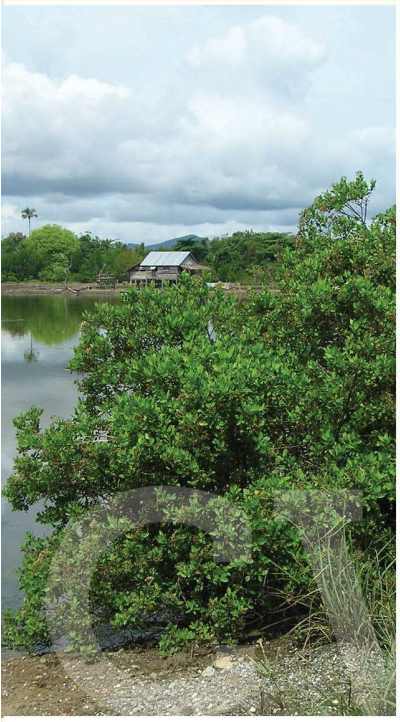
BUILDING COASTAL RESILIENCE TO REDUCE CLIMATE CHANGE IMPACT PROGRAMME IN INDONESIA

Climate Vulnerability and Capacity Analysis (CVCA)

of four districts in South Sulawesi, Indonesia



Makassar- Indonesia

2012

"This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of CARE International Indonesia and can in no way be taken to reflect the views of the European Union."

This project is funded by
The European Union

"Building Coastal Resilience to reduce climate change impact in Thailand and Indonesia" (BCR CC) is a three-year project in Sulawesi/Indonesia and Southern Thailand, implemented by CARE Deutschland Luxemburg e.V., Raks Thai Foundation and CARE International Indonesia and financed by the European Union.

The study is based on CARE International's Climate Vulnerability and Capacity Analysis Handbook" and can be downloaded from CARE´s climate change website at http://www.careclimatechange.org.

November 2012

Authors

Rieneke Rolos

Nina Rossiana

Leonardy Sambo

Katrin von der Dellen

Contributors

Nurtang Gani

Mukri Muslimin

Ikhsan Mahfud

Abdul Rahman Ramlan

Mohammad Syakir

Syamsuddin

Aliyas

Darna Maming

Rahmiyatal Munaja

Hasanuddin

Hery Syamsius

Special thanks to the local governments in Bone, Luwu, Luwu Utara and Wajo, the participating communities, to all involved other institutions and to Male Thienken and Julian Zschocke.

Table of Contents

List of Tables ii
List of Figures iii
List of Abbreviations iv
Executive Summary vi
1. Background & Objectives 1
2. Methodology 6
2.1 CVCA Process 6
2.2 Data collection methods applied in the CVCA 7
3. Findings 13
3.1 National and Provincial Level 13
3.1.1 Climate–Resilient Livelihoods 13
3.1.1.1 Climate Policies and Institutional Mapping 19
3.1.2 Disaster Risk Reduction 20
3.1.2.1 Natural Disasters 20
3.1.2.2 Policies 25
3.1.2.3 Capacity Development 28
3.1.3 Addressing Underlying Causes of Vulnerability 30
3.2 CVCA Findings at Local/Community level 31
3.2.1 Climate-Resilient Livelihoods 31
3.2.1.1 Bone District 32
3.2.1.2 Wajo District 34
3.2.1.3 Luwu District 35
3.2.1.4 North Luwu District 36
3.2.2 Disaster Risk Reduction 37
3.2.2.1 Bone District 38
3.2.2.2 Wajo District 38
3.2.2.3 Luwu District 39
3.2.2.4 North Luwu District 40
3.2.3 Capacity Development 40

3.2.4 Addressing Underlying Causes of Vulnerability 41
3.2.4.1 Bone District 42
3.2.4.2 Wajo District 43
3.2.4.3 Luwu District 43
3.2.4.4 North Luwu District 43
3.3 CVCA Findings at household and individual level 44
3.3.1 Climate-Resilient Livelihoods 44
3.3.2 Disaster Risk Reduction 45
3.3.3 Capacity Development 46
3.3.4 Addressing Underlying Causes of Vulnerability 46
4. Conclusion 47
4.1 Climate-Resilient Livelihoods 47
4.2 Disaster Risk Reduction 48
4.3 Capacity Building 49
4.4 Addressing Underlying Causes of Vulnerability 49
5. Recommendations 50
5.1 Climate Resilient Livelihoods 50
5.2 Disaster Risk Reduction 51
5.3 Capacity Development 51
5.4 Addressing Underlying Causes of Vulnerability: 52
List of References 53

List of Tables

Table 1: FGD Implementation schedule in 4 districts 8
Table 2: Gender groups and participants by district 9
Table 3: Project Area Target Population 11

List of Figures

Figure 1: Fishpond in Seppong village, Luwu district vi
Figure 2: Local houses in Bone district 1
Figure 3: Babang river in Babang village, Luwu district 2
Figure 4: FGD CVCA conducted in Tobia village, Luwu district 3
Figure 5: House and local transportation along To'bia river, To'bia village 4
Figure 6: Project locations in Indonesia 5
Figure 7: FGD CVCA conducted in Bone district 6
Figure 8: FGD CVCA participant in Bone district 8
Figure 9: FGD CVCA conducted in Bone district 12
Figure 10: Seaweed farmer *Gracillaria spp* in Pompengan village, Luwu district 13
Figure 11: Coral Reef Ecosystem 15
Figure 12: Water source for household during dry season in Bone district 16
Figure 13: Coastal conditions in Bone district 17
Figure 14: FGD CVCA in Bone district 18
Figure 15: FGD CVCA conducted in Bone district 20
Figure 16: Local house condition at high tide in Ulo-ulo sub-district, Luwu district 21
Figure 17: Abrasion in Seppong village, Luwu district 22
Figure 18: Seaweed farming East Bassiang Timur village, Luwu district 32
Figure 19: FGD CVCA woman community in Bone district 33
Figure 20: Capacity building for Seaweed farmer in Pasir Putih village, Wajo district 34
Figure 21: FGD CVCA conducted in Bassiang Timur village, Luwu district 35
Figure 22: FGD CVCA conducted in Luwu Utara district 37
Figure 23: Seaweed post harvesting in Luwu district 42

List of Abbreviations

BAKORNAS PB	Badan Koordinasi Nasional Penanggulangan Bencana National Coordinating Agency for Disaster Management
BAPPEDA	Badan Perencana Pembangunan Daerah Regional Development Planning Agency
BAPPENAS	Badan Perencanaan Pembangunan Nasional National Development Planning Agency
BCR CC	Building Coastal Resilience to Reduce Climate Change Impact in Thailand and Indonesia
BMKG	Badan Meteorologi Klimatologi dan Geofisika Meteorology, Climatology and Geophysics Board
BNPB	Badan Nasional Penanggulangan Bencana National Disaster Management Board
BPBD	Regional Disaster Management Strategy
CBA	Community Based Adaptation
CCHI	Composite Climate Hazards Index
CII	CARE International Indonesia
CVCA	Climate Vulnerability Capacity Analysis
CRED	Center for Research on Environmental Decisions
DIBI	Data dan Informasi Bencana Indonesia Indonesian Disaster Data and Information
DRR	Disaster Risk Reduction
EPPSEA	Economy and Environment Programme for Southeast Asia
EWS	Early Warning System
FGD	Focus Group Discussion
GoI	Government of Indonesia
HFA	Hyogo Framework for Action
ICCAP	Climate Change Adaptation Programme
IDR	Indonesian Rupiah
IDRC	International Development Research Centre
IEC	Information Education and Communication
NAP	National Action Plan
NAP DRR	National Action Plan Disaster Risk Reduction
PECCN	Poverty Environment Climate Change Network

PMI	Indonesian Red Cross
PRA	Participatory Rural Appraisal
RPJMN	Rencana Pembangunan Jangka Menengah Nasional National Middle Term Development Plan
RTF	Raks Thai Foundation
TAGANA	Taruna Siaga Bencana Cadets Disaster Preparedness
TKPK	Tim Koordinasi Penanggulangan Kemiskinan Poverty Alleviation Coordination Team
UNCCD	United Nations Convention to Combat Desertification

Executive Summary

People who live in coastal areas realize that the world that we are living in is not the same as it used to be. Especially villagers, whose livelihoods depend on natural resources, are more sensitive to environmental changes. Scientific research also recorded the trends and forecasted a more intense climate variation overtime, which might lead to increase in disaster risk. During the past four decades, climate related hazards such as floods, droughts, storms, landslides and wild fires have caused major loss of human lives and livelihoods, the destruction of economic and social infrastructures as well as environmental damages in Indonesia. In many parts of the world, the frequencies and intensities of these hazards tend to increase.[1] [2]

Figure 1: Fishpond in Seppong village, Luwu district (Photo by Ikhsan, 2011)

[1] Sivakumar 2005
[2] ADRC 2005

Climate change impact may materialize as:

1. Increased occurrences of heat waves which may increase the number of casualties, especially among vulnerable groups, such as elderly, children, or persons with chronic diseases and marginalized groups
2. Increased occurrences of droughts[3] in several areas which may potentially lead to land degradation which results in a damage of food crops or diminished harvest yields, increased deaths of livestock and risk of forest fires.
3. Increased frequency of high rainfall in various regions, triggering floods and landslides, with a greater potential of human casualties and loss of assets
4. Increased frequency and intensity of extremely powerful cyclones (hurricanes and storms), which are likely to affect regions in coastal areas, with an even greater potential of human casualties and loss of assets
5. Sea level rise in combination with storms in coastal areas causing impacts such as storm waves and river floods, which will lead to the destruction of communities' base of livelihood and protection infrastructure

This report is based on the implementation of CVCA (Climate Vulnerability and Capacity Analysis) in the Gulf of Bone (Teluk Bone) from November 2011 to April 2012. The CVCA process in the field was implemented by trained field facilitators which were recruited from villages and trained and supervised by CARE`s district facilitators and district government's technical team. Six Participatory Rural Appraisal (PRA) tools were used to collect information relating to past and current situation of livelihoods, seasons, changes in weather pattern including natural resources and availability of natural resources. The CVCA methodology enables village leaders and community planners to better understand and therefore be able to meet the needs of the vulnerable population in changing environments.

[3]UNCCD defines drought as "the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems (UNCCD, 1996, Part1, Article 1e)

The CVCA results of the four target districts in South Sulawesi identified seaweed farming, fisheries, pond fisheries, agricultural production (rice, corn and sweet potato), animal husbandry, small business, *ojek* (motorcycle taxi) driver and masonry as important livelihood resources in the project target communities. The most vulnerable groups in the community mainly work as farmers and fishermen. They are likely to be affected more by climate variability than others as the income of these groups is strongly related to weather conditions. The weather is increasingly unpredictable which disrupts planting schedule for farmers. Frequent strong winds and big waves (extreme weather) occur, which hinder income generation of fishermen. The climatic hazards and impacts to the community are:

- Flooding: Flood occurrences have become more frequent and impacted fishermen and farmers in a negative way. Floods damage dike ponds, which has a negative impact on seaweed farming since the level of salinity changes through the water inundation. Another impact on pond aquaculture is that in case of damaged ponds, the fish float out of the ponds. In the event of flooding, the entire area will be submerged in several villages, which will cause a crop failure, especially of rice and corn and will lead to a reduced harvest of palm oil and cocoa. Moreover, selling the product would be difficult as transport infrastructures are temporarily interrupted and markets cannot be accessed.
- High tide: High tides cause substantial losses for pond-farmers as ponds are usually located along the beach. The tides damage ponds and cause uncontrollable levels of salt in the pond, which results in very slow growth of fish. Similar counts for seaweed farmers, as high tides frequently destroy their planting set ups.
- Drought: In the event of a long drought less inflow of fresh water leads to high concentration of salt in the seaweed ponds which will affect fish growth and usually ruins the seaweed (*Gracilaria* and *Cattoni*) plants. In time of drought, most of the crops will wither to die.
- Strong rainfall impacts seaweed farming in a negative way, since the salinity of the pond water is reduced and seaweed (*Gracillaria*) needs a stable level of salinity to grow optimally.

