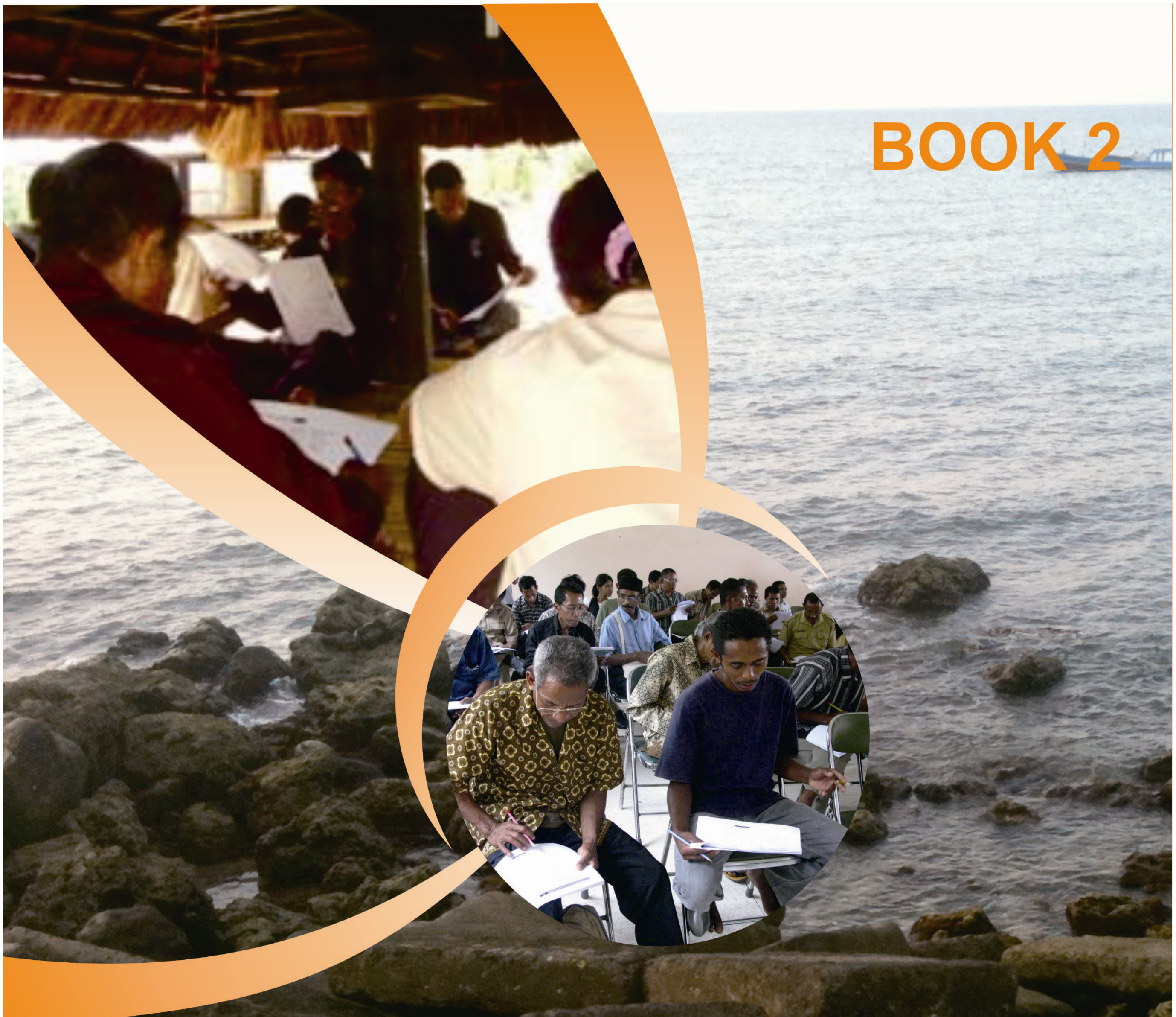

BOOK 2

ADAPTIVE CAPACITY TO CLIMATE CHANGE IN LEMBATA, SIKKA, AND TIMOR TENGAH UTARA (TTU)

Participatory Research on Climate Vulnerability

Australian AID
BNPB
AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

INSTITUT TEKNOLOGI BANDUNG 1920

Plan

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Report on Participatory Research on Climate Vulnerability

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I Introduction

1.1 Background

Indonesia faces many challenges to meet the Millennium Development Goals (MDG) targets, especially with rapidly degrading ecosystems, climate change and increasing vulnerability to disasters. In order to develop appropriate adaptation actions, Indonesia needs to develop scenarios and understanding of what the climate future will hold. Up until now, the study that focuses on the integration between climate model and scenarios with the adaptive capacity scenario as well as climate vulnerability is still rare. This has caused a lot of uncertainties in developing adaptations that are suitable in particular regions. Hence, a study that integrates both climate model and the adaptive capacity scenario really needs to be conducted at the national, provincial & district level.

Indonesia's Climate change vulnerability is augmented by its extensive coastlines and the fact that 44% of the population is agriculturally reliant for their livelihoods. East Nusa Tenggara (NTT) is selected as the study area for this research due to its condition as one of Indonesia's most disaster-prone areas. The location of this research is in Lembata, Sikka and Timor Tengah Utara Districts (Figure 1).

This book is part two of three books that present the reports from the study of "Participatory Research on Climate Vulnerability in NTT". The first book covers the current issue of climate model (the mean rainfall, mean temperature, and sea level rise) and its projection. The second book (this book) presents the current issues of socio-economic condition and adaptive capacities as well as its projection. The third book integrates the issues of climate models, adaptive capacities and recommendation of adaptation options in dealing with the climate vulnerability.

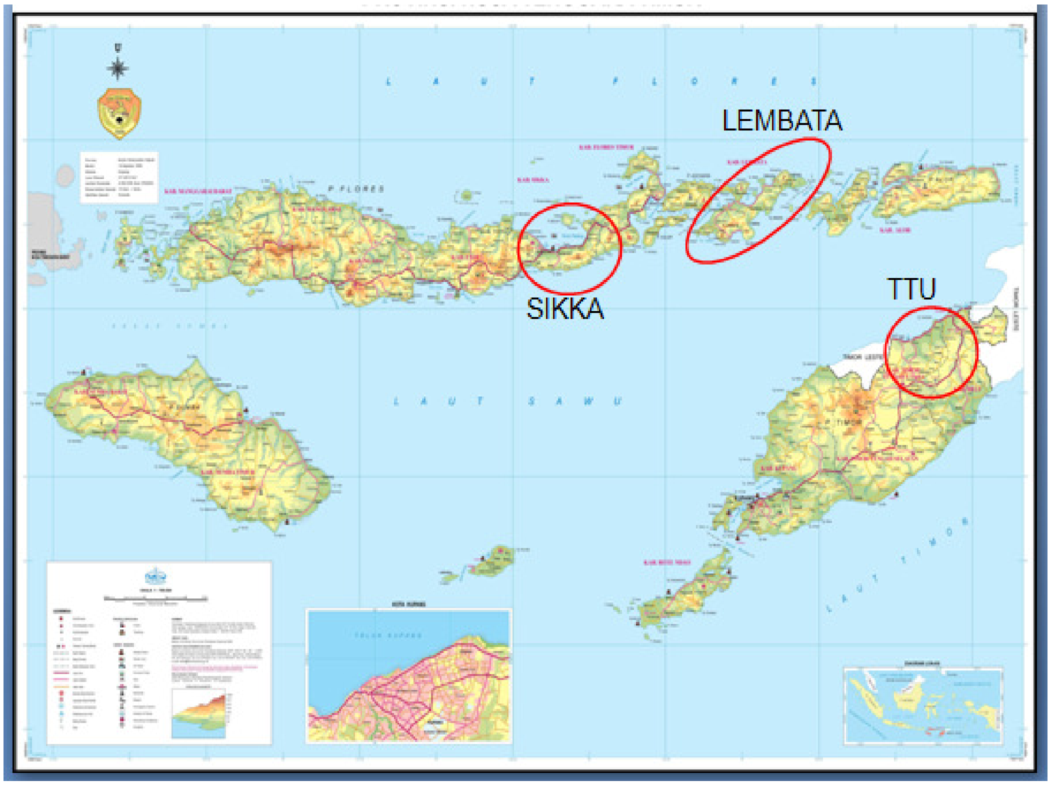


Figure 1. NTT Province and location of case study areas

1.2 Objective

The objective of the study in general was to develop participatory climate vulnerability of three districts in NTT (Sikka, Lembata and TTU). To achieve this objective, the proposed research used an innovative science-based approach to study the implications of climate change, therefore increasing the accuracy in assessing climate change vulnerability and also the effectiveness rate of the adaptation options. The research used the Climate Smart Disaster Risk Management approach that Plan was currently implementing across a number of countries and funded by DFID. The method and tools used through this research project aimed to build capacities in the three districts for adaptation to climate change, using a methodology that combined both science based and participatory approaches.

To ensure the participatory process, the research was conducted through partnership between Plan International, The Bandung Institute of Technology (ITB), University of Timor, local academics and research institutions, DRR practitioners and managers, local Governments, and vulnerable members of the community, including women and children.

The objective of this book is to provide the results from analysis of adaptive capacity. Through adaptive capacity approaches, it is targeted that the disaster risk reduction process of climate change impact can also be implemented by the local people, which will be supported and facilitated by the governmentz. The first target that will be identified is how far the local people are able to adapt to the climate change impact. Secondly, this analysis wants to provide an information system in this participatory disaster risk reduction research assessment.

1.3 Analytical Framework

In the analytical process, the general research framework is presented as follows in Figure 2, as for the detailed analysis process, it is described in Figure 3. First, the climate model is analyzed in detail using the consideration of mean rainfall, mean temperature and sea level rise. The adaptive capacity (this book) is analyzed using several indicators related to socio-economic and infrastructure factors of the districts. The results of the two analyses were integrated into a participatory climate vulnerability analysis showing the results of scenario of the climate as well as the adaptive capacity. Subsequently, the adaptation options were developed based on the scenarios in the participatory climate vulnerability. In each step, focus group discussions were carried with local policy and decision makers and local communities.

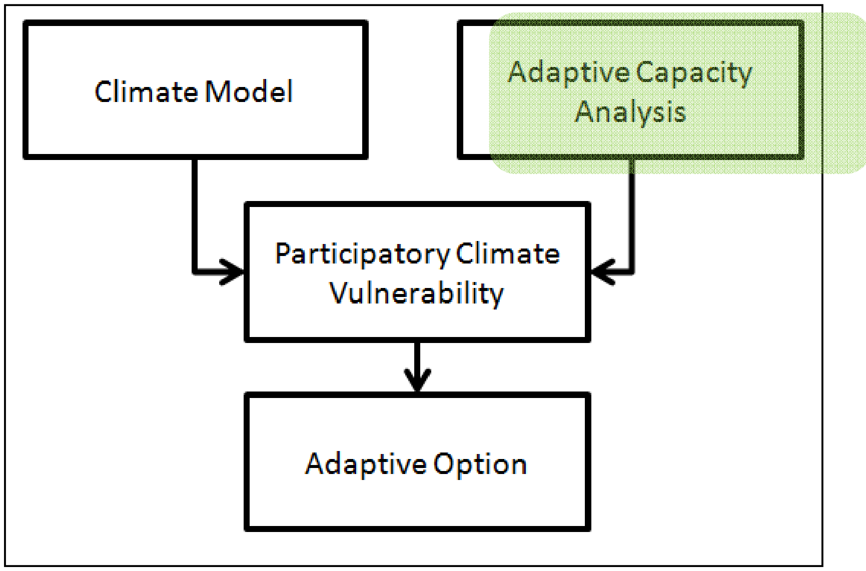


Figure 2. General Research Framework

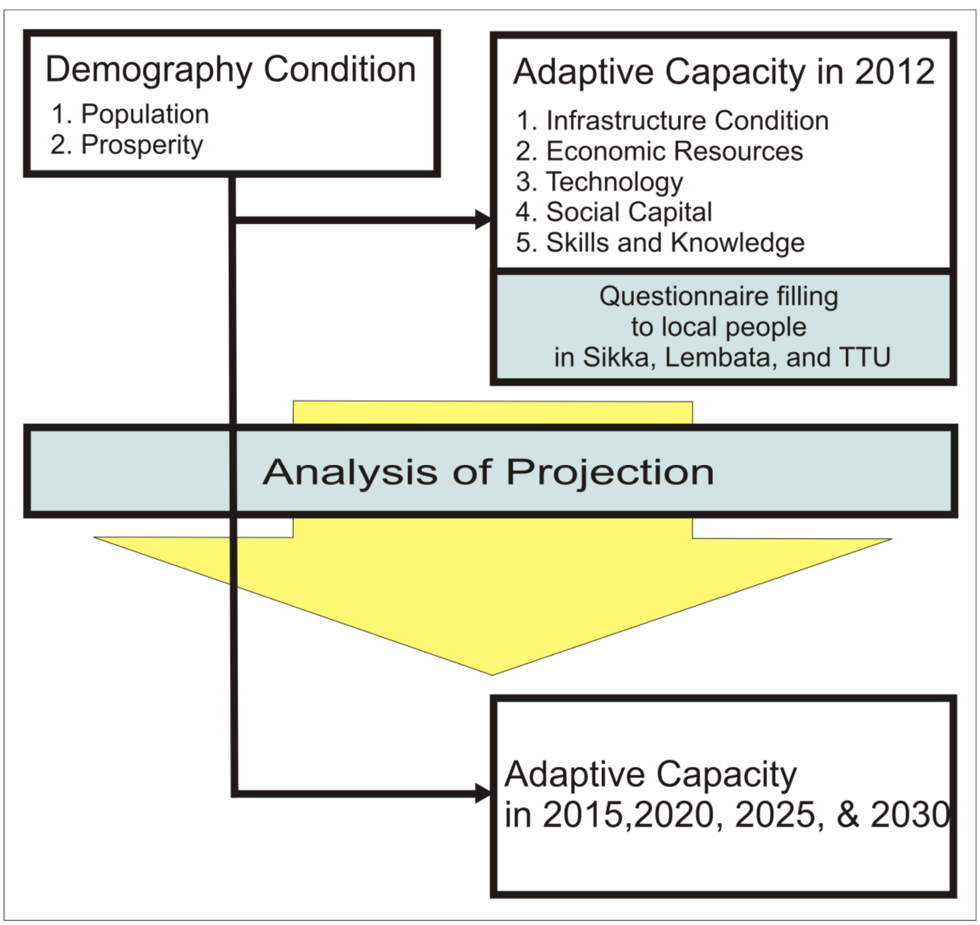


Figure 3. Detailed Adaptive Capacity Analysis Process

II Surveying Activities in Sikka, Lembata, and Timor Tengah Utara (TTU)

