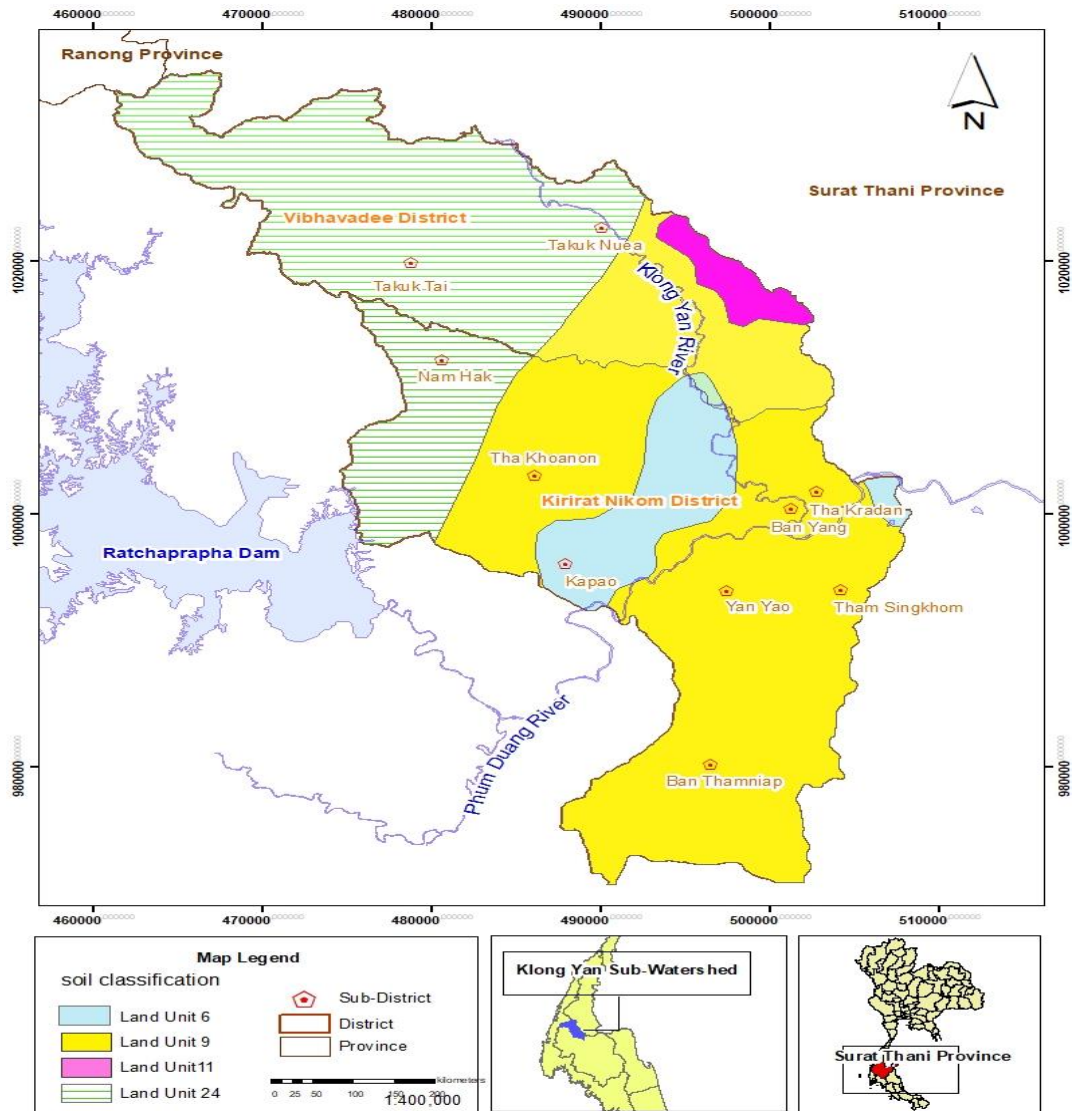


Figure 10 Map of soil at Kirirat Nikom and Vibhavadee Districts.
 Source: The Land Development Department, 2016.

In socio-economic condition, the total population at Vibhavadee District is around 6,877 households and Kirirat Nikom District is also about 15,393 households (Incident Action Plan of Drought at Surat Thani Province, 2018). The size of households is approximately 11-178 households in each village. In terms of economy in communities, agricultural sector is the primary income for livelihood in the community. In each village is rely on agricultural plantation, namely para rubber, oil palm, mix orchard (coconut, coffee, durian, langsung, mangosteen, pomelo, rambutan). In Vibhavadee District occupied on agricultural lands around 191,792 Rai while Kirirat Nikom District occupied approximately 416,072 Rai. (Incident Action Plan of Drought at Surat Thani Province, 2018). These reasons lead to water demand in communities extending as a result in increasing population and economic growth in particular in the agricultural purposes. Besides, in terms of the culture and tradition, villagers relied on local tradition based on way of life in the community. Such believe of ancestor provided villagers to respect and to retain the natural resources in the community.

4.2 Respondents of the study

Respondents of the study were conducted by using the purposive sampling method in order to select stakeholder's involvement. This technique used as identification and selection the people who are correspond to the objectiveness of the study (Tongco, 2007). Therefore, respondents who have experienced on policy guidelines on disaster risk reduction for climate change adaptation were selected to the interview. The number of respondents were 29 including governmental officials, local leaders, local wisdom scholars, non-profit organization, the network of watershed groups. General information of respondents is shown in Table 3.

Table 3 General information of respondents.

Component	Respondents (N=29)	
1. Gender	-Male	72.41%
	-Female	27.58%
2. Age	18-30	24.13%
	31-40	17.24%
	41-50	27.60%
	51-60	24.13%
	over 61	6.90%
3. Educational Background	- Primary school	3.44%
	- Secondary school	6.90%
	- High school	31.03%
	- Diploma	3.44%
	- Bachelor's degree	48.27%

	- Graduate school	6.90%
4. Career	- Employee	10.34%
	- Student	10.34%
	- Private business	13.38%
	- Agriculturist	44.82%
	- Civil officials	20.69%
5. Position of Career	- Civil officials	10.34%
	- Local gov. officials	6.90%
	- Sub-district headman	6.90%
	- Village headman	6.90%
	- The member of sub-district administration organization	17.24%
	- The member of civil protection volunteers	10.34%
	- The member of health volunteers	6.90%
	- Teacher	
	- NGO.	3.44%
	- Self-employed	6.90%
	- Local wisdom scholars	3.44%
	- The network groups	6.90%
		13.80%

Table 3. presents general information of the respondents in the study that is gender, age, educational background, career and position of career. The Respondents composed of males of 72.41% and females of 27.58%. The age of the respondents was between 18 and 60 years old. 27.60% of respondents are in the range 41-50 years while 24.13% of respondents are between 18-30 years and 51-60 years. Respondents from the member of sub-district administration organization are the most research interview accounting of 17.24%, following by the network of watershed groups (13.80%), governmental officials and the member of sub-district administration organization (10.34%), local governmental officers; sub-district headman; village headman; the member of health volunteers; local wisdom scholars (6.90%) respectively. For educational level, 48.27% of respondents graduated at the level of bachelor's degree and high school level (31.0%). Regarding to occupation of respondents, 44.82% work as agriculturist and 20.69% as governmental officials.

The roles and responsibilities of governmental organization respondents show in Tables 4 and the roles and responsibilities of non-governmental organization respondents show 5.

Table 4 The roles and responsibilities of government organization respondents.

Government organization	The role and responsibility
<ul style="list-style-type: none"> • Civil officials • Local governmental officials • Sub-district headman • Village headman • The members of sub-district administration organization • The members of civil protection volunteer • The members of health volunteers • Teachers 	<ul style="list-style-type: none"> • Supporting communication system, practicing emergency plan, announcing warning disaster, supporting information about disaster management, revising action plan, commander. • Collaborating and planning during emergency time, supporting knowledge on disaster management revising action plans. • Supporting cooperation on disaster management, conducting the information on early warning. • Supporting collaboration between governmental officials and local people. • Supporting the governmental officials in terms of communication system and practicing the operation exercise. • Monitoring both normal and emergency situation. • Supporting the governmental officials in terms of medicine, practicing the operation exercise. • Providing knowledge on disaster management and water resource management.