- Erosion: Soil erosion causes gradual loss of aquaculture sites and a lot of funds are needed to repair the dike ponds.
- Strong winds: Fishers face difficulties to go fishing, as the farmland will be ruined due to soil erosion. Houses with weak structures are likely to be damaged or destroyed.

The community in the target areas applied several simple adaptation strategies. People, who are facing rising sea levels pursue three general strategies: Firstly 'protection', through planting soft barriers like mangrove trees; secondly 'retreat' by moving further from the shore, or to 'accommodate' by switching to new sources of livelihoods. All departments of government and of national planning need to take climate change into account in all their own programmes but this is not only a job for the central government; it has to be a nationwide effort involving local government, communities and non-governmental organizations (NGOs), as well as the private sector.[4]

[4]UNDP 2007, pp. 14-15

1. Background & Objectives

Indonesia is the world's largest archipelago, consisting of about 17,500 islands that stretch from 06°08' North latitude to 11°15' South latitude and from 94°45' to 141°05' East longitude. It includes 3.1 million km^2 of territorial waters (62% of its total area), almost 2 million km^2 of land (38%), and 81,000 km of coastline with a population of 237 million inhabitants, which makes it the fourth most populated country in the world. The population has more than doubled since 1970 and is estimated to grow to 262 million people by 2020. The urbanisation rate is very high (4.4%). Two-thirds of the total population and more than half of the poor (57%) reside on Java. Indonesia supports tremendous species diversity of both animal and plant life in its pristine rain forests and its rich coastal and marine areas. Nearly 60% of Indonesia's terrestrial area is forested. The landscape is also mountainous and volcanic with over 500 volcanoes out of which 129 are still active. Furthermore, Indonesia holds at its disposal deposits of petroleum, natural (fossil) gas and metal ores. Indonesia's macro-economic development during the past 35 years is to a large extent based on its natural resources.[5]

Figure 2: Local houses in Bone district (Photo by Rahman Ramlan, 2011)

People in the project areas have started to notice the weather anomalies over the past twelve years. Indeed, the world is currently facing global warming, which can be attributed to human induced climate change. In the old days, people could predict the weather pattern, whereas

[5]WWF Indonesia 2007

nowadays it is extremely difficult to do forecasting. Impacts of climate change hit not only Indonesia, but the entire world. Floods, drought, disease, crop failure, are some of the negative impacts of climate change.[6] Whereas climate change scenarios on a global level are available there is not much knowledge on the impact of climate change on local livelihoods in place yet. In order to support coastal communities in their adaptation efforts to changing environmental conditions, the Raks Thai Foundation (RTF) and CARE International Indonesia (CII) are implementing the 3-year project "Building coastal resilience to reduce climate change impact in Thailand and Indonesia", which is funded by the European Commission.

Figure 3: Babang river in Babang village, Luwu district (Photo by Ikhsan, 2011)

This project attempts to build an understanding of the local population about the impact of climate change and to develop strategies for adapting to a changing environment. Public forums in the community are held to identify the key concepts and strategies for discussions among local residents and stakeholders. One component is to conduct a "Climate Vulnerability and Capacity Analysis" (CVCA) in four coastal districts in South Sulawesi (Bone, Wajo, Luwu and Luwu Utara).

[6]IPCC 2007

The CVCA methodology provides a framework for analysing vulnerability and capacity to adapt to climate change at the community level. The CVCA prioritises local knowledge on climate risks and adaptation strategies in the data gathering and analysis process. Key objectives include the following:

(1) Analysis of vulnerability and adaptive capacity at the community level: The CVCA is a methodology for gathering, organizing and analysing information on the vulnerability and adaptive capacity of communities, households and individuals. It provides guidelines and tools for participatory research, analysis and learning and takes into account the role of national institutions and policies in facilitating adaptation.

Figure 4: FGD CVCA conducted in Tobia village, Luwu district (Photo by Ikhsan, 2011)

(2) Combination of community knowledge and scientific data to yield greater understanding about local impacts of climate change: One of the main challenges of working at the local level on climate change adaptation is the lack of scaled-down information on impacts. This is coupled with inadequate data and information on weather and climate predictions. The participatory exercises and associated discussions provide opportunities to link community knowledge to available scientific information on climate change. This will help local stakeholders to understand the implications of climate change for their livelihoods, so that they are better able to analyse risks and plan for adaptation.

The CVCA methodology is based on a framework of "enabling factors" for Community-Based Adaptation (CBA). The CVCA implementation handbook presents a set of guiding questions for analysis of information at national, local and household/individual levels and provides guidance on facilitating a participatory process for multi-stakeholder analysis and collaborative learning.

Figure 5: House and local transportation along To'bia river, To'bia village
(Photo by Ikhsan, 2011)

This CVCA report gives an overview about the impact of climate change in the 40 communities in Wajo, Bone Luwu and Luwu Utara. The information is based on the triangulation of quantitative (household survey), qualitative (focus group discussion) and secondary data research results. Based on these findings, priority projects for each village will be defined and implemented. The best practices of these priority projects will be documented and presented to the local government and should be replicated by the government in other villages with similar conditions.

The CVCA analysis is limited by the fact that vulnerability assessment and identification of adaptation options were very limited since the NAP 2007 does only focus on Indonesia in general and does not specifically assess conditions in Sulawesi.[7]

[7]Republic of Indonesia a 2007

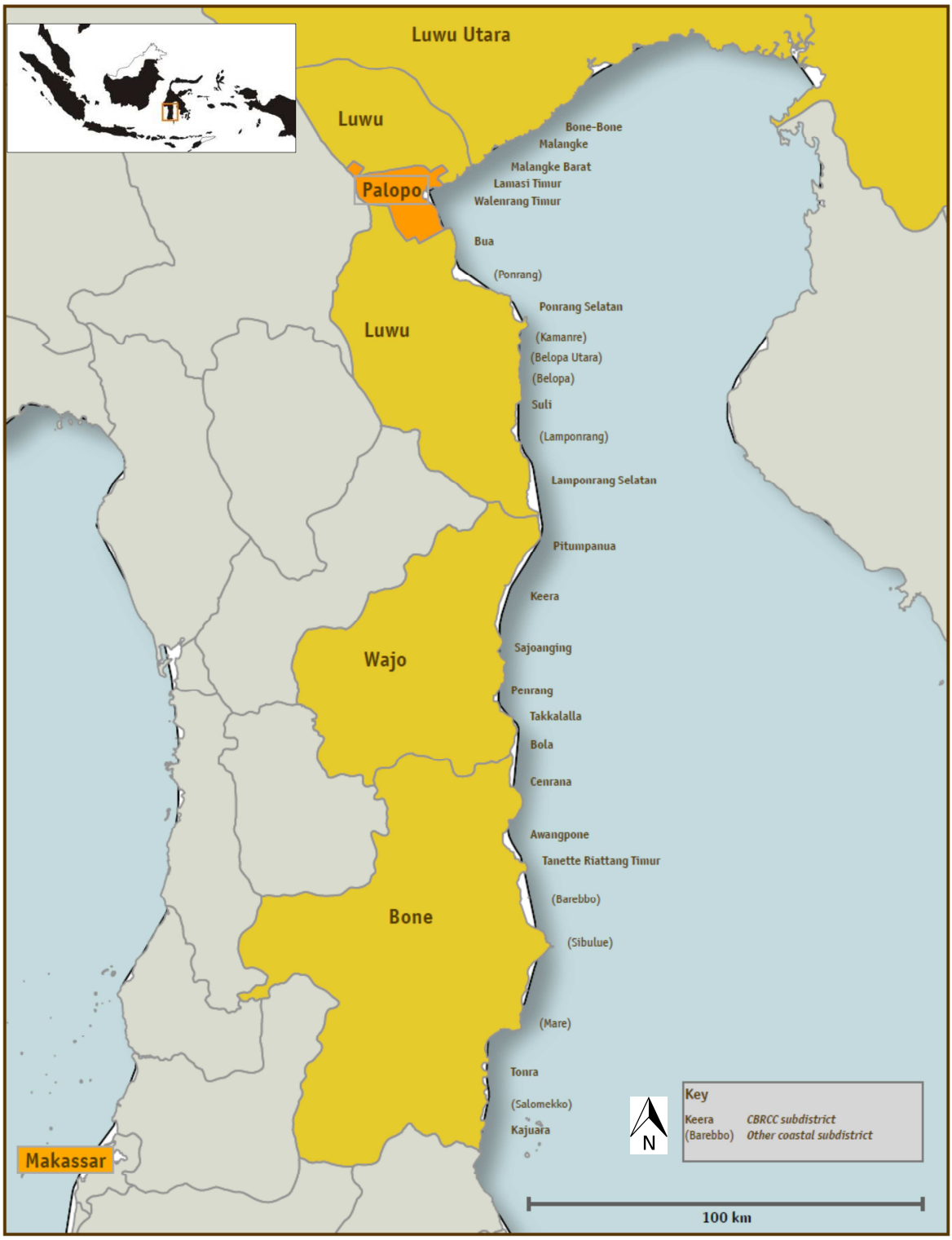


Figure 6: Project locations in Indonesia (Source: CARE Deutschland – Luxemburg e.V. (2012)

2. Methodology

2.1 CVCA Process

In preparation for the CVCA implementation the project team selected 40 villages to participate in the CVCA in consultation with sub-district government officials and civil society organizations. A participatory meeting was organized to determine selection criteria, which included distance to coastlines, population size (over one thousand families), sub-districts with the majority of coastal areas/population, poverty level, severe environmental degradation and external assistances available in certain villages. The selection also considered government's recommendation based on their experiences running development programmes in these areas. The stakeholders thus determined 10 villages in 5 sub-districts as project areas.

Figure 7: FGD CVCA conducted in Bone district (Photo by Rahman Ramlan, 2011)

In the second step, the field facilitators from the villages were trained in applying PRA (Participatory Rural Appraisal) tools and facilitating focus group discussions in their communities by BCR CC staff members and key stakeholders, who already received prior trainings by PECCN´s (CARE´s Poverty, Environment and Climate Change Network) Senior Climate Adaptation Advisor.

The CVCA was conducted at national, province and district/village level. The project team conducted Key Informant Interviews (KII) and secondary data collection at national, provincial and district level. Data at the village level was collected through Focus Group Discussions

(FGD) using six PRA tools in 40 villages. The results from the FGD discussion were presented to the community to verify the data.

Additionally to the qualitative data, quantitative data in form of a baseline study was raised. This baseline study describes the present living conditions in the target communities of the project. Based on a comprehensive analysis of survey data, the study presents findings on characteristics of resilience in the coastal areas of Southern Thailand and South Sulawesi/Indonesia is characterized.

2.2 Data collection methods applied in the CVCA

1. **Key Informant Interview**

   Key Informant Interviews were conducted with governmental officials from national and local government such as the Ministry of Environment, Ministry of Marine and Fishery, National Board of Climate Change, and The National and Local Meteorology, Climatology and Geophysics Agency (BMKG) based on the guiding questions in the CVCA handbook.

