Guidelines for Climate Change Risk and Adaptation Assessment and for Mainstreaming into Policy

June 2012

Ministry of Environment

Guidelines for Risk and Adaptation Assessment and for Mainstreaming into Policy

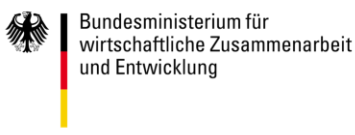
Final Draft

Published by:

Ministry of Environment

Jalan D.I. Panjaitan kav. 24, Jakarta 13410
Tel : +6221 858 0081
Fax : +6221 858 0081
Website : www.menlh.go.id
Email : slhi@menlh.go.id / adaptation.moe.id@gmail.com

The development of this document was supported by:



Guidelines for Climate Risk and Adaptation Assessment and for Mainstreaming into Policy

by:

Wilmar Salim
Djoko Santoso Abi Suroso
M. Suhardjono Fitriyanto
Mizan Bustanul Fuady Bisri

June 2012

Part I Introduction

1 Background and Structure of Guideline

Indonesia is strongly exposed to climate change. With over 17.000 islands, the rising sea level, changes in precipitation and extreme climate events are a major issue. Climate projections indicate that the mean wet-season rainfall will increase across most of Indonesia, especially in regions located south of the equator such as Java and Bali. At the same time, the length of the dry season is expected to increase. Moreover, an increase in the intensity and frequency of extreme events like El Nino, which have caused major droughts and fires in Indonesia, is already noticeable in the Asian region. The risk of floods during the rainy season and drought in the dry season is therefore likely to increase. This will particularly impact water resources, agriculture and forestry, fishery as well as health and infrastructure. Land subsidence, sea level rise, floods, droughts, landslides and forest fires already cause considerable damage in Indonesia. Adaptive measures can mitigate damage and avoid aggravating impacts of natural disasters. Therefore, the necessity for adaptation measures at national and local levels is rapidly emerging as central issue in the debate around policy responses to climate change. In order to prioritize, design and implement interventions to adapt to climate change, it is essential to adopt a coherent set of approach, framework and methodologies for examining vulnerability and adaptive capacity.

Many vulnerability studies, while being effective in raising awareness to the possible effect of climate change on a general level, have limited effectiveness in providing local scale guidance on adaptation. Methods and tools for vulnerability studies at the provincial/local level are different from the ones used on national and global scales. To effectively formulate adaptation strategies at the province level, it is proposed to apply ”meso level-multi sectoral approach” (MsLMSA) which means assessing vulnerability at the meso-level but considering the multi sectoral impacts of climate change e.g. water, agriculture and coastal / marine sectors. An appropriate approach has been developed and applied on Lombok Island and is the first MsLMSA based vulnerability study in Indonesia.

On the other hand, a shifting political system from centralized to decentralized structures urgently requires and challenges an increasing role of local (kabupaten/kota) governments to initiate local level activities in climate change adaptation. Therefore, the vulnerability assessment on climate change and integration of its result into local development planning also becomes essential. Thus, the MsLMSA based vulnerability study in Lombok Island was developed and conducted on provincial level (“meso level-multi sectoral approach” or McLMSA). Mainstreaming of V-A into development policies can follow two approaches, either directly influencing the preparation of the local mid-term development plan (RPJM) or integration of the annual sectoral plans.

Meanwhile, the Law No 32 of 2009 on Environmental Protection and Management has stipulated that the mitigation and adaptation to climate change become a factor that must be considered and integrated in planning and policy instruments. Two policy instruments related to adaptation to climate change are set up in this law, i.e. the Environmental Management and Protection Plan (RPPLH) and the Strategic Environmental Assessment (KLHS). RPPLH is expected to be the basis for

Medium-term Development Plan formulation, while KLHS is obligated to be included in any policy, plan, or program, either by central or regional governments. KLHS may contain six itemsamong which the estimation of vulnerability and adaptive capacity levels is one of them. In order to ensure that the vulnerability and adaptive capacity assessments are conducted appropriately by all levels of government, a guideline for conducting this study is necessary. The guideline shall be based on the experience on conducting the study on Lombok Island, as well as based on another pilot study on climate risk and adaptation assessment (CRAA) conducted on South Sumatera, Greater Malang area, and Tarakan. This assessment is only one out of several climate assessments conducted that can be used for KLHS and it can be one source for developing norms and standard procedure (NSPK) to conduct climate assessment for KLHS in the future.

This guideline consists of two parts, one on how to conduct the climate risk assessment and another one on how to mainstream it into policy making at regional and national levels. This guideline will include the following steps in its content:

1. Formulation of Problems and Identification of Vulnerable Sectors to Climate Change
2. Climate Science-bases Analysis
3. Analysis of Hazard due to Climate Change
4. Analysis of Vulnerability of Sectors due to Climate Change Impact
5. Analysis and Evaluation of Climate Risk for Sectors
6. Formulation of Adaptation Strategies for Sector
7. Multi-Risk Assessment and Adaptation Prioritization
8. Mainstreaming Adaptation Strategies into Development Policies

To conduct both activities, the climate risk assessment and its policy mainstreaming, some institutional support is necessary, which involves the establishment of an ad hoc body to coordinate both activities, as well as some capacity building for either government officials, or civil society. This guideline will mention about this matter in the later part. Some issue on conducting monitoring and evaluation on climate risk assessment and policy mainstreaming activities will also be mentioned in the final part of this guideline. However, before going into the guidelines, we will review the related policies at national level that give the bases for conducting climate risk assessment and policy mainstreaming in the next section.

2 Setting the Scene: National Policies as the Baseline for Conducting Climate Risk Assessment

The Government of Indonesia (GoI) has seen climate change challenge as one of the most challenging factor for its development in the context of national, provincial, as well as local development. Many of Indonesian interest lies with the capacity to conduct adaptation actions at several sectors which are vulnerable to the impact of climate change. Therefore, GoI has prepared several national policies and plans to function as baseline for creating further adaptation planning at local level; i.e. provincial, municipality, and regency. These national planning and policies should be taken account ofby local governments when they are about to develop further adaptation actions integration with local planning:

a) National Action Plan on Climate Change (*Rencana Aksi Nasional Perubahan Iklim/*RAN PI)
The RAN PI has been developed in November 2007 by The Ministry of Environment to become guideline by various institutions that willing to conduct mitigation and adaptation actions on climate change in a coordinated and integrated ways[1]. In terms of climate change adaptation, this plan states that **site specific phenomena and future condition/projection must become the main consideration for creating climate change adaptation policy**[2]. Therefore this document also highlights the **importance of public policy arrangement and statutory instrument** especially one within the sector that needs **to conduct climate change adaptation**[3]. This document then reviews several adaptation activities being done at that time; i.e. institutional development and adaptation actions that were limited to LULUCF and coastal sector. This document then gives seven recommendations in doing adaptations[4]: 1) integrating the adaptation agenda into national development plan (RPJP and RPJM), 2) review and streamline existing initiatives in order to enhance climate resilience, 3) institutionalizing process of climate information system for climate risk management, 4) **promote autonomous regions to integrate climate risk into local development plan**, 5) **information and knowledge utilization to reduce current and future climate risk**, 6) assuring domestic resources and financial support as well as optimizing international supports for conducting adaptation, and 7) using the no-regrets scenario in selecting adaptation options. The bold substance within this document gives the basis for conducting CRAA in a particular region.

b) "Yellow Book", National Development Planning: Indonesia's Response to Climate Change
The Yellow Book is being developed by National Planning and Development Agency (Bappenas) in March 2010. It serves as a bridging document which will address sectoral and cross-sectoral issues that are sensitive to climate change impacts and their influence to the national development planning document. It positions itself to enhance and sharpen the National Medium-term Development Plan (RPJMN 2010-2014). In general, this document intends to: 1) integrate climate change programs into national development planning process; 2) Present sectoral and cross-sectoral top priorities on climate change within the framework of sustainable development; 3) provide an overview of funding mechanisms and institutional arrangements to implement sectoral and cross-sectoral activities; and 4) provide clear guidance for development partnerships on climate change[5]. This document places energy, forestry, agriculture, coastal areas, small islands marine life and fisheries as the main adaptation priority. **Several of the programs proposed indicate similarity with the urgency of studying climate risk and its adaptation assessment**.

[1] National Action Plan on Climate Change (RAN PI), 2007, Ministry of Environment, p.2
[2] Ibid, Ministry of Environment, p.6
[3] Ibid, Ministry of Environment, p.19
[4] Ibid, Ministry of Environment, p.27 – 28
[5] Yellow Book: Indonesia's Responses to Climate Change, 2010, Bappenas, p.3

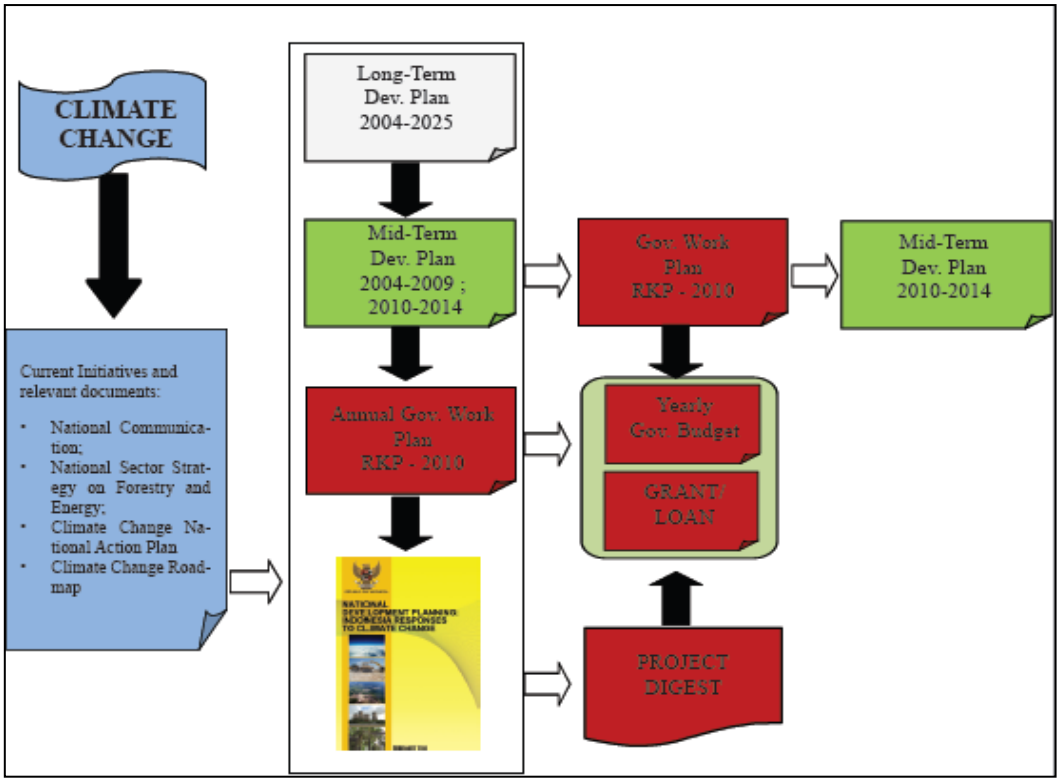


Figure 1 Linkage among climate change related documents, development planning, and budgeting process. Source: Yellow Book, 2010

c) Indonesia Climate Change Sectoral Roadmap (ICCSR)

The ICCSR has bee developed by National Planning and Development Agency (Bappenas) in March 2010. The document is meant to provide inputs to the 5 year Medium-term Development Plan (RPJMN) 2010-2014, and also to the subsequent RPJMN moving forward until the target year of 2029[6]. The scope of ICCSR is a combination between climate change adaptation and mitigation. To some extent the ICCSR indicates the importance of CRAA as it is stated there that ICCSR guides the initiative in a form of advanced research on the impact of climate change and the mapping of local vulnerability will be performed to strengthen the information system for adaptation in 2015[7]. In the ICCSR, adaptation part covers thewater, marine and fisheries, agriculture, and health sectors. ICCSR also provides the framework on how to have linkage with development planning as follows:

[6] ICCSR, 2010, Bappenas, p.6
[7] Ibid

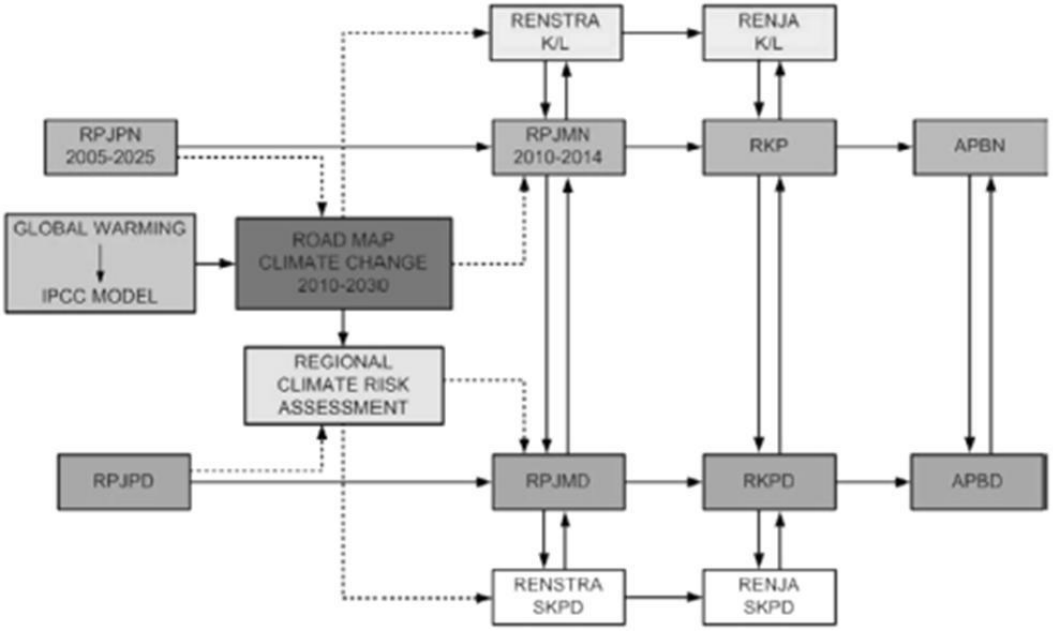


Figure 2 Inter-linkages between the Climate Change Roadmap and Development Planning. Source: ICCSR, 2010

Part II Guidelines for Climate Risk Assessment

3 KRAPI approach

Recent studies on Climate Change Impact, Adaptation, and Vulnerability (CCIAV) suggests that there are at least five types of approaches[8]; with the first four ones being a conventional approaches, consisting of impact assessments, adaptation assessments, vulnerability assessments, and integrated assessments[9]. As for the fifth approach, is termed as emerging approach in CCIAV, as it adopts a risk assessment framework. The fifth approach has begun to mainstream climate change adaptation into the enactment of development policy (IPCC, 2007). In addition, there was also some shift from research driven towards a more integrated policy-making approach, in which decision makers and the entire stakeholders participated in the assessment and sometimes act as the initiator (UNDP, 2005).