2. 1 Surveying Activities in Sikka, NTT

2.1.1 Schedule

Study of society (the process of filling questionnaires) was conducted on January 25, 2012. Schedule details are shown on table 1 below:

Table 1. Schedule of Surveying Activities in Sikka

Time	Schedule	PIC
09.00-10.00	1. Opening	Samuel
	2. Description on objective of questionnaire filling	Manu Drestha
10.00-10.30	Coffee break	Manu, Yayasan Bangwita
10.30-13.00	Questionnaire Filling	Manu, Samuel, Herry, Yanto
13.00-14.00	Lunch	Manu, Yayasan Bangwita
14.00-14.30	Closing	Manu, Samuel

Community Assessment (Completion of questionnaire) was performed at the House LK3I in Maumere, Sikka, NTT.

2.1.2 Output

A total of 70 sheets of questionnaires had been filled through the study on January 25, 2012 in the auditorium of the LK3I Maumere building. It was followed by 70 study participants consisting of 60 men and 10 women from 16 districts spread over Sikka District. The entire process was facilitated by Manu Drestha and assisted by three co-facilitators of the Foundation BANGWITA-Maumere, namely Samuel, Herry and Yanto.

The review process began with the opening from Samuel (BANGWITA Foundation), followed by a presentation on the intent and purpose of the review conducted by Manu Drestha. Following that was the explanation by Manu Drestha on the basic concepts of climate change, the process of climate change, description of some of the terms related to climate change and its relations with catastrophic climate change. On this session, a brief excavation on the types of disasters that are common in Sikka District was also conducted. The next question and answer session was conducted to deepen the understanding of climate change, disasters and purpose of conducting the study. Once this process was completed, more questionnaires were handed out. The Charging procedure was done in stages where the questionnaire facilitator guided the process of filling questions one by one. To ensure that participants filled out the questionnaire properly, co-facilitators supervised and assisted each participant.

Some of the impressions and concerns that arose in the question and answer session on climate change, disasters and the study's purpose were:

- With this short exposure, we would become more aware of climate change, adaptation and mitigation. During the socialization of climate change that was not as clear as this, many used the language and terms that we did not understand. Yos throat, Village Inuring.
- Trainings such as these need to be more frequent and should further aim to understand the basis of climate change and its relation to the disaster, the difference in adaptation and mitigation process, so that we could

determine the appropriate efforts to overcome them, Kristina Aventiana, Village Wailamung.

- Exposure to, and filling questionnaires with a few examples of activities that can be done for mitigation and adaptation due to floods, landslides and droughts, have inspired and motivated us to be more eager to help with disaster relief efforts, FABI Toa, Village Rubit.
- How to conduct follow up after this study? We need to know the results!, All participants

Sikka District demographic data for 2009 and 2010 had been obtained in BPS of Sikka in the form of an electronic file. Data / land use maps had been searched upon in BAPPEDA, Dishut and Sikka District Agriculture Office, but based on the information from them, the map didnot exist. There was a forest land that used maps, a map of potential wetland and dry land, but did not meet the basics of proper maps (the map only showed the forest area, area of wetlands and dry land, but did not show where those locations were). Maps are attached separately from this report.

All data had been recapitulated with questionnaires containing data about the respondent, an indicator of the infrastructure, technology indicators, economic indicators, social indicators, indicators of abilities and knowledges, impact, adaptation and selection of individual adaptation, with adaptation and adaptation options, the source of the type of assistance, the perception of risk and the likely adaptation to the front.

2.1.3 Learning

a. The questions and the questionnaire seemed too difficult to be understood by the participants, which were actually part of a rural community. Society tends to saturate and the answer seemed so long, especially in the final pages of the questionnaire that demanded descriptive answers. For the development, the questionnaire needs to consider the psychology of people in charge of answering the questions.

b. To ensure the effectiveness and validity (truth information) of the answer, it takes an emotional connection between the respondent / participant with the surveyor / facilitator assessment. This emotional connection would create a sense of openness from participants in filling out the questionnaire answers. It was very important to choose a surveyor / facilitators who could establish an emotional connection with participants / respondents. Another option was to involve the co-facilitators of the local community who could help the process of creating emotional connection between facilitators and participants.
c. Based on the observations of the facilitator, a basic understanding of the respondents about climate change and disaster were still lacking. This affected the charge questionnaire (disturbing the validity of the answers), especially in understanding of term adaptation and answer choices. A small example, was how the participants could answer the adaptations they are doing while they themselves did not know the meaning of the word, adaptation.
d. This required the expertise of a facilitator and co facilitator in explaining about the terms and basic concepts of climate change using local language / language that could easily be understood by the respondent.
e. The questionnaire was developed to focus the study on landslides and flood disasters only. But in reality, the disaster that was felt by the participants were not only floods and landslides, but also abrasion and failure to catch fishes experienced by fishermen , coastal and drought / crop failures, especially in rural communities. According to the confessions made by members of thesociety, the disaster that was considered catastrophic and had more impact on their lives was drought / crop failure. Therefore, although the questionnaire was specifically developed for the study of floods and landslides, but the information and data on dryness, abrasion and failure to fulfill fishing targets was still needed as additional information that could enrich the analysis.
f. The collection of secondary data, especially maps in areas of Eastern Indonesia is usually difficult. This means that these data do not exist or

could not be given to others easily. It would require much strategy and a lot of time to obtain these data. One strategy that can be done is to take advantage of local people / from the area that has affinity with those who possess such data.

g. Process of data recapitulation takes much time, especially descriptive data tabulation. For the development, the tabulation format is needed, so the recapitulation process can be done more effectively and swiftly .

2.1.4 Recommended Follow-Up

a. Results of the vulnerability analysis will need to be socialized with the issue of climate change and disaster to the Sikka District government, NGOs and communities, including communities in the villages who participated in the study. Socialization can also be done alongside the clarification stage of the analysis results that can be fixed before the analysis is further exposed.
b. Specific socialization strategies are needed to ensure that the research results are used as a reference / base balance of efforts to develop disaster risk reduction programs in Sikka District.
c. Determining who will control the post-assessment process. It is necessary to establish collaboration with related stakeholders in Sikka (government, NGOs and community organizations), in order to develop disaster risk reduction activities and to ensure controlling process.

2. 2 Surveying Activities in Lembata, NTT

To determine the trend of increasing climate change impacts in the future in the region of East Nusa Tenggara (NTT), Plan Indonesia in cooperation with Institut Teknologi Bandung (ITB) is currently conducting participatory research on climate vulnerability. Research supported by AIFDR (Australia Indonesia Facility for Disaster Reduction) is being done in the study area in the Sikka, Lembata, and Timor Tengah Utara (TTU) Districts. To complete the study, the study's research activities involve a series of vulnerabilities, one of which is spreading questionnaires to the community to obtain preliminary data on the level of the vulnerability.

Lembata District was one of the districts that is especially vulnerable to catastrophic climate disasters. Rainfall in this district had been increasing uncertainly and would have an impact on disaster vulnerability. Lembata has relatively dry climate with the average rainfall per year of 001,95 mm or 230 mm high in March and the lowest being 14 mm in May. Average air temperature of 26 ° C - 29 ° C with minimum and maximum temperature ranged between 23 ° C - 30 ° C. While the relatively low wind speeds averaged only 8.4 knots / hour. Therefore, the presence of such research was helpful in projecting the climate in this district for future periods.

Questionnaire filling activities carried on in the 5 (five) points to 9 (nine) sub districts in Lembata District. The schedule of those five points can be seen in the following table 2:

Table 2. Schedule of Surveying Activities in Lembata

No	Date	Place	Sub District (*Kecamatan*)
1	Saturday, 21 January 2012 (10.30 – 15.00)	Village's Office of Wuakerong	Nagawutung
2	Sunday, 22 January 2012 (10.30 – 14.00)	Village's Office of Kolontobo	Ile Ape
3	Sunday, 22 January 2012 (15.30 – 18.00)	Village's Office of Todanara	Ile Ape Timur
4	Monday, 23 January 2012 (11.30 –15.00) (16.00 –18.30)	Ebang (Tenda Adat) in Peusawa Village Desa Merdeka	Omesuri, Buyasuri, and Lebatukan
5	Tuesday, 24 January 2012 (09.00- 12.00)	Sub District's Office of Nubatukan	Nubatukan, Atadei and Wulandoni

The number of respondents who filled out this questionnaire was as many as 70 (seventy) of the respondents, which was in accordance with the directives given to the whole Lembata District. Respondents came from various professional backgrounds and were residents of the Lembata District. Photos of questionnaire filling activities are shown below;

Questionnaire Filling in Nubatukan, Atadei & Wulandoni

Questionnaire Filling in Omesuri dan Buyasuri

Questionnaire Filling in Ile Ape Timur

Questionnaire Filling in Nagawutung

2. 3 Surveying Activities in TTU, NTT

Based on result of data surveyed in TTU on 28 respondents, related to climate disasters caused by climate change, the adaptive capacity level in TTU was still generally in the low level. This condition was indicated by survey results in that location, especially to estimate the 5 indicators of adaptive capacity, namely infrastructure, economics, technology, social, and knowledge capacities, where the 5 indicators had score value lower than 0.6 (rough estimation) in range of 0 to 1.

It's found on an infrastructure indicator built in TTU, that 90 percent of their houses are legally owned, however most of the house's buildings were unfit for human habitation. 80 percent of the houses had only one floor and most of them were made from wood. The rest of their houses were made from wall combined with wood. 12 percent of the houses built did not have access to electricity. With such infrastructure conditions, if a climate disaster occurred in that area, it would very much be vulnerable to it, namely floods and landslides.

Now we move on to the economic indicator. Most of the people in TTU were farmers and worked for companies. 90 percent of their monthly incomes were lower than 500,000 rupiahs. Based on BPS data, income per capita in TTU was only 4 million rupiah per year. After a disaster occurred, income per capita in TTU District would receive informal aid, namely from families in other regions. The economic condition in TTU District was still relatively low for the people to solve the problem of climate change.

From the technology and transportation indicator, most of the TTU society used motorcycles as their daily vehicle. Based on survey, almost 94.5 percent of the society used motorcycle. Meanwhile other vehicles used were mini busses: 2.5 percent, midi busses: 0.5 percent, and trucks: 2.5 percent. To evacuate from a disaster, the buildings used were generally schools and governmental buildings. However, to reach the evacuation site, the access was still difficult and long. Because most of the people use motorcycles and not much larger sized vehicles, therefore TTU only reached a low rate for this indicator.

Next up, is social indicator. This indicator is aimed to monitor the social network built especially in areas prone to climate disasters. Result of the survey showed that people of TTU received aid from their relations and regional government during time of disaster. To prepare for facing the disaster, at least, people in TTU held meetings to discuss disaster solutions each year. For this problem, people in TTU also performed discussions to determine solutions for climate disasters in the future. The current social condition was still vulnerable, so an increase in the society's adaptive capacity on climate disaster was vital for the future.

The next indicator is skill and knowledge in solving solutions for climate disasters. Based on the survey conducted, the people in TTU had only ever gotten training on disaster management in 2010. This training was held by the Institute for Economic Analysis (IDEA), Yogyakarta, cooperating with Flores Institute Resources for Development (FIRD) in 2010. People in TTU received numerous benefits from this training in facing disasters. They now understood the system of disaster management that was informed, supported by local wisdom in that region. However, because training was held scarcely, the level of their skill and knowledge was still low for them to increase their adaptive capacity. Therefore, this indicator of TTU society was still considered low and inadequate for facing climate change in the future.

Based on 5 indicators of adaptive capacity discussed above, it can be concluded that the TTU people were still vulnerable to climate change in the future. And after seeing projections of climate variablity (temperature and rainfall) built by ITB team, the rough comparison between adaptive capacity and projection of climate disaster occurring in the future showed a significant difference, concluding that climate disasters had a higher potential to occur in the future, as also measured with adaptive capacity.