2. **Secondary data collection**

   Data and information gathered from books, reports and other documents through internet research with regards to climate variation, local context and reported risks.

3. **Focus Group Discussion**

   563 FGDs were conducted to identify the most vulnerable groups in communities, types of livelihood resources, the frequency and types of hazard occurrence in the localities, seasonal activities in communities, historical trends and seasonal changes overtime and important institutions within the communities, etc.

Figure 8: FGD CVCA participant in Bone district (Photo by Rahman Ramlan, 2011)

The groups consisted of around 7 people of the same sex and were facilitated by a field facilitator who applied different PRA tools (see further explanation below). The members of the FGDs were identified by gender, livelihood type, such as fishers, seaweed farmers or fish pond farmers, but most of the groups were only divided by gender. The livelihood groups were mainly diversified with different types of livelihood. Prior to the FGDs implementation a series of preparation activities was conducted, such as trainings for field facilitators, meetings to identify participants, determining schedule for each village and each group, conducting secondary data collection such as village demography, village map, etc. The table below shows the schedule of the CVCA implementation.

Table 1: FGD Implementation schedule in 4 districts

No	District	November 2011										Desember 2011			
		21	22	23	24	25	26	27	28	29	30	1	2	3	4
1	Bone			X	X	X	X	X	X	X	X				
2	Wajo			X	X	X	X	X	X	X	X	X	X	X	
3	Luwu		X	X	X	X	X	X	X	X	X	X	X	X	
4	Luwu Utara			X	X	X	X	X	X	X	X				

The number of gender groups and participants per district is shown in the following:

Table 2: Gender groups and participants by district

District	Number of Groups				Number of participants				Overall			
	Coastal		Inland		Coastal		Inland		Group		Participants	
	F	M	F	M	F	M	F	M	F	M	F	M
Bone	33	38	37	35	101	111	98	100	70	73	199	173
Wajo	33	37	34	36	313	353	303	324	67	73	616	677
Luwu	30	40	32	38	282	376	252	367	62	78	534	743
Luwu Utara	37	33	36	34	100	94	108	98	67	73	208	192
TOTAL	**133**	**148**	**139**	**143**	**796**	**934**	**761**	**889**	**266**	**297**	**1,557**	**1,785**
GRAND TOTAL									**563**		**3.342**	

The following PRA tools were used:

1. Hazard Mapping: To become familiar with the community, and to see how the place is perceived by different groups within the community. To identify important livelihood resources in the community, and individuals or institutions which have access and control over those. To identify areas and resources at risk from climate hazards and to analyse changes in hazards and planning for risk reduction.
2. Seasonal Calendars: To identify periods of stress, hazards, diseases, hunger, debt, vulnerability, etc. To understand livelihoods and coping strategies. To analyse changes in seasonal activities. To evaluate use of climate information for planning.
3. Historical Timeline: To get an insight into past hazards, changes in their nature, intensity and behaviour. To make people aware of trends and changes over time and to evaluate to some extent the risk analysis, planning and investment for the future.
4. Vulnerability Matrix: To determine the hazards with the most severe impact on important livelihood resources. To determine which livelihoods resources are most vulnerable and to identify coping strategies currently used to address the hazards identified.
5. Venn Diagram: To understand which institutions are most important to the community and to analyse engagement of different groups in local planning processes and to evaluate access to services and availability of social safety nets.

6. Daily Activity Scheme: To understand the productive and reproductive activity of men and women in a day.

4. Household survey

A baseline survey which was conducted in November-December 2011 provided information on the target population down to the household level. The household surveys conducted through the baseline study provided relevant data and analysis of the current situation. The study collected demographic information of the participating villages, socio-economic data, which include an illustration of current livelihoods and potentials, climate risks, disaster preparedness measures, factors affecting resiliency and adaptive behaviours. The study was conducted in Indonesia and Thailand to compare the current adaptation strategies and gaps with the achievements made by the end of the project.

Specific objectives of the baseline study are:

- To design a quantitative household survey which is complementary to CARE's CVCA and to gather baseline data from which change/impact in relation to the project indicators can be measured
- To assess the current livelihood situation in target villages and to assist in directing program activities
- To develop a methodology that can be easily replicated for future monitoring and evaluations, so that a genuine assessment of changes can be made over time and the impact can be measured

The baseline study was conducted throughout November and December 2011 under guidance of a climate change expert and a survey analyst. The following gives a brief description of the methodology that was applied in the baseline study.

(1) Document review and preparation

The archival study began in late November 2011 with a thorough review of BCR CC project documents and available information on the localities. Results of the CVCA process that were available at this stage were reviewed. Based on this information, the household survey questionnaire was prepared. Parallel to the document review, travel and meeting arrangements were made. Draft survey questionnaires and enumerator training material were translated prior to the start of activities, and were then further refined

during the initial stages of activities. In each of the two countries 20 enumerators were selected by the BCR CC team.

(2) Data gathering

The enumerators were trained in a half-day workshop – including an introduction of the project, "do's and don'ts" in interviewing, proper documentation, and the sampling method. Field practice then was gained during a final test run which took place in the following morning. The interviews were conducted between December 9th and 16th.

Table 3: Project Area Target Population

Project Area	Target population	Sampling (pps)
Indonesia	**95.417**	**720**
Luwu	18.655	180
Luwu Utara	20.554	180
Bone	28.421	180
Wajo	27.787	180

In total 720 household interviews were conducted in Indonesia. The sampling strategy was based on the Probability Proportional to Size (PPS) Sampling Technique in which the probability of selecting a sampling unit (e.g.village, zone, district, health centre) is proportional to the size of its population. Therefore, the technique allows for giving a probability (i.e., random, representative) sample. With this method a pre-determined number of respondents was selected in each unit and staff allocated accordingly. Sampling was done randomly amongst coastal villages. Each day was concluded with a review and the processing of the newly gathered data.

(3) Data analysis and report-writing

All gathered data was documented and analysed (frequency distributions, correlations and cross tabulations) through the Statistical Package for the Social Sciences (SPSS). The results were documented in a report.[8]

[8] CARE Deutschland –Luxemburg e.V. 2012

Figure 9: FGD CVCA conducted in Bone district (Photo by Rahman Ramlan, 2011)

3. Findings

3.1 National and Provincial Level

The following information is based on secondary data research and interviews with key informants from different ministries, the meteorological agency, national climate change council of Indonesia and provincial governments.

3.1.1 Climate–Resilient Livelihoods

The combination of high population density and high levels of biodiversity, together with 80,000 kilometres of coastline and islands, makes Indonesia one of the most vulnerable countries to the impacts of climate change. Indonesia has to take up the challenge of climate change, putting climate adaption into the development agenda, promoting sustainable land use, as well as demanding support from industrialized nations.

Figure 10: Seaweed farmer *Gracillaria spp* in Pompengan village, Luwu district (Photo by Ikhsan, 2011)

The Indonesian climate is tropical - hot and humid -, but more moderate in the highlands. Climatic and weather conditions of the archipelago are characterized by an equatorial double rainy season. The dry season generally prevails from May to September, and the wet season generally prevails from December to March, whereas October, November and April fall into the

transition period. These patterns do not always rigidly take place, however, since a large part of the archipelago is covered by sea and diurnal differences are not significant, which makes precipitation possible anytime. The mean annual relative air humidity ranges from approximately 80 to 90%. The mean maximum temperature can reach 33°C, whereas the mean minimum air temperature is 21°C.[9]

The research on comprehensive national climate variation information identified several impacts of climate change, which are described in the bullet points below:

Water availability

- Decreased rainfall during critical times of the year may lead to a high drought risk and crop failure. Decreasing agricultural production causes food insecurity and increasing poverty.[10]
- Increased rainfall during already wet times of the year may lead to a higher flood risk, such as the Jakarta flood on 2 February 2007 that inundated 70,000 houses, displaced 420,440 people and killed 69 people and caused economic losses of Rp 4.1 trillion (US$ 450 million).
- Delayed wet season (monsoon) and a temperature increase beyond 2.5°C is projected to substantially drop rice yields and incur a loss in farm-level net revenue of 9 to 25%.[11]

Sea-level rise

- Currently increase by 1-3 mm/year in coastal areas of Asia, projected to accelerate to a rate of about 5 mm per year over the next century.
- Increase from 13 million to 94 million people flooded annually in South Asia (under very conservative sea-level rise scenarios 40 cm by 2100).
- 1 million people at risk from flooding and seawater intrusion due to sea-level rise, which also will impacting the aquaculture industry (e.g., fish and prawn industries) and infrastructure along the coasts of South and South-East Asia negatively.[12]

Biodiversity and ecosystem services

- Up to 50% of Asia's total biodiversity is at risk due to climate change and climate related hazards.[13]

[9]WWF Indonesia 2007
[10]Wang et al.2006
[11]Lal 2007
[12]WWF 2007

- 88% loss of coral reefs in Asia in the next 30 years due to warming sea-surface temperatures, sea level rise, and other added stresses e.g. pollution. This will impact the marine habitat in form of decreasing local biodiversity.[14]

Figure 11: Coral Reef Ecosystem (Photo by Ikhsan, 2011)

- Significant declines in fish larvae abundance and large-scale changes in fish habitat, such as skipjack tuna, are projected in the equatorial Pacific. As a consequence, competition over sea resources will increase.[15] [16]
- Massive coral bleaching is leading to widespread loss of coral reefs and biodiversity, including the fish that many Indonesians rely on for food and livelihoods.Corals need algae to survive. In increasing water temperature algae produce a poison which corals cannot absorb. If these conditions persist, the corals will die.[17]
- Sea-level rise, increased extreme weather events, warming temperatures, and changes in ocean circulation and salinity patterns impacting Indonesia's marine turtle populations.[18]Turtles will suffer from multiple problems if temperatures predicted in climate change projections are reached. Young turtles which grow in warmer water show

[13]Cruz et al. 2007
[14]Wilkinson 2004
[15]Cruz et al. 2007
[16]Loukos et al. 2003
[17]WWF 2007
[18]WWF 2007

reduced swimming ability and prefer shallower waters near the coast which makes them vulnerable to human actions (hunting).[19]

Figure 12: Water source for households during dry season in Bone district
(Photo by Rahman Ramlan, 2011)

- More frequent forest fires significantly impact the wildlife habitat and biodiversity which results in serious economic losses, domestic and trans-boundary pollution – the economic costs of the droughts and fires in 1997-1998 were about US$ 9 billion.[20]
- Sea-level rise, reduced freshwater flows, and salt-water intrusion, in addition to the existing stresses primarily due to human activities threaten Indonesia's coastal mangroves. Mangroves as a natural buffer against climate related hazards, such as flooding and storm are the natural habitat for marine organisms and wildlife. They also provide a habitat for birds and mammals. Mangroves also improve the water quality besides the protecting of coastlines from abrasion.[21]
- Changes in species distribution and reproduction timings,[22] causing difficulties for fishermen to locate the fish in the sea.