In the context of mainstreaming climate change into development policy in Indonesia, it is recommended to differentiate climate risk and adaptation assessment into macro, meso and micro levels in which it may be workable towards the hierarchical structure of government: national,

[8] Assessment approach can be defined as direction and scope of study in which particular assessment being conducted. An approach may consist of several different methods. In addition, method itself is being defined as a systematic analytical process.

[9] See "*Decentralized Vulnerability Assessment to Climate Change Assessment in Indonesia: Using Regional-Multi Sector Approach at Provincial Level"*, in Suroso (2008).

province and local (see Table 1). Each level of assessment represents the detail of analysis taken; hence it indicates the level of accuracy of the results which corresponds to adaptation needs for each level of government's structure. The method at a meso-level approach uses province as the administrative location of the study. Therefore, it is less detailed than the micro-level study conducted at city or district level. At a meso-level study, the impact of climate change will be analyzed in the sense that it would affect selected sectors at a province level.

Table 1 Various Levels of Risk and Adaptation to Climate Change

Scale	Data and Analysis	Scope	Level of Planning	Accuracy	Finance
Macro	Qualitative	National	Adaptation Policy	Low	Low
Meso	Combination of qualitative and quantitative	Provincial	Adaptation Strategy	Medium	Medium
Micro	Quantitative	Local	Adaptation Actions	High	High

Source: modified from Messner (2005) in Suroso (2008)

The risk assessment framework has been well developed within natural disaster communities and has started to be adopted in climate change study (Klein, 2004). Since the Third Assessment Report, definition of vulnerability from the IPCC has been improved to take into account social vulnerability (O'Brien, et al., 2004) and to reconcile with risk assessment (Downing and Patwardhan, 2005). The framework and methods for vulnerability assessment must also include adaptive capacity indicators (*Turner, et al.*, 2003; *Schroter*, 2005; *O'Brien and Vogel*, 2006).

Affeltranger, et al. (2006) proposed a risk notation (Risk), as a function of Hazards and Vulnerability using the formula[10]:

$$Risk\ (R) = Hazards\ (H)\ \mathrm{X}\ Vulnerability\ (V)$$

IPCC (2001) defines vulnerability as follows: "*a function of character, magnitude and rate of Climate Change and the variation to which a system is exposed, its sensitivity and its adaptive capacity*". In the context of risk and adaptation assessment to climate change, based on the risk notation from Affeltranger, et al. and vulnerability definition from the IPCC above, we can determine two definitions as follows:

1) Hazard due to climate change is a function of characteristic, magnitude, and rate of climate change and variability.
2) Vulnerability of a system to climate change is a function of exposure, sensitivity, and adaptive capacity.

In general, the climate risk assessment should be conducted for both baseline situation and future projection. For baseline analysis, year 2010 can be used as reference, thus almost all of the single year data were dated 2010 and historical data end in 2010. The climatic projection that was being done in science basis part of this assessment goes until the year 2100, with reference points every 30 years. As for the risk projection, year 2030 was chosen for the projection. Therefore, hazard, vulnerability, and risk projection do not go beyond 2030; with several analyses using reference years

[10] See further Suroso (2008).

every 5 years. The selection of year 2030 as the end year was also due to the time frame of development system in Indonesia; more precisely it is compatible with the General Spatial Plan (RTRW) that is drafted until 2030 and with the the Long-Term Development Plan (RPJP) that is legal until 2025.

The risk assessment process used n KRAPI approach can be illustrated in the diagram below. The detail of each step in this approach is provided in the following sub-chapters.

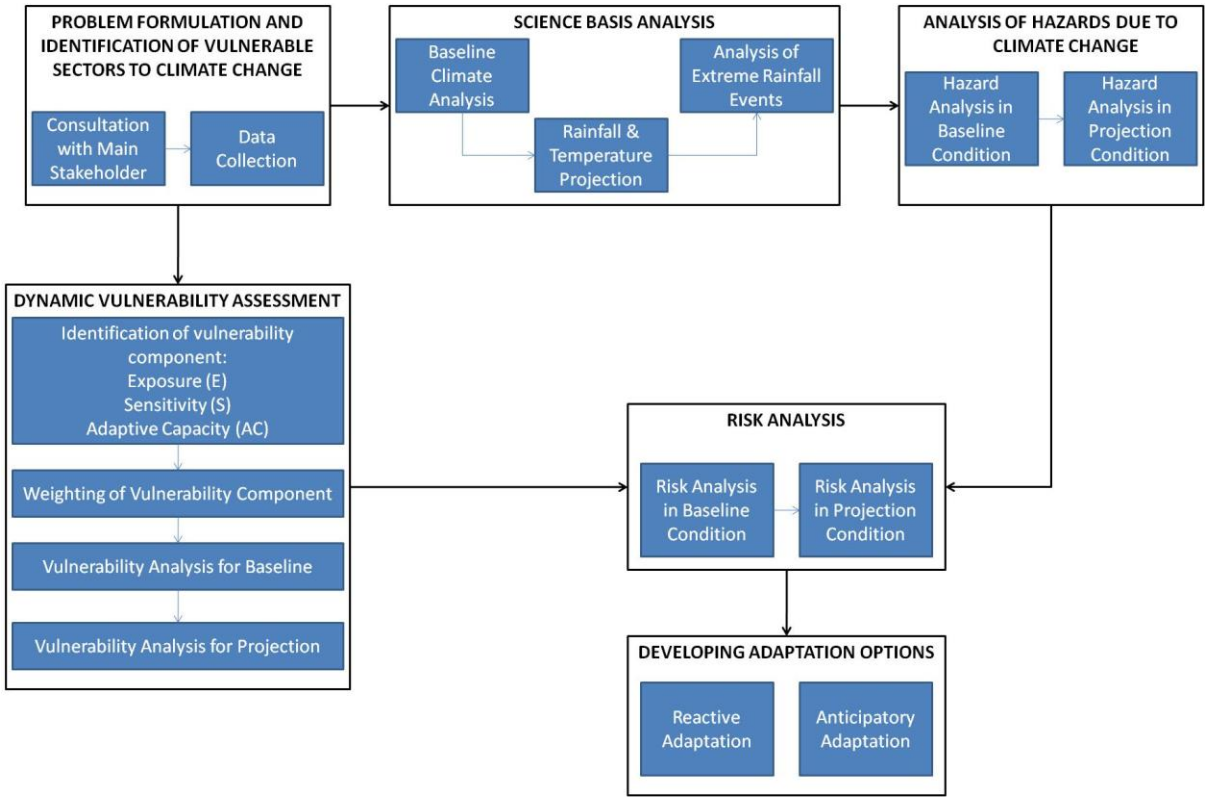


Figure 2 Climate Risk Assessment Process in KRAPI Approach

3.1 Problem formulation and identification of vulnerable sectors to climate change

This step is very important in laying the foundation for the implementation of the study. Techniques which can be implemented include brainstorming, public consultations, and focus group discussions. This step is aimed at determining sectors which are considered to be vulnerable to climate change and also as a forum for early interaction with stakeholders in concerned regions. In this step, we can also communicate on data needs and availability between the involved experts in this study and related institutions in the region.

Initially the expert talks to the main selected stakeholders, this could be officials from the Development Planning Agency (Bappeda) and Environmental Protection Agency (BLH), and from other agencies, NGOs, Associations etc. whenever necessary, in order to identify if climate

variabilities have occurred in the past and what sectors that may be or have been affected by this climate variability.

Some data collection may also be conducted during this initial step, focusing on any hazards or disasters related to climate variability, such as floods, landslide, rob, etc. This type of data is normally available from the Bappeda or BLH, or Disaster Alleviation Agency (BPPD). In this initial step it is also useful to identify if any Strategic Environmental Assessment has been conducted in that region.

Besides the above activities, it is advisable to visit the local BMKG (Meteorology, Climatology, and Geophysics Agency) office in order to discover what climate-related data available in that office.

The initial discussion and data collection may be conducted within 2 to 3 days, depending on the condition and location of the study, as well as whether initial contacts with local officials have been established or not. The formulation of problem and the identification of sectors vulnerable to climate change itself should take around 1 to 2 weeks only.

3.2 Science Basis Analysis

In this step, character, magnitude, and rate of hazards are analyzed based on current and historical climate information, and also future projections of climate change. Hence, it is very important to conduct analysis of science basis as a major reference for hazard analysis.

In principle, analysis of science basis include: (1) baseline climate analysis based on historical data, and (2) future climate projection, as well as (3) analysis of extreme events. Hadi et.al. (2011) describe methods of the three analysis as follows:

1. Baseline Climate Analysis
    - Exploratory Data Analysis (EDA)
    - The Statistical Definition of Climate Change
    - Empirical Mode Decomposition (EMD)
    - Empirical Projection Using Global Climate Indices
2. Rainfall and Temperature Projections from IPCC-AR4 Model Outputs
    - Statistical Downscaling
    - Bias Correction and Spatial Disaggregation (BCSD) with EMD Regression
    - Downscaling with Analogue Technique
3. Analysis of Extreme Rainfall Events

Data needed in this analysis are mainly rainfall and temperature data, which can be available from local or regional BMKG office, and from global datasets, such the Global Historical Climatology Network (GHCN) for rainfall data and University of Delaware for surface temperature data. In order to be able to use the global dataset, regional downscaling approach must be undertaken. As for the local data, it may not be available for the required time period, thus the result of downscaling from global dataset may be the only consistent data that can be used. In order to validate the data, the

climate expert may use two approaches here, i.e. cross-validation with regional datasets, such as from other weather stations nearby, and confirmation with local residents.

Another scientific analysis needed is about the analysis and projection of sea level rise and extreme events. In this analysis information needed are patterns of sea level, surface currents, tidal level and currents, sea surface temperature, and wind waves. Data needed in this analysis is based on satellite imagery and computer modeling. For sea level and surface current are based on the Hybrid Coordinate Ocean Model (HYCOM). The tidal level and currents are calculated using the Finite Volume Coastal and Ocean Model (FVCOM). The sea surface temperature can be calculated using the satellite-derived data (NOAA Optimum Interpolation Version 2 and NOAA Pathfinder). Meanwhile, the extreme event related to ENSO phenomenon is based on the changing patterns of ocean surface temperatures in the Pacific Ocean. Therefore, the frequency of El Nino and La Nina can be estimated using the data of NINO3 (the region of the eastern Pacific Ocean). And lastly, analysis of significant wave height (SWH) is based on Wavewatch III model.

In order to conduct the all the above analyses, experts in climate and meteorology and modeling are a must; however there are only few people in this expertise in Indonesia currently. Therefore it is suggested that this analysis is conducted at regional level by climate experts and adapted to local level under the guidance of the experts.

In order to conduct all the above analyses, it may take between 2 to 4 months duration, depend on data availability.

3.3 Analysis of Hazards due to Climate Change

There may be six types of hazard caused by climate change and variability related to the four sectors overed in this study, i.e. decreasing agricultural production; decreasing water availability; flooding; landslide; coastal inundation; and increasing disease events. Analysis of each hazard type can be conducted using different method or model, with different inputs or parameters. Most parameters used in the analysis are taken from the science basis analyses. The hazard analysis is performed for current conditions, as baseline, and the future, which has taken into account the climate projection in the method or model. The list of method or model and the parameters used in hazard analysis for each hazard type is provided in the table below.

Table 2 Method/Model and Parameters in Hazard Analysis

Hazard Type	Method/Model	Main Parameters
Agriculture	Crop production decline	Crop productions Crop yields Harvest area
Water: Flood	HECRAS	Rainfall SLR Soil type Land use change
Water: Landslide	GEOSLOPE	Rainfall Soil type Land use change
Water: Shortage	Water balance	Rainfall Temperature Soil type Land use change
	Water budget	Total Run-Off Population Land use
	FEM WATER	Aquifer geometry Permeability Groundwater storage
Coastal: Inundation	Cumulative Inundation model and scenario	Storm surge La Nina Tide Wind wave SLR
Health: Dengue, Malaria, Diarrhea	Regression and correlation model	Rainfall Temperature Incidence rate

In order to conduct all the above analyses by each individual expert on sector related to different hazard type, it may take around 2 to 3 months, provided that the result of science basis analysis is available. Result of hazard analysis can be presented as a map of each individual hazard. A sample of coastal inundation hazard map of Tarakan Island is provided below.

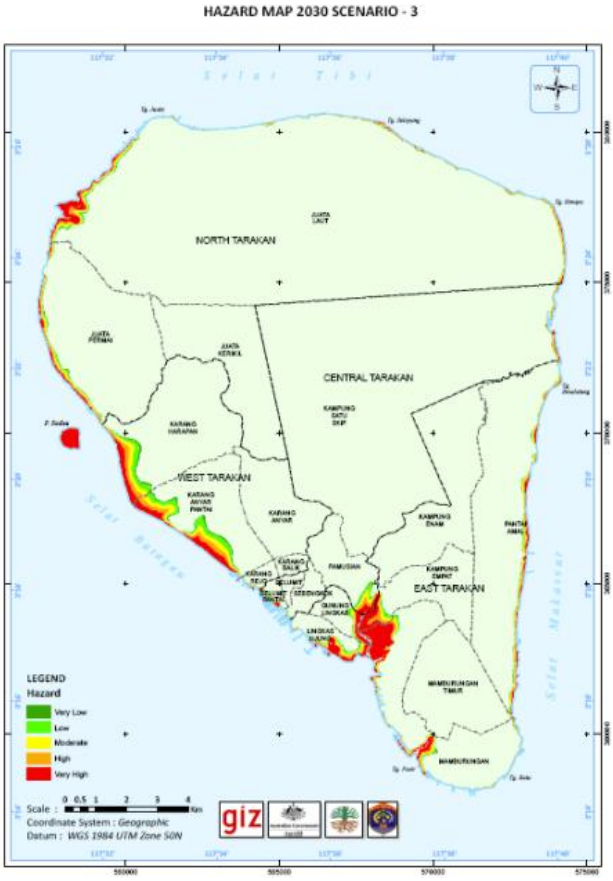


Figure 4. Sample of Hazard Map: Coastal Inundation on Tarakan Island in 2030

3.4 Dynamic Vulnerability Assessment

Vulnerability assessment is recommended to be conducted by incorporating the changing conditions of variables being measured. This approach is called the dynamic vulnerability assessment. In order to guide the analysis, several rules are established as attributes of the dynamic vulnerability framework in this study. Those rules are as follows:

- Indicators used in the vulnerability assessment in each sector may be different.
- The unit of analysis for some indicators assessed at provincial level may also be different with the ones at district level. For Meso Level Multi Sectoral Approach (province) the unit of analysis is district or subdistrict. Meanwhile, for Micro Level Multi Sectoral Approach (district), the unit of analysis is subdistrict or village.
- For some indicators in which the spatial data (image) is available the actual size from the image is used in the analysis.
- For indicators that are dynamic in nature, its change in pattern may be used to project its future condition.. these indicators are explained further below.