III Focus Group Discussion Activities

In conditions where the effects of climate change are great and the greater the degree of adaptation to lower and higher degrees of climate, are what ignite climate vulnerability. East Nusa Tenggara Province is one of the provinces in Indonesia that have high levels of vulnerability due to climate change. It has been seen from a variety of climate data and climate disasters that's observed by several agencies in recent years. Historical data shows the increasing level of climate events, especially landslides and floods, which ultimately cause harm to the population in the region.

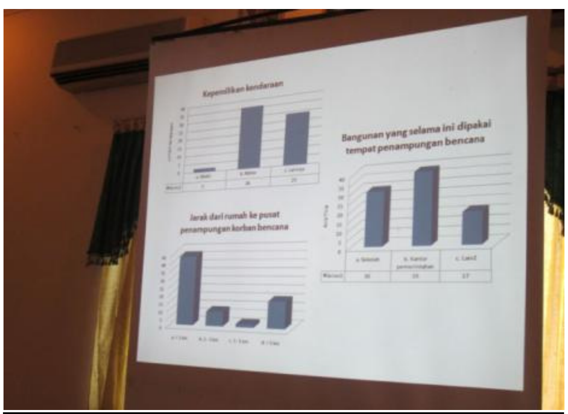
To figure out the trend of increasing climate change impacts in the future in the Province of East Nusa Tenggara (NTT), Plan Indonesia in cooperation with Institut Teknologi Bandung (ITB) is conducting participatory research on climate vulnerability. The research is supported by AIFDR (Australia Indonesia Facility for Disaster Reduction), and takes the study area in the Sikka, Lembata, and Timor Tengah Utara (TTU) Districts.

The results of this research is expected to be utilized by the government and people in the district for consideration in making development policies in the region related to climate change adaptation efforts.

One of the activities of a series of research activities vulnerability to climate change impacts in the NTT Province is Focused Group Discussion (FGD) activity. This activity aims to gather information about the impacts of climate change and also information on the adaptive capacity of communities, especially in Sikka, Lembata, and TTU. Previously, it had been made for distributing the questionnaire to collect similar information sourced from the local community. For complete information, the FGD activity was conducted by inviting stakeholders, NGOs and related agencies and is expected to strengthen the validity of the information in the study area of Sikka, Lembata, and TTU District. Purposes of Focus Group Discussion in Kupang are as follows:

FGD activity held in Kupang, NTT


ITB Team presented results of research in NTT



Result of surveying presented by consultant of Sikka


Consultant of Lembata presented result of surveying

1. Delivering the initial results of climate projections, the projected sea level rise and climate hazards, as well as the adaptive capacity of communities in the face of climate-related disasters in the Province of NTT (Sikka, Lembata, and TTU). Specific socialization strategies are needed to ensure that research results are used as a reference / base balance of efforts to develop disaster risk reduction programs in Sikka District.

2. Obtain feedback from participants related to participatory research project on climate vulnerability.
3. Obtain more detailed information about the state of climate change impacts in NTT (Sikka, Lembata, and TTU).
4. Obtain more detailed information about the adaptive capacity that can be developed in NTT (Sikka, Lembata, and TTU), including their local wisdom.

IV Demography Condition in Sikka, Lembata, and Timor Tengah Utara (TTU)

The demography condition shows various characteristics of people in an area. In relation to climate change disasters, some demography conditions may further give a wide impact to the people. In this research, only these 2 aspects of demography will be reviewed; population and prosperity.

4.1 Population

Population represents the number of people which occupy an area. The event of hazards can be categorized as a disaster when there are damages/losses/victims of units or people. In accommodating for the long term impacts of climate change disasters, the number of population analyzed with its future projection become one of main steps in this research. The projection will use exponential method as shown in the formula below:

$$Pt = Po.e^{r.t}$$

with,

Pt : Population in (t) year

Po : Population in based year

e : Coefficient (2.71828)

r : Population Growth Rate

t : Difference of year

Figure 4 shows that in the next 40 year period (2010-2050), the population increase in Sikka District will be the biggest, with 95.000 people, compared with the TTU District with 70.000 people and Lembata District with 58.000 people. This projection result definitely has a close relation with each of the other area's size being smaller than the Sikka District, which has the widest area as well as the largest current population.

On the other hand, the result of this population projection also showed that theSikka District had the biggest potency for vulnerability in facing the impact of climate change disasters. The rapidly increasing number of people in this area, will lead to the increase of the number of victims there once disaster strikes.

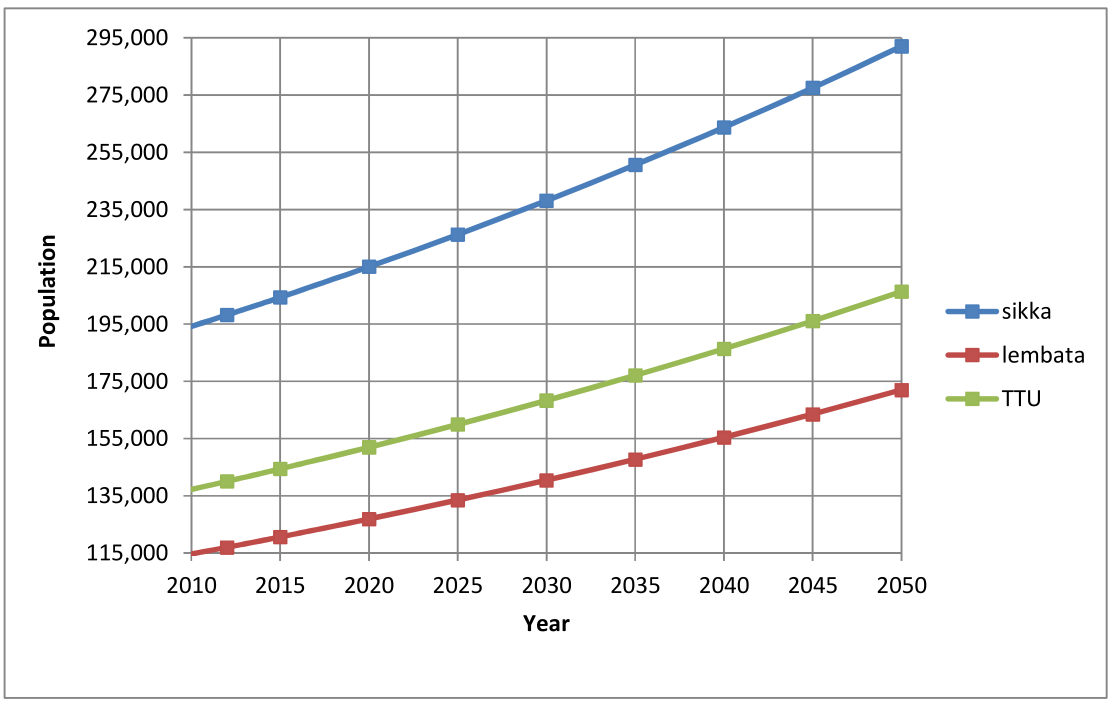


Figure 4. Projection of population per 5 year in study areas during 2010-2050

4.2 Prosperity

Prosperity can represent the level of people's welfare in an area. In a climate change context, the level of people's welfare essentially can give us the general understanding of the people's capability in facing climate change impacts. In this research, the people's prosperity in an area was represented by its Gross Domestic Product (GDP). Total number of production (GDP), was also in line with the level of people's capability in these areas. Logically, people with bigger level of prosperity (directly linked to economic condition) would have better capability in facing and dealing with any disaster event. For example, they could buy more permanent structure of housing or choose a safer location to live in, which coulds reduce the impacts of climate change. This economic condition also relates to the people's level of education and health.

Historical data showed that the development of GDP in study area was quite significant, especially in the Sikka District. Figure 5 shows that in between the 2006 until 2010 period, Sikka District had the biggest increase of GDP value with over Rp 700 billion, compared with the TTU District with Rp 300 billion, and the Lembata District with Rp 200 billion.

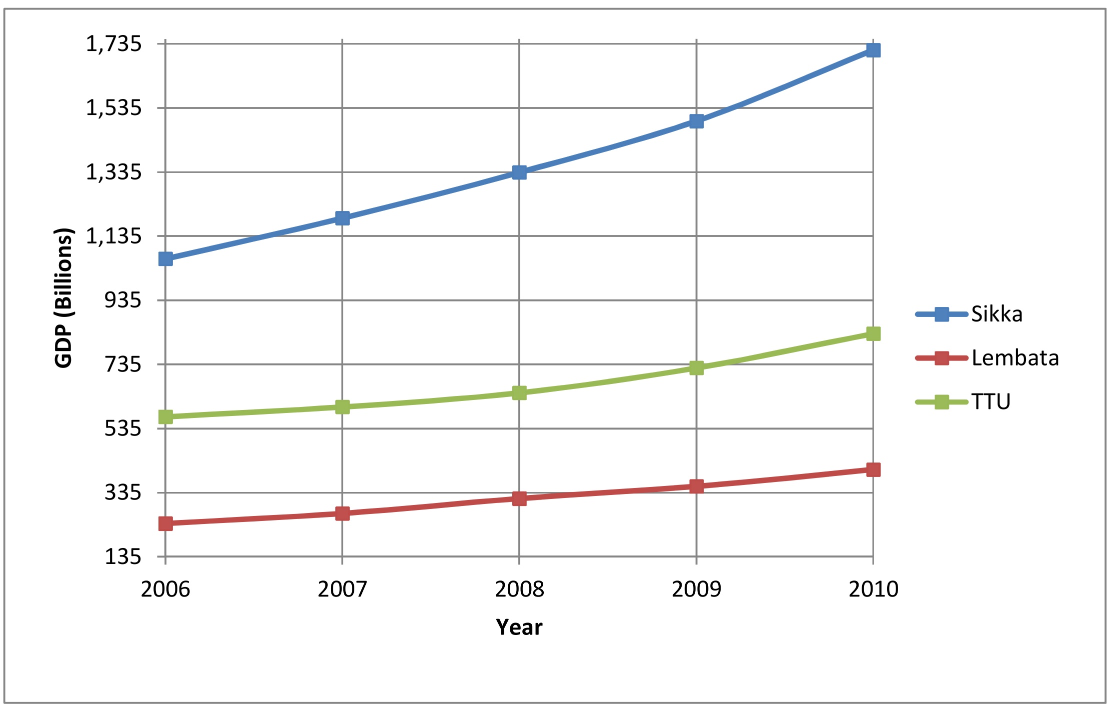


Figure 5. GDP of study areas during 2006-2010

In order to accommodate the impact of climate change in the future, those values of GDP will be projected until the next 40 years. The projection will use exponential method because the GDP increasing pattern in the study areas, will lead to the non linear trend. The formula method is shown below:

with,

Pt : GDP in (t) year

Po : GDP in based year

E : Coefficient (2.71828)

r : GDP Growth Rate

t : Difference of year

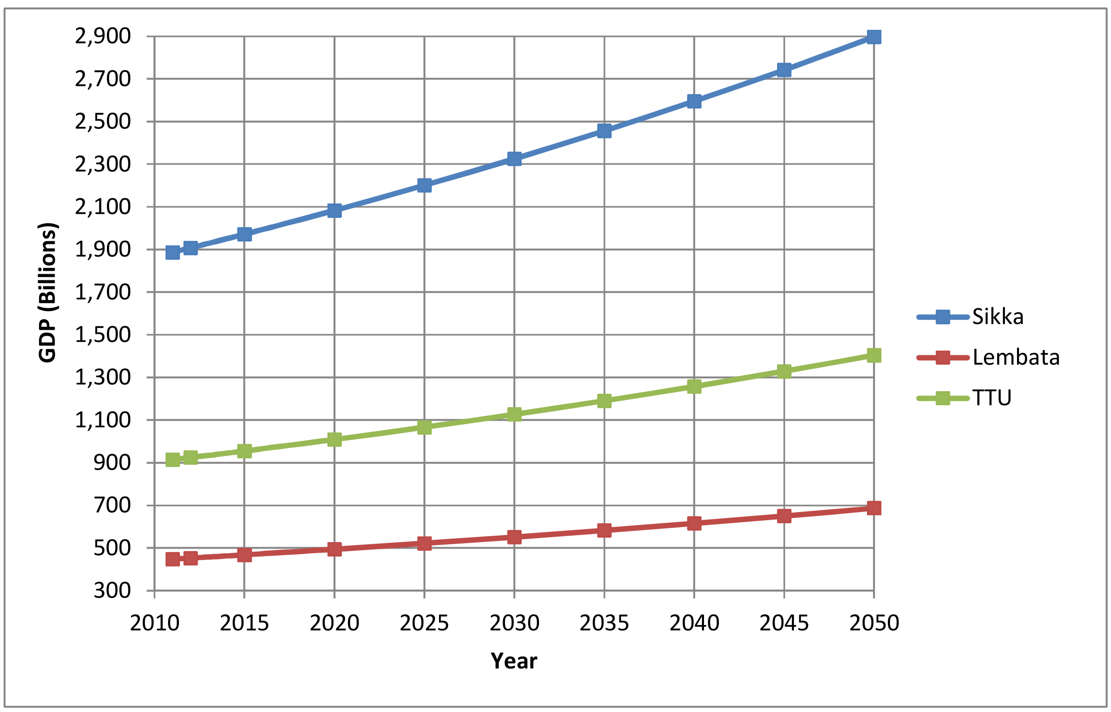


Figure 6. Projection of GDP per 5 year in study areas during 2010-2050

Figure 6 shows that between the 2010 and 2050 period, the GDP increase in Sikka District is still the biggest with Rp 1.000 Billion, compared with TTU District with Rp 400 billion and Lembata District with Rp 250 billion. On the other hand, this result also indicates that Sikka District will have the lowest potency of vulnerability in facing climate change impact. The bigger the economic resources are, the more it can give the people flexibility in choosing various kinds of adaptation options.