Table 5 The roles and responsibilities of non-government organization respondents.

Non-government organization	The role and responsibility
<ul style="list-style-type: none"> • Non-government organizations • Self-employments • Local wisdom scholars • The network groups 	<ul style="list-style-type: none"> • Supporting knowledge on water resource management, the creation of conservation forest through local activates. • Practicing operation exercise, following news and information from government agency. • Providing local knowledge both disaster preparedness and water management. • Monitoring both normal and emergency situation from the upstream, midstream and downstream, following news and information from government agency, practicing evacuation.

4.3 Policy guidelines on disaster risk reduction

4.3.1 The National Disaster Prevention and Mitigation Plan 2015

The National Disaster Risk Management Plan 2015 has guidelines to develop system of disaster prevention, preparation and potential formation in order to manage the remaining disaster through knowledge activities and measures. In addition, this plan has embraced the relevant global frameworks for action based on the Sendai Framework for Disaster Risk Reduction 2015 - 2030. Therefore, the National Plan on Disaster Risk Management is the tool for reducing disaster effects to guideline disaster management through activity in integrated manner with all sectors in order to lead the basis of sustainable development.

The policy guidelines consist of disaster risk reduction, emergency management, build back better and safer, and international cooperation on disaster management (Figure 11). The details are as follows: (Department of Disaster Prevention and Mitigation, 2015).



Figure 11 Disaster Risk Management Cycle.

Source: National Disaster Risk Management Plan, Department of Disaster Prevention and Mitigation (2015).

1) Disaster risk reduction is the action to respond before disaster occurrence in order to avoid or reduce negative effects from related disasters through the analysis of the factors and impacts of the disaster under measures or actions. Therefore, this action is guidelines to avoid the impact of the disaster through disaster prevention, mitigation and strengthening preparedness on disaster risk reduction which include:

i. Guidelines for Disaster Prevention and Mitigation.

Preventions and mitigations are actions to avoid the disaster impacts through the implementation of structural and non-structural measures. These guidelines consist of infrastructure building, land-use planning, reinforcing laws and regulations, planning the collaboration with stakeholders, training and educating on disaster preventions and mitigations and financial supports.

ii. Guidelines for Disaster Preparedness.

Preparedness actions are measures to reduce the disaster risks prior disaster occurrence through activities in communities. These actions include increasing educations, strengthening the volunteer group and the network, exchanging knowledge, setting warning systems and communication systems, practicing the evacuation plans, raising awareness, and reviewing laws and regulations.

2) Emergency management is action to respond during-disaster occurrence through organizational structure, decision-making processes and command system in order to reduce the impact from the disaster. This phase includes the setting of the incident command center, the emergency operations, the communication systems, the data center and the emergency medical service system. Therefore, the emergency

action has provided the response of the incident situation in a rapid, efficient and timely manner.

3) Build back better and safer is the action to respond after disaster occurrences. This step composes the restoration of damaged public utilities and facilities, infrastructures, environmental system and people who are affected to be back to normal situation. Therefore, the rehabilitation and reconstruction has contributed the opportunity for disaster relief, leading normal livelihood.

4) International cooperation on disaster management is action in the post-disaster process. This action provides development and coordination with international agencies in order to request for disaster rehabilitation. Thereby, developing collaboration with national organization will provide the strengthening for addressing disasters.

In this regard, it can be concluded that the policy guidelines on disaster risk reduction aims to increase the efficiency of disaster management that includes disaster prevention and reduction and preparedness.

4.3.2 Respondent's views on policy guidelines on disaster risk reduction

The questionnaire about policy guidelines on disaster risk reduction shown in Appendix A consists of 4 sets of questions as follows:

- i. The policy guidelines on disaster risk reduction
- ii. The importance of policy guidelines on disaster risk reduction
- iii. The measures for disaster risk reduction in the community
- iv. The respondent's experience in handling flooding problems in the community.

The data obtained from interviews were analyzed by using descriptive research method and summarized as the following details.

The respondents were examined about policy guidelines on disaster risk reduction. The study found that 31.03 % of the respondents knew about the policy guidelines. They explained that the policy guidelines on disaster risk reduction were integrated with the community planning and multiple sectors such as governmental sector, private sector, and the network group through knowledge and training activities. In addition, respondents viewed that policy guidelines are the ways to practice pre-disaster steps, during-disaster steps and post-disaster steps in order to decrease the disaster risks. Moreover, the respondents mentioned that policy guidelines are the access information for planning – before, during and after disaster. Finally, respondents noted that policy guidelines on disaster risk reduction are measure to lay down for disaster risk reduction.

Another point of views from the respondents was that policy guidelines on disaster risk reduction are necessary because it would help preventing and coping with the disaster impacts in a long term. In addition, the respondents indicated that the policy's achievements on disaster risk reduction were important due to the reduction of losses and damages from the disasters. Additionally, the respondents stated that the policy guidelines ensure the people in the communities to be ready to cope with the upcoming disasters in a long term. Moreover, the policy actions can suggest the communities to response and recover the managing of the remaining disaster risk. The policy actions were also advantaged to provide the communities with well-timed disaster preparedness and capacity building on disaster occurrence.

In terms of disaster prevention and mitigation, this study reviewed that physical structures, namely concrete weirs, small dam, rock embankment were indicated by the respondents (77.78%). Meanwhile, 88.89 % of the respondents indicated that laws and regulations on construction such as community urban planning were needed for the construction control in the community. Also, 100 % of the respondents unanimously agreed with stakeholder collaboration planning such as meeting in the community, for example, monthly planning the meeting among the network of Klong Yan groups should be arranged. The network of Klong Yan groups consists of the community leader, local wisdom scholars, the network of friend-warning groups, and the Forest and Sea Foundation members. This activity provides the opportunities for people to exchange knowledge and discuss the existing problems together within the community. Additionally, 77.78 % of the respondent's opinions revealed that the improvement and revision of law in terms of disaster risk management will help reducing risk disaster. In local organization, there was an improvement of the action plan of disaster prevention and mitigation for sub-district administration organization every year. Besides, all respondents (100%) pointed that the educating on this issue of disaster prevention and mitigation will help people realize the necessity of the disaster management such as the methods of preparation, and evacuation practices. There was also supportive disaster management with technology of warning system such as emergency communication system, radio system, and emergency alert. There were also an adaptation of local knowledge and local wisdom in order to monitor the adverse disaster, namely the speed of the water flow or the changing color of the river, including raised awareness and preparedness on disaster management both in normal and emergency situations.

For financial issue, all the respondents (100%) agreed that there should be more organizations to budget them for this management. At present, the budget on development was provided by sub-district administration organization; the budget on the emergency and recovery situations were provided by the Department of Disaster Prevention and Mitigation; the budget on agricultural development such as organic farms were provided by the Forest and Sea Foundation; the financial supports on reforestation and check dam were provided by the Coca-Cola Foundation; the budget on mountain plumbing was provided by Utokapat Foundation.

Regarding preparedness measures, all the respondents (100%) were well-educated of preparedness before, during and after disaster. Those respondents stated that there was a training by using local knowledge for preparation such as the observation of the nature and surroundings such as monitoring the frequency of the rainfall, the rising level of the river, and the changing color of the river. Furthermore, there was a training on pre-evacuated preparation, for instance, the food, the medicine, the fuel supplies, and the vehicles as well as the primary and secondary routes for the emergency situation. Also, raising awareness of the disaster effects in the community were all agreed by 100 % of the respondents. They noted that holding a meeting on 14th of every month makes them aware of the dangerous effects among members of Klong Yan network groups. They exchanged information and experiences about the effects of the flood which lead others to conserve the forest in the community. Besides, the respondents also said that they tried to encourage others to join the reforestation, building more weirs, and planting perennial trees in order to reduce flash floods and soil erosion as a method of raising awareness among the people.