[19]Science Daily July 2 .2011, p.1
[20]Applegate et al. 2002
[21]Tran et al.2005
[22]Cruz et. al 2005

Human health

- More frequent and severe heat waves, floods, extreme weather events, and prolonged droughts leading to increased injury and illness.
- Increase in infectious diseases, poor nutrition due to food production disruption, ill-health due to social dislocation and migration, and increased respiratory effects from worsening air pollution and burning.[23]

Figure 13: Coastal conditions in Bone district (Photo by Rahman Ramlan, 2011)

- A rise in the number of dengue fever cases during the rainy season due to abundance and outbreak of mosquitoes.[24]
- Increased diarrheal disease and endemic morbidity and mortality due to poor sanitation during flooding and drought.[25]
- Rise in severe respiratory tract problems due to an increase in the frequency and spread of wildfires that release toxic gases such as carbon monoxide, ozone, nitrogen dioxide and hydrocarbons.[26]

[23]Checkley et al. 2000
[24]Peace 2007
[25]Checkley et al. 2000

- More phytoplankton blooms, providing habitats for survival and spread of infectious bacterial diseases, such as, cholera due to increasing temperature.[27]
- Increased water-borne diseases such as cholera and diarrhoeal diseases (e.g., Giardia, Salmonella, and Cryptosporidium) due to flooding.[28]

Water availability and food security are highly sensitive and vulnerable to changes in temperature and precipitation.[29] Less water during the dry season impacts food production, such as rice, and overflowing water during flooding can damage the rice fields.

Prolonged droughts, increased flooding, and more frequent and severe storms may lead to major agricultural losses and a substantial drop in food productivity.

Increased frequency and severity of El Niño events and fires will impact food production and will reduce the ability of natural systems to provide ecosystem services e.g. habitat for fisheries.

Figure 14: FGD CVCA in Bone district (Photo by Rahman Ramlan, 2011)

[26]Peace 2007
[27]Pascual et al. 2002
[28]McMichael et al. 2003
[29]Cruz et al. 2007

Warming ocean temperatures, sea-level rise, and increased storms will impact coastal systems by increasing coral bleaching events, changes in fish availability, inundation of coast lines and mangroves, and exacerbating risks to human health related with endemic causes.[30]

3.1.1.1 Climate Policies and Institutional Mapping

Indonesia released its National Climate Change Action Plan in 2007, which called for greater integration of mitigation and adaptation into national development goals through better coordination between relevant agencies (energy, transportation, forestry, and agriculture). It also claims to incorporate climate-related funding decisions into all development plans, with the most promising signs of institutional coordination in medium- and short-term development plans. The plan is based upon "pro-poor, pro-job, pro-growth and pro-environmental" principles. It is also apparent, that many sectors treat mitigation or adaptation as a climate co-benefit of development policies. This implies a broader adaptation strategy involving governments, civil society and the private sector – combining approaches at the government and institutional level with bottom-up approaches rooted in local knowledge. While adaptation is vital across a whole range of development activities, it is particularly important for fishery and agriculture, coastal zones, water supplies, the health sector and for urban areas, with water playing a cross-sectoral role in all these areas.

Besides the mitigation agenda, the adaptation agenda is considered as `key aspect of the national development agenda´ with the goal of achieving an agreed level of progress in the development sector that is resilient to current and future climate variability. The integration of climate change adaptation to national development plans constitutes a long-term objective of the national climate change adaptation agenda.

At the local level the climate information is gathered and analysed by the local Meteorology, Climatology and Geophysics Agency (BMKG) and shared with related institutions particularly provincial and district governments. The information is collected, analysed and published by local BMKG office through the 6-monthly Bulletin Newsletter, which contains information on rainfall and dry season development and advice for farmers on their planting schedule. This information is forwarded to provincial and district level, where it should be further downscaled and interpreted within the regional context. On the district level the information is not further

[30]WWF 2007

distributed to the communities. Three day and weekly weather forecasts for the national level are disseminated through media information. One of the challenges faced by communities, and particularly vulnerable groups within communities, is simply a lack of access to information that would facilitate planning and risk management. Ensuring that communities are able to access critical information such as seasonal forecasts and early warnings will support their efforts to manage their livelihoods in a context of uncertainty.

Figure 15: FGD CVCA conducted in Bone district (Photo by Rahman Ramlan, 2011)

3.1.2 Disaster Risk Reduction

3.1.2.1 Natural Disasters

Floods, droughts, landslides and forest fires are the common types of climate related hazards in Indonesia. The El Niño Southern Oscillation (ENSO) is found as one of the natural phenomena that resulted in devastating consequences for most areas in Indonesia.

Climate-related hazards in Indonesia are also caused by the location and movement of tropical cyclones in the Southeast of the Indian Ocean (from January to April) and the East of Pacific Ocean (from May to December). These tropical cyclones impact Indonesia in the form of strong winds and long-lasting heavy rain. Strong winds also occur during the transition period from the Northeast Monsoon into the Southwest Monsoon and vice versa.

Figure 16: Local house condition at high tide in Ulo-ulo sub-district, Luwu district (Photo by Ikhsan, 2011)

Due to the combination of the population density, the high level of biodiversity and 80,000 km of coastal line (which makes up 14% of the world's coastal lines) and 17,500 islands Indonesia is vulnerable towards climate change impacts. The rainfall pattern will change and the dry season will last longer. Many islands are at risk of being submerged due to the rise of the sea level, and many other impacts will emerge.[31] According to the ministry of marine affairs and fisheries, within only two years (2005-2007), Indonesia has lost 24 small islands in Aceh, North Sumatra, Papua, Riau Islands, West Sumatra, South Sulawesi and Thousand Islands area. In these cases, the people most vulnerable against the rising of the sea level and tropical cyclone are the farmers and fishermen.[32]

In 2009, the Economy and Environment Program for Southeast Asia (EEPSEA) and the International Development Research Center (IDRC) developed a 'climate change vulnerability, adaptive capacity and exposure map' for South East Asia. Furthermore they created a map for

[31]GFDRR 2011
[32]Republic of Indonesia a 2007

climate related hazards, namely floods, landslide, drought, tropical cyclones and rising of sea level.

Figure 17: Abrasion in Seppong village, Luwu district (Photo by Ikhsan, 2011)

According to the EEPSEA and IDRC research results, areas with high risk are located in highlands in the centre and South of Papua, DKI Jakarta and West Java and West and South Sumatra. Areas with medium risk are North and Central Sulawesi, other parts of Sumatra, East Java and East Nusa Tenggara. The lowest adaptation capacity is recorded in Papua and East Nusa Tenggara. In almost 100% of the Indonesian islands, the population is mostly concentrated in the coastal areas with low elevation (less than 10 meters) which is exposed to the high risk of a rise in the sea level.[33]

To illustrate the rising sea level hazard, the Institute for Essential Services Reform (IESR) conducted a research to project the impact of rising sea levels on Java Island, an island where more than half of the Indonesian population resides. The research shows that in 2010, 2025, 2050 and 2100, the areas which would be submerged by the sea will be 40 square kilometres, 66.6 km^2, 111 km^2 and 138.8 km^2respectively. From this projection, it can be concluded that the vulnerability against climate change, particularly the rising of sea level will also increase every year.[34]

[33]IDRC 2010
[34]IESER 2009

Among the non-climate related hazards earthquakes, tsunami and volcanic eruption are the main natural disasters in Indonesia.

Indonesia is located in a zone where three active tectonic plates meet, which causes tectonic earthquakes. The movement of the Eurasian plate, which meets the Indo-Australian plate, causes a 77mm shift per year. The active plates of the Eurasian stretch from the West coast of Sumatra to the South coast of Java to the Flores Sea and Arafura Sea. The Pacific plate stretches from the North of Papua to the Halmahera islands and Sulawesi. Indonesia, particularly the Eastern part, is the meeting point of three main plates: the Eurasian plates, the Indian-Australian plates moving to the North, and the Carolina (Pacific) plates moving to the West. The plate's border with the highest seismic activity is located offshore of Sumatra, Java, Nusa Tenggara, Banda Islands, Sulawesi and Papua.

The Indonesian earthquake hazard-zoning map, developed by the Bandung Technology Institute's Disaster Mitigation Centre (*Pusat Mitigasi Bencana-Institut Teknologi Bandung/PMB-ITB*), shows that almost all areas of Indonesia are prone to earthquake, varying from very low to very high intensity. Based on the disaster risks index, the areas with high and highest risk of earthquake are located in the West part of Sumatra, South of Java, Bali, West Nusa Tenggara, East Nusa Tenggara, central and northern part of Sulawesi and part of Papua.

If earthquakes with a certain magnitude occur in the ocean Tsunami are likely to occur. From the period of 1629 to 2000 a number of 108 Tsunami has been recorded of which 98 (90.7%) have been triggered by an earthquake, while 9 (8.3%) have been triggered by volcanic eruptions, and one (1%) was caused by a landslide.

The tsunami in Indonesia possesses a unique characteristic. As a local tsunami it hits the coast with a time difference of 20 to 30 minutes after the earthquake. This is due to the close proximity of the fault line in the Indian Ocean, that has a great potential to trigger a tsunami. Based on the tsunami occurrence history, tsunami prone areas were identified as being coastal areas directly facing the border of tectonic plates, such as the West coast of Sumatra, South of Java, Nusa Tenggara, North of Papua, Sulawesi and Maluku, as well as East of Kalimantan.

This was also supported by the disaster risk index, developed by the Bandung Technology Institute Disaster Mitigation Centre: Cities and municipalities on the West coast of West Sumatra

province, in the South part of Java, North of Aceh and Lampung are at a high risk of being hit by a tsunami.

The third main common non-climate related hazard is volcanic eruption. Indonesia is encircled by a series of active volcanoes, spreading from Aceh to the Aru Sea in the West and South part of Indonesia, and from Sulu Sea to Tomini Strait as well as stretching along the West coast of Halmahera Islands. Known as the 'ring of fire', Indonesia's volcanoes form a 7,000 kilometres long row. There are 129 active volcanoes spread in Sumatra Island, Java, Bali, Nusa Tenggara, North Sulawesi and Maluku Islands, in addition to 500 volcanoes, which are inactive, but the country still needs to be wary of. The number of active volcanoes in Indonesia makes up 13% of all active volcanoes in the world. Currently, more than 10% of the Indonesian population resides in areas of active volcanoes. Within the last 100 years, more than 175,000 people died in volcanic eruptions.

Beside the volcanic eruption hazard in forms of material spew or toxic gas, volcanoes pose an indirect threat such as lava or other hazardous volcanic material mudflow during the rainy season. Based on the disaster risk index, most of districts/cities with very high risk and high risk of volcanic eruption are mostly located in Java Island. However, there are many districts with high risk and very high risk located in Sumatra Island, West and East Nusa Tenggara, as well as in North Sulawesi.[35]

It is also important to note, that there are man-made, underlying causes of vulnerability that can affect the people in urban and rural communities of Indonesia. These causes include but are not limited to population growth, unsustainable management of ecosystem sand pandemics.

In the global risk analysis report prepared by the World Bank, Indonesia was identified as one of 35 countries with a high risk of deaths due to multiple hazards, with 40% of the population living in high risk areas. With a population of more than 230 million people, this means more than 90 million people are vulnerable to disaster and climate change threats.[36]

Over the last decades, the number of disasters in Indonesia increased every year. Based on the data collected from the Centre for Research on the Epidemiology of Disasters (CRED), between 1980 and 2009, more than 19,929,305 people of Indonesia have been impacted by 309 different

[35]Republic of Indonesia 2010, pp. 2-3
[36]GFDRR 2011

disasters, or about 64,496 people per disaster occurrence. The natural disasters, which struck Indonesia within the period of 1980 to 2008, have caused an economic loss of approximately USD 21,454,183. This means, per year, Indonesia has suffered an economic loss of USD 766,220 per disaster occurrence. Although the disaster data of this period indicates, that most of the deaths were caused by earthquakes and tsunami, the largest percentage of population was affected by climate related disasters.[37]

3.1.2.2 Policies

In 2005, 168 countries attended the World Conference on Disaster Risk Reduction in Kobe, Japan and adopted the Hyogo Framework for Action (HFA) 2005-2015 as a global agenda to reduce disaster risks. In support to this global commitment, the Government of Indonesia has formulated a National Action Plan for Disaster Risk Reduction (NAP DRR) for 2006-2009 as a follow up to the commitment towards Hyogo Framework of Action (HFA), by elaborating on five priorities, namely (1) Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation; (2) Identify, assess and monitor disaster risks and enhance early warning systems; (3) Use knowledge, innovation and education to build a culture of safety and resilience at all levels; (4) Reduce the underlying risk factors; (5) Strengthen disaster preparedness for effective response at all levels. Since 2007-2008, the Government of Indonesia has included a disaster risk reduction programme in their regular development programme.[38] Currently, the NAP DRR 2010-2012 is being implemented.