V Adaptive Capacity Condition and Projection in Sikka, Lembata, and Timor Tengah Utara (TTU)

Nowadays, the urgency for adaptive capacity assessment of people in disaster-prone areas becomes one of main focus in the effort to implement the disaster risk reduction concept. Through adaptive capacity assessment in this research, we will further be able to know about the capability of Sikka, Lembata and TTU's people in choosing, developing and implementing their adaptation option to tackle the climate change impact in each of their areas.

Practically, the adaptive capacity assessment has its own conceptual framework which identified some of main indicator in the early process. This adaptive capacity research only focused in household unit assessment, which used 5 main indicators; infrastructure conditions, economic resources, technology usage, social capital, and skills-knowledge. Each of these indicators consisted of many unit parameters (measure instrument) and each parameters also had a number of simple to complex variables. Selected indicators were the result of experts' agreement from Indonesia, Thailand, Philippines, and Vietnam, which were accompanied in the *Economy and Environment Program for Southeast Asia* (EEPSEA). The experts adopted these capacity indicators from Smit et al. (2001) and modified them in the accordance of each area's condition and characteristic. The main indicators, their parameters, measure instruments and also classification are shown in table 3 below.

Data collection process would use the primary data survey method, through questionnaire filling in Sikka, Lembata, and TTU District, which the process was explained earlier. The result from this questionnaire data processing would be used as representation of people's adaptive capacity level in the current year (2012 as a based year).

Table 3. Indicator of Adaptive Capacity Assessment

Measure Instrument	Classification	Parameter
Infrastructure Condition		
Houses Ownership	**High**	Non ownership (stay at the family/relate/etc houses)
	Normal	Rent ownership
	Low	Full ownership
House Type	**High**	Permanent house
	Normal	Semi permanent house
	Low	Non permanent house
Number of House's Floor	**High**	More than 2 floors
	Normal	Two floors
	Low	One floors
Electric Availability	**High**	Source from State Electrical Company (PLN)
	Normal	Source from other
	Low	None of electrical source
Source of Clean Water	**High**	Source from State Water Company (PDAM)
	Normal	Source from well, pump, pipe, or river
	Low	None of clean water source
Economic Resources		
Type of Job	**High**	Type of job which not affected by climate change impact
	Normal	Type of job which affected by climate change impact
	Low	Type of job which must leaved because of climate change impact
Income (UMR NTT Rp 850.000/month)	**High**	Income more than minimum regional number (UMR)
	Normal	Income approximately at UMR

Measure Instrument	Classification	Parameter
	Low	Income less than UMR
Affected of Income by Climate Change Impact	**High**	Not affected
	Normal	A little affected
	Low	A big affected
Loan Need	**High**	Need not a loan
	Normal	Need a loan
	Low	Highly need a loan
Technology		
Distance between House to Shelter	**High**	Close distance
	Normal	Normal distance
	Low	Long distance
Building used as a Shelter	**High**	More than 1 building option
	Normal	Only 1 building option
	Low	None of option
Accessibility from House to Shelter	**High**	Easy accessibility
	Normal	Quite difficult/difficult accessibility
	Low	Highly difficult/ none of accessibilty
Transport Mode in Evacuation Process	**High**	More than 1 mode option
	Normal	Only 1 mode option
	Low	None of mode option
Media for Receive Diasaster Information	**High**	Have more than 1 media
	Normal	Have only 1 media
	Low	Have not media
Social Capital		
Assistance Availability	**High**	Have more than 1 assistance acess
	Normal	Have only 1 assistance acess
	Low	Have not assistance acess
Discussion in the Neighborhood related Disaster	**High**	Once in a week / month
	Normal	Once in 6 months / a year
	Low	Never have discussion
Frequency of Interaction in the Neighborhood	**High**	Often have interaction
	Normal	Seldom have interaction
	Low	Never have interaction
Membership of Disaster Organization	**High**	Join more than 1 organization
	Normal	Join only 1 organization
	Low	Not join organization
Skills and Knowledge		
Participation in Disaster Training	**High**	Follow more than 1 training in recent years
	Normal	Follow only 1 training in recent years
	Low	Never follow training in recent years
Advantage in the	**High**	Very useful

Measure Instrument	Classification	Parameter
Disaster Training	**Normal**	Quite useful
	Low	Not useful
Knowledge in Disaster Management	**High**	Have more than 1 skills/knowledge
	Normal	Have only 1 skills/knowledge

Source : Adopted from Radityo, 2011

In the assessment, after each of measure instruments had been classified based on its own parameter, the next step was to convert the result of classification into classification value. High classification, which represented the highest level of adaptive capacity, would convert into the biggest value (3). Normal classification would be given at value (2), and a low one would be handed the lowest value (1). The process of adaptive capacity assessment in this research will use sub district (Kecamatan) as a unit of analysis.

The next step was to count up all of measure instrument's value in every sub district (Kecamatan) in Sikka, Lembata, and TTU District. To obtain the final assessment, the next process was to calculate the range (R), class interval (K), and distance of class interval as described as follow:

Range (R)

= Largest value of classification – Smallest value of classification

Through *Sturges* formula, Class Interval (K)

= 1 + (3,3). logN

(N is the number of variable indicator. In this case, it is associated with the number of measure instrument. N = 20)

Distance of Class Interval

= R/K

The final step was to compare the total value of classification with some of the obtained class interval, in order to get the level of adaptive capacity which is represented into the final score.

As for the projection of adaptive capacity, this research will use prosperity as a reference. The given understanding is when people's economic condition are represented by their prosperity, it will also indicate their capability in developing their own adaptive capacity, especially for tackling the climate change impact as this research's focus.

Besides temporal analysis, this adaptive capacity assessment also uses spatial analysis in order to make the results more understandable. Through interpolation method, the level of adaptive capacity in every sub district (Kecamatan) in the study areas will be analyzed toobtain an adaptive capacity map as a final product.

5.1 Adaptive Capacity in Sikka

Based on questionnaire filling results from 70 respondents in Sikka District, it was found that for several measure instruments, people in study areas still had a low level of adaptive capacity. This indication for example, was found using economic resource indicators such as their level of income, necessity to obtain loan, and how much their income and quality of life is affected by impacts of climate change.

The result of the infrastructure condition survey showed that approximately 63% of occupied houses are owned with full ownership status. Most of them were semi permanent type with only 1 floor. Only 27 % of households hadn't had electricity from the State Company, which a large number of them use pipe to obtain clean water.

On the economic indicator, 35% of respondents worked as farmers. This had the largest proportion. On the other hand, this type of work is quite vulnerable to climate change impact. Income rate per month was still approximately between Rp 500.000 to Rp 1.500.000, which at this level is very vulnerable to climate change impact. The economic condition had also became worse with the high necessity for loan related to disaster management process in each of their area.

As for the technology indicator, which most people in Sikka have quite a high level of adaptive capacity, most of them had prepared more than one building to be used as shelter when a disaster event occured. Besides that, 43 % of the house's respondents had less than 1 km of distance to the shelter, mostly with a relatively easy access. This could increase the people's adaptive capacity there, especially to be more prepared for avoiding potential disasters. In addition, there is more potential for people's capacity in Sikka to increase due to the area having more than 1 media information availability.

Social indicator showed that most of the respondents had had more than 1 source of assistance. There is also a routine discussion on disasters, which is held once per year. Even though 36 of the respondents interacted quite often in their neighborhood, most of them weren't part of disaster organizations.

On the knowledge perspective, most of the respondents (51 respondents) had never followed disaster training in the last 5 years. Finally, this certainly could reduce people's adaptive capacity when facing any climate change impacts. On the other side, the result also found that most respondents had had traditional ways in facing and dealing with potential disasters. Availability of traditional ways which have strong relations with the local wisdom, certainly can be used as value added in order to increase the people's adaptive capacity.

Through consideration of the 5 indicators with each of its measuring instrument, we then performed the calculation to determine the adaptive capacity level in Sikka District. This calculation process produced the following values:

Range (R) = 40

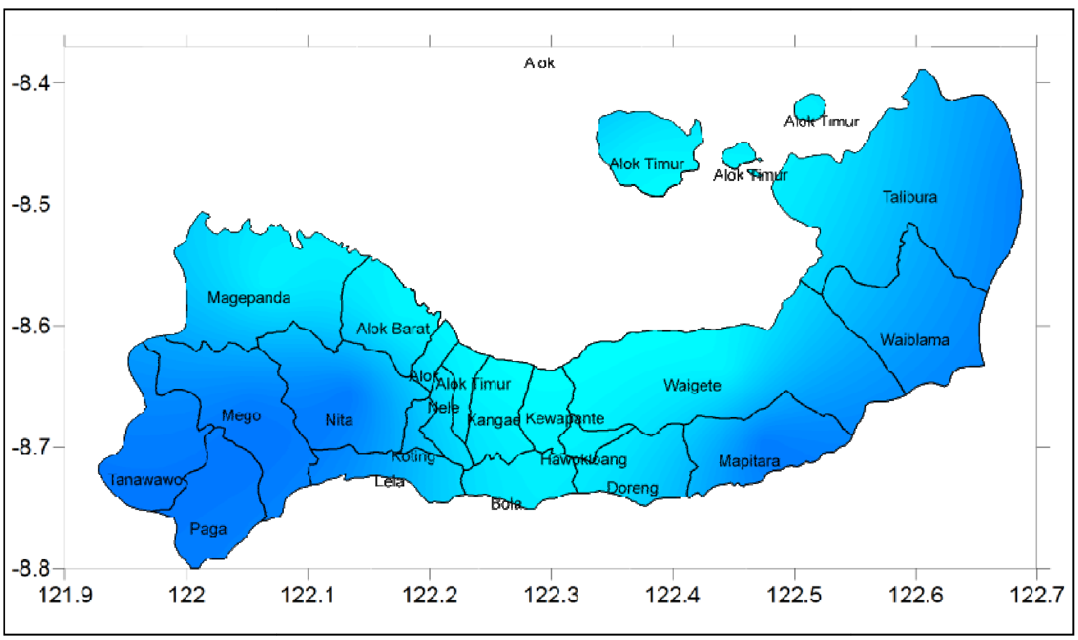
Class Interval (K) = 1 + (3,3). log20 = 5,29 (rounded to 5 classes)

Distance of Class Interval = R/K = 40/5,29 = 7,56

Table 4. Interval of Adaptive Capacity Value in Sikka District

Interval of Value	Adaptive Capacity Level	Final Score
20-27,56	Very Low	0
27,56-35,12	Low	0.25
35,12-42,68	Fair	0.5
42,68-50,24	High	0.75
50,24-57,8	Very High	1

In Figure 7 below, it showed the adaptive capacity rate in 2012 in Sikka District area. In this region, the adaptive capacity was pretty high compared with the other 2 regions (Lembata and TTU), as proven by the index of adaptive capacity only reaching a maximum of 0.4. Extreme rainfall and sea level rise would lead to potential of flooding in the area and significantly affect public facilities and infrastructure. The Nita, Mego, Mapitara, Talibura, and Alok areas are among areas with a high enough adaptive capacity in Sikka. While the region is far to the coast, it will not always be prone to tidal flooding.



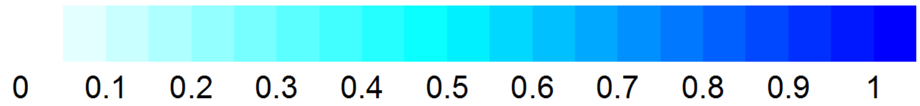


Figure 7. Adaptive Capacity of Sikka District in 2012

5.2 Projection of Adaptive Capacity in Sikka

In Figure 8, it shows the level of adaptive capacity in 2015, which will increase from the year 2012, particularly in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area, with average index of 0.4 compared with the average index of 0.2 in 2012. In the Sikka District, increase of the adaptive capacity level will occur in the Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area.