The study found that there were many groups in the community, for example, volunteer groups, the network of friend-warning groups, the network of Klong Yan groups, Klong Yan Youth Group, the network of warning friends, Mr. warning groups, the member of civil protection volunteers, and the member of health volunteers. Those groups were supported by government sectors and non-profit organizations to participate in community education. All the respondents (100%) also accepted more education and willingly exchanged knowledge inside and outside their community. Preparation of basic necessities, such as dried foods, drinking water, and medicines, is one of the most important method that should be provided prior.

The annual evacuation practice, based on emergency situation, was held by all the respondents (100%). This study reviewed that there was an annual evacuation practice with all sectors in the community in order to ensure enhancing capacities of preparedness for disaster risk reduction. There was also a yearly revision of the working plan of disaster prevention and mitigation by sub-district administration organization. Furthermore, the study found that the implementation on monitoring and early warning systems from the questionnaire was chosen by all the respondents (100%). The method of monitoring was following-up the weather situation from television, radio, facsimile, mobile-phone, broadcast tower, broadcast mobile-car and social media as known as Line groups, and Facebook of Thai Meteorological Department. Moreover, there was real-time monitoring the situation from the network of friend-warning groups at the upstream area by using radio system. Setting the communication system or channel to respond for warning disaster, including backup community system was also chosen by all the respondents (100%). Additionally, the result further found that there were the warning towers to broadcast the situation and activate emergency alert around the community as well as a daily morning radio communication system test by the network of radio communication groups.

On the other hand, the majority of respondents (68.97%) was not familiar with the policy guidelines. They viewed that they relied on their experiences to deal with flood problems and other related ones. The details can be concluded as follows:

- Encouraging knowledge through preparedness training for people in communities.
- Raising awareness and perception on the adverse impacts of disaster.
- Straining awareness on environment and forest conservation.
- Practicing yearly evacuation plan.
- Exchanging new knowledge with other communities.
- Building check dams at the upstream through local activities in order to reduce flash flood during monsoon season.
- Setting the network group for disaster warning in the communities.
- Keeping up-to-date news and information from the government offices.
- Setting early warning system with certainty.
- Supporting funds and finance allocations.
- Promoting community urban planning with appropriate topography of each area.
- Reinforcing laws and regulations in risky areas such as river banks, hillside or nearby waterway.
- Avoiding any constructions along the river and flooding areas, and building houses above flooding level.

Thus, it could be summarized that only 31 % of the respondents were familiar with the policy guidelines on disaster risk reduction, namely National Disaster Prevention and Mitigation Plan 2015. They viewed that the policy guidelines on disaster risk reduction is very useful to the reduction of losses and damages from the impact of flood. However, approximately 69 % of the respondents were not familiar with the policy guidelines. They viewed that their experience such as knowledge and training, increasing awareness, improving law and regulations, setting the communication system and early warning system, financial allocations and setting the network groups through local activities and measures with a wide range of sectors would help to manage the disaster risk reduction.

4.4 Policy guidelines on climate change adaptation on water resources

4.4.1 The Thailand Climate Change Master Plan (2015-2050)

According to the Thailand Climate Change Master Plan 2015-2050, the frameworks has been used for addressing climate change. The purpose of this plan is to support preparedness to climate change in terms of adaptations, mitigation and building capacity to impacts of climate change in a long term. In this regard, this plan has embraced the relevant global frameworks for actions based on the United Nations

Framework Convention on Climate Change and the Kyoto Protocol. (Thailand Climate Change Master Plan 2015-2050, 2015).

The Master Plan composes of climate change adaptation, mitigation and capacity building on climate change. Its implementation has divided into three periods, including short-term by 2016, medium-term by 2020 and long-term by 2050. Therefore, the Thailand Climate Change Master Plan 2015-2050 has been used as a policy framework that leads to address the climate change in a long term.

In terms of adaptation, implemented education and knowledge creation and raising awareness for climate change adaptation have been introduced to the public at all sectors. In addition, a financial mechanism also provides to support its implementation. There is also developed database systems for managing the adverse impact of climate change. The priority sectors for climate change adaptation include water management (flooding and drought), agriculture, tourism, public health, natural resource management, and settlement and human security.

Water resource management is one of priority sectors for climate change adaptation. It aims to integrated water management, preparedness on disaster prevention and reduction (flood and drought) and disaster risk management. The details are as follows:

1) Integrated water management is guidelines to integrated water management and to increase the effective water management which include:

- i. to share integrated information about water resources with water-related organizations.
- ii. to encourage public participation in policies and planning projects on watershed management with all sectors such as public sectors, agricultural sectors, energy sectors and industry sectors.
- iii. to set master plan on infrastructure for water resources.
- iv. to encourage public conservation of water usages at all sectors, namely agricultural sectors, household sectors and business sectors.
- v. to support the capacity of local organizations.
- vi. to manage land-use planning focusing on climate change and watershed management.
- vii. to promote the implement of water resource management under the international cooperation.

2) Preparedness on flooding prevention and reduction is guidelines to prepare for the impacts of climate change as a result in disasters which include:

- i. to restore watershed forest in order to reduce and prevent soil erosion problems.
- ii. to improve water-related structures such as retention, check dam, water way by using public participatory process with appropriate geography condition.

- iii. to improve, develop, and enhance irrigation areas including reservoirs in dry season.
- iv. to improve and manage water resources with appropriate system to each watershed by considering the climate change condition.
- v. to study and assess the capacity of the water demand in each watershed by considering the climate factors.
- vi. to study the water demand and assess the potential water supply as well as enhance the water efficiency for climate change adaptation.

3) Flood risk management is guidelines to cope with impacts of climate change in terms of flooding management which include:

- i. to assess climate change scenario by using different climate models to estimate and forecast the effects, quantity, water flow, and the distribution of water resources in water cycle and watershed around the country.
- ii. to assess the risk map of flood and drought covering in national, region, basin, province and local levels in order to plan the preparedness.
- iii. to develop the weather forecast system precisely.

In this regard, it can be concluded that the policy guidelines for climate change adaptation on water resources includes adaptation to the impact of climate change and capacity building for climate change implementation. Water resource is one sector of the policy guidelines of adaptation for the impact of climate change that aims to enhance the preparedness, adaptation, development under water resource management including integrated water management, preparedness on flooding prevention and reduction and flood risk management.

4.4.2 Respondent's views on policy guideline for climate change adaptation on water resource management

The questionnaire about policy guidelines for climate change adaptation on water resource management shown in Appendix A consists of 6 sets of questions as follows:

- i. The policy guidelines for climate change adaptation on water resource management.
- ii. The opinion of policy guidelines for climate change adaptation on water resource management
- iii. The integrated water resource management
- iv. The preparedness on flooding prevention and reduction
- v. The handing on flood risk management
- vi. The respondent's experience in climate change adaptation

The data obtained from interviews were analyzed by using descriptive research method and summarized as the following details.

Based on the policy guidelines for climate change adaptation on water resources, the study found that 24.13% of the respondents knew about policies guidelines. They indicated that policy implements on climate change adaptation are for supporting the ecotourism activity in communities, namely rafting in Klong-Yan watershed. Moreover, the respondents noted that policy guidelines are to build check dams in the upstream forest in order to storage water in dry season and to mitigate the flood problem during the rainy season. In addition, the respondents also mentioned that policy guidelines on climate change adaptation are for providing local reservoirs at various points to store water during wet season. Finally, respondent viewed that policy guidelines are for improving the houses that can withstand the impact from floods.

Another perspective from the respondents was that the policy guidelines for climate change adaptation on water management in the community are very useful because it will help the farmers growing their crops that can withstand the flood such as durians or palm trees. Moreover, the respondents viewed that the policy guidelines are very beneficial because the respondents can adapt their way of life to the impact of climate change. In addition, the respondents noted that policy guidelines are the significant tool to help local people managing their water resources under the climate change, especially the farmlands that far from the watervasting. Moreover, the agriculturist can produce their crops better under the change of climate condition. These are the solutions from the reduction of damages by the impact of climate change.