Table 3 Indicators Used in Dynamic Vulnerability Assessments

Hazard Type	VA Components	Indicators

Hazard Type	VA Components	Indicators
Agriculture: Crop Production Decline	Exposure	Size of agricultural area (D) Number of people working in agriculture (D)
	Sensitivity	Size of non-irrigated field (D) Farmer's income (D) Topography
	Adaptive capacity	Irrigation network (D) Education level (D) Share of Agriculture Sector in GDRP
Water: Flood and Landslide	Exposure	Urban population density (population per urban area) (D) Land use (D)
	Sensitivity	Function and status of critical infrastructure (D)
	Adaptive capacity	People's welfare (housing type, income per capita) (D) Drainage (flood) or road (landslide) network (D)
Water: Shortage	Exposure	Demand for water provision (D)
	Sensitivity	Type of water resources Water quality
	Adaptive capacity	People's welfare (housing type, income per capita) (D) PDAM network (As proxy to access to drinking water (D)
Coastal: Inundation	Physical vulnerability	Elevation Slope Land use (D)
	Social vulnerability	Urban population density (population per urban area) (D)
	Economic vulnerability	Critical infrastructure (D)
Health: Dengue	Exposure	Urban population (D)
	Sensitivity	Type of water supply (with PDAM or not) (D) Urban population density (D) People's mobility (D)*
	Adaptive capacity	Provision of health facility (D) Accessibility to health facility (D)
Health: Malaria	Exposure	Population living near breeding site (swamp rice field, forest, or inundated areas) (D)
	Sensitivity	Distance to breeding site Availability of mangrove area (D) Type of housing (permanent or not) (D) Sensitive population (fisherman, fish farmer, etc) (D)*
	Adaptive capacity	Provision of health facility (D) Accessibility to health facility (D)
Health: Diarrhea	Exposure	Urban population (D)
	Sensitivity	Type of sanitation (toilet or not) (D) Type of water supply (PDAM or not) (D) Prolonged flood area Proportion of sensitive population (infant and senior) (D)
	Adaptive capacity	Immunization program (D) Provision of health facility (D) Availability of clean water (PDAM network) (D)

Note: * data may not be available in all areas

Indicators that can be used in the vulnerability assessment are according to hazard type, using the equation that vulnerability (V) is a function of exposure (E), sensitivity (S) and adaptive capacity (AC)[11], are listed in the table above. Indicators that are dynamic in nature, and thus its change may be analyzed in the vulnerability assessment, are marked as (D). Most of dynamic indicators used in the assessments are based on targeted conditions in the future stipulated in official documents such as the Long-Term Development Plan (RPJP) or Spatial General Plan (RTRW), for example indicators related to land use are based on the spatial pattern plan map from RTRW. However, there are dynamic indicators based on projected conditions in the future from existing trends, for example projection of urban population or farmer's income.

Data needed to represent those indicators are mostly available either in the statistical yearbook from the local statistics office, or development data book from the Bappeda, or other more specific sources, such as in health sector. Some data may also need to be verified by observation on the ground, for example the drainage or road network. Some data related to space also requires spatial analysis using GIS, for example urban population density is calculated from the population size divided by the size of urban areas in the map, and not by the size of administrative area (village or subdistrict or district).

As for projection analysis, the spatial data should be based on the Spatial Structure and Pattern Plan in the future, as appeared in the General Spatial Plan of the region (RTRW). Several future data is also based on the projection calculated in the RTRW document, for example the projected population. See samples of population density maps for baseline and future conditions below.

[11] Except for coastal inundation that has different components.

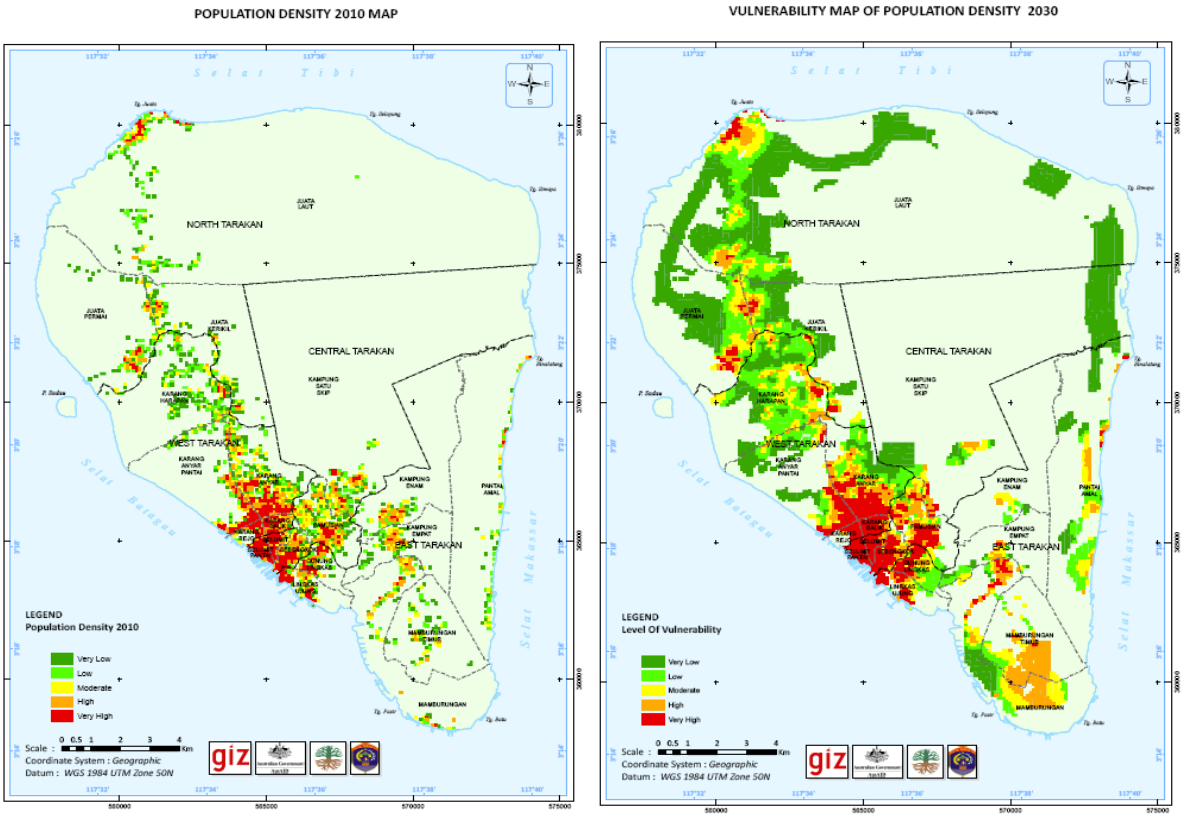


Figure 5 Sample of Vulnerability Indicator Maps: Urban Population Density on Tarakan Island in 2008 and 2030

At the time of doing the vulnerability analysis for each hazard, the value of each indicator may be different, thus in order to assign weight for each indicator for each hazard, two methods may be used, i.e. expert judgment and analytical hierarchical process (AHP). The expert judgment method is simpler; the sector's expert determines the weight for each indicator based on the expertise. The AHP method involves several steps, starting from developing a questionnaire based on the list of indicators, distributing the questionnaire to experts familiar with the substance (at least three, including the sector's expert), inputting the responses to the questionnaire into a computer program called e.g. "Expert Choice", then running the program, with the result being the weight of each indicator.

To conduct the assessment, the sector's experts work together with an expert on vulnerability assessment who can assist on determining the type and quality of data to be used. The vulnerability assessment resulted in a composite vulnerability map for each individual hazard type. A sample of vulnerability of Tarakan Island to coastal inundation is provided below. The vulnerability assessment for each sector may take 1-2 months, depend on data availability.

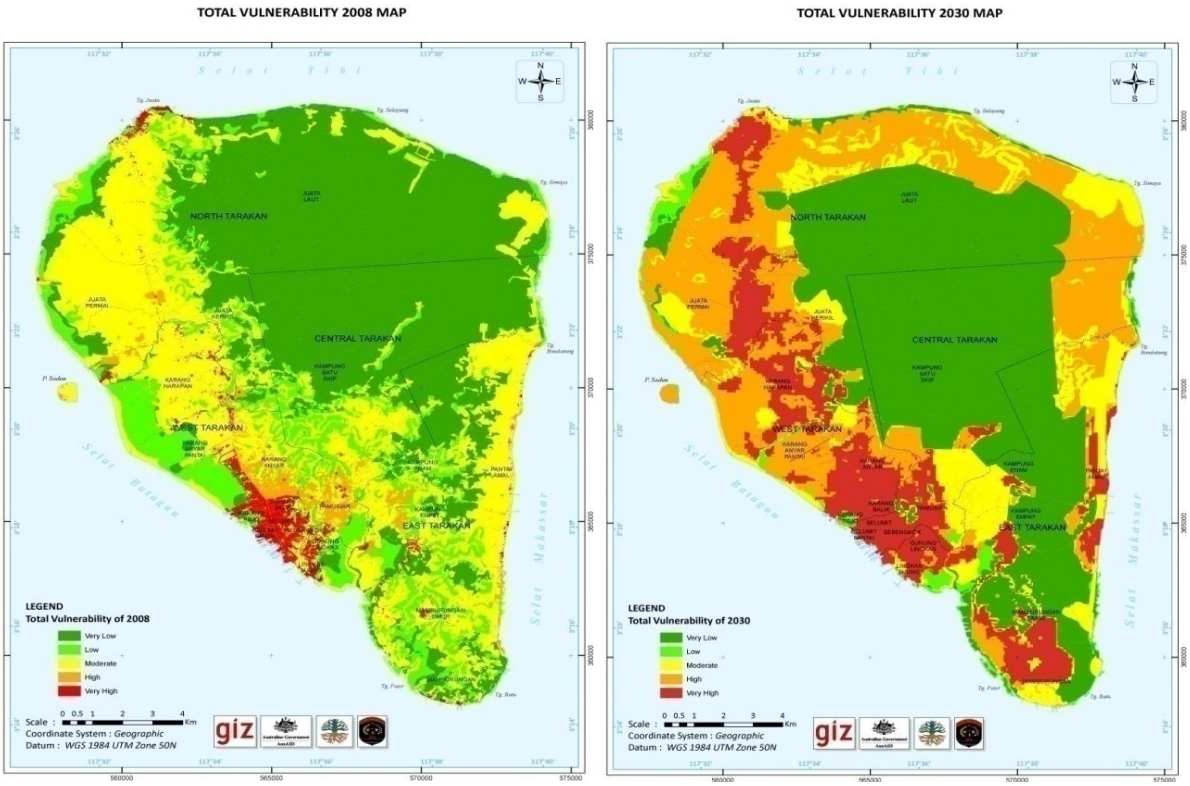


Figure 6. Sample of Composite Vulnerability Map to Coastal Inundation of Tarakan Island in 2008 and 2030

3.5 Risks Analysis

Risk analysis is conducted with a basic model of risk as a function of hazard and vulnerability. There are two types of risk to be calculated, one is the current risk as a baseline, and another one is the future risk that takes into account climate projection in the future. The current risk is measured based on current hazard and vulnerability, while the future risk is measured based on projected hazard using IPCC SRES scenario and projected vulnerability. As mentioned above, in projecting vulnerability, two main data sources are used, i.e. for spatial data such as land use and road network, the Spatial Structure and Pattern Plan in the General Spatial Plan (RTRW) document is used as reference. Meanwhile, population projection 20 years from the current year can be calculated using the available annual growth rate, or the projection available from RTRW document.

For both risk assessments, the risk level is determined from the combination of hazard and vulnerability levels as illustrated in the chart below. There are five classes of hazard as well as vulnerability, from “very low” to “very high”, which woud result in five classes of risk as well. For example an area with the combination of “very low” or “low” hazard with “very low” or “low” vulnerability would result in as “very low” risk area. Meanwhile, an area with the combination of “high” or “very high” hazard with “high” or “very high” vulnerability would result in as “very high” risk area.

Following that classification, the risk analysis results in a risk map for each hazard type for both baseline and future risks, which is then overlaid with the land use map, as well as a table that

summarizes the location and size of area based on computer calculation on the map. The risk analysis and maps generation may be conducted by a GIS analyst under supervision of the sector's expert. This analysis should take only between 1 to 2 months, provided that maps of hazard analysis and vulnerability assessment have been produced.