Following the HFA ratification, a formal Disaster Management institution at the central level was established in 2008, which entitled the National Agency for Disaster Management (BNPB) as a replacement of National Coordinating Agency for Disaster Management (Bakornas PB) under Presidential Decree No. 8/2008, which deals with the planning and implementation of disaster risk management.

Indonesia has ratified the United Nations Framework Convention on Climate Change through Law number 6 of 1994. Ten years later on, Indonesia ratified the Kyoto protocol through Law number 17 of 2004. These commitments require comprehensive efforts and action in adaptation and mitigation. In 2007, under the coordination of the Ministry of Environmental Affairs, a

[37]Palang Merah Assessment2009
[38]Government of Indonesia 2010

national action plan anticipating the climate change (Rencana Aksi Nasional dalam Menghadapi Perubahan Iklim/RAN PI) was formulated as a guideline in carrying out coordinated and integrated efforts in mitigation and adaptation to climate change, in line with the national development objectives. The development of climate change adaptation capacity in the future should be based on experience and the capacity built to overcome disaster risks related to the current climate. Therefore, the formulation of the climate change adaptation agenda must be linked to the national action plan for disaster risk reduction.[39]

In addition to that, Law number 27 of 2007 on coastal and small island management says, that in facing climate change in the coast and small islands, disaster risk reduction needs to be integrated in the coastal and small islands management and utilization plan, involving responsibilities from the central government, provincial government and/or the community.[40]

The importance of disaster risk reduction has also been reflected in the Agenda for Humanitarian Action, adopted in the 28th International Conference of the Red Cross and the Red Crescent in December 2003. In this conference, the Red Cross and the Red Crescent Movement and Indonesia's parties committed to the Geneva Convention to take action in the aim of reducing vulnerabilities to risks and impacts of disasters. This commitment was further proclaimed in the International Federation of Red Cross and Red Crescent Societies (IFRC) Global Agenda Goal of 2006-2010, which explicitly calls for a collective action with the vulnerable community to reduce the disaster risks. In building this global commitment, IFRC has formulated a framework to build a more resilient and safe community.[41]

The Indonesian Government's National Disaster Management Plan for 2010-2012 addresses many of these challenges. Some of the specific institutional measures to support climate change adaptation in the natural hazard arena in this document are listed below:

- Strengthening environmental management capacities of local government agencies, particularly through decentralization.
- Taking stock of existing adaptation activities in Indonesia. Lessons learned from these experiences would aid in building capacity for future adaptation.

[39]GFDRR 2011
[40]Republic of Indonesia b 2007
[41]IFRC 2009

- Continuing support and development of policies that address urban and rural sanitation and wastewater management, especially in the context of the decentralization process, is needed. This includes inter alia development of a national strategy for access to sanitation and wastewater treatment across scales, and plans for environmental, economic, and socially sustainable water and wastewater utilities.
- Addressing the institutional and financial constraints that prevent improvement in the monitoring and enforcement of policies and legislation to reduce deforestation. Moreover, decentralization poses new challenges for monitoring and enforcing policies.
- Improving the mainstreaming of environmental concerns into development policy. In particular, public investment planning and regional planning of land and natural resource management could be better integrated into all relevant environmental issues.[42]

The Metrological and Climate board (BMKG) installed the disaster information system DIBI to monitor, store and disseminate hazard (earthquake, tsunami, landmass moving, volcanic eruption) and vulnerability data, but the data is not complete and lacks of a joint format, which makes it difficult to compare. There is no legal instrument in place, which regulates the policy related to monitoring, storing and dissemination of disaster data [43] In some areas local governments together with non-government partners such as the university developed disaster information systems that are specific to local needs.

One of the constraints faced in the provision of disaster information are the geographical conditions of the country, particularly if we consider that Indonesia is a vast archipelagic country with thousands of islands that are scattered along the equator. Information dissemination is also hampered by Internet connectivity and communication network that are centred in the major islands only. The non-proactive culture of the Indonesian people further impedes seeking for disaster related information.

In the future, Indonesia will maximize the use of media as an instrument for dissemination of information to the public, such as the radio, television, hand phone and the print media. The institutional capacity of DIBI in the regions will also be enhanced to provide disaster-related information that is accessible for the public, with support from civil society organizations, religious and community leaders and local NGOs. DIBI will serve as a “hub” for website links of

[42]Republic of Indonesia 2010
[43]Republic of Indonesia a 2007

organizations that have developed a web-based disaster database. It is expected that the capacity of media in disaster-related issues will also be improved.[44]

Early Warning Systems (EWS) for main hazards, particular for floods, tsunamis, extreme weather, extreme waves, volcanic eruptions and forest fires have been developed by the relevant agencies. EWS systems on local level can be found for flooding and volcanic eruption. Standard operational procedures for maintenance and in case of warning are not developed in all provinces yet. Currently the national government is in the process of developing a grand design for multi-hazard early warning system.[45]

3.1.2.3 Capacity Development

Institutions, which are involved in research, planning and implementation of adaptation, are the National Council on Climate Change Indonesia (DNPI), Ministry of Environment of Indonesia (KLH) and the National Planning and Development Agency of Indonesia (BAPPENAS), whereas the ministry of environment has the leading role in climate change adaptation.

The Ministry of Environment's Climate Change Division is the focal point, serving as the designated national authority for the Clean Development Mechanism (CDM). A National Committee on Climate Change and a related Steering Committee were established to offer broad policy guidance and to make funding allocation decisions. The Steering Committee consists of an advisory panel and a technical committee headed by the MoE and BAPPENAS.

Detailed policy guidance is provided in the Indonesia Climate Change Sectoral Roadmap 2010, which aims to expedite the implementation of these documents and to mainstream climate change issues into national development planning. Specific climate change adaptation policies are absent, except Indonesia's (draft) Climate Change Adaptation Programme (ICCAP), which aims to embed climate risk and opportunity management mechanism within national, provincial and local development plans.

The national MoE responds to local priorities by developing a long-term plan for adaptation for water, agriculture and food security and the socio economic sector, considering projected climate change scenarios.

[44]Key Interview Metrological Board Makassar October 2011
[45]Key Informant Interview Ministry of Environment and Metrological Board, Makassar October 2011

The government has allocated limited funding for climate adaptation programs in the national budget. Indonesia's Climate Change Trust Fund (ICCTF), which is managed by UNDP as interim trustee, is funded by DFID (USD 9.12 million) and AusAID (USD 1.80 million) and used for climate change mitigation and adaptation pilot projects, whereas the focus is still more on mitigation:

1) Energy and Energy Efficiency (Budget approved: USD 2,178,484)
This project is being implemented by the Ministry of Industry and focusses on the steel, pulp and paper sectors, to find possible reductions of the greenhouse gas emissions. It also aims to strengthen networking and capacity building, mainly to identify energy saving opportunities.

2) Forestry and Peatlands (Budget approved: USD 1,247,843)
The Ministry of Agriculture will carry out research and technology development of sustainable peat management to enhance carbon sequestration and mitigation of greenhouse gas emissions.

3) Adaptation and Resilience (Budget approved: USD 1,206,872)
The Bureau of Meteorology, Climate and Geophysics (BMKG) will implement a project named Public Awareness, Training and Education Program on Climate Change issue for all levels of societies in Mitigation and Adaptation. It will be based on increasing farmers' and fishermen's awareness of climate change through a local radio program and dialogue between farmers and fishermen. The project will contribute to enhanced food security and higher adaptive capacity of the targeted farming and fishing communities, which constitute the majority of livelihoods in Indonesia.

Since 2000 Indonesia made considerable gains in integrating environmental issues into development plans, in particular with respect to mainstreaming climate change into the national development strategy whereas there are still capacity constraints for climate change adaptation strategies:

- Ability to analyse and apply climate information
- Capacity to assess vulnerability to climate change
- Effective system for dissemination of climate information
- Capacity to assess and implement adaptation options

In order to address the challenges of climate variability, institutional capacity especially at the local level, where climate impacts occur, has to be enhanced. Climate science should be taken into account, to know "to what to adapt to" and suitable strategies of "how to adapt" at the community level need to be assessed and improved.[46] [47] [48]

3.1.3 Addressing Underlying Causes of Vulnerability

Indonesia considers the triple track development strategy of `pro-poor, pro-job and pro-growth´ as an integral part for addressing climate change, since poverty alleviation is essential for responding to climate change that is making the poor most vulnerable.[49]

As it is expressed in Indonesia´s NAP addressing climate change,[50] the national planners fully understand the link between poverty and climate change vulnerability. But when it comes to implementation there is a lack of technical expertise in coastal zone management regulations. There is a need for feasibility studies prior to the actions which ensure successful implementation.

Women are especially vulnerable to the impact of climate change since they have to take care of the household and the family members' food and health security. Therefore this group needs specially to be targeted. The government has admitted that it needs to pay more attention to women and marginalized groups, but in practice, the gender equality and marginalized communities' issues are not addressed properly. This might be due to the fact that there are still unclear indicators of gender empowerment or the absence of systematic procedure for selection of the most vulnerable communities. Unclear indicators would make it difficult to measure impacts or to learn what would be the contributing factors to the success or failure of the empowerment project.[51]

The planning process in Indonesia is a bottom up approach. On local level communities formulate ideas for their annual planning. In the village meetings every person, who is 17 years old, is allowed to participate. The ideas from the village meetings have to be approved at the sub-

[46] Key informant interview DNPI Jakarta, October 2011
[47] Key informant interview KLH Jakarta, October 2011
[48] Key informant interview Bappenas Jakarta, October 2011
[49] Republic of Indonesia a 2007
[50] Republic of Indonesia a 2007
[51] UNDP Indonesia 2007

district level. It is important to sensitize the governmental staff on climate change sensitive planning, since the chances for approval will be higher. The sub-district planning again has to be approved by the district and the district proposals by the province up to the national level.

3.2 CVCA Findings at Local/Community level

The following information derives from the results of the FGDs.

3.2.1 Climate-Resilient Livelihoods

Based on landscape types, areas that are vulnerable to climate change in the targeted districts, are those with vast coastal zones, mountain areas and forests. Coastal zones are vulnerable to sea level rises, which are likely to result in the loss of land that is important for fish farming, rice production etc. Mountain areas are vulnerable towards landslides, which are likely to occur in high slope areas during the rainy season. Forests are primarily vulnerable to fires, a result of extreme climate events such as El Niño.

Overall, the FGD results show that the important livelihood resources in the target communities are seaweed farming, agriculture (rice, corn and sweet potato), fisheries, ponds fisheries, animal husbandry, small business, ojek (motorbike taxi) driver and masonry.

The coastal communities reported that they can sense the pest attacks happen more frequently to the seaweeds or agriculture products due to prolonged drought. In most cases the pests are not local and thus the farmers have difficulties in combating these new breeds of attacks. Farmers use seeds which require a shorter cultivation period, although the harvest will be the same as with the previous sort, the seedling cannot be generated, which reduces the benefit since new seeds have to be bought.