The respondents were also requested for the guidelines for climate change adaptation on water management in their community. In terms of integrated water resource management, the study found that encouraging participation for planning policy on water management were accepted by 85.71% of the respondents. They explained that there was collaboration planning on watershed management through meeting among all sectors such as the network of Klong Yan groups, local wisdom scholars, local leaders and the Forest and Sea Foundation members. In addition, 28.57 % of the respondents agreed that creating master plan on water resource management will support adaptive capacity to climate change. Those respondents noted that there was local meeting to attend for sub-committee on water resource development in Southern Regions. Furthermore, campaigning for water saving in agriculture sectors, household sectors, and industry sectors were selected by respondents (85.71%).The respondents stated that there was campaign for water saving through a wide range of activity from local organization in order to increase knowledge and raise awareness. Besides, 85.71% of the respondents indicated that supporting the local plans can lead to strategic development at the province level. They claimed that there was the local plan based on the action plan of sub-district administration organization. Therefore, this plan was further formulated to the strategic plan at the provincial level. The last but not least, all respondents (100%) agreed with stakeholder cooperation on water management through local activities at the community level. They explained that there were many activities on the cooperation of water management mechanism such

as the conservation and reforestation, rehabilitate natural water resources, increasing check dams, and removing drainage water ways.

Regarding preparedness of flooding prevention and mitigation, the study found that 100% of all respondents highly agreed with restoration of watershed forest. They explained that restoring watershed forest will help reducing risky flood during rainy season in the community. There was also reforestation at the upstream by public and private sectors. In addition, 100% of all respondents pointed that the development of basic structures such as retentions, flood-prone areas, and drainage channels were needed the preparedness of flood-prevention and mitigation. The study found that there was local structures system to control water flow in the community such as check dams, concreted weirs, rock embankments, reservoirs, pumping mountain systems and farm ponds. Moreover, improving river banks and the drainage system for flooding in the community were all agreed by 100% of all respondents. They disclosed that there was maintaining the drainage system by removing debris and garbage for preparedness flooding as well as in the rivers before the upcoming rainy season. However, 28.57% of respondents noted that there was not the expansion of irrigation system in the community. They explained that there were structural measures such as pumping mountain systems, water diversion and pipes to distribute water resources to the outside of the community. Finally, the creation of water storages such as individual ponds were agreed by 100% of all respondents. They viewed that small ponds are alternatives for them to storage water during the dry season. This action will help mitigating the flood problem during rainy season.

In terms of flood risk management, 28.57% of respondents revealed that mapped the risky area of disaster at the community level will help disaster risk reduction, namely flood problem. The study found that there were local maps at the sub-district level in order to represent the geographic community. Meanwhile, 100 % of all respondents pointed that the setting on disaster warning systems will help reducing risk flood. In the community, there was following-up and forecasting the weather situation by using radar mappings and risk maps from the website of Thai Meteorological Department and The Department of Disaster Prevention and Mitigation. Finally, setting the network groups was also selected by all the respondents (100%). They also explained that the network will help monitoring flood situation during emergency situations. In the community, there was a wide range of groups in order to monitoring real-time situation, namely the network of radio communication groups, the network of friend-warning groups, the network of One Tambon One Search and Rescue Team (OTOS), and the network of Klong Yan groups.

On the other hand, 75.86% of 22 respondents did not know about to the policy guidelines for climate change adaptation on water management. The study found that they used their experiences to cope with the impact of climate change on water management. The details are summarized as follows:

- Educating people in the community about the knowledge of climate change, the impact of climate change and adaptation to cope with the disaster situations.
- Building preparedness in the community through awareness-raising about the adverse impacts of climate change.
- Promoting reforestation project with all sectors such as governmental sectors, private sectors, public sectors, non-governmental organizations and youth groups under the public participation process.
- Supporting conservation of watershed forest through local activities such as check dam schemes, local rituals to conserve the forest, planting more trees along the river bank.
- Constructing more ponds, reservoirs or rainwater-harvestings in order to storage and conserve some water during in the dry season.
- Developing the water distribution system to link between the inside and outside of irrigation areas.
- Building the network of conservation of natural environment, forests and water resources.
- Dredging waterways and campaigning not to dump trash into the waterways.
- Enforcing the punishment of those who invade waterways.
- Priority of developing water retentions in the risk area of water shortages.

Therefore, it could be summarized that only 24.13% of respondent knew the policy guidelines for climate change adaptation on water management. They viewed that the policy guidelines as climate change master plan is crucial to climate change adaptation. However, about 75 % of respondents did not familiar with this policy. They noted that their experiences such as increased knowledge and perception, restoring the watershed-forest, networking the conservation of natural environment, constructing ponds or reservoirs, and enforcing a mandatory law and regulation would help them to adapt to the adverse impacts of climate change.

4.5 Policy guidelines on water resource management

4.5.1 The Strategic Plan on Water Resource Management 2015

Based on the Strategic Plan on Thailand's Water Resources Management 2015, the strategies have been used for managing water resource with all dimensions, namely floods, drought, water shortages and water quality. In this regard, this plan based on the principle of the integrated water basin and water management, government policies and the national economic and social development plan from the past to the present and the United Nation's Sustainable Development Goals (Apipattanavis et al, 2015).

The strategies for policy guidelines consist of water consumption, water production (agricultural and industrial sectors), disaster management, water quality management, forest conservation and soil erosion prevention and administrative management. Its implementation has divided into three periods, including short-term during by 2015-2016, medium-term during by 2017-2012 and long-term during by 2022-2026 (The Policy Committee for Water Resource Management, 2015). The Strategic Plan on Thailand's Water Resource Management 2015 has been used as policy frameworks to prevent and solve water resource management in a long term. The details of these strategies are as follows:

1) Water management for consumption.

This strategy refers to ensure clean water supply for consumption in communities, villages and economic areas. The guidelines on water management for consumption include as follows;

- i. Supporting water supply and constructing water plumbing systems.
- ii. Developing plumbing systems in urban communities and economic zones.
- iii. Increasing the efficiency of local plumbing systems and supporting water storage areas or rain-fed harvesting.
- iv. Increasing effective-water users.
 - to campaign for water saving.
 - to increase the capacity of water supply.
 - to control water users with appropriated capacity.
 - to campaign 3R water resources management.

2) Building water security for production section (industry sector and agricultural sector).

This strategy refers to build water demand management under the balance water reserve and water demand, especially industry and agricultural sectors. The guidelines on water security for production sectors include as follow;

- i. Water demand management.
 - to identify zoning areas and to control the expansion of industry zones.
 - to set water rules or water allocation.
- ii. Agricultural zoning management.
- iii. Increasing the water supply scheme and irrigation systems.
 - to enhance water storage.
 - to improve the existing water projects.
 - to set rice product systems.
 - to enhance the water distribution system on small pond levels.
 - to improve the project management.

iv. Developing and rehabilitating natural water resources in rainfed-agricultural areas.

- to support the conservation of water resources.
- to improve construction for water storages.
- to use groundwater.
- to support pond farms or local community's water resources.

v. Developing the new water storages and water distribution systems.

- to develop water resources at low capacity basins.
- to support water supply resources.
- to build water distribution system.

vi. Developing water diversion and connection between inside and outside watersheds.

vii. Developing water sources for economic zoning or new industry development.

3) Flood management.

This strategy refers to manage flood-related management in terms of prevention and mitigation from flooding in communities and the economic zone. The guidelines on flood management include as follows;

i. Improving the main waterway.

ii. Developing the water drainage system and flood diversion to prevent floods.

- to increase the effective water drainages.
- to build the catchment area or flood-prone areas.

iii.) Preventing flooding in the urban area.

- to set the flooding system.
- to improve the water-drainage system.

iv. Identifying land-use areas at watershed and province levels and improving urban planning.

- to enforce measures for land-use planning.
- to support laws and regulations in the urban community.

v. Developing and managing the river catchment or the risk of flooding.

vi. Supporting the adaptive capacity and evacuation.

- to adjust the agricultural land in flooding areas.
- to avoid any constructions or building along the river or flooding areas.
- to adaptive the agricultural system or crop planning.