Table 4 Chart for Risk Analysis

		HAZARD				
VULNERABILITY		Very Low	Low	Moderate	High	Very High
	Very Low	VL	VL	L	L	M
	Low	VL	L	L	M	H
	Moderate	L	L	M	H	H
	High	L	M	H	H	VH
	Very High	M	H	H	VH	VH

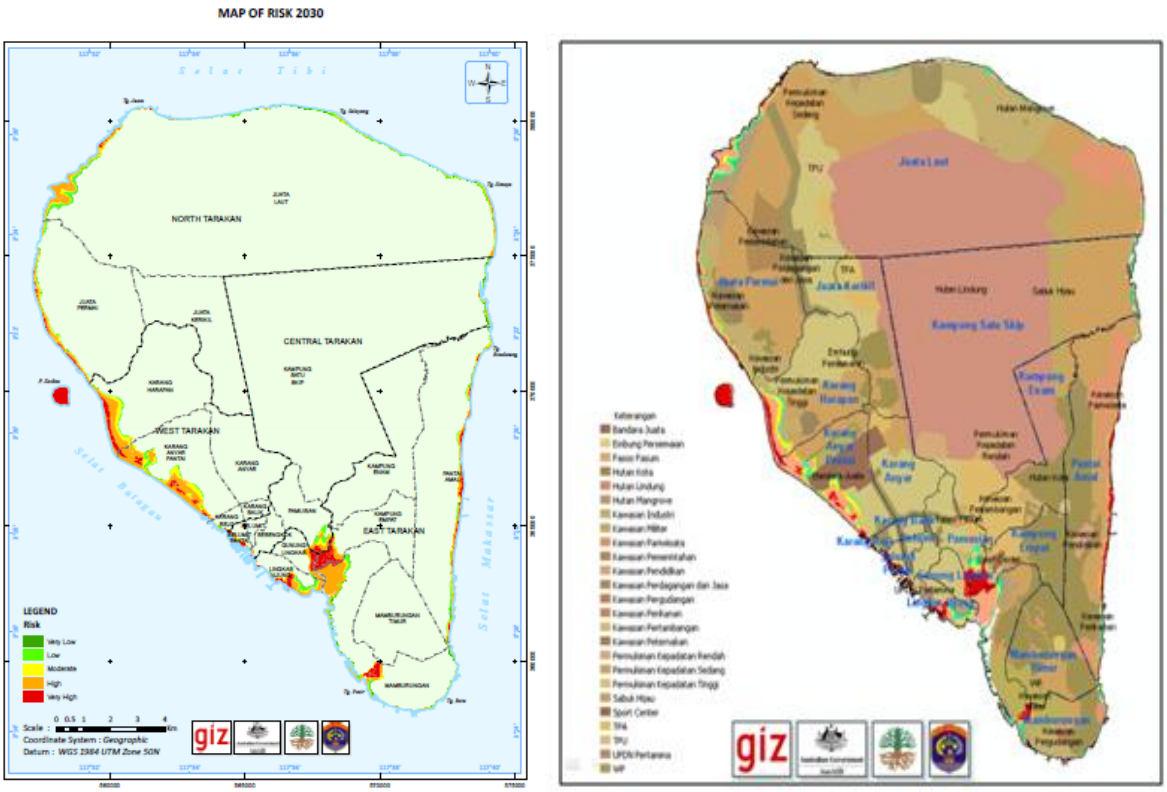


Figure 7 Sample of Coastal Inundation Risk Map of Tarakan Island in 2030 (with an overlay to future land use map on the right)

3.6 Developing Adaptation Options

The phenomena and impacts of climate change caused by the increasing of GHG emissions are real and will lead to greater disastrous impacts for development activities and the future of mankind. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007) has shown various possible challenges caused by the impact of climate change; even with mitigation actions, sea level rise, increasing sea temperature, and extreme events that would threaten various sectors from water resources, agriculture, human health, coastal, until development activities as a whole. Among countries that are prone to climate change impact, developing countries are the most vulnerable to climate change impacts because they have fewer resources to adapt: socially, technologically and financially[12]. However, amidst the possible disastrous conditions due to the climate change societies were still divided whether particular country or area should develop adaptation actions. Regarding this condition, Stern (2006)[13] previously stated that the rehabilitation actions towards impact of climate change would be more expensive compared to adaptation and mitigation actions. Therefore, adaptation activities need to be developed in areas that are prone to the climate change in order to curb farther impacts of climate change that would be more costly to rehabiitate.

Climate change adaptation according to UNFCCC (2008: 10) is "a process through which societies make themselves better able to cope with an uncertain future". Thus, "adapting to climate change entails taking the right measures to reduce the negative effects of climate change (or exploit the positive ones) by making the appropriate adjustments and changes. There are two categories of adaptation: reactive, in which immediate actions are required, and anticipatory, which could take more time to implement. In developing adaptation options for each hazard, the sector's experts work based on risk maps, either for the baseline or future condition. From the risk maps a typology of an area can be observed, based on its physical characteristics, such as topography or morphology of the area, or other characteristics as identified in vulnerability assessments. The sector's experts look at this typology and then outline recommendation for adaptation options. Those options may consist of hard or soft adaptation measures. Samples of adaptation options for each vulnerable sector are provided in the table below.

The basic principle in outlining the adaptation options is that in order to reduce risks from climate change, the adaptation should aim at reducing the vulnerability, which means either reducing the exposure and sensitivity, or increasing the adaptive capacity. Thus when outlining the adaptation options, the sector's experts must always review the conditions of each indicator used in the dynamic vulnerability assessment in order to identify correctly the cause of vulnerability or risk that one area has. For example, the western coast of Tarakan island is predicted to be inundated during sea level rise events in the future, and the characteristics of that area are a lowland with mangrove ecosystem, inhabited by urban and fisherman population in high density areas along with some critical infrastructures such as the airport and oil storage facility. The adaptation options for such area would consider all of these characteristics, i.e. to ensure that mangrove ecosystem shall be

[12] UNFCC, 2008, Climate Change: Impacts, Vulnerabilities, and Adaptation in Developing Countries, p.6
[13] In Arifin, B. *Antisipasi terhadap Perubahan Iklim* – Anticipation Towards Climate Change, Kompas Newspaper (24/1 2011), p.15

preserved, density will be controlled through zoning regulation, fisherman residential area will accommodate sea level rise by raising the building level, and critical infrastructures shall be protected by a seawall or other hard measures.

Table 5 Samples of Adaptation Measures (Source: UNFCCC, 2008)

Sector	Reactive Adaptation	Anticipatory Adaptation
Water resource	• Protection of groundwater resources • Improved management and maintenance of existing water supply systems • Protection of water catchment areas • Improved water supply • Groundwater and rainwater harvesting and desalination	• Better use of recycled water • Conservation of water catchment areas • Improved system of water management • Water policy reform including pricing and irrigation policies • Development of flood controls and drought monitoring
Agriculture	• Erosion control • Dam construction for irrigation • Changes in fertilizer use and application • Introduction of new crops • Soil fertility maintenance • Changes in planting and harvesting times • Switch to different cultivars • Educational and outreach programs on soil and water conservation and management	• Development of tolerant/resistant crops (to drought, salt, insect/pests) • Research and development • Soil-water management • Diversification and intensification of food and plantation crops • Policy measures, tax incentives / subsidies, free market • Development of early warning systems
Coastal zone	• Protection of economic infrastructure • Public awareness to enhance protection of coastal and marine ecosystems • Building sea walls and beach reinforcement • Protection and conservation of coral reefs, mangroves, sea grass and littoral vegetation	• Integrated coastal zone management • Better coastal planning and zoning • Development of legislation for coastal protection • Research and monitoring of coasts and coastal ecosystems
Human health	• Public health management reform • Improved housing and living conditions • Improved emergency response	• Development of early warning system • Better and/or improved disease / vector surveillance and monitoring • Improvement of environmental quality • Changes in urban and housing design
Ecosystems	• Improvement of management systems including control of deforestation, reforestation and aforestation • Promoting agroforestry to improve forest goods and services • Development/improvement of national forest fire management plans • Improvement of carbon storage in forests	• Creation of parks/reserves, protected areas and biodiversity corridors • Identification/development of species resistant to climate change • Better assessment of the vulnerability of ecosystems • Monitoring of species • Development & maintenance of seed banks

Part III Guidelines for Policy Mainstreaming of Climate Change Adaptation

4. KRAPI Approach

Adaptation can be defined as a process through which societies make themselves better able to cope with an uncertain future. Adapting to climate change entails taking the right measures to reduce the negative effects of climate change (or exploit the positive ones) by making the appropriate adjustments and changes[14]. It may range from structural adaptation construction (for example polder and sea wall construction) until non structural adaptation (for instance retreat strategies, education, early warning, etc.). However, the decision about types of adaptation activities that will be developed basically must be based on the level of climate risk on particular areas. It should be intended so that adaptation to climate change will prevent and remove of maladaptive practices. Mal-adaptation refers to adaptation measures that do not succeed in reducing vulnerability but increase it instead[15]. Therefore, related parties that are willing to develop a climate change adaptation action must improve their understanding about climate hazard and its impact, vulnerability, and adaptation.

UNFCCC highlighted that the most effective adaptation approaches for developing countries are those addressing a range of environmental stresses and factors. Strategies and programs that are more likely to succeed need to be linked with coordinated efforts aimed at poverty alleviation, enhancing food security and water availability, combating land degradation and reducing loss of biological diversity and ecosystem services, as well as improving adaptive capacity. The difficulty is furthered by the fact that many developing countries face difficulties in integrating climate change concerns into national policies due to a lack of resources and institutional capacities. Capacity-building, for example, to integrate climate change and socio-economic assessments into vulnerability and adaptation assessments, helps to better identify effective adaptation options and their associated costs[16]. Thus development stakeholder must realize that adapting to climate change impacts will entail adjustment and changes at every level – at community, regions, and national. The adjustment is necessary because future vulnerability to climate change depends not only on climate change but also on the type of development path that is pursued[17].

Therefore, integrating adaptation to climate change into planning and development processes is a necessity for sustainable development over the long term. One of the strategies to assure such integration is by assuring that local development planning agencies are being informed by the relevant outputs of impact and vulnerability assessments. In addition, environmental and sectoral institutions need to be strengthened in order to be able to address the complexities in addressing and coordinating the implementation of adaptation action. Moreover, policy and development planners require effective tools and frameworks for developing, disseminating and building capacity for adaptation and integrating it into policy at all levels.

Recently there was also a shift in that activities related to climate risk and adaptation are no longer a research-driven, but more oriented towards policy-making in which decision maker or stakeholder

[14] Op.cit., UNFCC, 2008, p.10
[15] Ibid, UNFCC, 2008, p.30
[16] Ibid, UNFCC, 2008, p.29
[17] Ibid, UNFCC, 2008, p.10

participate in the activities[18]. In order to have a clear path to drive risk and adaptation assessment into policy-making, it is important that particular parties that are willing to conduct climate risk and adaptation assessment should identify at what level the assessment will influence the policy.

Risk management is well fitted for plan making and review processes at the stages where issues are being identified and a range of possible response options evaluated. The iterative process of plan formulation, monitoring and evaluation enables for revision of plans over time in order to take account of improved understanding of risks due climate change. In considering climate change issues, the period over which the decision will have effect is of fundamental importance. Generally, whenever a decision is likely to have effects that will last 30 years or more, the implications of climate change should be taken into account.

Different to climate change mitigation that mandates local government to perform enactment over local action plan for emissions reduction (RAD GRK), there is no single regulation mandating local government to develop a climate change adaptation plan. Therefore, adaptation policies, programs, and actions that are possible to be implemented by local government must be integrated with the existing development system or sector agenda.

The objectives of mainstreaming of climate change risk and adaptation assessment into development planning are as follows:

1. To enhance awareness on climate change impact and its adaptation management for regional/local government and stakeholders.
2. To assess compatibility (suitability) of adaptation options recommended by sectoral expert with the annual program of local government, both in terms of content, location, and timing.
3. To judge the priority levels of adaptation options, especially which are not compatible to the annual program of local government
4. To recommend on which ways or how to mainstream the prioritized adaptation options into local and even national development planning.

The framework for mainstreaming adaptation involves several steps and elements. First of all, sectoral experts developed adaptation options recommendation based on the hazard, vulnerability and risk assessments, illustrated in respective maps. The experts presented the outputs of their assessment in a public consultation as an exposition to local stakeholders in order toget their feedback. The stakeholders invited to the public consultation are officials from the government, village administration, representative of non-government organizations, and faculty members of local universities. The public consultation is normally conducted twice, first is when there is an initial result of sectoral assessment, and the second after the final assessment has been done. During the first public consultation a questionnaire on local plan status can be filled in by government officials and all available planning documents can be requested.

[18] UNDP, 2005, Adaptation Policy Frameowrks for Climate Change; Developing Strategies, Policies, and Measures, Cambridge Unviersity Press, Cambrige and New York

Then the policy expert should study local planning and policy documents, namely the Long-Term Development Plan (RPJP), the Spatial General Plan (RTRW), and the Medium-Term Development Plan (RPJM), regarding the timing and status of those documents, and then scrutinizes the substance in order to find the connection with climate change adaptation. The highlights of those documents are presented to participants during the second public consultation in order to remind all what has been written in the official documents as the legal basis for integrating adaptation options. Or, if it has not been written there, then the expert highlights the area of possibility for mainstreaming climate change adaptation into the documents. This part is useful in showing all stakeholders the "hook" in integrating and mainstreaming climate change adaptation into local planning and policy.

The next step during second public consultation is that every sector discusses what adaptation options are preferred by stakeholders. Tools used in this discussion are the hedonic-qualitative cost benefit analysis (HQCBA) and the importance level rating matrix. The stakeholders identify what factors determine the likelihood of executing the proposed adaptation option into real action. The preferred adaptation for each sector is determined either based on the result of HQCBA (the highest score option) or the importance level matrix (the most rated option). The HQCBA is a good method to identify criteria used by stakeholders in choosing which option is preferred. Those criteria could be from physical or social aspects, not only economic aspect. They can be related to strategic issues that may be specific to the region under analysis, such as poverty, food or water shortage, or land degradation but should include criteria that measure cost/benefits related to gender and, in general include criteria that measure costs/benefits relative to the achievement of the MGDs (Millennium Development Goals).

Following the exercise to identify the preferred adaptation options, adaptation areas prioritization is conducted using multi-risk assessment method. In this exercise stakeholders are presented with results of risk analysis of all sectors, which highlight areas where multiple climate risks occur at high and/or very high level. The areas are then identified as prioritized areas for climate change adaptation.

The last activity in integrating climate risk and adaptation assessments into local development plan is measuring the compatibility between preferred and/or prioritized adaptation with local government programs. The idea is to see whether the identified adaptation options fit into programs that the local government has already planned. If the proposed adaptation strategies have not been incorporated in the government programs, thus they can be recommended to be next year's program, either in that region, or to central government. Diagram below illustrates activities conducted for integration process into development planning and program. Step 3, 4, and 5 will be explained in separate sections below.