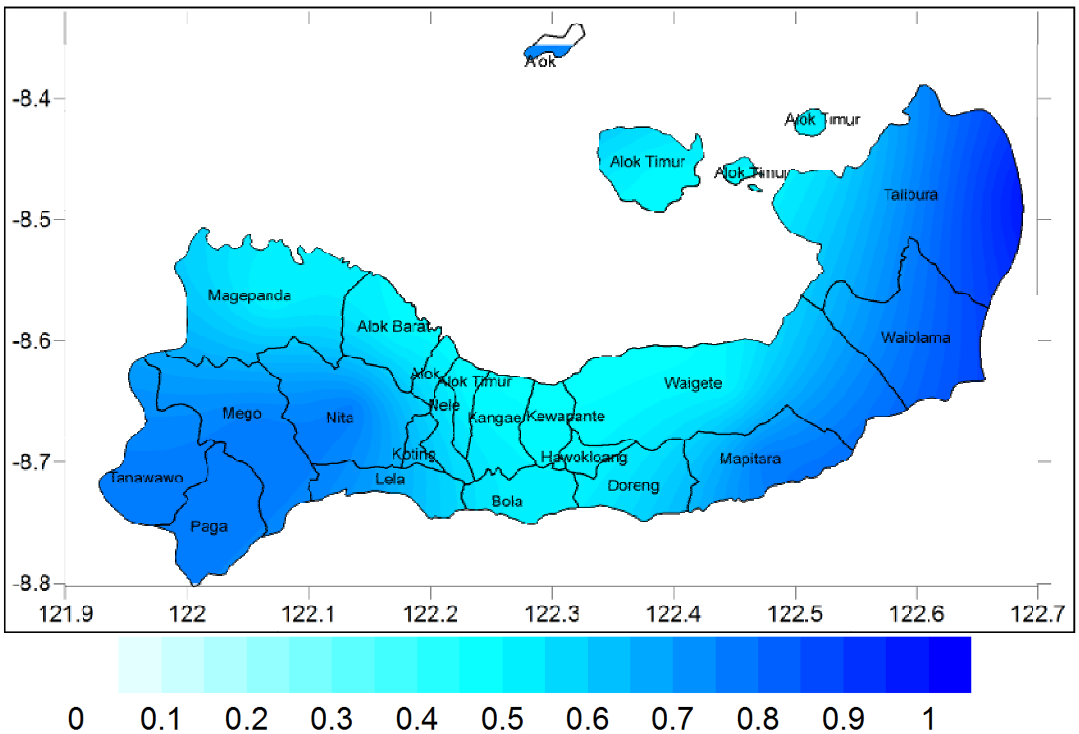


Figure 8. Adaptive Capacity of Sikka District in 2015

In 2020, the level of adaptive capacity will increase in Sikka District. In this district, the increase in adaptive capacity will occur in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area with a large increase in the average index of 0.5. The highest adaptive capacity will be achieved in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area with an index of 0.85. The adaptive capacity in 2020 is mapped as seen in Figure 9.

In Figure 10, it shows level of adaptive capacity in 2025, which will increase from the year 2012, particularly in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area, with average index of 0.6 compared with the average index of 0.2 in 2012. In the Sikka District, increase of the adaptive capacity level will occur in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area.

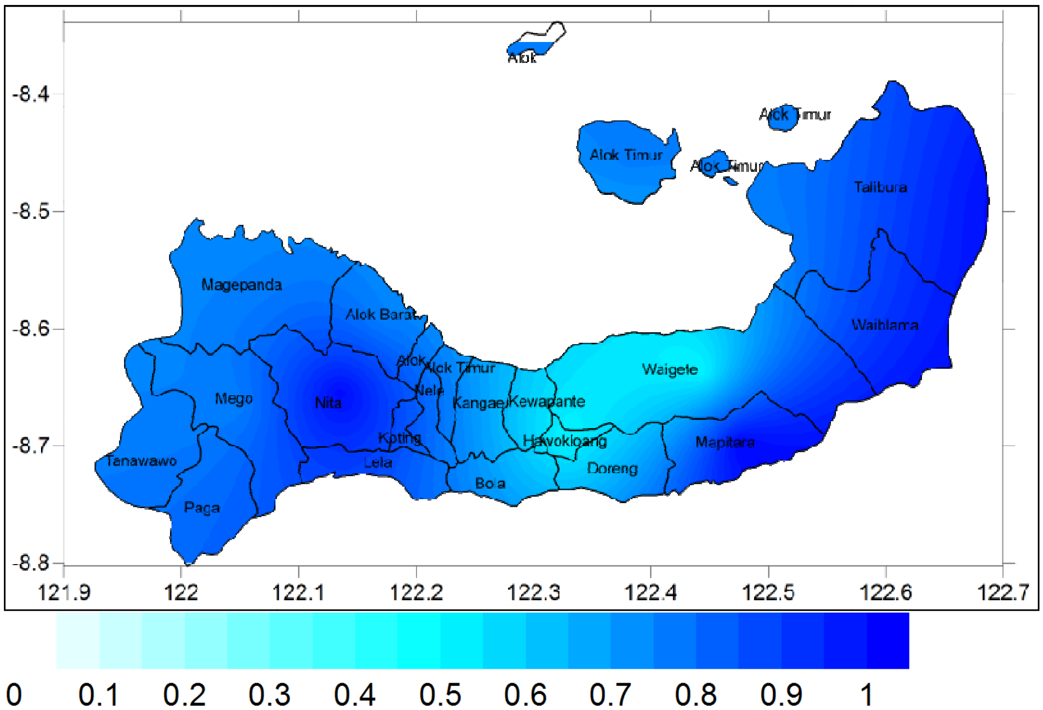


Figure 9. Adaptive Capacity of Sikka District in 2020

In 2030, the level of adaptive capacity is expected to increase in Sikka District. In this district, the increase in adaptive capacity will occur in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area with a large increase in the average index of 0.9. The highest adaptive capacity will occur in Tanawawo, Mapitara, Talibura, Paga, Nita and Waiblama area with the index reaching 0.85. The adaptive capacity in 2020 is mapped as seen in Figure 11.

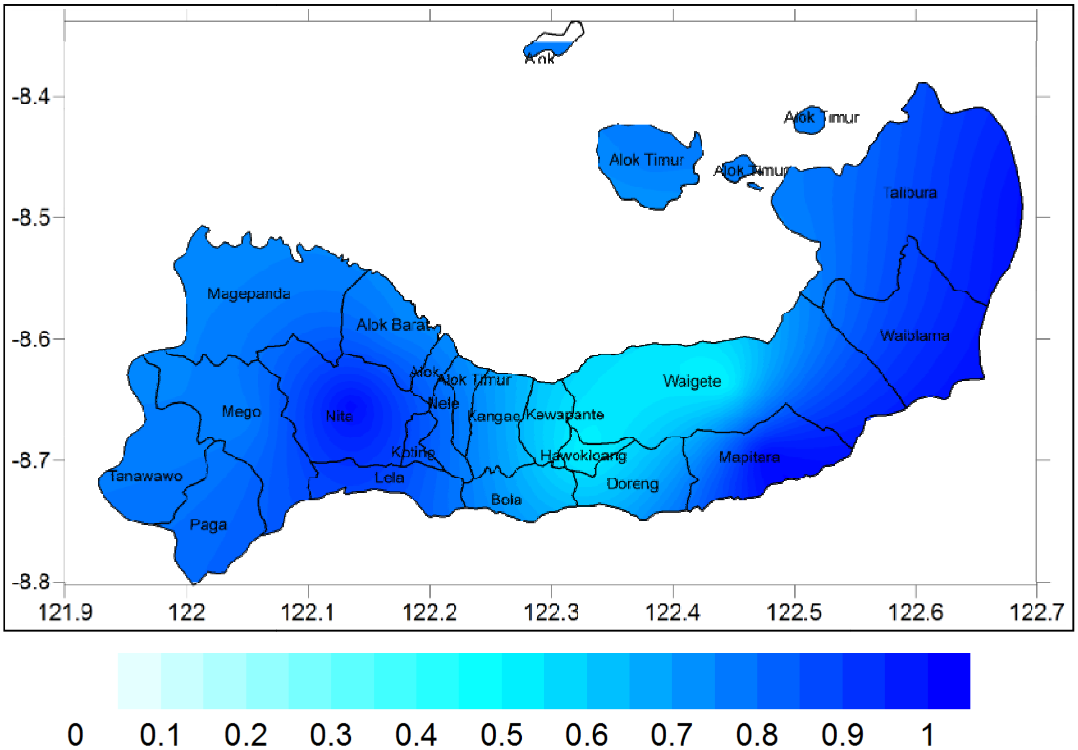


Figure 10. Adaptive Capacity of Sikka District in 2025

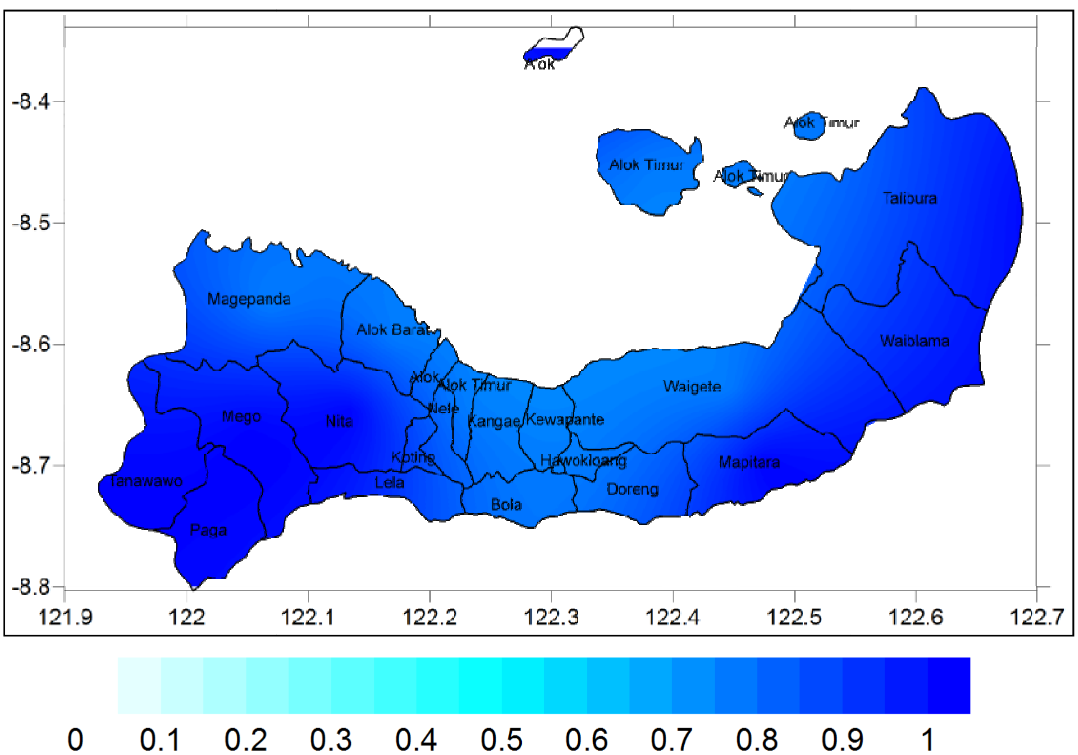


Figure 11. Adaptive Capacity of Sikka District in 2030

5.3 Adaptive Capacity in Lembata

Assessment of adaptive capacity in Lembata District was done throughquestionnaire filling by 70 respondents. Some of the main indicators were typesof jobs and level of income, also predictions of how much the people were going to be affected by climate change impact, which had a better and more positive rate than the Sikka District, using the assessment methods of adaptive capacity. Significant difference can be found in the distance between the people's houses and their shelter, which most of the respondents' houses being more than 5 km away from the shelter, compared with people of the Sikka District, with an average distance of less than 1 km.

The infrastructure indicator overview showed that 86% of respondents live in houses they legally own. Most of the houses were permanent types which had only 1 floor. Most of them, approximately 64 houses had had electricity system from the State Company (PLN), with 41% of the respondents' houses getting clean water from the local pipe in Lembata.

On the economic indicator, it was found that most of the respondents in Lembata, 32 respondents, worked in the private sector. This type of job was classified into the high adaptive capacity job because it is not affected by the climate change impact. On the income side, the people of Lembata were still classified into the low level of adaptive capacity, because 68 % of the respondents received less than Rp 500.000 for their monthly income. Some findings which could increase the people's adaptive capacity in the study areas was the fact that their source of income was not closely related to impacts ofclimate change, and also 70% of the respondents' possessing low necessity for obtaining loans.

Indicator of technology showed that most respondents had no building option as shelter and had at least 1 ready to be used option of transportation. On the other hand, over 84% of the respondents' houses had more than 5 km of distance from the shelter, although they claimed that it still had a relatively easy access. Meanwhile the adaptive capacity from a large number of respondents also could increase with the availability of more than 1 media of information there.

On the social perspective, it seemed that most respondents had more than 1 source of assistance. Around 67% of respondents did not have meetings regularly to discuss disaster topics, even though most of them interacted quite often in their neighborhood.

The knowledge indicator gavef overview that most of the respondents (68%) had never attended disaster training in the last 5 years. This could reduce the people's adaptive capacity, especially in their level of preparation for facing a disaster event. Almost 47 % of respondents in the Lembata District also had recognized and used traditional ways in anticipating for upcoming disasters.