4) Water quality management.

This strategy refers to solve the water quality problem by using wastewater treatment system and eliminating garbage and weeds in rivers. The guidelines on water quality management include as follows:

- i. Developing and improving wastewater treatment system.
- ii. Reducing wastewater from primary sources.
 - to identify the quantity of effluent wastes.
 - to prevent wastewater from the urban community, industry zones and agricultural lands.
- iii. Controlling the salinity level.
- iv. Eliminating weeds and garbage in the river.

5) The conservation and restoration of upstream forest and the prevention of soil erosion.

This strategy refers to restore and conserve at upstream forests in order to adjust the balance of ecosystem and to prevent soil erosion in highland areas. The guidelines on the conservation and restoration of upstream forest and the prevention of soil erosion include as follows;

- i. Conservative and rehabilitation of upstream forests in order to adjust the balance of ecosystems.
 - to support reforestation at upstream forest.
 - to build check dams.
 - to identify measures on land-use.
- ii. Preventing and reducing soil erosion.
 - to plant covering.
 - to plant perennial trees.
 - to support the pilot project on the watershed area with high land-use change.

6) Administrative management.

This strategy refers to formulate National Water Act in order to manage the appointing organizational administration, supporting local communities, developing strategic plans and master plan on water resource management. The guidelines on administrative management include as follows:

- i. Formulating National Water Act.
- ii. Improving organizational structures for operations.
- iii. Supporting organizational water resource management both domestic and international networks.
- iv. Setting strategic plans, master plans and action plans for both normal and crisis situations at the national and watershed levels.
- v. Supporting the study and researches on sub-watershed management.
- vi. Developing database for making decision systems.

- to develop systems on water resource managements for both normal and crisis situations.
 - to develop the effective information on water resource.
 - to develop infrastructural system on decision support system.
 - to develop and support the planning development, conservation and usages.
- vii. Supporting water management, maintenance and renovation of irrigation systems.
- viii. Enforcing the waterway invasion.
- to formulate the databases on watercourse invasion and public water resources.
 - to improve laws on the boundary of waterway and public dices.
 - to enforce the effective laws.
 - to campaign awareness and perception.
- viii. Monitoring and evaluation.
- ix. Supporting public relations and participation.

In this regard, it can be concluded that the strategy of policy guidelines on water resources aims to solve and prevent all water-related problems under the integrated basin framework and water management, policies and the national economic and social development plan and the United Nation's Sustainable Development Goals. The strategies include water consumption, water management for agricultural and industrial sectors, water-related disaster, water quality, forest conservation and soil erosion prevention and administrative management.

In 2018, Thailand has set up the National Water Resource Organization. It aim to create policy and planning on integrated water resource management under 6 strategies on water management. This organization is responsible for policy and plan advisor, regulation, facilitation and operation on water resource management. The roles of this organization are as follows: (Office of The National Water Resources, 2018)

- 1) The policy and plan advisor.
 - Proposing the policy on strategic plans and master plans.
 - Proposing policies and measures on water resource management in the emergency time.
 - Proposing the development of technology and innovation on water resource management.
 - Proposing the direction of international water management.

2) The Regulator.

- Identifying the prioritization of the criteria on area-based.
- Directing policies and strategies on water resource management.
- Reviewing project plans and budgets according to plan strategy.
- Examined and evaluated the implementation of the strategic plan.
- Establish the standard of information and linkage information with the relevant departments.

3) The Facilitator.

- Supporting the training and knowledge on water resource managers.
- Operating as the national water resource committee.
- Operating as sub-basin committee.

4) The operator.

- Supporting a master plan and water resource management plan in the watershed level.
- Supporting the center operation during emergency time.

4.5.2 Respondent's views on policy guidelines on water resource management.

The questionnaires about policy guidelines on water resource management shown in Appendix A consists of 5 sets of questions as follows:

- i. The policy guidelines on water resource management.
- ii. The opinion of policy guidelines on water resource management.
- iii. The measures for water resource management in the community.
- iv. The problems/barriers on water resource management in the community.
- v. The respondent's experience in solving for the effective water resource management.

The data obtained from interviews were analyzed by using descriptive research method and summarized as the following details.

According to policy guidelines on water resource management, the study found that 48.27% of the respondents familiarized with the policy guidelines. They explained that the policy guidelines on water resource management was the planning

on water management through the participatory process with all sectors, namely government sectors, private sectors, public sectors, NGO, the network groups. In addition, respondents viewed that policy guidelines are the set of sub-committee to respond in each watershed system. Moreover, the respondents noted that policy guidelines are the action plan to action in each sub-watershed area. Additionally, the respondents mentioned that policy guidelines on water resource management are the conservation of natural environment through cultural and traditional practices such as the forest ordination. Moreover, the respondents noted that policy guidelines are a usage of local wisdom in order to manage water resources such as check dams, mountain plumping, small ponds. Furthermore, the respondents viewed that policy guidelines are the conservation and restoration of forest and ecosystem. In addition, the respondents pointed that policy guidelines are the set of network groups on water management. Importantly, the respondents viewed that policy guidelines on water resources are awareness-raising through local activities in communities. Finally, the respondents indicated that policy guidelines are the restoration and improvement of the river and canals in communities.

Another opinion from the respondents was that policy guidelines on water resource management are very useful because it would help coping with natural disasters such as floods and drought. In addition, the respondent stated that the policy guidelines on water management are necessary because of reduction of losses and damages from the severe flood. Moreover, the respondents noted that policy's implements are vital because it would help local people the building awareness of conservation of forest and water resources. Furthermore, the policy guidelines were also advantaged to provide communities with work together, leading the participatory process on water resource management.

In terms of structural measures, this study reviewed that the development and improvement on alternative reservoir were indicated by the respondents (71.42%). Moreover, 100% of the respondents totally agreed that the construction of check dams in the upstream forest will help water resource management. Besides, 85.71% of respondent's opinions claimed that the development of water distribution systems and diversion structure toward the dry area are another man-made on water management. In addition, digging ponds at farm lands in the community were agreed by 85.71% of the respondents. Furthermore, 92.85% of the respondents indicated that the improvement of main waterways will help the local people on water management in communities. Additionally, the improving water treatments system was chosen by 71.42% of the respondents. Meanwhile, the building natural levee for water management was agreed by 35.71% of the respondents.

In regarding non-structure, this study viewed that the campaign of water saving was indicated by the respondents (50%). In addition, the creation of rules and regulation on water management in the community were agreed by 42.85% of the respondents. On the other hand, (100%) of all the respondents were unanimously agreed with a usage of local wisdom on water management such as distribution system. Additionally, the supporting on knowledge and perception of water resources was accepted by the respondents (100%). Also, the conservation and forest

rehabilitation at the upstream were all agreed by (100%) of the respondents. Furthermore, the prevention of soil erosion such as planting cover crops, plant perennial trees was selected by all the respondents (100%). The identification of measures and guidelines for land use under ecosystem in the area were accepted by the respondents (50%). Furthermore, 71.42% of the respondents agreed that there should be measures, rules and regulation in the community on water management. In addition, 85.71% of the all respondents pointed that the removal of weed and garbage in the river will help to increase water flowing and drainage in the community. Also, the creation of the corporation on water resource management with other sectors was agreed by the all respondents (100%).

Besides, the creation of local plans on water resources management in the community was agreed by the respondent (85.71%). Also, the supporting the budget and funds from government and private sector was accepted by the respondent (85.71%). However, the setting land-use zoning in the community was agreed by the respondent (35.71%). Finally, the modification of the agricultural pattern and timing with appropriated capacity in the community were accepted by 42.85% of the respondents.

The respondents were asked about the problems on water resource management in communities. The detail can be summarized as follows:

- Lacks of measures on waste water treatment in the community. The wastewater from household, agricultural sectors still remain to discharge without the treatment system.
- The forest encroachment due to land-use change in order to plant monoculture-planting farms such as rubber plantation, durian. This cause lead to the damages of the upstream forest and watershed systems.
- The official government in the community did not adequately on water management.
- The poor implementation on local urban planning, low enforcements of existing laws and regulations on land-use zoning.
- Lacks of cooperation with some stakeholders such as agriculturists.
- Lacks of the enforcing laws and regulations on water management.
- Lacks of budget issues for the development project on water management.