The descriptions of the findings at each district of BCR CC supported communities are presented below:

Figure 18: Seaweed farming East Bassiang Timur village, Luwu district
(Photo by Ikhsan, 2011)

3.2.1.1 Bone District

The CVCA analysis covered the five sub-districts Awangpone, Kajuara, Tonra, Tanateriattang Timur and Cenrana. These locations reside along the eastern coast of South Sulawesi of approximately 100 km from the provincial capital. The coastal communities in these districts are categorized as vulnerable communities towards climate change.

The Metrological agency of Sulawesi (provincial level) characterised Bone in their "Composite Climate Hazard Index" (CCHI) as "high" risk regarding climate disaster in 2009. Projections for 2020 and 2050 indicate a "high" risk. The CCHI is the numerical result of the vulnerability multiplied with the adaptive capacity at district level. Socio-economic data (land use, cultivated crops, poverty rate, disaster occurrence, disaster impact etc.) and geographical data (rainfall, wind etc.) serve as a database for the vulnerability and the adaptive capacity.[52]

[52]DNPI 2011

Figure 19: FGD CVCA woman community in Bone district (Photo by Rahman Ramlan, 2011)

Based on the FGD results in 10 selected villages, the project revealed that the main livelihood for the communities are fisheries, pond fisheries, seaweed culture and farming which are depending on natural resources. Persons, who work in these fields, are identified as part of the most vulnerable groups relating to the impact of climate change.

Climate related information from the district level (rain and drought, planting and harvest time recommendations) has not been effectively distributed throughout the community. The community recommended to setting up a weather forecast system to be able to determine the planting schedule. The provided information could be further discussed and follow up actions could be agreed on in the "*Tudang Sipulung*" (a traditional community forum for discussion and decision making. Nowadays in many communities this system is not in use anymore but could be reactivated.)

The capacity of local governments and institutions to understand the risks of climate change is low and needs to be improved, especially in terms of community-based adaptation strategies. Currently the local planning focuses more on hard infrastructure, like dams, instead of supporting people in developing alternative livelihoods.

In terms of climate policy the main attention is directed to mitigation efforts to reduce carbon dioxide emissions. These measures are important, but for the poorest people in the coastal districts of Bone, who only contribute to a small part to the emission of such gases, the most urgent need is to find ways to cope with environmental conditions. Adaptation efforts to the changing environment require more attention and budget from the government as up to now.

3.2.1.2 Wajo District

The six coastal sub-districts Pitumpanua, Keera, Sajoanging, Bola, Penrang and Takalalla participated in the CVCA. This region is located around 200 km away from the provincial capital.

The 2009 CCHI of Wajo was categorized as "very high". The projections for 2020 and 2050 indicate a "very high" CCHI. Underlying reasons for this are the high poverty rate in combination with frequent flooding and drought and change of land use in coastal areas, such as turning mangrove areas into fish pond areas.[53]

Figure 20: Capacity building for Seaweed farmer in Pasir Putih village, Wajo district (Photo by Nurtang Gani, 2011)

In Wajo information on climate data is available in some departments (environment, transportation and food crops and livestock) at the district level but not further disseminated to the sub-district level.[54]

The FGD results in 10 villages showed that the main livelihood of the community are rice farming, seaweed culture, pond fisheries, small scale trading and animal husbandry. The most vulnerable groups relating to climate change are people residing along the river basin and coastal line especially women and children of the poor.

[53] DNPI 2011
[54] Key Informant Interview with representative from district government Wajo in September 2011

In Wajo neither governmental nor non-governmental agencies are involved in research, planning and implementation of adaptation active Board, Environment Board, Fishery and Marine Department, Agriculture and Livestock Department, Community Development and Village Board, Social and Health department.[55]

3.2.1.3 Luwu District

In Luwu six coastal sub-districts were involved in the assessment: East Lamasi, East Walenrang, Suli, Bua, Ponrang Selatan, and South Larompong.

Figure 21: FGD CVCA conducted in Bassiang Timur village, Luwu district
(Photo by Ikhsan, 2011)

The 2009 CCHI of Luwu was categorized as "high". The projections for 2020 and 2050 indicate a "high" CCHI. Underlying reasons for this are the sea level rise and a high risk of flood due to many rivers, which are coming from the mountains and lead into the sea. [56] [57]

The FGD results showed that the most likely livelihood groups at risk of climate change impacts are seaweed pond farmers (Gracillaria sp), seaweed culture farmers (Cottoni sp), fishermen using floating cage devices called Sero, farmers and cattle breeders.

Local institutions do not have any access to climate information yet.[58]

[55] Key Informant Interview with representative from district government Wajo in September 2011
[56] DNPI 2011
[57] DNPI 2011

Although not empirically proven, the people believe that the climate change has made them poorer. Both natural and artificial ecosystems are affected by climate change such as a higher level of salinity in ponds during drought, which adversely affects the aquaculture. From this experience above, the communities in the six sub-districts developed adaptation strategies towards climate change impact, such as building sea water irrigation systems, which balance the salinity level in seaweed pond cultures (*Gracillaria sp*). During the prolonged drought season which is accompanied with tidal waves, the local community applied an adaptation strategy of raising and enlarging pond embankments. High tide is the type of hazard that significantly impacts the seaweed farming, as it destroys the embankment structure and causes uncontrolled salinity levels in the ponds. High tides also impacted the fishermen as fishers would have troubles going to sea. As an adaptation strategy, the fishermen started learning new skills, for example to use seaweed cultures to diversify their income source in case they could not go to the sea to fish.

3.2.1.4 North Luwu District

The assessment in North Luwu covers three coastal sub-districts: Bone Bone, Malangke and Malangke Barat sub-districts.

FGD results showed that the livelihood activities in these areas are pond farming, horticulture, seaweed farming (type: Cattonik), fisheries and masonry.

The 2009 CCHI of North Luwu was categorized as “very high”, since the projections for 2020 and 2050 also indicate a “very high” CCHI. Underlying reason for this is a high occurrence of floods, which destroy seaweed and fish ponds located along the coast.[59]

[58]Key informant interview with Secretary of BAPPEDA in Luwu September 2011
[59]DNPI 2011

Figure 22: FGD CVCA conducted in Luwu Utara district (Photo by Mukri Muslimin, 2011)

Currently district agencies, like the agency for social service manpower and transmigration, the regional disaster management agency, the department of crops, horticulture and animal husbandry, the department of forestry and plantation, the department of marine and fisheries, the department of transportation and non-government institutions involved in disaster management, like the Indonesian Red Cross (PMI), have access to climate data.

At present there is no institution in North Luwu which can estimate the possible impact of climate change and therefore no local plans and policies support climate resilient livelihoods, yet. The district government plans to support conventional shrimp cultivation,[60] which is the opposite of a sustainable and climate friendly development.

3.2.2 Disaster Risk Reduction

The interviews from the FGD showed that the community lately noticed the changes in wind patterns: wind is now stronger and longer and the direction is unpredictable; rainfall patterns are also unpredictable, sometimes high in intensity rainfall and the duration varies. Within the last 10 year's period the temperature increased, which initially started slowly and is now getting more and more extreme.

[60]Key Informant Interview with BPBD North Luwu in September 2011

The communities are aware that they need information related to climate change and early warning especially for flooding in their area. Early Warning Systems (EWS) are available in some sub-districts but are not functioning properly. The government is planning to establish more advanced EWS. The government at times is quite fast in informing of incoming floods accurately and they also believe that they are ready to respond to disasters.

3.2.2.1 Bone District

The focus group discussion results showed that the main hazards, which threaten the livelihood of the communities, are floods, droughts, storms, tidal surges and pest attacks. These events occur on an annual basis however a Disaster Risk Reduction strategy is lacking in the area.

The government started with developing a disaster prevention plan, which anticipates the degradation or destruction of infrastructure. A number of new infrastructures were also planned and constructed to mitigate risks, such as dikes and drainage canals. Unfortunately there is still no EWS in Bone and disaster preparedness activities in this area are minimum to none.

TAGANA (*Taruna siaga bencana* – youth disaster preparedness team) is a voluntary emergency response team that supports affected communities, after a disaster has already occurred, as a first response team (evacuation, first aid etc.). They also conduct evacuation and first aid trainings.

The FGD result shows that historically, a big flood would be followed by long droughts in the region every year. To anticipate these annual hazards, the community in the region initiated adaptation strategies. Some have raised dike walls and built embankments. Coastal communities changed their base of livelihood and switched to rice and seaweed farming. As a strategy to deal with periods of drought, some farmers also built irrigation systems and some started to work as labourers or motorcycle taxi drivers.

3.2.2.2 Wajo District

The main hazards in the area include floods, high tides and storms, which cause abrasion. In particular abrasion has occurred since 1960s. Other hazards with less impact than those mentioned before are prolonged droughts followed by pest attacks. All of these contribute to environmental degradation and crop failure. Flooding and abrasion frequently damaged settlements and farms, which led to great losses by farmers and fishermen.

To prevent floods, people dug water absorption holes and build drainages aside from dredging the river and building simple embankment. As preventive mechanisms against damage caused by high tides, communities reforested mangroves, build dykes and wave breakers.

The local government, through the Regional Disaster Management Agency with the Social Department, the BAPPEDA (Planning and Development Board), the Department of Public Works, the Health Office and the Department of Agriculture are the constituents of the disaster management agency. Despite of the fact that this structure is existent no other actions are taken. It would be important for communities to receive early warning information relating to floods, since this is a common disaster in the district.

3.2.2.3 Luwu District

The FGD results showed that the main hazards faced by targeted communities are flood, tidal waves, strong winds and droughts, which are often followed by pest attacks. The FGD results also show that a lot of infrastructure and public facilities such as houses, village office, mosques, schools, roads and bridges were damaged due to frequent climate related hazards.

Strategies, that have been implemented by farmers, to cope with floods, include increasing the embankment wall to prevent spill-off fish from the ponds and overflow water from the river and sea. To face the long drought, the rice field farmers dig wells for agriculture, and if there is still some water left they change the crops by planting corn and soybean or work as daily labourers in other villages. Another adaptive strategy is to build a plastic fence to prevent the pest from entering the rice field. When tidal waves or strong winds hit, the fishermen will find jobs as daily labourers in other villages or work as *ojek* drivers. Women on the other hand perform additional productive activities, such as seaweed binding, weaving (fishing gear), making the roofs of Nipa leaves or selling cakes to increase the family income.

According to Dr. Iqbal, the head of environmental board of Luwu district, the Government has been monitoring the disaster information. The information obtained, was analysed by a local government team and distributed to the sub-district and village level through various available media; direct site visits were performed to obtain an actual risk status. The most relevant government agency in charge of Disaster Risk Reduction are the Regional Disaster Management Agency and the Department of Public Works & Water Resources (PU & SDA), which closely cooperate with other relevant agencies such as the Department of Health, Forestry, the Social

Welfare Department, and the Fire Department. The head of Bappeda of Luwu district mentioned that limited financial support especially for infrastructure is still the classic problem of effective disaster management at the local government level.

According to the FGD results the EWS in Luwu district is technically in place but not functioning because of a lack of data input, lack of socialisation etc.

3.2.2.4 North Luwu District

The FGD results showed that the main hazards in Luwu Utara are flooding, high tides, drought, pests/diseases, high waves and strong winds. In the last 10-20 years more frequent floods, have been caused by high tides and big waves. This indicates a significant change in the natural conditions. Floods usually affect the salinity of the fish ponds and seaweed ponds, causing substantial financial loss to farmers, therefore the most vulnerable group in the communities are the seaweed and fishpond farmers and fishermen.