Through consideration of the 5 indicators with its every instrument of measure, we then performed the calculation to determine the adaptive capacity level in Lembata District. This calculation process produced value of Range (R), Class Interval (K), Distance of Class Interval, and its interpretation table as described below:

Range (R) = 40
Class Interval (K) = 1 + (3,3). log20 = 5,29 (rounded to 5 classes)
Distance of Class Interval = R/K = 40/5,29 = 7,56

Table 5. Interval of Adaptive Capacity Value in Lembata District

Interval of Value	Adaptive Capacity Level	Final Score
20-27,56	Very Low	0
27,56-35,12	Low	0.25
35,12-42,68	Fair	0.5
42,68-50,24	High	0.75
50,24-57,8	Very High	1

In Figure 12, it shows the adaptive capacity in 2012 in Lembata District area. In this district, the adaptive capacity was pretty low compared with the 2 other regions (Sikka and TTU), proven by the index of adaptive capacity only reaching 0.4. Extreme rainfall and sea level rise would not significantly affect public facilities and infrastructure, especially those that are caused by the occurrence of flood. Wulandoni was included alongisde areas with extremely high adaptive capacity compared with other areas in Lembata. While the region is far to the coast, it will not always have the biggest potential for rain to occur.

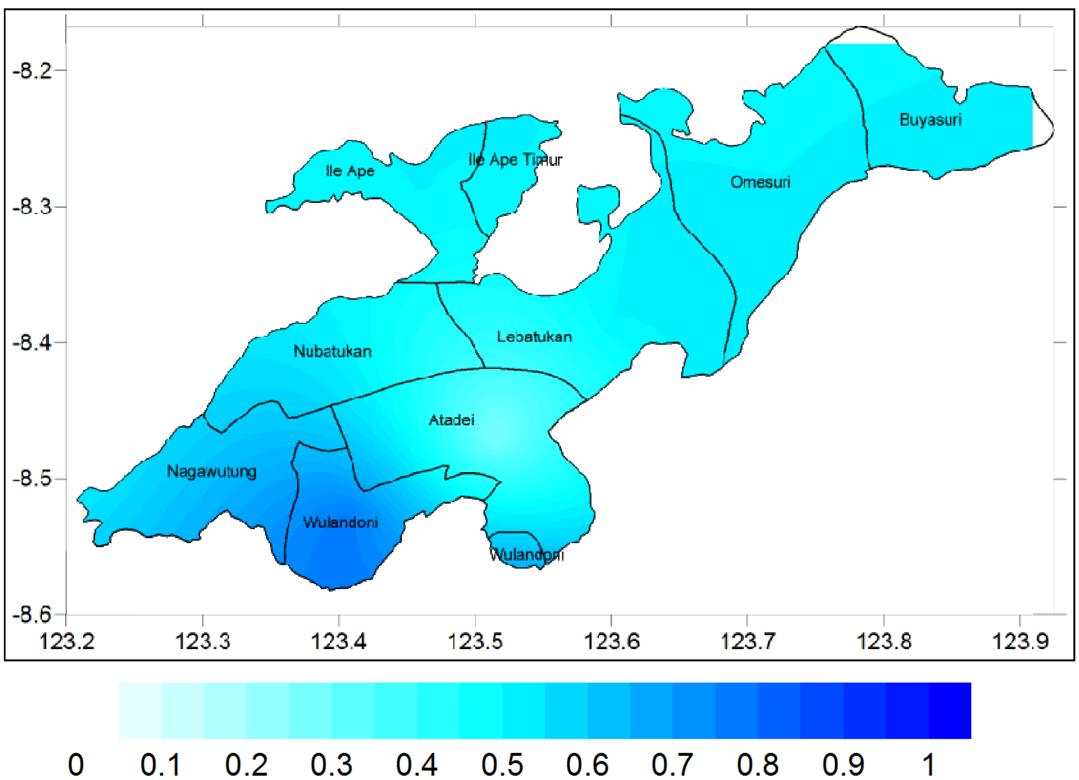


Figure 12. Adaptive Capacity of Lembata District in 2012

5.4 Projection of Adaptive Capacity in Lembata

In Figure 13, it shows the level of adaptive capacity in 2015, which will increase from the year 2012, particularly in Wulandoni and Nagawutung area, with average index of 0.4 compared with the average index of 0.2 in 2012. In the

Lembata District, the increase of the adaptive capacity level will occur in Wulandoni, Nagawutung, and Lebatukan area.

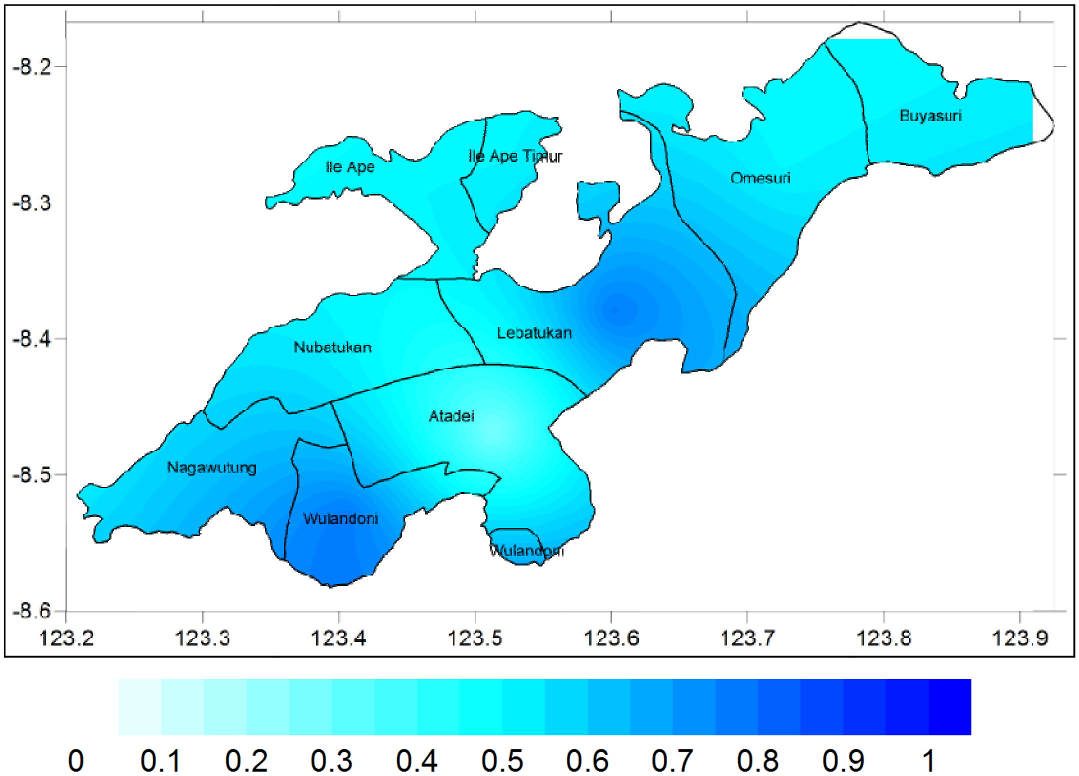


Figure 13. Adaptive Capacity of Lembata District in 2015

In 2020, the level of adaptive capacity will increase in Lembata District. In this district, the increase in adaptive capacity will occur in Wulandoni, Nagawutung and Buyasuri area, with a large increase in the average index of 0.5. The highest adaptive capacity will occur in Wulandoni, Nagawutung and Buyasuri area with the reaching 0.85. The adaptive capacity in this year 2020 is mapped as seen in Figure 14.

In Figure 15, it shows the level of adaptive capacity in 2025, which will increase from the year 2012, particularly in Wulandoni, Nagawutung and Buyasuri area, with an average index of 0.6 compared with the average index of 0.2 in 2012. In the Lembata District, increase of the adaptive capacity level will occur in Wulandoni, Nagawutung and Buyasuri area.

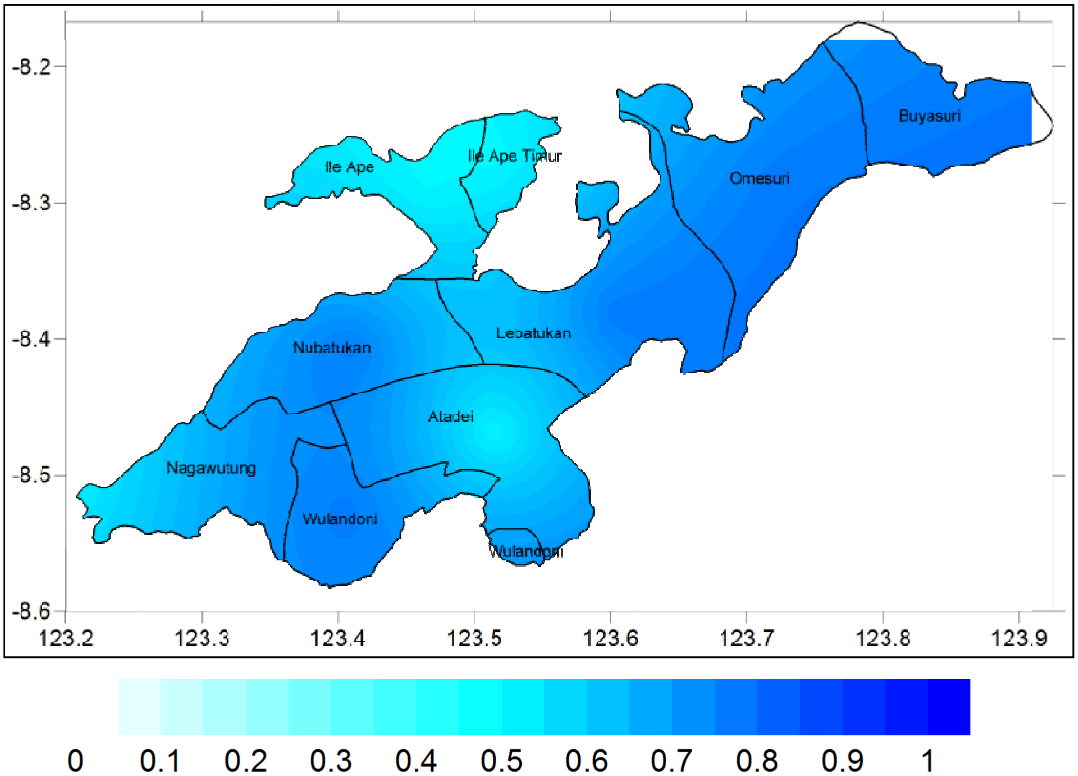


Figure 14. Adaptive Capacity of Lembata District in 2020

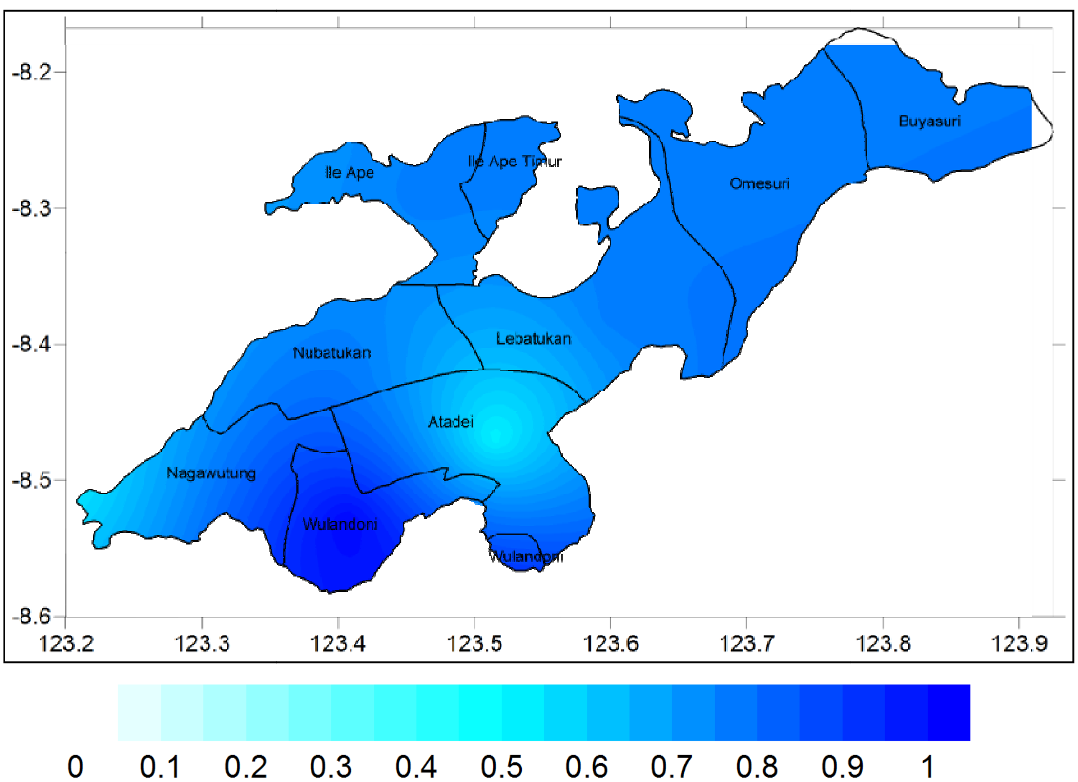


Figure 15. Adaptive Capacity of Lembata District in 2025

In 2030, the level of adaptive capacity will increase in the Lembata District. In this district, the increase in adaptive capacity will occur in Wulandoni, Nagawutung and Buyasuri area with a large increase in the average index of 0.9. The highest adaptive capacity will occur in Wulandoni, Nagawutung and Buyasuri area with the index reaching 0.85. The adaptive capacity in this year 2030 is mapped as seen in Figure 16.