On the other hand, 51.72% of the respondents did not familiar with the policy guidelines on water resource management. They revealed that they count upon their experience to cope with the effective water resource management. The detail can be summarized as follows:

- Setting the network group on water resource management with all sectors.
- Exchanging knowledge on water resource management with other communities.

- Raising awareness and perception about the conservation of forest and water resources.
- Supporting knowledge on waste water treatment in communities.
- Building the waste water treatment system in each household.
- Constructing check dams at the upstream in order to retain the water in dry season and conversely, they will help to mitigate floods in rainy season.
- Encouraging knowledge and raising awareness on water resources, especially the young group in communities.
- Supporting the combination between local knowledge and modern technology for water management.
- Creating local plans on water resource management in each community.
- Improving the waterway and drainage system in communities.
- Planting cover plants and perennial trees in order to reduce the soil erosion at the area of slope areas.

Thereby, it would be summarized that approximately 48.27% of the respondents knew about the policy guidelines on water resource management such strategic plan on water resource management. They indicated that the policy guidelines on water resource management is essential to the management of all water-related problems. The problems on water resource management in the community consisted of land use change, forest encroachment, lacks of knowledge on waste water treatment, poor implementation of local planning. However, around 51.72% of the respondents did not familiar with this policy guideline. They view that their experiences, namely encouraging knowledge and raising awareness, building the waste water treatment system, constructing check dams at the upstream, improving the waterway and drainage system with all sectors would help people to manage on water resource management.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions of the study

The objective of this research was to study policy guidelines on disaster risk reduction for climate change adaptation on water resource management in Klong Yan Watershed, Suratthani Province. Vibhvadee District and Kirirat Nikom District were the study areas because these areas have suffered from severe floods in Klong Yan Watershed for a decade. Data collection used in this study including desk study of secondary data and in-depth interviews of primary data by using a set of questionnaires. A set of questionnaires consists of 3 parts, namely disaster risk reduction, climate change adaptation and water resource management. The in-depth interview was used under the purposive sampling method approaching to the target stakeholders in the study area. Descriptive research method was used for data analysis.

The research results provide relevant data on the policy guidelines on disaster risk reduction for climate change adaptation on water resource management which can be concluded as follows:

5.1.1 The policy guidelines on disaster risk reduction

The research findings found that only 31 % of the respondents were familiar with the policy guidelines on disaster risk reduction such the National Disaster Prevention and Mitigation Plan 2015. They indicated that the policy guidelines on disaster risk reduction is very useful to provide the communities with well- disaster preparedness and capacity building on disaster occurrence, leading to the reduction of losses and damages from the impact of disaster.

However, about 69 % of the respondents were not familiar with the policy guidelines on disaster risk reduction. They noted that effective policy implementation requires knowledge training, awareness raising, improving law and regulations, supportive water-related infrastructures, financial support, building communication systems and early warning systems and the creation of the network groups through local activities and measures.

5.1.2 The policy guidelines for climate change adaptation on water resource

The study found that only 24.13% of the respondents knew the policy guidelines for climate change adaptation on water management such the Thailand Climate Change Master Plan 2015-2050. They viewed that the policy guidelines as climate change master plan is crucial to adapt to the adverse impacts of climate change.

However, about 75 % of respondents did not familiar with this policy. They viewed that effective policy guidelines require increased knowledge and perception,

restoring the watershed-forest, networking the conservation and rehabilitation of natural environment, constructing ponds or reservoirs, and enforcing a mandatory law and regulations.

5.1.3 The policy guidelines on water resource management.

The research results found that around 48.27% of the respondents knew about the policy guidelines on water resource management such strategic plan on water resource management. They noted that the policy guidelines on water resource management is essential to the management of all water-related problems, leading to sustainable development in the future.

However, around 51.72% of the respondents did not familiar with this policy guideline. They noted that the policy guidelines require encouraging knowledge and raising awareness, building the waste water treatment systems, building check dams, improving the waterway and drainage systems.

In addition, the respondents expressed their opinions on problems on water resource management in the community consisted of land use change, forest encroachment, lacks of knowledge on waste water treatment, poor implementation of local planning.

5.1.4 The linkage of the study results on the national policy on disaster risk reduction.

Priorities 1: understanding disaster risk. The respondent results found that they were an understanding disaster management, including (i) the promotion of knowledge on methods of preparation and evacuation practices, (ii) the expansion of cooperation between inside and outside with other communities on disaster management (iii) supporting the partnership of disaster risk knowledge, (iv) the awareness and perception on disaster and (v) supporting local mapping.

Priorities 2: strengthening disaster risk governance to manage disaster risk. The respondent results found that they were supporting on prevention, mitigation, preparation, response, recovery including (i) revising action plan in sub-district levels (ii) supporting monthly planning the meeting, (iii) supporting the empowerment of local communities (iv) the promotion of budget allocation.

Priorities 3: investing in disaster risk reduction for resilience. The respondent results found that they were investing on reduction and prevention through structural and non-structural including (i) supporting the financial by government agency, (ii) promoting water-related infrastructure, (iii) strengthening the integrated planning on the conservation of environment, (vi) strengthening the communication system and early warning system in the community.

Priorities 4: enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction. The respondent result found that they were preparedness on disaster recovery including (i)

revising local action plans, (ii) investing technological warning system, (iii) supporting the role and responsibility on disaster management community, (v) training the network groups, (vi) supporting the cooperation between stakeholders and other related sectors and (vii) improving methods of preparedness for disaster management.

5.2 Recommendations

Regarding the research results, there are some recommendations to be considered on the following issues.

i. The knowledge and raising awareness on water resource management should be included in the policy guidelines for climate change adaptation on water resources.

ii. The network groups in communities need to be set up in a long term implementation to increase their capacity to the impact of climate change on water resource management.

iii. The public participation process in communities should be taken into actions on disaster risk reduction.

iv. The policy guidelines on disaster risk reduction should be considered at the bottom-up approach based on successful projects of the Hydro and Agro Informatics Institute.

v. The office of National Water Resources should be the main policy organization to collaboration with related agencies on disaster risk reduction for climate change adaptation on water resource management.

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Appendix A

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY



เลขที่แบบสอบถาม.....

แบบสอบถามข้อมูล

เรื่อง แนวทางนโยบายการลดภัยพิบัติเพื่อการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศ
กรณีศึกษาลุ่มน้ำคลองยัน จังหวัดสุราษฎร์ธานี

คำชี้แจง:

1. แบบสอบถามนี้จัดทำขึ้น โดย นางสาว ศิวพร พรหมแดน นิสิตปริญญาโท สาขาสังแวดล้อม การพัฒนา และความยั่งยืน บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย
 2. วัตถุประสงค์เพื่อสอบถามความคิดเห็นเชิงลึกของผู้มีส่วนได้เสียในแนวทางนโยบายการลด ความเสี่ยงจากภัยพิบัติเพื่อการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศ กรณีศึกษาลุ่มน้ำคลอง ยัน จังหวัดสุราษฎร์ธานี
 3. แบบสอบถามประกอบด้วยคำถาม 5 ตอน มีทั้งหมด 11 หน้า ดังนี้
 - ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม จำนวน 7 ข้อ
 - ตอนที่ 2 คำถามเกี่ยวกับแนวทางนโยบายด้านการลดความเสี่ยงภัยพิบัติ จำนวน 4 ข้อ
 - ตอนที่ 3 คำถามเกี่ยวกับการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศในการจัดการ ทรัพยากรน้ำ จำนวน 6 ข้อ
 - ตอนที่ 4 คำถามเกี่ยวกับการจัดการทรัพยากรน้ำ จำนวน 5 ข้อ
- ข้อมูลที่ท่านให้ไว้ในแบบสอบถามนี้ ทั้งข้อมูลส่วนบุคคล และข้อคิดเห็นต่างๆ ผู้ศึกษาจะนำมา วิเคราะห์และประมวลผล เพื่อประกอบการศึกษาสำหรับวิทยานิพนธ์นี้เท่านั้น
- ผู้ศึกษาขอขอบพระคุณเป็นอย่างสูงที่ท่านได้ให้ความร่วมมือในการตอบแบบสอบถามครั้งนี้
- ขอแสดงความนับถือ
- นางสาว ศิวพร พรหมแดน