CVCA results showed that the communities applied several adaptation strategies to avoid financial losses due to flooding. To prevent losses in pond cultures they started to terrace ponds by dividing one pond into smaller ponds. In times of high tides, only the ponds further from the coastline, which are not affected by the flood, will be used to raise fish. Communities built dikes to protect their communities with funds provided by the government. During phases of drought, people dug shallow wells to find water. Some have also changed their types of crops from rice to corn which needs less water for cultivation.

In North Luwu district DRR strategies are still in the beginning. Early warning systems for flood in coastal areas and landslides in mountainous areas are planned.

Currently the governmental Regional Disaster Management Agency (BPBD) can only rely on its capacity to respond to disasters, rather than preparing for one. The BPBD would only respond after a call from affected village.

3.2.3 Capacity Development

The interviews at the district level showed similar results for all the four districts. The results are therefore presented together and not district-wise. In all districts the different government departments established groups to simulate disasters.

In several districts different government agencies can access the current and future climate information. However, the Environmental Department and the Regional Disaster Agency are predominantly in charge of monitoring and evaluating this information, especially taking the local situation into account. Afterwards the information would be given to the lower administrative level, which – unfortunately - rarely happens. Therefore it is very important to sensitize these institutions to ensure their better understanding of the data and to enable them to make correct assumptions given the data.

There are already existing groups in the communities, like the village legislative bodies, the agriculture extension teams, religious groups and others, that could be trained to adapt to climate change and to distribute relevant climate information to villagers. A precondition for this would be the availability of local climate information.

3.2.4 Addressing Underlying Causes of Vulnerability

The impact of climate change predominantly threatens the lives of the poor, women, children and the elderly. Analyses of the daily patterns in the coastal areas show the women's role to be, to take care of the food security, the water supply and the health of the household members. This makes them more vulnerable towards the impact of climate change. Both, a prolonged drought and floods negatively impact the water supply, for instance. Although women showed that they were capable to deal with short-term climate variations, the current condition indicates that they are not able to deal with this in the long run.

Limiting factors of adaptive capacity are knowledge, financial situation, equipment and social resources. Switching to other business or invest in hazard prevention mechanisms is only an option for people who have the capital.

Every year an annual development plan called *Musrembang* starting from the village level up to the national is developed under the umbrella of BAPPEDA and BAPPENAS (national level). At village level everybody above the age of 17 years is allowed to participate in the formulation of an activity and a budget proposal for the next year. However, in reality the voices of women and marginalized groups are less respected compared to the men's opinion. For example, Focus Group Discussions were purposefully conducted separately to ensure the active participation of all part-takers.

Figure 23: Seaweed post harvesting in Luwu district (Photo by Ikhsan, 2011)

3.2.4.1 Bone District

The impact of extreme weather events hinders the access to clean water. The FGD results illustrate that during floods most of the water facilities get damaged and water has to be bought from other villages. This means that farmers can only plant paddies once rather than twice a year since they can only afford to buy irrigation water for one planting cycle, which leads to a reduced income.

Given that farmers and fisherman had access to the appropriate climate information, their adaptation strategies would still be very limited, as they do not possess fertile land, do not have access to water and only possess limited capital to create another business in the informal sector.

In 2010/2011 the Community Empowerment Assessment foundation (YKPM) assessed women's participation and planning mechanisms in Bones district. In Bone there is a strong patriarchal culture where women attend the village meetings but do not usually play an active role. Decisions are generally made by the village leader and his close family.[61]

[61]Key Informant Interview with YKPM South Sulawesi 2011

3.2.4.2 Wajo District

The most vulnerable persons as identified in the CVCA, are the poor (especially women and children), which are located along the river banks and coastal communities. During tidal waves and floods, community members usually switch jobs to more viable income generating activities such as daily labour, stone carpenter and *ojek* driver. However these options are very limited for the poor, since they do not possess enough capital for other activities. This also becomes a problem in case of a disaster. The poor then do not have any savings to lean back on and thus cannot rebuild their livelihoods easily, if at all.

During droughts some farmers need to find alternative ways of irrigation. Some start to drill wells, but those without the necessary capital often have to switch to other jobs temporarily in order to survive. They usually become daily labourers at other farms, or work as construction workers.

Meanwhile, Wajo women are mainly working on seaweed cultures or at home, which includes seaweed binding, weaving, fixing the nets or fishing gear, making the roofs from nipa leaves or selling cakes.

3.2.4.3 Luwu District

Farmers, fishers or seaweed farmers are the most vulnerable, since their livelihood is highly dependent on good weather conditions and on the availability as well as the quality of natural resources. This is why they would be severely affected by environmental degradation or climate related disasters. Additionally their limited knowledge of the reasons for their vulnerability hampers the development of adaptation strategies.

The most important participation process on village level is the *Musrembang* in which the development goals for the next year are defined. The community agrees on proposals which are submitted to the district level for approval. In theory women have a voice in the planning process and can articulate their opinion. However in fact proposals made by women are more often neglected compared to ones made by men. This is illustrated by the fact that many infrastructure programs are approved and less women specific projects such as vocational training are passed.

3.2.4.4 North Luwu District

In North Luwu fishery groups are said to be very vulnerable to climate change, especially due to their lack of capital. For this reason they tend to borrow money from loan sharks (locally

"Punggawa"), who, instead of fixing the amount of interest of the loan, determine the selling price of the agricultural product. This creates a further vulnerability of the fishers/farmers. Furthermore the access to land transportation in North Luwu district is a major challenge. During the rainy season streets are frequently flooded and markets cannot be accessed by larger vehicles. This therefore hinders the selling of agricultural products and leads to reduced income.[62]

Besides the fishermen, the women and children are also amongst the poorest within the communities. This is mainly due to the fact that they have less capacity to bounce back after disasters that destroyed their livelihoods, for example rebuilding dikes would be unaffordable, or during droughts they would have less capacity to build artesian wells to water their farms. Additionally most women work in seaweed farms. During strong periods of rainfall in the rainy season, seaweed farming has to stop since the seaweed requires sunny weather in the post-harvest treatment to achieve the best quality. In these times the women have to find different jobs, like working for other farmers. Women whose husbands work out of the village must find other ways to survive on their own while waiting for their spouse to return. Especially children suffer from the reduced income, which results in food insecurity and reduced calorie intake. Skills improvement would enable the women to find other income generation activities.

3.3 CVCA Findings at household and individual level

Based on a comprehensive analysis of survey data and results, this study presents findings on the resilience in the area of South Sulawesi/Indonesia. The results show how, and in which way, the local population in the target area is currently affected by climate change experienced through climate variability and extremes. The strategies they employ to adapt to the challenges posed by this change have been running at some point. Besides the existing adaptation strategies this study also identified gaps in resilience.

3.3.1 Climate-Resilient Livelihoods

The findings from the survey show, that livelihoods of households are mostly derived from climate-sensitive sectors such as fishing and agriculture. At the same time, they are diversified only to a small degree.

The household income in South Sulawesi's coastal villages is lower than in West Sulawesi. Almost every third household (32,1%) is registered as 'poor'. Yet the differences between the

[62]FDG North Luwu 22 November and 5 December 2012

districts are striking. Findings reveal that the poverty rate in Luwu Utara district (40,6%) is almost twice the rate in Wajo district (20,6%).

Furthermore the data shows that the overall local population living in the coastal areas is mostly gender-balanced, but with a slight surplus of women in some of the locations. While fishing villages are characterized by higher male rates, a higher female rate is typically to be found in coastal villages that are characterized by agriculture and other non-fishing based livelihood sources.

More than one out of four interviewed people fear that "weather conditions become more unpredictable", which shows that climate variability is a critical concern in South Sulawesi.[63]

The communities have developed several coping strategies due to climate change impacts but there is no or very limited direct technical assistance from the government department on the appropriate techniques or technology. The main applied coping strategies are:

- Farmers change their planting pattern to fit the season. For example, they use specific crops for the dry season, find proper land that suits their needs, elevate the dams, look for a better water source, and some change their livelihoods (for those who can't generate income otherwise)
- Fishers build simple wave breakers, use fishing nets, elevate dams, add bamboo stems to the dams to avoid them from breaking, fill sand sacks to strengthen the dams or change their livelihood, by planting sago, farming seaweed or by becoming motorcycle food sellers (*paggandeng*), market laborers, merchants or motorcycle drivers (*ojek*).

3.3.2 Disaster Risk Reduction

In the target project area, only every tenth interviewee is afraid of the potential consequences of a natural disaster. This could be due to the fact that the government supported the region in times of hardship after natural disasters, but this is still the exception in these coastal areas. Additionally, more than six out of ten households in Indonesia stated to not have been provided any support during or in the aftermath of a natural disaster. The support that had been granted, if at all, was solely given to a small number of affected households, and even then was barely enough or "not at all" helpful.

[63]CARE Deutschland-Luxemburg e.V. 2012, p. 17

3.3.3 Capacity Development

Households that had been negatively affected by climate change in the past were generally unaware of possible ways to adapt to the changing environment. This process is further hindered as half of the households in Indonesia do not have reliable access to climate information, nor do three out of four households have ever heard about the term 'climate change' before. They do not know to "what they should adapt to" and "how to adapt to it".[64]

Furthermore many people still have difficulties understanding the difference between the climate change adaptations and the hazard risk reduction.

Considering the lack of local government support (only 50% of the households in the project area can rely on help from the government) given to affected households for disaster recovery, the importance of family and social networks cannot be stressed enough and other sources of support cannot be overstated.

3.3.4 Addressing Underlying Causes of Vulnerability

There are a significant number of households that do not have access to basic household infrastructure. This lack is strongly correlated with their low income and poverty, and will be best approached through poverty-related development planning that is focused on pro-poor measures for infrastructure improvement. In general the poor have less capacity to recover after a disaster due to competing priorities they need to tend to with limited resources. Women, who are currently pursuing jobs in the seaweed industry, often have to stop this temporarily during the rainy season or in case of flooding. What is unique about this industry is, is the fact that basically only women work in it, and thus it represents a big empowerment opportunity for these women, even though they do not receive adequate salary. Unfortunately, women's economic efforts are largely invisible in South Sulawesi, and women often report that they "do not work" or "support their husband", although they make considerable contributions to household businesses.

[64]CARE Deutschland-Luxemburg e.V. (2012), p. 27.

4. Conclusion

4.1 Climate-Resilient Livelihoods

Based on available data on climate change at national level, Indonesia will experience a modest temperature increase, between 1.04°Cand1.42°C every hundred years. Furthermore the rainy season will start later and will be shorter, even though but the amount of precipitation will be the same. This implies an increased intensity of rainfall during the rainy season, whilst during the dry season the rainfall will decrease in the Indonesian region along the South of equator (such as Java and Bali). Therefore the risk of floods and droughts will increase.[65]The change of these rainfall patters will affect water resources, agriculture, infrastructure (including settlement, transportation, hydro power plant debit and spatial planning), fisheries, swamps and peat as well as coastal areas. Furthermore a sea level rise will inundate productive coastal zones and reduce farming and aquaculture opportunities which threaten food security. Finally the increasing temperature and drought will intensify water- (cholera) and vector-borne diseases (malaria and dengue).

With regards to the observed climate changes in South Sulawesi Province and particularly in the targeted BCR CC districts, the communities reported they experienced a delayed beginning and an itself shorter rainy season. Therefore there are more intense rains or higher temperatures, which represent poor fishing conditions. The variability of the seasons, such as more unpredictable rainfall patterns or temperatures, has resulted in significant changes to the window of opportunity for planting and harvesting crops, when to catch fish or not to catch, and when to plant seaweed or harvest. Finally the wind changes direction more frequently and is unpredictable.