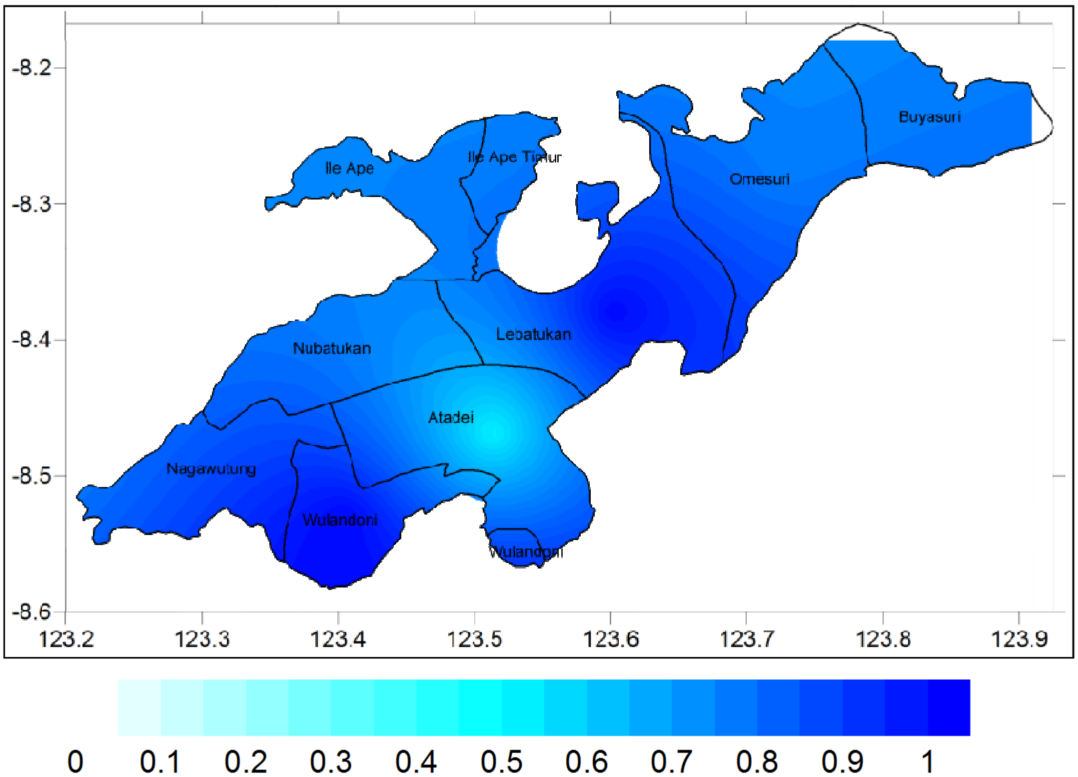


Figure 16. Adaptive Capacity of Lembata District in 2030

5.5 Adaptive Capacity in TTU

Based on results of data surveyed in TTU on 28 respondents related to climate disasters caused by climate change, the adaptive capacity level in TTU was still generally in the low level. This condition was indicated by survey results on that society using the 5 indicators of adaptive capacity, namely infrastructure, economics, technology, social, and knowledge, where such 5 indicators had a score value lower than 0.6 (rough estimation) in range of 0 to 1.

It was found on an infrastructure indicator built in TTU, that 90 percent of the houses were the people's own, however most of the houses' buildings were unfit for human habitation. 80 percent of the houses were one floor buildings that are mostly made from wood. The rest of their houses were made from a wall combined with wood. 12 percent of the houses built did not have access to electricity. With such infrastructure conditions, if a climate disaster were to occur in that area, therefore it would very much be vulnerable to it, notably floods and landslides.

Then, we take a look at the economic indicator. Most of TTU's society members were farmers and worked for companies. 90 percent of their incomes were lower than 500,000 rupiahs. Based on BPS data, the number of income per capita in the TTU District was only 4 million per year. After a disaster occurred, income per capita in TTU District received informal aid, namely from families in other regions. The economic condition in TTU District was still too low for the people to try solving the problem of climate change.

From the technology and transportation indicator, most of TTU's society used motorcycles as their daily vehicle. Based on survey, less than 94.5 percent of the people used motorcycles. Meanwhile the other vehicles used were mini busses: 2.5 percent, midi busses: 0.5 percent, and trucks: 2.5 percent. To evacuate from disasters, the buildings used for evacuating were generally schools and governmental buildings. However, to reach the evacuation site, the access to it was still difficult and long. Because most people used motorcycles and very few used the larger sized vehicles, it was evident that this indicator of TTU's society was still low.

Following that, is social indicator. This indicator aims to see the social network built around locations where climate disaster frequently occurred. Result of survey showed that several TTU people received aid from their relations and regional government following a disaster. To prepare for facing a disaster, however, people in TTU held meetings to discuss disaster solutions each year.

For this issue, people in TTU also performed discussions to figure out solutions in facing potential climate disasters in the future. This social condition helps determine an increase in the society's adaptive capacity for facing climate disasters in the future.

The next indicator is skill and knowledge in determining solutions for climate disasters. Based on survey results conducted, the society in TTU received training on disaster management in 2010. This training was held by the Institute for Economic Analysis (IDEA), Yogyakarta, cooperating with Flores Institute Resources for Development (FIRD) in 2010. People in TTU had experienced benefits from this training in facing a disaster. They have understood the system of disaster management that had been informed to them, and are supported by local wisdom in that region. However, because trainings were rarely held, the level of their skills and knowledge were still low for them to increase their adaptive capacity. Therefore, this indicator of the TTU society marked that the people would still be struggling in trying to deal with climate change in the future.

Through consideration of the 5 indicators with its instruments of measure, we then performed the calculation to determine the adaptive capacity level in the TTU District. This calculation process produced value of Range (R), Class Interval (K), Distance of Class Interval, and its interpretation table as described below:

Range (R) = 40

Class Interval (K) = 1 + (3,3). log20 = 5,29 (rounded to 5 classes)

Distance of Class Interval = R/K = 40/5,29 = 7,56

Table 6. Interval of Adaptive Capacity Value in TTU District

Interval of Value	Adaptive Capacity Level	Final Score
15-21,14	Very Low	0
21,14-27,28	Low	0.25
27,28-33,42	Fair	0.5

33,42-39,56	High	0.75
39,56-45,7	Very High	1

Figure 17 below shows the adaptive capacity in 2012 in the TTU District area. In this district, the adaptive capacity was still low, proven by the index of adaptive capacity only reaching 0.4. Extreme rainfall and sea level rise would significantly affect public facilities and infrastructure, especially if a disaster such as a flood were to occur. Insana Tengah and Bikomi Selatan are included in areas with extremely low adaptive capacity. While the region is far to the coast, however, it won't suffer from constant flooding.

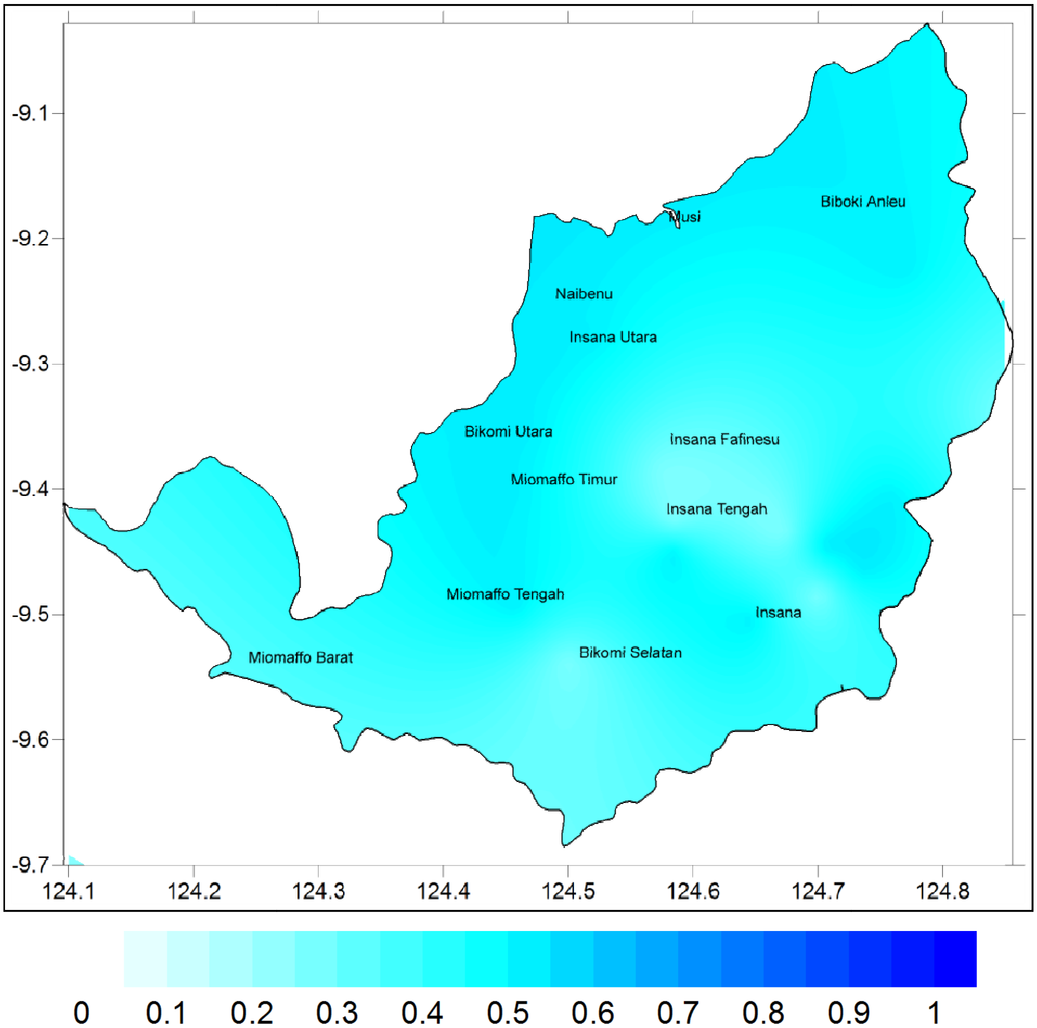


Figure 17. Adaptive Capacity of TTU District in 2012

5.6 Projection of Adaptive Capacity in TTU

In Figure 18, it can be seen that the level of adaptive capacity in 2015 will increase from the year 2012, particularly in Biboki Anleu and a part of TTU in the northern area, with an average index of 0.4 compared with the average index of 0.2 in 2012. In the TTU District, an increase of the adaptive capacity level will occur in Bikomi Selatan, Bikomi Utara, and Biboki Anleu.

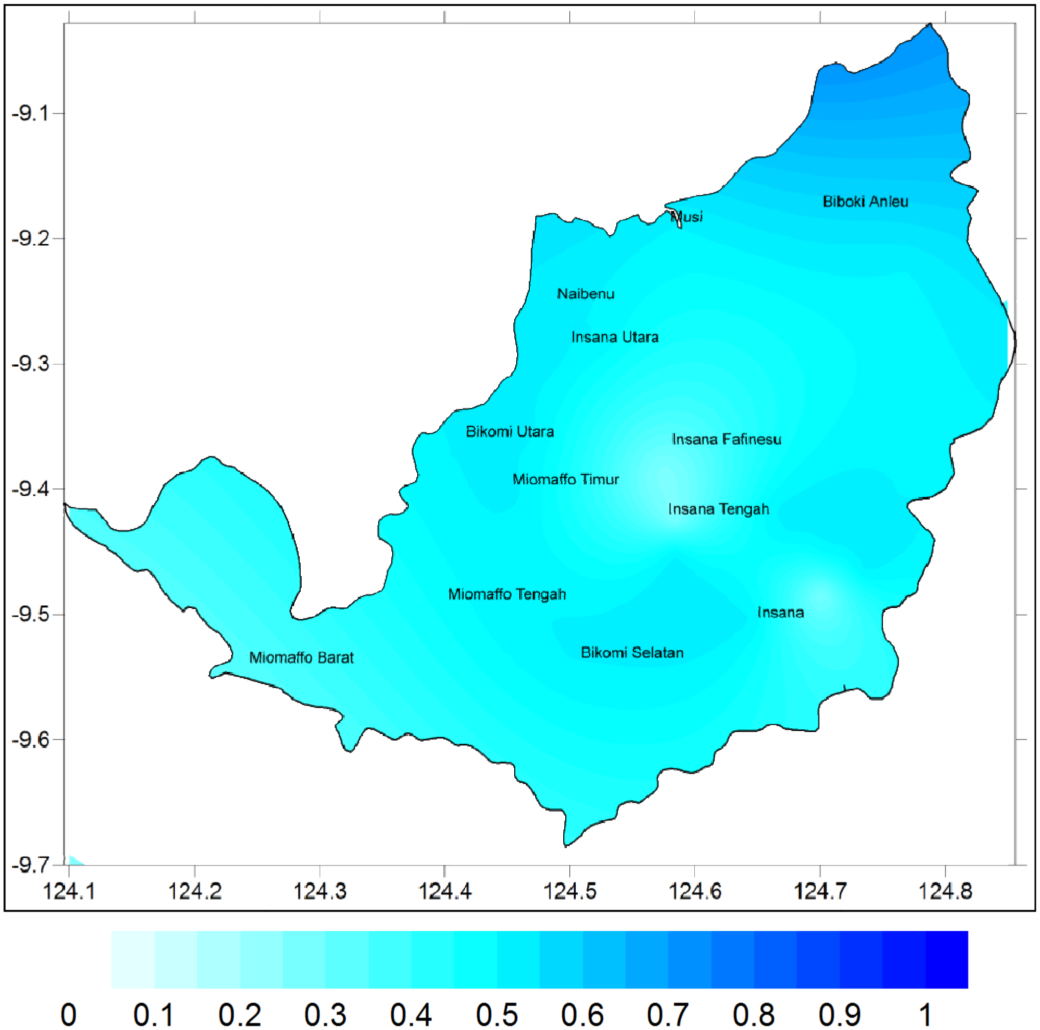


Figure 18. Adaptive Capacity of TTU District in 2015

In 2020, the level of adaptive capacity will increase in the TTU District. In this district, the increase from the 2012 adaptive capacity level will occur in Biboki Anleu, Biboki Selatan, Insana Tengah, Bikomi Selatan and Miomaffo Barat with a large increase in the average index of 0.25. On the other side only Miomaffo Barat and Insana Tengah, will experience an increase of adaptive capacity level from the 2015 level. The smallest level of increase in adaptive capacity will be achieved in Insana Fafinesu, with 0,25 unit, and the highest one will be in Biboki Anleu with an index of 0.85. The climate change impact in the year 2020 is mapped as seen in Figure 19.