คำชี้แจง กรุณาทำเครื่องหมาย “X” ลงใน () ที่ท่านเลือกตอบ และโปรดเติมคำตอบลงในช่องว่าง

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

1. เพศ

() ชาย () หญิง

2. อายุ

() 18-30 ปี

() 31-40 ปี

() 41-50 ปี

() 51-60 ปี

() 61 ปีขึ้นไป

3. ระดับการศึกษา

() ไม่ได้รับการศึกษา () ประถมศึกษา

() มัธยมศึกษาตอนต้น () มัธยมศึกษาตอนปลาย

() อนุปริญญา/ปวส () ปริญญาตรี

() สูงกว่าปริญญาตรี

4. อาชีพหลัก

() รับจ้างทั่วไป

() นักเรียน/นักศึกษา

() ค้าขาย/เจ้าของกิจการ/ธุรกิจส่วนตัว

() เกษตรกร

() รับราชการ

() อื่น ๆ (โปรดระบุ).....

5. ปัจจุบันท่านดำรงตำแหน่งใดในชุมชนของท่าน

() ข้าราชการพลเรือน

() ข้าราชการท้องถิ่น

() กำนัน

() ผู้ใหญ่บ้าน

() สมาชิก องค์การบริหารส่วนตำบล (อบต.)

() ครู/อาจารย์

() สมาชิก อาสาสมัครป้องกันภัยฝ่ายพลเรือน (อปพร.)

() สมาชิกอาสาสมัครสาธารณสุข(อสม.)



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- | | |
|-----------------------------|---------------------------------|
| () เจ้าของธุรกิจท้องถิ่น | () กลุ่มองค์กรที่ไม่แสวงผลกำไร |
| () เครือข่ายลุ่มน้ำคลองยัน | () ประชาชนชาวบ้าน |
| () พระสงฆ์ | () อื่นๆ (โปรดระบุ)..... |

ตอนที่ 2 คำถามเกี่ยวกับแนวทางนโยบายการลดความเสี่ยงจากภัยพิบัติ

1. ท่านรู้จักกับแนวทางนโยบายการลดความเสี่ยงจากภัยพิบัติหรือไม่

() รู้จัก (โปรดระบุ)

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() ไม่รู้จัก (ข้ามไปตอบ ข้อ 4)

2. ท่านคิดว่าแนวทางนโยบายการลดความเสี่ยงจากภัยพิบัติมีความสำคัญกับความเป็นอยู่ของชุมชนอย่างไร

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3. ท่านคิดว่าแนวทางใดต่อไปนี้เป็นไปได้มากที่สุดเพื่อป้องกันและลดผลกระทบจากความเสียหายจากภัยพิบัติ (ตอบได้มากกว่าข้อ)

3.1 มาตรการเพื่อป้องกันและลดผลกระทบจากภัยพิบัติ

- () การใช้สิ่งก่อสร้าง (โปรดระบุ)

.....

- () การออกกฎระเบียบ ข้อบังคับการก่อสร้างอาคาร สิ่งปลูกสร้าง (โปรดระบุ)

.....

- () การวางแผนกำหนดการใช้ประโยชน์ที่ดิน (โปรดระบุ)

.....

- () การวางแผนร่วมกันระหว่างผู้มีส่วนได้ส่วนเสียในพื้นที่ (โปรดระบุ)

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- () การปรับปรุง ทบทวนกฎหมายที่เกี่ยวข้องในด้านการจัดการภัยพิบัติ (โปรดระบุ)

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- () การให้ความรู้เรื่องการป้องกันและลดผลกระทบจากภัยพิบัติ (โปรดระบุ)

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- () การสนับสนุนงบประมาณในการจัดการภัยพิบัติ (โปรดระบุ)

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3.2 มาตรการเพื่อเตรียมความพร้อม

- () การฝึกอบรมและให้ความรู้เพื่อเตรียมความพร้อมก่อนเกิดภัย ระหว่างเกิดภัย และหลังจากเกิดภัย (โปรดระบุ)

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- () การจัดตั้งอาสาสมัครในชุมชน (โปรดระบุ)

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- () การแลกเปลี่ยนองค์ความรู้ระหว่างคนในชุมชนและหน่วยงานภายนอก (โปรดระบุ)

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- () การติดตั้งระบบการแจ้งเตือนภัย (โปรกระบุ)

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- () การเตรียมระบบสื่อสารและช่องทางรับส่งข้อมูลข่าวสารหลายช่องทางเพื่อการแจ้งเตือนภัย ตลอดจนเตรียมระบบสื่อสารสำรอง (โปรกระบุ)

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- () การจัดทำแผนปฏิบัติการในด้านต่างๆ เช่น แผนอพยพ แผนติดตามสถานการณ์ (โปรกระบุ)

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- () การซักซ้อมแผนอพยพเป็นประจำทุกปี (โปรกระบุ)

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- () การติดตามสถานการณ์และสภาพภูมิอากาศจากหน่วยงานต่างๆที่เกี่ยวข้อง (โปรกระบุ)

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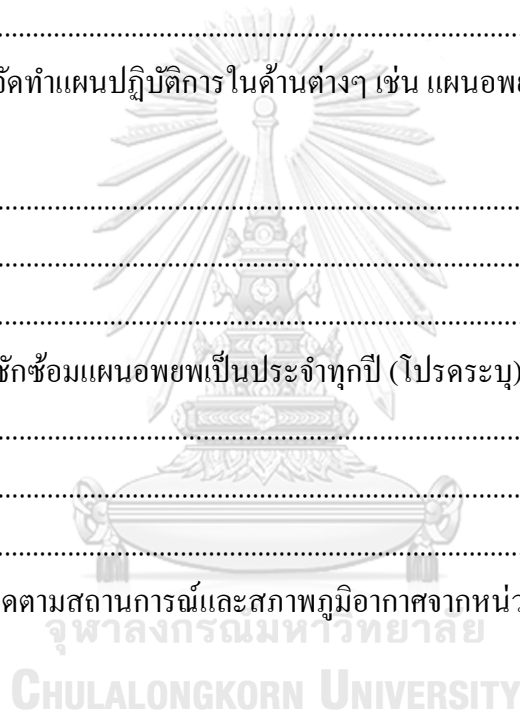
.....

- () การสร้างเครือข่ายในการทำงานเพื่อให้มีภาคร่วมปฏิบัติงาน (โปรกระบุ)

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- () สร้างความตระหนักถึงผลกระทบของภัยพิบัติแก่ประชาชนในชุมชน (โปรดระบุ)

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4. จากประสบการณ์ของท่าน ท่านคิดว่าวิธีการ/นโยบายแบบไหนที่สามารถนำไปใช้ในการลดความเสี่ยงจากน้ำท่วมอย่างมีประสิทธิภาพ

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ตอนที่ 3 คำถามเกี่ยวกับการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศในการจัดการทรัพยากรน้ำ

1. ท่านรู้จักกับแนวทางการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศหรือไม่

() รู้จัก (โปรดระบุ)

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() ไม่รู้จัก (ข้ามไปตอบข้อ 6)

2. ท่านมีความคิดเห็นอย่างไรเกี่ยวกับมาตรการการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศของคนในชุมชน

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3. ชุมชนของท่านมีการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศต่อการจัดการน้ำอย่างไรบ้าง (ตอบได้มากกว่าข้อ)

- () การบูรณาการข้อมูลด้านทรัพยากรน้ำร่วมกันระหว่างหน่วยงาน ต่างๆ โดยรวมข้อมูลด้านการเปลี่ยนแปลงภูมิอากาศในการจัดการน้ำ (โปรดระบุ)