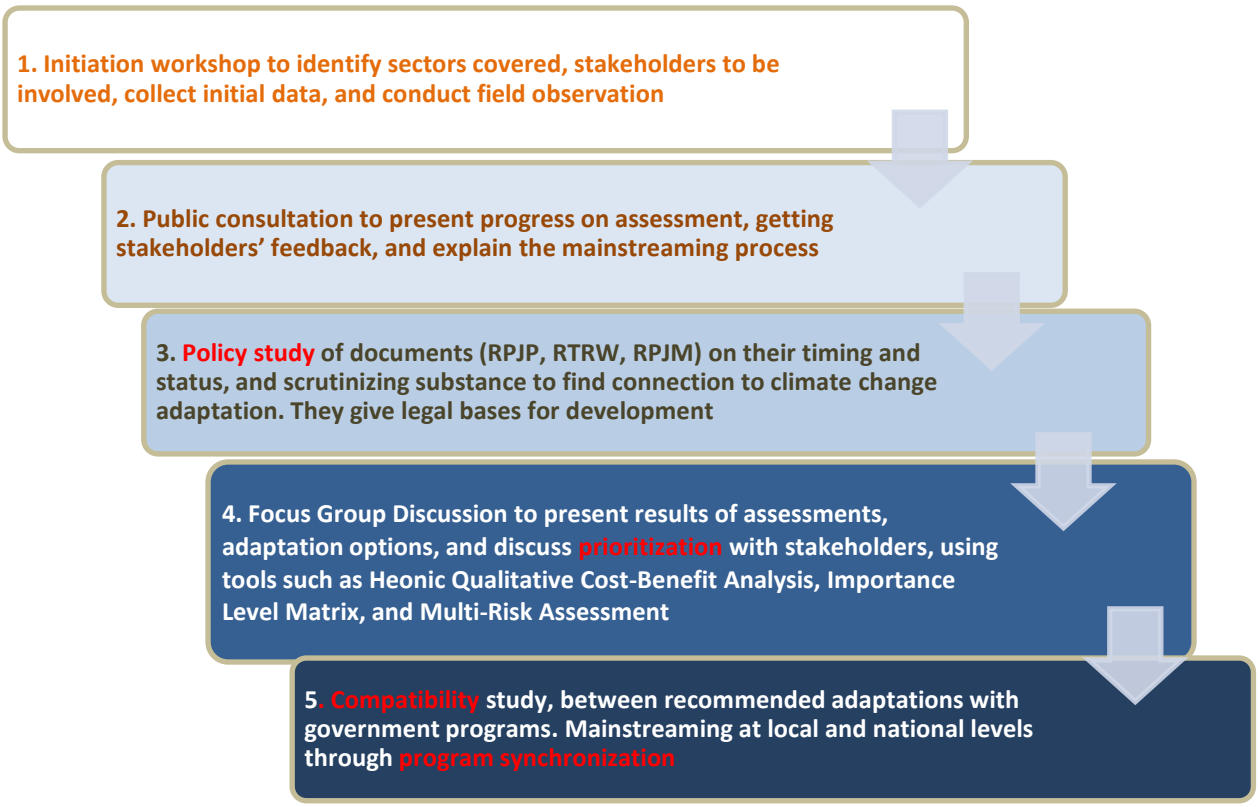


Figure 8 Process of Integrating Climate Change Adaptation into Existing Program

4.1 Framework for Policy Study and Integration

In general, in Indonesia there are two development planning regimes; the non spatial development planning and spatial planning. The baseline regulation for non spatial development planning is Law 25/2004 on National Development Planning System, as for the spatial planning is Law 26/2007 on Spatial Planning. The brief of each regulation are as follows:

a) Law 25/2004 on National Development Planning System
On the 1st article of The Law 25/2004, it has been written that National Development Planning System is a whole set of development planning activities that produce multiple development plans in long term, medium term, and yearly terms that will be implemented by central and local governments. In terms of long term planning it will be valid for 20 years, central government will produce National RPJP (RPJPN).This will consist of the detailed nation's goals, and local government will produce Local RPJP (RPJPD), consisting of local development vision and mission based on RPJPN. The medium term plan will be valid for 5 years, central government will produce National Medium Term Planning (RPJMN) which consists of detailed of Presidential vision and mission based on UUD 1945; local government will produce Local Medium Term Planning (RPJMD) based on local leader's vision; and line ministries and local agencies will

produce Renstra K/L or Renstra SKPD based on each particular functions and authorities. On a yearly basis, central government produces Governmental Programs Plan (RKP), similar in local government (called RKPD), and line ministries as well as local agencies in the form of Renja K/L. The relation between each planning product can be seen in the figure below.

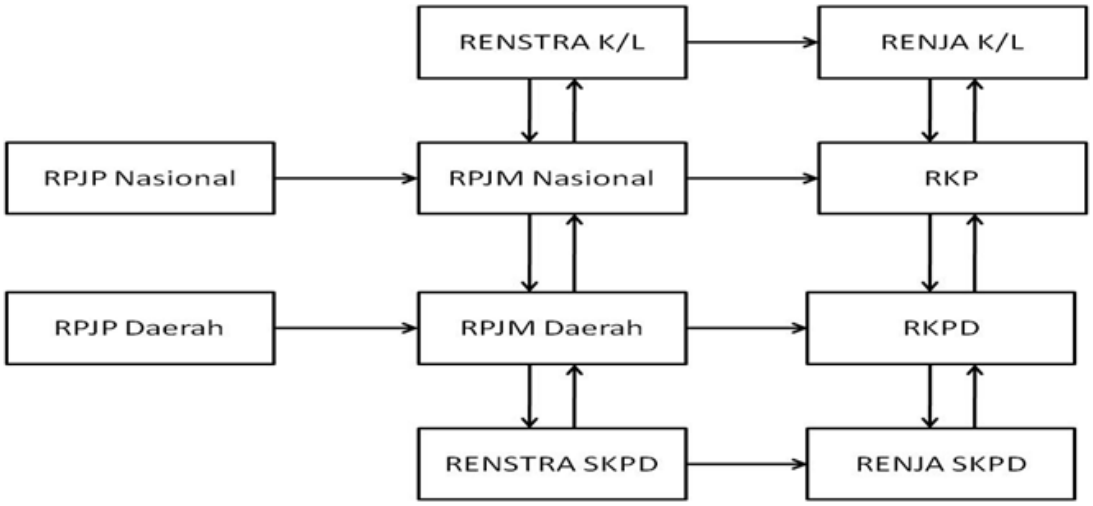


Figure 9 Arrangements in Indonesian Development Planning System. Source: Law No. 25/2004

Figure 10 below describes the planning process of each non spatial plan.. The most appropriate period for integrating CRAA is into Medium Term Development Plan (RPJM); i.e. all the stages before the RPJM being legalized by local regulation (Perda). In term of science basis output of CRAA, it would be optimal if the output being introduced to the draft of RPJM(D) during formulation stage, although during the communicative and consultative stages (e.g. Musrenbang) the output may still be considered for integration.

On the other hand, if the CRAA process or outputs are being done for the micro level, then it may be introduced to enrich the substance of sectoral RKP for adaptation action in each sector affected by the impact of climate change. The RKP of each sector are being practiced each year, thus if the CRAA output may be introduced before particular RKP being legalized it would be the most appropriate time. The initial substance of RKP development process is mostly prepared by each sector agency. Therefore it is important that throughout the process the particular party that develops CRAA is able to communicate to each sector agency. If this step can be practiced well, it is expected that the result of CRAA may be integrated by the agencies themselves. The earlier CRAA output being introduced, it will have a higher chance for particular adaptation action being planned at the policy and budget plan. The process of integrating CRAA into development program could also be conducted by a series of FGD or workshop, which should be initiated by the prioritization process.

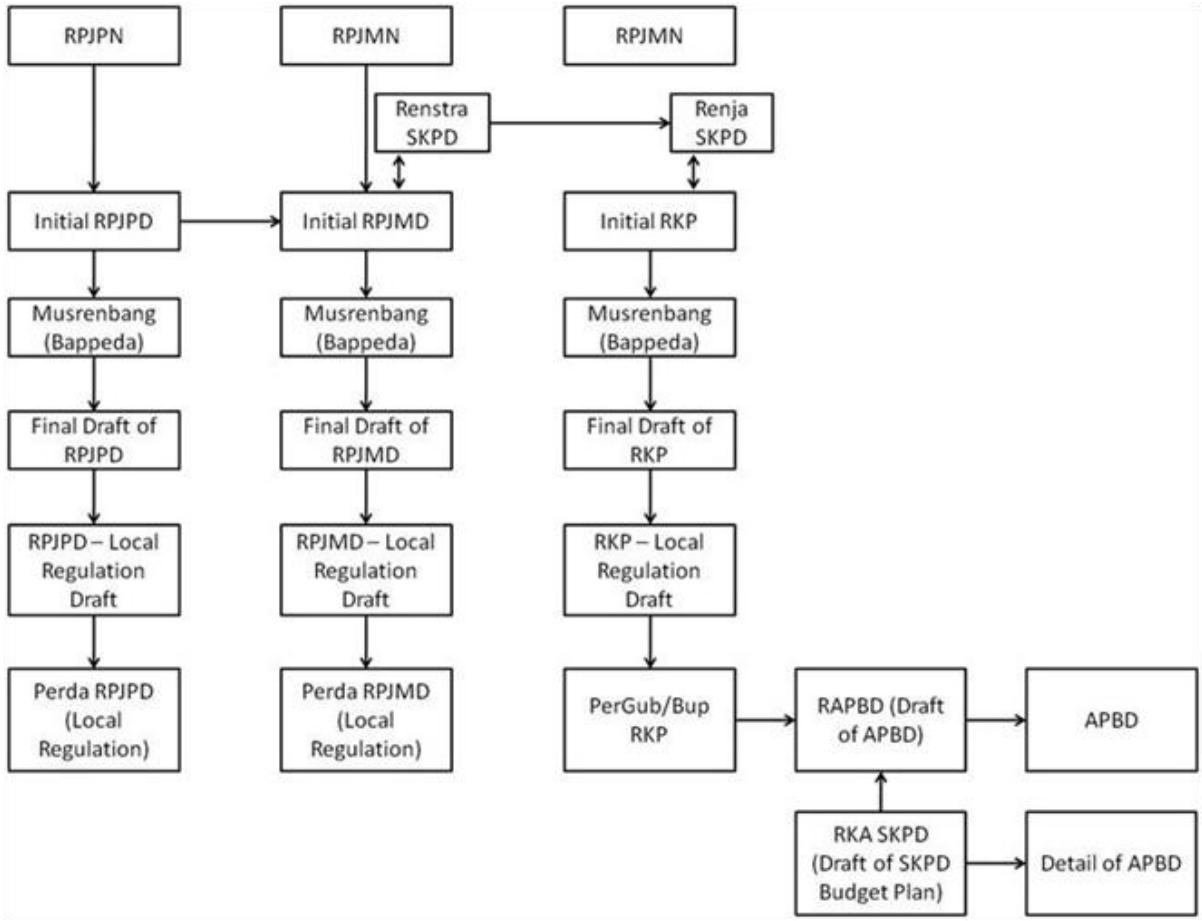


Figure 10 The Process of Non Spatial Planning Development. Source: modified from Law No. 25/2004

b) Law 26/2007 on Spatial Planning

Aside from non spatial development planning, in Indonesia there exists also the arrangements for spatial planning that becomes one of the baseline for arranging development activities from national, provincial, and local level. The fundamental law that regulates this kind of development planning is Law 26/2007 on Spatial Planning. Based on Article 14 in Law 26/2007, it is stated that there are two types of planning products; general spatial plan and detailed spatial plan. The general spatial plan consists of National General Spatial Plan (RTRW Nasional), Provincial General Spatial Plan (RTRW Provinsi), and Municipality/District General Spatial Plan (RTRW Kabupaten/Kota). As for detailed spatial plan, it consists of National Strategic Area Plan or Islands Spatial Plan; Provincial Strategic Area Plan; and Municipality/Regency Detailed or Strategic Area Spatial Plan. Article 14 of Law 26/2007 also explains that general spatial plan is not operational tool, thus it should be followed by detailed spatial plan. The relation between each spatial planning product can be seen in the Figure 11.

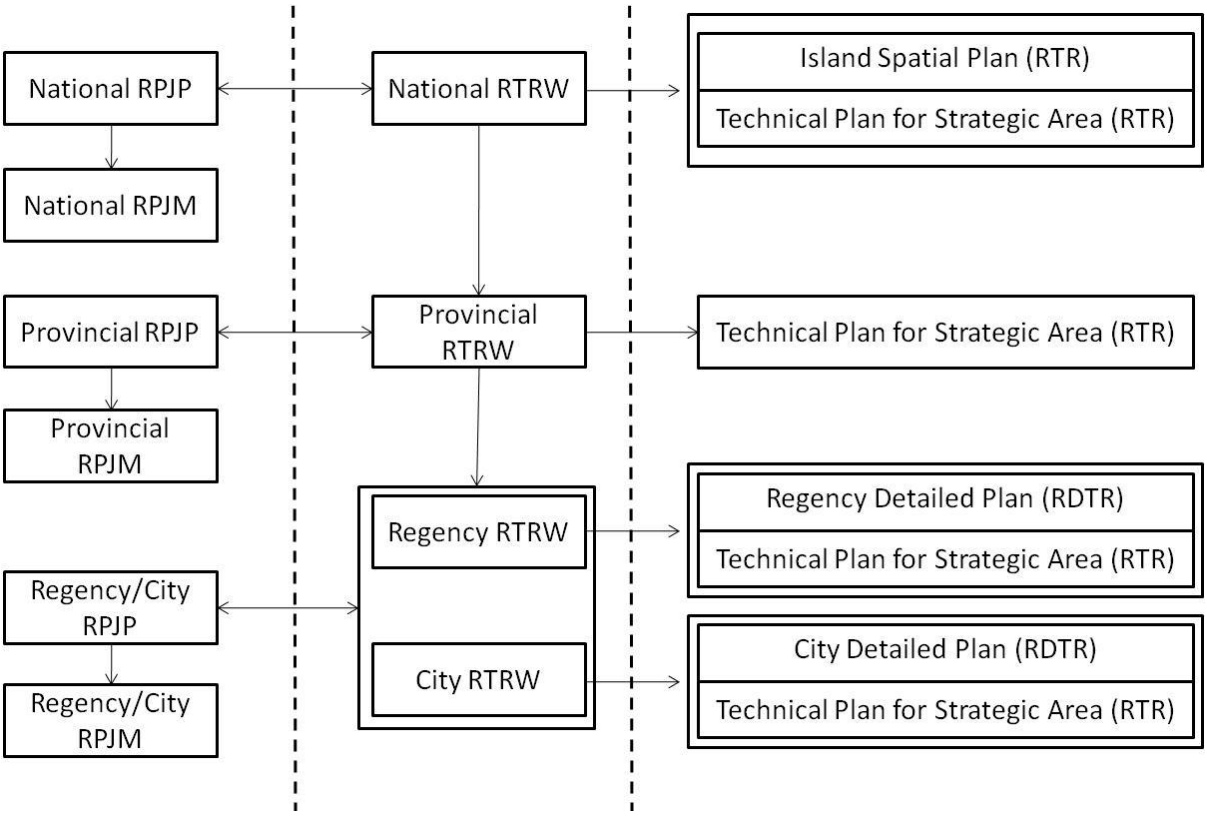


Figure 11 Arrangements in Indonesian Spatial Planning System. Source: Law 26/2007

The spatial and non spatial development planning, i.e. RTRW and RPJP should complement one to another. Spatial program as a result of RTRW should be integrated and acknowledged by RPJMD and strategic plan from each agency (Renstra SKPD). Thus, RPJMD and Renstra SKPD will be detailed in RKPD and Renja SKPD for practiced each year. This will be the baseline for budgeting plan in APBD. The relation between spatial and non spatial development system with budgeting planning system can be seen in Figure 12.