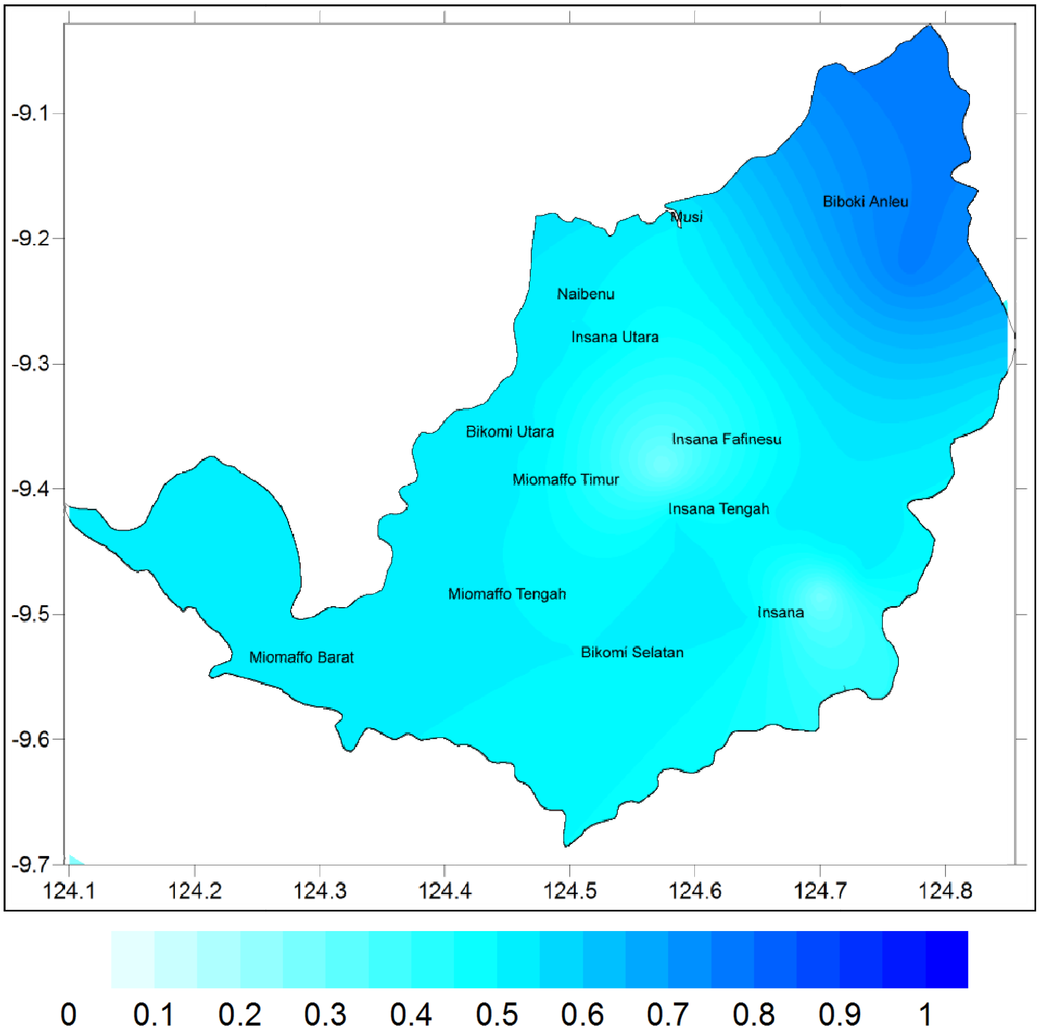


Figure 19. Adaptive Capacity of TTU District in 2020

In Figure 20, it shows the level of adaptive capacity in 2025, which will increase from the year 2012, particularly in Miomaffo Timur, Miomaffo Barat, Insana Tengah, Biboki Selatan, Biboki Anleu, and Bikomi Selatan with 0,25 unit of average index increasing. Only in Miomaffo Timur will the level increase from the 2012 level. The highest level of adaptive capacity will occur in Miomaffo Timur and Biboki Anleu in the north with around 0,75 unit of index. On the other side, Insana Fafinesu will still have the smallest level with 0,25 unit of index, which means that there is still no increase in level from the current level of adaptive capacity in 2012.

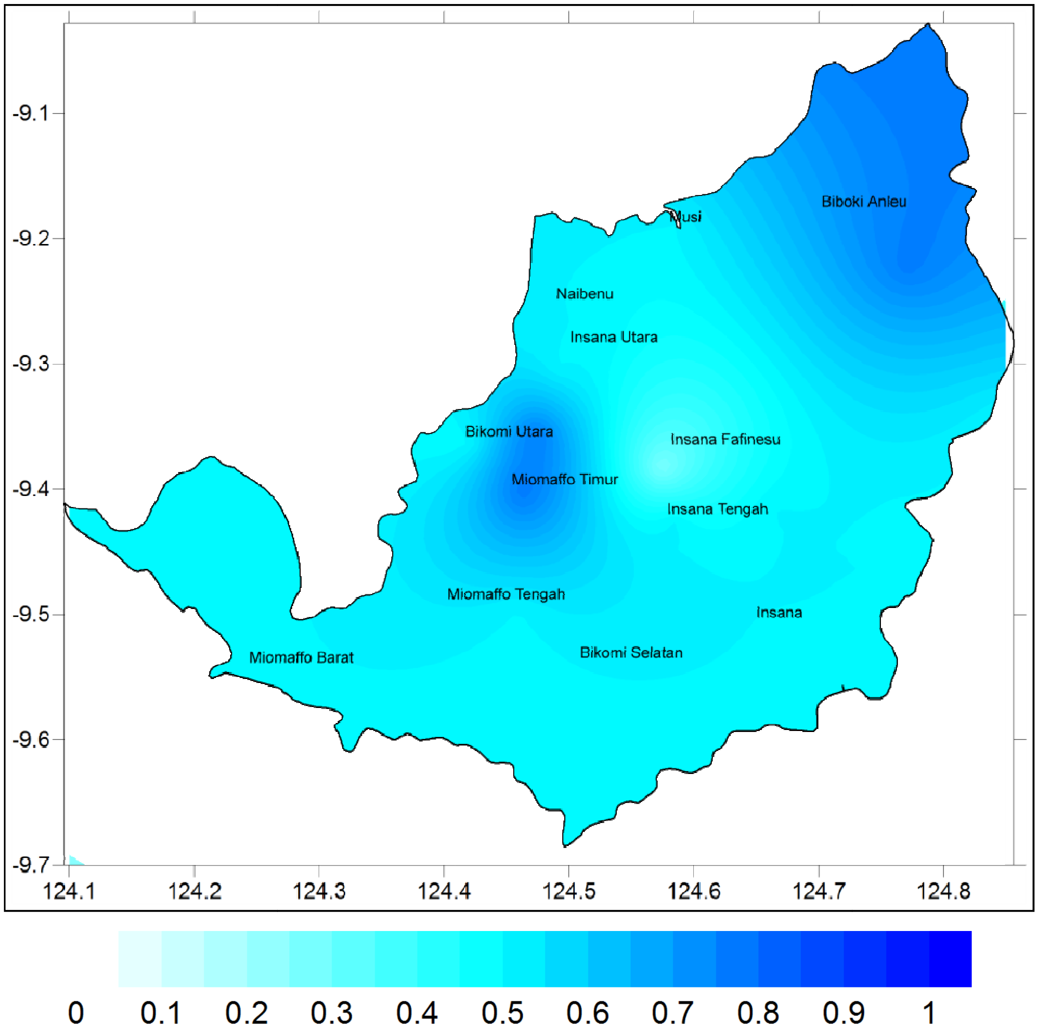


Figure 20. Adaptive Capacity of TTU District in 2025

In 2030, the level of adaptive capacity will increase overall in almost all of TTU's Districts. From the level achieved in 2012, all of 11 sub districts in TTU will have increase their adaptive capacity level except for Insana Fafinesu. Biboki Anleu will have the highest level of increase at 0,5 unit, while the others will only be at around 0,25 unit. Only Miomaffo Tengah, Insana, Insana Utara, Biboki Anleu, Bikomi Utara, and Musi will have their level of adaptive capacity increase from the 2025 level. The highest level will occur in Biboki Anleu with approximately 1 unit of index, which the smallest will be in Insana Fafinesu at 0,25 unit of index. The climate change impact in the year 2030 is mapped as seen in Figure 21.

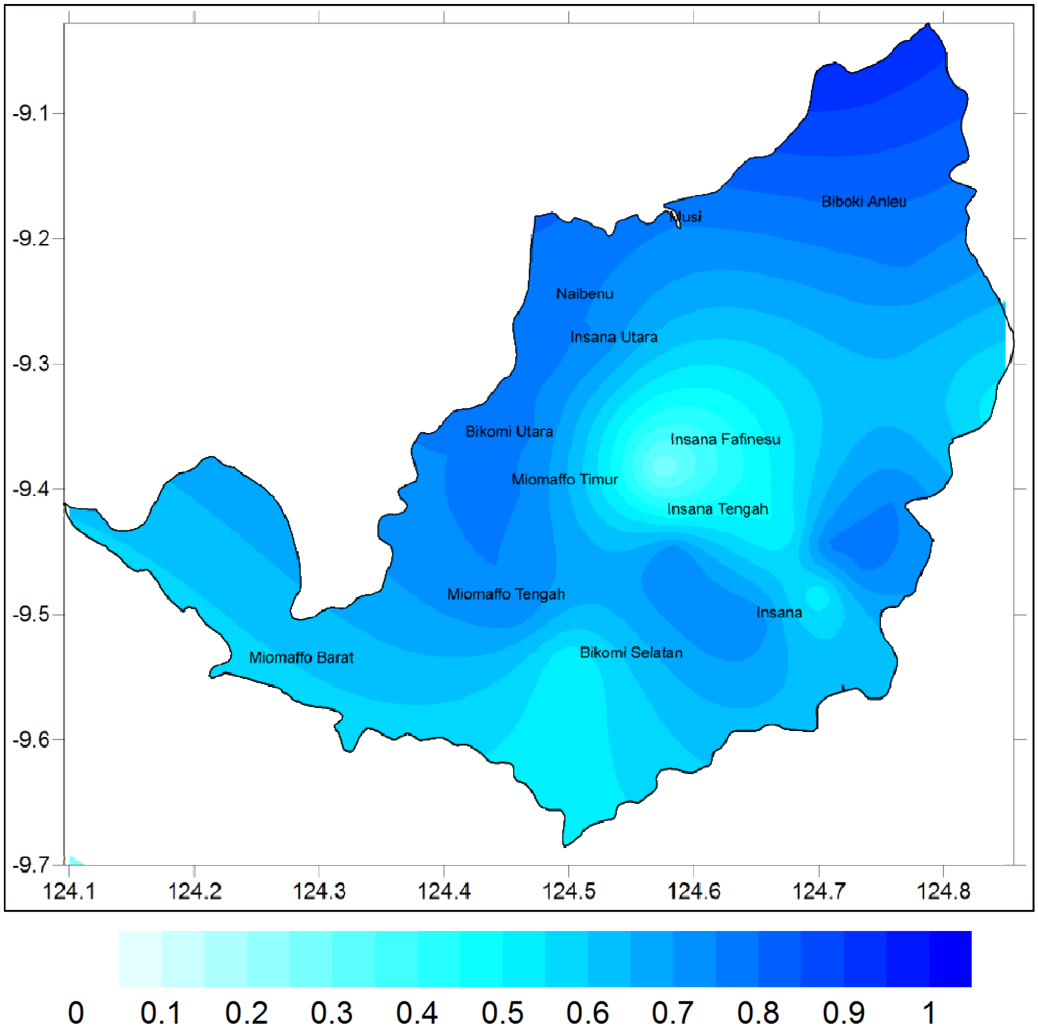


Figure 21. Adaptive Capacity of TTU District in 2030