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- () การผลักดันให้เกิดกระบวนการมีส่วนร่วมในการกำหนดนโยบายและวางแผนการจัดการน้ำในลุ่มน้ำ (โปรดระบุ)

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- () การจัดทำแผนแม่บทด้านทรัพยากรน้ำ อย่างเป็นระบบ (โปรดระบุ)

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- () การส่งเสริมอนุรักษ์การใช้น้ำ ทั้งในภาคเกษตร ภาคครัวเรือน (โปรดระบุ)

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- () การจัดทำแผนการใช้ประโยชน์ที่ดิน โดยคำนึงถึงความสอดคล้องกับการเปลี่ยนแปลงสภาพภูมิอากาศและแนวทางจัดการในลุ่มน้ำนั้น (โปรดระบุ)

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- () การผลักดันแผนในชุมชนไปสู่การปฏิบัติในยุทธศาสตร์พัฒนาในระดับท้องถิ่นและจังหวัด (โปรดระบุ)

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- () การผลักดันการดำเนินงานภายใต้กลไกความร่วมมือในการจัดการน้ำระหว่างชุมชน (โปรดระบุ)

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4. ชุมชนของท่านมีการสร้างความพร้อมในการรับมือและลดความเสี่ยงจากอุทกภัยอย่างไรบ้าง
(ตอบได้มากกว่าข้อ)

- () การเร่งฟื้นฟูป่าต้นน้ำ (โปรดระบุ)

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- () การพัฒนาโครงสร้างพื้นฐาน เช่น แหล่งชะลอน้ำ ช่องทางผันน้ำ พื้นที่แก้มลิง
(โปรดระบุ)

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- () การปรับปรุงสภาพลำน้ำและคันดินริมตลิ่ง (โปรดระบุ)

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- () การขยายพื้นที่ชลประทานให้ครอบคลุมพื้นที่ที่มีศักยภาพทางการเกษตร
(โปรดระบุ)

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- () แหล่งน้ำสำรองในฤดูแล้ง (โปรดระบุ)

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- () การจัดการน้ำให้มีความเหมาะสมกับแต่ละลุ่มน้ำ โดยคำนึงถึงปัจจัยทางภูมิอากาศที่
เปลี่ยนแปลง (โปรดระบุ)

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- () ศึกษารูปแบบและประเมินศักยภาพความต้องการใช้น้ำในพื้นที่ต่างๆ (โปรดระบุ)

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5 ชุมชนของท่านมีการจัดการความเสี่ยงจากอุทกภัย อย่างไรบ้าง (ตอบได้มากกว่าข้อ)

- () การใช้เทคโนโลยีแบบจำลองทางภูมิอากาศ แผนที่ มาประเมินและคาดการณ์ผลกระทบจากการเปลี่ยนแปลงสภาพภูมิอากาศ (โปรดระบุ)

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- () การจัดทำแผนที่แสดงพื้นที่เสี่ยงต่ออุทกภัยในระดับ ชุมชน (โปรดระบุ)

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- () การใช้ระบบการพยากรณ์สภาพอากาศในการเตือนภัยล่วงหน้า (โปรดระบุ)

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- () การสร้างเครือข่ายการเตือนภัยล่วงหน้า (โปรดระบุ)

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- () การทำประกันความเสียหายหากเกิดภัยธรรมชาติในชุมชน (โปรดระบุ)

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6. จากประสบการณ์ของท่าน ท่านคิดว่าวิธีการ/นโยบายแบบไหนที่สามารถนำไปใช้ในการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศในการจัดการทรัพยากรน้ำอย่างมีประสิทธิภาพ

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ตอนที่ 4 คำถามเกี่ยวกับการจัดการทรัพยากรน้ำ

1. ท่านรู้จักกับแนวทางการจัดการทรัพยากรน้ำหรือไม่ (โปรดระบุ)

() รู้จัก

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() ไม่รู้จัก (ข้ามไปตอบข้อ 5.)

2. ท่านมีความเห็นอย่างไรเกี่ยวกับการจัดการทรัพยากรน้ำในชุมชนของท่าน (โปรดระบุ)

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3. ท่านคิดว่าแนวทางใดต่อไปนี้จะช่วยจัดการทรัพยากรน้ำในชุมชน (ตอบได้มากกว่าข้อ)

3.1 วิธีการจัดการด้านโครงสร้าง

- () การพัฒนาและปรับปรุงแหล่งกักเก็บน้ำสำรอง เช่น ฝายน้ำล้น อ่างเก็บน้ำในหมู่บ้าน
- () การสร้างฝายชะลอน้ำประเภทต่างๆ ในพื้นที่ต้นน้ำ
- () การผันน้ำและสร้างเส้นทางน้ำเชื่อมโยงแหล่งน้ำไปยังพื้นที่ขาดแคลนต่างๆ
- () การขุดสระน้ำในไร่นาของเกษตรกร
- () การปรับปรุง ขุดลอก เส้นทางน้ำที่ตื้นเขินให้ระบายอย่างมีประสิทธิภาพ
- () การบำบัดน้ำเสียจากชุมชนก่อนปล่อยลงสู่แม่น้ำลำคลอง
- () การสร้างคันดินกั้นน้ำ
- () อื่นๆ โปรดระบุ

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3.2 วิธีการจัดการที่ไม่ใช้โครงสร้าง

- () การรณรงค์การใช้น้ำในชุมชนอย่างประหยัด
- () การกำหนดกติกา การใช้น้ำร่วมกันในชุมชน
- () การใช้ภูมิปัญญาชาวบ้านในการจัดทำระบบส่งน้ำ
- () การจัดการผลผลิตทางการเกษตรให้สอดคล้องกับทรัพยากรน้ำในพื้นที่ชุมชน
- () การให้ความรู้และการสร้างความตระหนักแก่คนในชุมชนถึงความสำคัญของทรัพยากรน้ำ
- () การอนุรักษ์และฟื้นฟูพื้นที่ป่าต้นน้ำที่เสื่อมโทรม
- () การป้องกันการพังทลายของดิน โดยใช้วิธีการทางธรรมชาติ เช่น การปลูกพืชตามแนวระดับ พืชคลุมดิน และพืชหมุนเวียน
- () มีการกำหนดมาตรการแนวทางการใช้ประโยชน์ที่ดินในพื้นที่อนุรักษ์ให้สอดคล้องกับระบบนิเวศในพื้นที่
- () การสร้างมาตรการ กฎระเบียบในชุมชนในการใช้ทรัพยากรน้ำในชุมชน
- () การกำจัดวัชพืช ขยะมูลฝอยในแม่น้ำ ลำคลอง เพื่อลดการกีดขวางการระบายน้ำ
- () การสร้างความร่วมมือด้านการจัดการน้ำจากหน่วยงานภายนอกชุมชน
- () การสร้างแผนการจัดการทรัพยากรน้ำภายในชุมชน
- () การจัดระเบียบการใช้ประโยชน์ที่ดินในการกำหนดเขตการพัฒนา
- () การปรับรูปแบบการทำเกษตรหรือเลือกชนิดพืช และระยะเวลาปลูกให้เหมาะสมกับศักยภาพของพื้นที่
- () การได้รับงบประมาณ/กองทุน จากหน่วยงานภาครัฐและภาคเอกชนในการ
- () อื่นๆ (โปรดระบุ)

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4. ท่านคิดว่าปัญหาและอุปสรรคในการจัดการทรัพยากรน้ำในชุมชนได้แก่อะไรบ้าง (โปรดระบุ)

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5. จากประสบการณ์ของท่าน ท่านคิดว่าวิธีการ/นโยบายแบบไหนที่สามารถนำไปใช้ในการจัดการทรัพยากรน้ำอย่างมีประสิทธิภาพ

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VITA

NAME siwaporn promdaen
DATE OF BIRTH 13 September 1984
PLACE OF BIRTH ChiangMai Province
HOME ADDRESS 111 M 1 MuangNay, ChiangDao Sub-District, ChiangMai Province 50170



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