The Government of Indonesia has released policies and decrees relating to climate change adaptation. They have also developed a National Action Plan (NAP) addressing climate change and integrated it into National Medium-Term Development Plan (RPJMN). This document is available and promoted by the national government, but the implementation of these policies, decrees and plans at the local level is still very meager. Many good policies are not well implemented at the grass-root level, primarily because they are unclear, or merely due to the lack

[65]Republic of Indonesia a 2007

of political will and lack of capacity such as interpretation of climate data considering the local context.

Livelihoods in the project area are mostly derived from climate-sensitive sectors such as fishing and agriculture. At the same time incomes are only diversified to a small extent. This high degree of resource-dependency, accompanied by a low degree of income diversification, is a clear cause for concern. On-going climate variability and extremes in the region have the potential to further deteriorate the local economic systems. For local communities in the coastal areas, there is a strong demand for innovative community-based adaptation activities that reduce the risks from coastal hazards based on this dependency.

The climate information is available at district level even though it is very limited but it is not further processed for the demand on a local level or distributed to the village. The people strongly demand this information and they can only get it partly from the television or radio.

4.2 Disaster Risk Reduction

Prevention and mitigation activities that aim to reduce the impact of disasters are still an exception in regional planning. Disaster risks are not considered in spatial plans, like declaring zones, which are at risk of flooding, and prohibiting social infrastructure (e.g. housing) on these.

Information on environmental conditions and weather forecasts are crucial for the planning of activities in the primary sector to avoid a disaster. If a dry period is forecasted, for example, drought resistant seeds can be used to avoid a crop failure. Finally the CVCA shows that climate data is available at district level but not further processed and distributed to the local level.

Furthermore institutions promote disaster relief actions, instead of supporting the preparation for these disasters. TAGANA is a disaster preparation institution under the Social Department and Indonesian Red Cross (PMI) on district level, but even this institution focuses more on post disaster relief and rehabilitation activities (e.g. distribution of food/non-food items) instead of disaster preparation. The CVCA exemplified that there is a lack of adequate disaster preparation strategies and activities. For this reason evacuation routes and shelters are existent but not maintained.

Governmental support, during and after a natural disaster, is still an exception and often fails to reach the most affected households. Reasons for this are manifold such as resource constraints

and insufficient levels of communication and/or coordination between the central and local governments.

Furthermore there is a lack of coordination in planning and programming for post disaster recoveries between involved sectors which can result in conflicting actions. For example, the Ministry of Public Works planned to rehabilitate roads, but redundantly the water management unit digs up the newly rehabilitated work to install piping systems.

In conclusion it can be said that a lot of resources are allocated for emergency and reconstruction activities rather than prevention and preparation activities, like building awareness, improving DRR systems and distributing IECs.

4.3 Capacity Building

Even though climate information is provided on the district level, there is a lack of capacity to further interpret the information considering the local context and to give recommendations for fishermen and farmers on the ground. If this information was available, it could be easily distributed to the affected communities via existing networks such as fishermen groups.

Whilst there are policy regulations on climate change on national and provincial level, they have not been implemented on a local level yet. There is still a lack of knowledge on adaptation possibilities in the communities. In times of hardship people can solely rely on their own capacity and their social networks instead of external assistance from the government.

4.4 Addressing Underlying Causes of Vulnerability

Especially the women and children of fishermen, seaweed farmers and farmers belong to the most vulnerable people. Women are often involved in seaweed businesses which are interrupted during floods. At the same time their husbands are often working in other cities since they cannot earn money in the primary sector during extreme weather conditions. This results in a income decrease and food insecurity which could lead to malnutrition. On a national level the government already admitted to put women more in the focus of its policies.

The role of women during critical times is very crucial. Results from the discussion analysis show that women have to deal with the consequences of climate change, like food security, health and water supply on a daily basis. Despite their important role of taking care of the family and management of the household, they do not participate equally in the decision making process, as men do. Additionally, even though they show that they are able to cope with the

climate change impact in the short run, the current condition indicates that they are not capable of developing a sustainable long term adaptation strategy without further support.

5. Recommendations

5.2 Climate Resilient Livelihoods

A strategy to assist vulnerable communities in their process to adapt to climate change by establishing climate resilient livelihoods has to be developed. These recommendations may serve as a starting point:

The first step in building climate resilient livelihoods is the systematic assessment of the climate variability impact on livelihoods together with the community to get an overview of cause and effect of environmental problems on the ground and existing adaptation strategies. This should be accompanied by climate projections on a local scale, to increase the awareness of the population. Furthermore the government on all administrative levels has to be encouraged to consider climate aspects and their consequences in core policies and regional planning.

People already started to adapt their livelihoods to their changing environment in order to be able to survive. These adaptation strategies should be identified and further improved, for example with technical trainings, field schools and community learning centres in cooperation with the government, to ensure the long-term sustainability of the action.

Improving access to climate-related information and providing increasingly useful weather forecasts to the local population will be the most important backbone to any development and adaptation strategy in the project areas.

Research and provision of drought and salt-tolerant crops for farmers in Eastern Indonesia is needed to adapt to projected future climate trends such as prolonged droughts and sea level rise. Furthermore crop diversification reduces the risk of crop failure since only parts of the yield are affected.

Since income in Southern Sulawesi´s coastal communities is mainly generated in climate sensitive sectors, supporting the development of alternative climate proof livelihoods and diversification of income sources could lead to a reduced vulnerability towards climate change.

Innovative interventions need to be accompanied by comprehensive feasibility studies to ensure that the intervention is suitable in the local context and climate proof. If technologies are not proofed before, and fishers and farmers fail in applying them, they will have to return to their traditional ways of working and will be very cautious when applying new technologies in the future.

If farmers and fishermen had access to the right information and tools, they should be able to make some of the necessary adaptations by themselves and to define the direction of their future development.

5.3 Disaster Risk Reduction

Climate related natural extreme events tend to increase during the course of climate change. Within DRR activities a stronger focus has to be put on preventive activities.

Coastal Zone Management, like the allocation of buffer zones, e.g. mangrove areas, which protects the coastal area from disasters such as abrasion and tidal waves, reduces the impact of climate related hazards.

Early Warning systems (El Niño, flood, drought etc.) and reliable weather forecasts help to avoid that extreme natural events turn into a disaster. If a prolonged dry season is forecasted, drought resistant seeds can be used to avoid crop failure and food insecurity.

For a functioning early warning system input of climate, population, poverty, topographic etc. data is essential. So far, the Disaster Information System DIBI on national level lacks data input from relevant ministries and is currently not functioning. Besides the data infrastructure, the capacity of the staff which is assigned for the operation of the system has to be trained. The dissemination of data from the national, via provincial to the district and sub-district level has to be regulated to ensure that the information reaches the affected population promptly to allow them to take preventive actions. To make this process more efficient local EWS, who can monitor, formulate and disseminate the warning message, have to be identified and trained. Additionally the population has to be trained in how to react in case of an early warning.

5.4 Capacity Development

The CVCA showed that there is a lack of knowledge in “what to adapt to and “how to adapt to it”. Whereas climate policies on national level are available (Indonesia´s Climate Change

Adaptation Program), these recommendations cannot be further sharpened on regional and local level yet. Involving governmental officials on all levels of the vulnerability assessments and the design of adaptation strategies is one way to increase their capacity and awareness of issues relating to climate change. Afterwards formulated strategies should be considered in the planning process and in the budget allocation.

Given that climate change adaptation is quite a young field, sharing the best practices on local level is essential for building expertise. Communities can learn from each other via community learning centres. Furthermore the best practices should be replicated in areas with similar basic conditions and considered in local planning.

A special need for capacity building on district level however still remains. Processes like analysing climate data considering the local context to provide reliable weather forecasts and climate information, which helps farmers and fishermen to schedule their activities, are still lacking significantly.

5.5 Addressing Underlying Causes of Vulnerability:

Women have a crucial role in dealing with the impact of climate change. They are the ones who have to deal with crop failure and a lack of water. Therefore they have to be specifically targeted in adaptation projects and their concerns have to be considered in decision making processes. Furthermore, involving women in vulnerability assessments enables them to formulate environmental problems they face and to articulate these in village meetings.

Additionally access to basic services is not given in a significant number of households in Southern Sulawesi. When natural disasters occur, the availability of water is significantly affected, which is why improving the water supply would be a first step to reduce climate change vulnerability.

Compared to men, women working in the seaweed industry earn less in a similar branch and position. Therefore advocating for a fair payment based on their skills and not on their gender should be initiated.

Finally, limitation factors for adaptation are mainly a lack of skills and financial resources, yet trainings in alternative occupations (e.g. seaweed farming and processing) would help to overcome these limitations.

List of References

Applegate (2002): "Forest Fires' in Indonesia: Impact and Solution"

Asian Disaster Reduction Centre (ADRC), (2005): "Total disaster risk management"

CARE Deutschland –Luxemburg e.V. (2012): "Baseline study Building coastal resilience to reduce climate change impact in Thailand and Indonesia"

Checkley et al. (2000): "Effect of El Nino and ambient temperature on hospital admissions for diarrheal diseases in Peruvian children"

Cruz et al.(2007): "Asia. Climate Change. Impact Adaptation and Vulnerability. Contribution of working group II to the 4th assessment report of the IPCC"

DNPI (2011): "Pemetaan Kerentanan di daerah provinsi serta inventarisasi kebijakan dan kelembagaan dalam rangka antisipas dampat perubahan iklim"

GFDRR (2011): "Vulnerability, Risk Reduction and Adaptation to Climate Change"

Institute for Essential Reform (IESER) (2009): "Urban Climate Change Adaptation: Vulnerability Assessment of Jakarta and Java Island"

IDRC (2010): "Mapping Climate Change Vulnerability in Southeast Asia"

IFRC (2009): "Disaster: how the Red Cross Red Crescent reduces risk"

IPCC (2007) "Report of the Inter-governmental Panel on Climate Change"

Lal (2005): "Implications of climate change on agricultural productivity and food security in South Asia"

Loukos et al. (2003): "Potential change in skip jack tuna habitat from a global warming scenario"

McMichael et al. (2003): "Climate change and human health – Risks and Responses"

Palang Merah (2009): "Palang Merah Baseline Assessment 2009"

Pascual et al. (2002): "Cholera and climate: revisiting the quantitative evidence"

Peace (2007): "Indonesia and Climate Change: current status and policies"

Republic of Indonesia a (2007): "National Action Plan addressing Climate Change"

Republic of Indonesia (2010): "National Action Plan Disaster Risk Reduction"

Republic of Indonesia b (2007): "UNDANG-UNDANG REPUBLIK INDONESIA
NOMOR 27 Tahun 2007"

Science Daily (2011, July 11): "Climate Change Threatens Endangered Freshwater turtle", p.1)

Sivakumar (2005): "Impact of present and future variability on agriculture and forestry in the arid and semiarid tropics"

Tran et al. (2005): "Building of climate change scenario for Red River catchments for sustainable development and environmental protection"

United Nations Convention to combat desertification (UNCCD) (1996), Part1, Article 1e)

Ministry of Environment (2007): “Indonesia Country Report, Climate Variability and Climate Changes and their implication”

UNDP Indonesia (2007): “The other half of climate change”

Wang et al.(2006): “The relative role of climatic and human factors in desertification in semi arid China”

WWF Indonesia (2007): “Climate change in Indonesia implication for humans and nature”

Wilkinson (ed.)(2004): “Status of coral reefs of the world”

Source of Photo : Rahman Ramlan