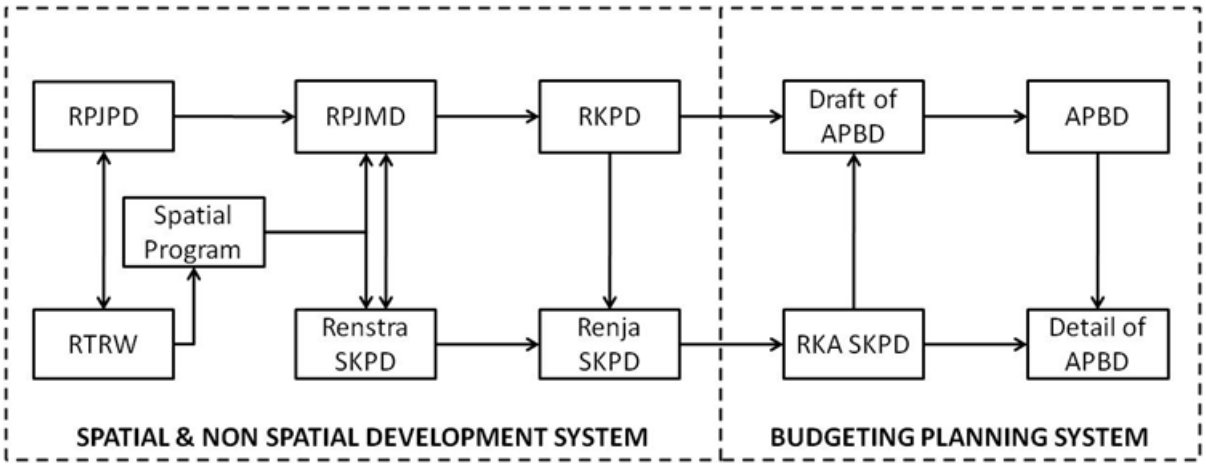


Figure 12 Relations between Spatial and Non Spatial Development System and Budgeting Planning System. Source: Oetomo, 2010

On the other hand, recently the Government of Indonesia also published the Law 32/2009 on Environmental Management and Preservation. Article 9 of Law 32/2009 states that for environmental management and preservation, government at each level (national, provincial, and municipality/regency) will perform the enactment of Environmental Management and Preservation Plan (RPPLH). One of the substances that will be included in the RPPLH are adaptation and mitigation climate change activities[19]. In addition, central and local government also should develop a strategic environmental assessment (KLHS). The result of the KLHS then may be integrated with General Spatial Plan (RTRW), Medium Term Development Plan (RPJM), Long Term Development Plan (RPJP), and other plans, policies, or programs[20]. In relation with climate risk, the KLHS may include the assessment over vulnerability conditions and climate change adaptation capacity[21]. However, there are still no detailed government regulations or guidelines for local government to develop their RPPLH or KLHS, but the Ministry of Environment acknowledges that KRAPI can be used as one approach to comply with the requirements of the KLHs.

Integrating CRAA output into spatial development plan of any regions; i.e. provincial, district, and city level, must be conducted in a manner that it suits and does not violate enacted regulations. In this sense, for integrating CRAA output into the Provincial General Spatial Plan (RTRW Provinsi) it must follow the arrangement given by the Ministry of Public Works Regulation (Kepmen PU) Number 15/PRT/M/200 and Ministry of Public Works Regulation (Kepmen PU) Number 16/PRT/M/2009 for District level. As for City level, City Government may assign several points in their RTRW to be enriched by CRAA output as long as it suits the arrangement given by the Ministry of Public Works Regulation (Kepmen PU) Number 17/PRT/M/2009. Example of the possible enrichment of RTRW of South Sumatera Province based on CRAA study is given in Appendix 1. While examples of possible enrichment from CRAA for District and Municipality General Spatial Plan are given in Appendix 2 and 3.

As stated earlier, the output of CRAA can also be integrated into the Detailed Spatial Plan (RDTR) which may be prepared for part of a city or strategic area. However, even after the publication of Law 26/2007, there is still no further guideline for the RDTR or Master Plan for Strategic Area. The Appendix 4 provides entry points how CRAA output may be integrated to Detailed Spatial Plan based on Ministry of Settlement and Area Decree (Kepmen Kimpraswil) 327/M/KTPS/2002. Depending on the availability of documents, the policy study activities may take 2 to 3 months to complete, resulting in an identification of possible enrichment in policy and planning documents by climate risk and adaptation assessments.

4.2 Prioritization of Adaptation Options

After the risk assessment have been completed by each sector and have been followed by initial adaptation recommendation, the adaptation prioritization is started. There are two ways of prioritization, i.e. option and area prioritization. Option prioritization is to determine which

[19] Law 32/2009 on Environmental Management & Preservation, Article 10
[20] Law 32/2009 on Environmental Management & Preservation, Article 15
[21] Law 32/2009 on Environmental Management & Preservation, Article 16

adaptation options are preferred by stakeholders, primarily by government agencies in charge of related sector. Meanwhile area prioritization is to delineate which areas in that region that need to be prioritized for climate adaptation, which can be due its risk conditions or strategic importance.

4.2.1 Option Prioritization

Prioritization of adaptation options that resulted from sectoral experts is conducted during second or third public consultation where the stakeholders assess which adaptation options are preferred. Tools used in this consultation are (1) the Hedonic-Qualitative Cost Benefit Analysis (HQCBA) worksheet and (2) the Importance Level Rating (ILR) matrix. The stakeholders identify what factors determine the likelihood of executing the proposed adaptation option into real action. The preferred adaptation for each sector is determined either based on the result of HQCBA worksheet (the highest score option) or the ILR matrix (the most rated option).

The HQCBA is more difficult to do because everybody is asked to identify attributes associated with an adaptation option, whether on the costs or benefits sides, while not everybody during the public consultation could understand the costs or benefits of every adaptation option proposed (see example in Appendix 5a). The ILR matrix was preferred to be used than the HQCBA, because it is more simple to fill in and it lists adaptation option based on unit of analysis (location), the risk level and the vulnerability dominant factor (see example in Appendix 5b).

4.2.2 Area Prioritization

Following the exercise to identify the preferred adaptation options, adaptation area prioritization is conducted using multi-risk assessment method. In this exercise stakeholders are presented with results of risk analysis of all sectors, which highlight areas where multiple climate risks occur at high and/or very high level. The areas are then identified as prioritized areas for climate change adaptation.

For this exercise, the expert overlays all the general risk profile of sectors in order to identify. a particular administrative area that is exposed by more than one hazard. In addition, the adaptation prioritization is conducted through iterative process of short-listing the area based on its vulnerability components.

The compilation of risk assessment and adaptation options from all sectors would be used as the basis for adaptation prioritization. For this purpose, first a multi-risk map is generated and then overlaid with the current land use map (for baseline) and the land use plan map (for future condition). Adaptation prioritization would then follow several principles, either for current or projected risk. The key principles are:

- Whether risk exists on single or multiple sectors
- Whether risk occurs on strategic area or not
- Whether risk affects large area or not

From there adaptation priority areas could be delineated with a general guidance as follows:

1. If high and very high risk areas, either on single or multiple sectors, exist right now, then reactive adaptation is needed.
2. If there are multiple or compounding risks areas, either current or in the future, then reactive or anticipatory adaptation is needed.

The process of prioritization involves several meetings with stakeholders (government agencies, universities, and non-governmental organizations), and may take between 2 to 3 months to complete, resulting in identification of prioritized adaptation options and areas by stakeholders.

4.3 Compatibility Analysis

The next step in integrating climate change adaptation is about measuring the compatibility between preferred and/or prioritized adaptations with local government programs. The idea is to see whether the preferred adaptation options fit into programs that the local government has planned. The tool for this method is the compatibility matrix. It compares adaptation options with government program side by side along with its location, risk level and importance level (as a result of ILR matrix). In this step government officers are requested to provide a list of programs that have been proposed in the annual work plan (RKP) that are related to environment and/or climate change. Based on that list, the expert will identify which program compatible with the proposed adaptation strategy, and which program is not.

The compatibility assessment will recommend on what adaptation strategies need to be mainstreamed into future government planning and programs and how. The output of the compatibility study will be whether the adaptation strategy is compatible with existing programs or not (program compatibility), and/or whether the location of proposed strategy is compatible with the existing programs or not (location compatibility). Then the recommendation from compatibility analysis would be either the incompatible programs are mainstreamed into future plans or the incompatible locations are suggested to be added in the existing plans or programs.

The process of compatibility study involves discussions with government officers and the whole process may take 2 to 3 months to complete, resulting in the compatibility matrix. General template of a compatibility matrix is in the Appendix 6.

Beyond compatibility analysis regional government may also proceed with integrating the prioritized adaptation options with programs that central government agencies may have. This is called as synchronization with national government programs. The purpose of this synchronization Is to find additional fundings available either from national government or international donor agencies. The process of synchronization is conducted through several consultations between sectoral agencies at local, provincial, and national levels.

The whole process of policy mainstreaming activities as described above is illustrated in the diagram below.

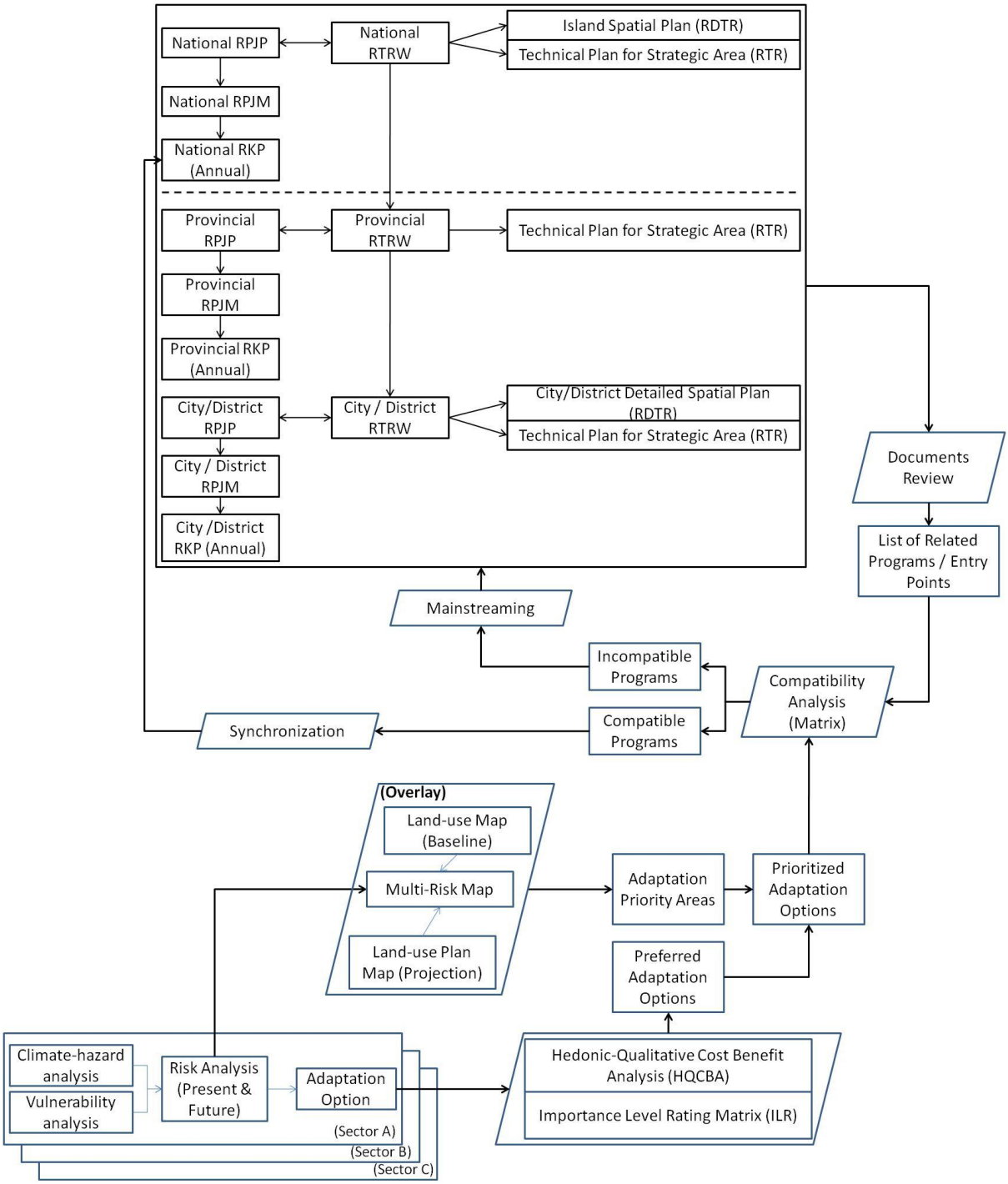


Figure 13. Policy Mainstreaming Climate Adaptation Process of KRAPI Approach

Part IV Institutional and Capacity Building

5 Institutional support: Climate Change Taskforce Establishment

Based on the experience in several places, in order to support Climate Risk and Adaptation Assessment, it is suggested to establish a climate change taskforce at the local level. The taskforce should include different elements of the society, namely government agencies, universities, and non-governmental organization, and to some extent, the private sector, with the following roles:

a) Government agencies serve the function of coordinator, data provider as well as institutions that will incorporate results risk assessment and recommended strategies in the government programs. Normally the leadership of the taskforce is seated by the most senior officer in government.

b) Universities are involved as academic institutions that have the capacity to conduct assessment, either for hazard, vulnerability, or risk analysis, as well as to perform monitoring and evaluation. Universities may also offer trainings for government officers to build their capacity.

c) Non-governmental organizations that can be involved in the taskforce are those that have concerns on environmental and disaster issues, as well as community development In general. They may represent particular local community or civil society in general.

d) Private sector can be involved especially when the climate change impact is predicted to affect private businesses, but they can also serve the function of program donor, through corporate social responsibility (CSR) scheme.

6 Capacity Building

In order to conduct assessment and mainstreaming activities in a proper manner, different expertise is necessary. The list is as follow, but not conclusive:

1. To conduct hazard, vulnerability, and risk analyses, expert in each sector must have specific education background, associated with the hazard being analyzed. The qualification of sector's expert is as follow:
   a. Agriculture: expert in agriculture and climate (agro-climatology)
   b. Water resources: hydrology and/or hydrogeology
   c. Coastal: oceanography and/or ocean engineering
   d. Health: public health and/or environmental health
2. To conduct policy mainstreaming activities, expertise needed is the one with background in development study, urban and regional planning, public policy, and /or community development.

It is understood that improvement of the existing capacity is needed in order to conduct the above activities with the respective qualification. Therefore it is important to assess the capacity of government officers in the agencies dealing with the impact of climate change and variability. Those who need some training may seek them from universities that are apart of network of universities interested in climate risk-related issues. If the taskforce is established as suggested above, then government and can work together with university representatives to provide training for

government officers, non-governmental organization staff, as well as community representatives in order to increase awareness as well as preparedness for climate-related risks.

7 Monitoring and Evaluation

UNFCCC[22] highlighted that application for both hard and soft adaptation to climate change should be an iterative process consisting of four-stage sequence (Figure 7) which may be applicable for local context. The first stage would be responsibility to collect and interpret the necessary information about climate change. Second stage is designing appropriate adaptation response that is not only technically feasible but also is consistent to the local development's objectives and key policy criteria (cost-effective, environmentally sustainable, culturally compatible, and socially acceptable). The third stage would be implementation of technical aspect of an adaptation action with adequate support from effective institutions (formal and non formal). Lastly, the fourth stage is continuous monitoring and evaluation to allow adjustments, course corrections, further innovation, and feedback.

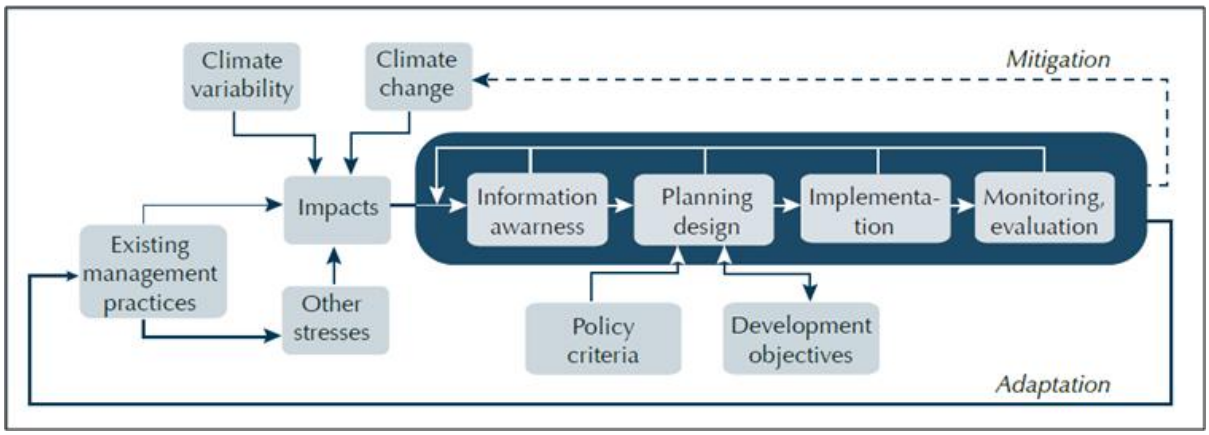


Figure 12 Iterative Steps in Planned Adaptation to Climate Change. Source: UNFCC, 2006

With this framework it is important to set up monitoring and evaluation mechanism that will keep track activities conducted in one region to provide feedback into the process in order to be used for re-assessment. If the taskforce is established, thus the monitoring and evaluation function can be performed by university representatives, as well non-governmental organizations.

[22] UNFCC, 2006, Technologies for Adaptation to Climate Change, p. 9 – 10

Appendix 1 Substance of Provincial General Spatial Plan (*RTRW)* of South Sumatera Province based on Kepmen PU 15/PRT/M/2009 and Its Possible Enrichment from CRAA

CH.	TITLE	SUBSTANCE BASED ON PERMEN PU 15/KTPS/M/2009	SUBSTANCE ON RTRW SOUTH SUMATERA	POSSIBLE ENRICHMENT FROM CRAA
I	Introduction	1. Legal base 2. Provincial profile, consist of : a. Overview of the province includes orientation map and administration division b. Population and human resource condition c. Natural hazards d. Environmental resources e. Economical potencies 3. Development Issues (strategic issues) 4. Maps : Orientation, Existing land use, Disaster risk, and Population density	1a) RTRW have incorporated Law 32/2009 1b) RTRW did not list Law 24/2007 on Disaster Management 1c) RTRW did not list Law 27/2007 on Coastal and Small Islands 2a) Tanjung Api-api Sea Port as national transportation strategic area and its development policy 2b) South Sumatera Long Term Plan mentioned about sustainable natural resources utilization in its Mission and Development Path 2c) South Sumatera Medium Term Plan mentioned about agriculture development as one of the priority 2d) RTRW South Sumatera mentioned that there is a National Policy that South Sumatera functions as National Barns; i.e. include in agriculture and coastal activities. 2e) Description of climate condition in South Sumatera 2f) Description natural hazard potencies in South Sumatera 3) Strategic issue related with climate risk : utilization of regional resources for agriculture sector, development of Tanjung Api-api, river basin management, 4) Maps of various disaster's risk	1a) According to Law 32/2009 RTRW must include the enactment of Strategic Environmental Assessment (KLHS) 1b) RTRW South Sumatera will be lack in linkage between spatial planning and disaster management; i.e. include negative impact of climate change 1c) RTRW South Sumatera must include and develop its coastal area 2a) For adaptation to climate change impact, National Government may contribute. 2b) Issue of climate change impact may be included as on this part of Long Term Plan 2c and 2d) It may be one of the baseline for introducing and mainstreaming adaptation to climate change in agricultural sector. 2e) Climate risk assessment activity may enrich this part 2f) Climate risk assessment may sharpen description and enhance type of natural hazard in South Sumatera 3) Climate risk assessment can be utilized to sharpen detail of related strategic issues. 4) Climate risk assessment can add disaster's risk
II	Goals, Policy, and Strategy	1. Provincial goals to be achieved by spatial plan 2. Provincial spatial planning policy and strategy	1) South Sumatra's spatial plan goals include the term sustainable resources utilization; i.e. utilization resources for economic activities in a manner that preserve the environment	1) Resilience to climate change that proposed by CRAA can be functions as one of the detail of this particular goal. 2a) CRAA output may highlight the risk on

CH.	TITLE	SUBSTANCE BASED ON PERMEN PU 15/KTPS/M/2009	SUBSTANCE ON RTRW SOUTH SUMATERA	POSSIBLE ENRICHMENT FROM CRAA
			2a) Development on Tanjung Api-api International Port 2b) Enhancement of water resources management to support urban activities and policy on natural barns 2c) Policy and strategy on conservation area 2d) Policy and strategy on utilized area 3) Spatial plan concept developed in South Sumatra acknowledge that the considerations are river basin area and national barns policy	Tanjung Api-api prior to climate change impact 2b) CRAA output may highlight exposure on water sector prior to climate change impact 2c) CRAA may enhance the implementation of conservation area; i.e. mangrove forest and rehabilitation of critical land 2d) CRAA may enhance further implementation of this policy and strategy; i.e. for agriculture area and irrigation development 3) CRAA give further guidance on how the concept on river basin and agriculture sector should be practiced to cope with climate change impact
III	Spatial Structure Plan	1. Urban system plan 2. Utilities / Lifelines system; i.e. a. Transportation system [road network, terminal (A and B type), rail system, rail station, harbor, and airport] b. Energy and electricity; i.e. includes power house and network c. Water resources d. Telecommunication e. Other infrastructure; i.e. economic (central market, modern and traditional market), health facility (hospital type A and B), education facility (university), regional waste facility, cultural facility, sport facility, and religion facility for regional scale. In this part, RTRW should attach Spatial Structure map which describe urban system and	1) Assignment of spatial structure for South Sumatra consists of National Center (PKN), Regional Center (PKW), and Local Center (PKL); i.e. include also settlement area and functions assigned for each center. 2a) Assignment of national (primary arterial) and regional level (primary collector) roads, terminals, railroad 2c) Water resources infrastructure plan include irrigation system and clean water 2e) South Sumatra RTRW on development plan of social and economical facilities include plan for health facility provision; i.e. Regional Hospital, Health Center, Maternity House, etc.	1) CRAA may overlay impact from climate change to coastal area and river basin, thus give recommendation on development guidance for each center. For instance, Palembang Municipality prior to Musi River, all the centers nearby river basin, and Kayu Agung that's located on the coastal. 2a) Several existed and planned roads and railroad may prone to impact of climate change; e.g. access Kayu Agung – Palembang, Muara Enim – Palembang – Tanjung Api-api, etc. International Seaport Tanjung Api-api may also include as vital infrastructure that in the CRAA. Significant impact of climate change on water sector may also be overlay with water transportation network. 2c) CRAA output may be introduce and integrated to development plan of several dams. Impact on water sector regarding drought risk may be use to sharpen analysis on clean water provision. 2e) Regencies and Municipalities with high risk prior to disease influence by the climate may be assigned to increase number of health facility or

CH.	TITLE	SUBSTANCE BASED ON PERMEN PU 15/KTPS/M/2009	SUBSTANCE ON RTRW SOUTH SUMATERA	POSSIBLE ENRICHMENT FROM CRAA
		infrastructure/utilities		enhance the quality of health service provision.
IV	Spatial Pattern Plan	1. Conservation area a. Preservation forest b. Areas that provide protection for its subordinate; c. Local preservation area; d. Natural and cultural reserve e. Natural hazards prone areas; f. Geological conservation area g. Other conservation area 2. Utilized area a. Production forest area b. Community forest area c. Agriculture area d. Horticulture area e. Fisheries area f. Mining area g. Tourism area h. Settlement area i. Other utilized area In this part, RTRW should attach Spatial Pattern Map that assigns conservation and utilized area.	1a) RTRW South Sumatra assign several conservation area as follows: preservation forest, peat area, river bank, lake bank, and natural – cultural reserve 1b) Conservation area planned in RTRW South Sumatra also include identification over natural hazards 2) RTRW South Sumatra assign several functions on utilized area as follows: production forest, limited production forest, conversion production forest, wet agriculture, dry agriculture, *perkebunan*, fisheries, settlement, military, and mining area. The spatial pattern also allocates specific area for the International Seaport Tanjung Api-api complex.	1a) CRAA output may be utilized to give correction for conservation area. For instance impact on coastal sector can give correction to preservation forest and natural reserve on the coastal area (see Spatial Pattern Map). Significant impact on water sector such as flood risk may also be utilized to correct the river basin and lake demarcation lines. For instance current map on conservation area has not clearly determined protection for river demarcation lines. 1b) CRAA output can give enhancement over natural hazards identification such as for flood risk map. 2) Significant impact from climate change on coastal and water sector can be use to give further enhancement for utilized area near those two areas; especially area for fisheries and settlement area near river basin/coastal (include the industry and Tanjung Api-api Seaport). As for impact on the agriculture sector it may be done from a non spatial strategy and directly influence the business activity of it sector. CRAA recommendation on the water sector that may request for adjustment on the upstream of river basin; it can also be used to give correction for utilized area such as forest area or agriculture area that are prone to the risk of landslide.
V	Strategic Area	1. Location and type of strategic area 2. Map of strategic area that indicate delineation provincial level strategic area and national	There are 15 strategic areas in South Sumatra which consist of National and Provincial Strategic Area. National Strategic Area in South Sumatra is Kerinci Seblat National Park. There are several strategic	CRAA output may be use to propose adaptation to related strategic area as follows: a) Palembang Metropolitan Area may influence by impact on water sector regarding flood risk, thus adaptation action to the risk should be

CH.	TITLE	SUBSTANCE BASED ON PERMEN PU 15/KTPS/M/2009	SUBSTANCE ON RTRW SOUTH SUMATERA	POSSIBLE ENRICHMENT FROM CRAA
		strategic area that lies in the province	areas that may be affected by the impact of climate change as follows: Palembang Metropolitan Area, OKI Coastal Area, Tanjung Api-api Area, Muara Enim Area, Musi Rawas Agropolitan Area, OKI Agropolitan Area, and East OKI Agropolitan Area	conducted especially on a high density area. b) Tanjung Api-api area may be influence by impact on coastal sector. Thus, the adaptation should be prepared regarding flood risk. On the other hand, the development of Tanjung Api-api also must be conducted in the manner that it still preserves the mangrove area. c) For Muara Enim Area, Musi Rawas Agropolitan Area, OKI Agropolitan Area, and East OKI Area; CRAA on water and agriculture area may be highlighted in term of water provision for agriculture activities, drought, flood, and plantation productivity. d) CRAA output may strengthen several development guidance for OKI Coastal Area; i.e. control on coastal environment, rehabilitation for mangrove, and capacity building for coastal community
VI	Reference for Spatial Utilization	Table that indicates long term programs which being detailed into five years term; includes primary programs, location, volume, time, financial prediction, and source of funding, institutions, and responsible agencies. The table being structured as follows: 1. Programs for spatial structure plan implementation 2. Programs for spatial pattern plan implementation 3. Programs for strategic area plan implementation	1) RTRW South Sumatra have included development activities for their urban center, transportation network, ocean transportation (including Tanjung Api-api seaport), and social-economic facilities (which include health facilities) 2a) In the development activity time table general development activity for spatial pattern (conservation and utilized) have been listed. However, on the description part, there are several detailed explanation regarding activity for disaster prone area, ocean demarcation lines, and river demarcation lines. As for the utilized area the RTRW only give several remarks for development implementation for forest area.	1) CRAA output may give further advisor regarding detailed of development activities for each infrastructure and for the schedule of each activity. 2a) CRAA output may enhance and sharpen detail requirement for implementation of conservation area especially for disaster prone area, river demarcation lines, and ocean demarcation lines.
VII	Terms for Spatial	1. Reference for zoning regulation; i.e. zoning regulation reference for	1) RTRW South Sumatra gives references for zoning regulation for both conservation	CRAA output may give recommendation for detail of how the development references,

CH.	TITLE	SUBSTANCE BASED ON PERMEN PU 15/KTPS/M/2009	SUBSTANCE ON RTRW SOUTH SUMATERA	POSSIBLE ENRICHMENT FROM CRAA
	Utilization Management	spatial pattern and zoning regulation reference for utility network. 2. Permit regulation; i.e. a. List of existing and planned permit regulation. b. Permit mechanism for spatial utilization within Provincial Government domain c. Guidance for decision making related with planned future permit regulation 3. Incentive and disincentive arrangement a. Incentive and disincentive for provincial government b. Incentive and disincentive from provincial government for regency/municipality government c. Incentive and disincentive from provincial government for the society 4. Administrative sanction	and utilization area; that's including preservation area, coastal, mangrove, and river basin for conservation area; as well as forest, fisheries, mining, and settlement for the utilized area. In addition several development guidance for infrastructure also being given. 2) As for substance about permit regulation, incentive – disincentive mechanism and administrative sanction are being given in a normative way.	permit regulation, incentive – disincentive, and administrative sanction should be practiced in particular area throughout South Sumatra.

Appendix 2 Substance of District General Spatial Plan (*RTRW Kabupaten*) based on Kepmen PU 17/PRT/M/2009 and Its Possible Adjustments from CRAA

CH.	TITLE	SUBSTANCE	POSSIBLE ENRICHMENT FROM CRAA
I	Introduction	1. Legal base 2. Regency profile, consist of : a. Overview of regency includes orientation map and administration division b. Population and human resource condition c. Natural hazards d. Environmental resources e. Economical potencies 3. Strategic Issues 4. Maps : Orientation, Land cover, Disaster prone area, and Existing population density	1. With the enactment of Law 32/2009 on Environmental Protection which mandate local government to provide strategic environment assessment in which also may incorporate the CRAA. 2. The result from CRAA can also enrich the substance of municipality profile. It should be performed as one of the natural hazards that may impact the city. 3. The result of CRAA can also enrich the development issue of the city.
II	Goals, Policy, and Strategy	1. Goals to be achieved by spatial plan 2. Spatial planning policy and strategy	By integrating CRAA output into the development issue, thus the development goal, policy, and strategy can be drive in order to overcome the climate risk.
III	Spatial Structure Plan	1. City system plan 2. Utilities / Lifelines system; i.e. a. Transportation system; i.e. road network, terminal (type A and B), railroad system, rail station, harbor, and airport b. Energy and electricity; i.e. power house, electrical transmission (extra high, high, medium, and low voltage), and distribution station. c. Water resources; i.e. water spring for settlement and urban area, irrigation system, river, lake, dam, etc. d. Telecommunication system In this part, RTRW should attach Spatial Structure map which describe system of civic centers and infrastructure	1. CRAA output should highlight how particular impact of climate change will affect the urban centers. 2. CRAA process should consider the existing and planned utilities in which the result then should be able to explain how climate change impact will affect the utilities. To some extent, utilities also can be positioned as adaptive capacity to the climate risk.
IV	Spatial Pattern Plan	3. Preservation area h. Conservation forest i. Areas that provide protection for its subordinate including peat and water recharge; j. Local preservation area; i.e. beach demarcation line, river demarcation, lake or dam, and spring area. k. Green open space; i.e. neighborhood garden, city garden, and cemetery.	1. CRAA process should performed by taking concern on existing and planned preservation area. 2. CRAA output can proposed new preservation area to overcome the climate risk; for instance increasing the volume of demarcation line, green belt, open space, etc. 3. CRAA output can add the variation of natural

CH.	TITLE	SUBSTANCE	POSSIBLE ENRICHMENT FROM CRAA
		l. Nature and cultural reserve; m. Natural hazards prone areas; landslide, storm surge, and flood n. Other preservation area 4. Utilized area j. Housing; high, medium, and low density k. Commercial and services; includes traditional market, mall, and modern retail l. Offices; government and private m. Industry; including SME n. Tourism; cultural, nature, and built tourism o. Non green open space p. Other utilization; evacuation point (open space that can be use as melting point), agricultural, mining (with strict arrangement), informal sector, public service (education, health, religion, security, and safety), military, others depends on municipality functions and roles In this part, RTRW should attach Spatial Pattern Map that assigns preservation and utilization area.	hazard prone areas. 4. CRAA output can propose revision for allocation of utilization area and possible adaptation action.
V	Strategic Area	3. Location and type of strategic area 4. Map of strategic area that indicate delineation of each strategic area	1. CRAA process should recognize the existence of strategic area in a city. 2. CRAA output should explain how the impact of climate risk will affect each strategic area; at least in term of type of impact.
VI	Spatial Utilization Programs	Table that indicates long term programs which being detailed into five years term; includes primary programs, location, volume, time, financial prediction, and source of funding, institutions, and responsible agencies. The table being structured as follows: 4. Programs for spatial structure plan implementation 5. Programs for spatial pattern plan implementation 6. Programs for strategic area plan implementation	1. Related with possible adaptation action for spatial structure, in this part CRAA output may give a more detail information about the adaptation action follows the arrangement of spatial utilization program. 2. Related with possible adaptation action for spatial pattern, in this part CRAA output may give a more detail information about the adaptation action follows the arrangement of spatial utilization program. 3. Related with possible adaptation action for strategic area, in this part CRAA output may give a more detail information about the adaptation action follows the arrangement of spatial utilization program.

CH.	TITLE	SUBSTANCE	POSSIBLE ENRICHMENT FROM CRAA
VII	Terms for Spatial Utilization Management	5. Zoning regulation arrangement for spatial structure and pattern 6. Permit regulation; i.e. d. List of existing and planned permit regulation. e. Permit mechanism for spatial utilization f. Guidance for decision making related with planned future permit regulation 7. Incentive and disincentive arrangement d. Incentive and disincentive for government e. Incentive and disincentive for society 8. Administrative sanction 1. Offender which not apply for spatial utilization permit 2. Applicants which did not meet the permit regulation 3. Permit grantee whom violate the spatial plan arrangement	1. CRAA output may give principle for zoning regulation. 2. Each adaptation action resulted from CRAA may be equipped with incentive-disincentive mechanism to push its implementation. 3. The CRAA output may address a more rigid terms for issuing permit or also increase the strictness of administrative sanction for several location that are very prone to climate impact.

Appendix 3 Substance of City General Spatial Plan (*RTRW Kota*) based on Kepmen PU 17/PRT/M/2009 and Its Possible Adjustments from CRAA

CH.	TITLE	SUBSTANCE	POSSIBLE ENRICHMENT FROM CRAA
I	Introduction	1. Legal base 2. Municipality profile, consist of : a. Overview of municipality includes orientation map and administration division b. Population and human resource condition c. Natural hazards d. Environmental resources e. Economical potencies 3. Development Issues 4. Maps : Orientation, Existing land use, Disaster risk, and Population density	1. With the enactment of Law 32/2009 on Environmental Protection which mandate local government to provide strategic environment assessment in which also may incorporate the CRAA. 2. The result from CRAA can also enrich the substance of municipality profile. It should be performed as one of the natural hazards that may impact the city. 3. The result of CRAA can also enrich the development issue of the city.
II	Goals, Policy, and Strategy	1. Goals to be achieved by spatial plan 2. Spatial planning policy and strategy	By integrating CRAA output into the development issue, thus the development goal, policy, and strategy can be drive in order to overcome the climate risk.
III	Spatial Structure Plan	1. Urban centers 2. Utilities / Lifelines system; i.e. a. Transportation system (land, sea, and air) b. Energy and electricity c. Telecommunication d. Water resources e. City infrastructure; i.e. drinking water, sewerage, waste, drainage, pedestrian, and disaster evacuation. In this part, RTRW should attach Spatial Structure map which describe system of civic centers and infrastructure	1. CRAA output should highlight how particular impact of climate change will affect the urban centers. 2. CRAA process should consider the existing and planned utilities in which the result then should be able to explain how climate change impact will affect the utilities. To some extent, utilities also can be positioned as adaptive capacity to the climate risk.
IV	Spatial Pattern Plan	1. Conservation area a. Preservation forest b. Areas that provide protection for its subordinate including peat and water recharge; c. Local preservation area; i.e. beach demarcation line, river demarcation, lake or dam, and spring area. d. Green open space; i.e. neighborhood garden, city garden, and cemetery. e. Nature and cultural reserve;	1. CRAA process should performed by taking concern on existing and planned preservation area. 2. CRAA output can proposed new preservation area to overcome the climate risk; for instance increasing the volume of demarcation line, green belt, open space, etc. 3. CRAA output can add the variation of natural hazard prone areas.

CH.	TITLE	SUBSTANCE	POSSIBLE ENRICHMENT FROM CRAA
		f. Natural hazards prone areas; landslide, storm surge, and flood g. Other conservation area 2. Utilized area a. Housing; high, medium, and low density b. Commercial and services; includes traditional market, mall, and modern retail c. Offices; government and private d. Industry; including SME e. Tourism; cultural, nature, and built tourism f. Non green open space g. Other utilization; evacuation point (open space that can be use as melting point), agricultural, mining (with strict arrangement), informal sector, public service (education, health, religion, security, and safety), military, others depends on municipality functions and roles In this part, RTRW should attach Spatial Pattern Map that assigns preservation and utilization area.	4. CRAA output can propose revision for allocation of utilization area and possible adaptation action.
V	Strategic Area	1. Location and type of strategic area 2. Map of strategic area that indicate delineation of each strategic area	1. CRAA process should recognize the existence of strategic area in a city. 2. CRAA output should explain how the impact of climate risk will affect each strategic area; at least in term of type of impacts.

Appendix 4 Substance of RDTR based on Kepmen Kimpraswil 327/M/KTPS/2002 and Its Possible Enrichment from CRAA

CH.	TITLE	SUBSTANCE	POSSIBLE ENRICHMENT FROM CRAA
I	Area Development Goal	Area development goals define by issues, problems, and policy based on urgency of particular area	CRAA process and output can drive the development issue or urgency for particular area in their preparation of RDTR.
II	Spatial Structure Plan	1. Population distribution; i.e. number and population density in each block/area. 2. Spatial structure (service centers) a. Commerce (regional, city, and neighborhood level). b. Education (University, High school, Junior high school, Elementary, Kindergarten) c. Health facility (Hospital Class A, B, C, D) d. Sport and tourism facility (city and neighborhood scale) 3. Transportation system a. Road based transportation; i.e. road network, terminal, and trajectory. b. Railway; i.e. railroad, station, and offices c. River, lake, and ferriage based; i.e. terminal and trajectory d. Sea transportation; harbor and trajectory e. Air transportation; i.e. airport and flight route 4. Utility network a. Telephone system; i.e. automatic phone station, cable house, secondary cable network, and cellular network b. Television cable system; i.e. transmission system and cable network c. Electricity; i.e. power house, high voltage transmission, main substation, and distribution substation d. Gas network; i.e. gas workshop and gas network / pipe e. Clean water system; i.e. *bangunan pengambil air baku*, pipe transmission, and container vessel f. Drainage; i.e. drainage network and polder g. Sewer; i.e. pipeline, treatment facility, and collection dam h. Waste; i.e. Final collection facility, treatment facility, and temporary collection facility	In the process of CRAA input data as well as the spatial structure and pattern plan should be incorporated as variable of the analysis. With a more precise scale of climate risk impact, the CRAA output should describe how each impact will affect the component of spatial structure within particular area. Based on the impact, the possible adaption action can be addressed for each component; i.e. population distribution, service center, transportation, and utility network.

Appendix 5a Hedonic Qualitative CBA Worksheet for Coastal Sector (Score for Cost from -1 to -9, score for Benefit from 1 to 9)

Option 0: No Adaptation		**Option 1: ICZM**		**Option 2: Restoring Mangrove and Coastal Forest**		**Option 3: Accommodate**	
Cost	**Score**	**Potential Cost**	**Score**	**Potential Cost**	**Score**	**Potential Cost**	**Score**
-Financial		-Financial		-Financial		-Financial	
1.		1.		1.		1.	
2.		2.		2.		2.	
-Non-Financial		-Non-Financial		-Non-Financial		-Non-Financial	
1.		1.		1.		1.	
2.		2.		2.		2.	
Total Cost		**Total Cost**		**Total Cost**		**Total Cost**	
Benefit	**Score**	**Potential Benefit**	**Score**	**Potential Benefit**	**Score**	**Potential Benefit**	**Score**
-Financial		-Financial		-Financial		-Financial	
1.		1.		1.		1.	
2.		2.		2.		2.	
-Non-Financial		-Non-Financial		-Non-Financial		-Non-Financial	
1.		1.		1.		1.	
2.		2.		2.		2.	
Total Benefit		**Total Benefit**		**Total Benefit**		**Total Benefit**	
Total Cost-Benefit		**Total Cost-Benefit**		**Total Cost-Benefit**		**Total Cost-Benefit**	

ICZM: Integrated Coastal Zone Management including Managed Realignment, Coastal Setback, and Protection (hard and soft)

Appendix 5b Importance Level Rating Matrix (Rating from 1 to 5)

Unit of Analysis	**Risk level**	**Vulnerability dominant factor**	**Adaptation option 1**		**Adaptation option 2**	
			Rating	**Remark**	**Rating**	**Remark**
Kecamatan 1						
Kecamatan 2						
Kecamatan 3						

Appendix 6 Compatibility Matrix between Climate Change Adaptations and Programs in Annual Plan

No	Adap-tation Option	Pro-gram 2012	Compatibility of the program	Location of the program	Location of high risk level	Compatibility of the location	Importance level of the options	Recommendation upon the incompatibilities	Mainstreaming of the recommendation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(case-A)	(*)	(*)	Proposed option by expert is compatible to the program	(*)	(*)	Location of high level of risk is compatible to one of the program	4-5	This option is NOT necessary to be followed up (i.e. the program is necessarily to be implemented)	
(case-B)	(*)	(*)	Proposed option by expert is compatible to the program	(*)	(*)	Location of high level of risk is compatible to one of the program	**1-3**	Re-discuss (elaborate) the level of importance: • If it is still less important, then the program is NOT necessarily to be implemented • If it is raised to be more important then it becomes case-A	
(case-C)	**(*)**	**(*)**	**Proposed option by expert is compatible to the program**	**(*)**	**(*)**	**Location of high level of risk is NOT compatible to one of the program**	**4-5**	**Elaborate whether location of the program would be recommended to be changed or added with one of high risk**	• **Next annual program of the local government** • **Endorse to cen-tral government** • **Endorse to Donor (ICCTF)**
(case-D)	(*)	(*)	Proposed option by expert is compatible to the program	(*)	(*)	Location of high level of risk is NOT compatible to one of the program	**1-3**	Elaborate in 2 levels: 1. See case-B 2. If yes, then it becomes case-C	
(case-E)	**(*)**	**(*)**	**Proposed option by expert is NOT compatible to the program**	**(*)**	**(*)**		**4-5**	**Elaborate to make sure whether this option is still being most important. If it is OK then provide recommendations as a new program (Note: be aware with the related nomenclature of program)**	• **Next annual program of the local government** • **Endorse to the central government** • **Endorse to Donor (ICCTF)**
(case-F)	(*)	(*)	Proposed option by expert is NOT compatible to the program	(*)	(*)		**1-3**	Re-discuss (elaborate) the level of importance: • If it is still less important, then the option is NOT necessarily to be followed up • If it is raised to be more important, then it becomes case-E	

Note: (*) Filled prior to the workshop by the KRAPI team:

a. Columns (1), (2), (6) are filled based on the CCRAA sectoral reports
b. Columns (3)and (5) are filled based on the yearly program (e.g., 2012) provided by the local government (We have to search which program that is likely compatible or similar to the respective adaptation option)
c. Columns (4) and (7) are filled based on step-1 and step-2 above
d. Column (8) is filled based on the results of prior workshop (i.e. assessment of importance level rating matrix); This column is recently appropriate for Greater Malang case
e. Prepare some suggestions of columns (9) and (10) for the attendances of the workshop