# Climate Vulnerability and Capacity Analysis Report

## South of Thailand

Building Coastal Resilience to Reduce Climate Change Impact
in Thailand and Indonesia (BCR CC)

raks thai foundation

care

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Implemented by
**CARE Deutschland-Luxemburg e.V.**
**in cooperation with Raks Thai Foundation**

Funded by
**The European Union**

Bangkok, February 2013

# Acknowledgements

**"**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**.

**February 2013**

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Special thanks to the Provincial Natural Resources and Environment Office and local governments in Chumphon, Nakhon Si Thammarat, Krabi, and Trang Province, Provincial Administration Organization, Sub-district Administration Organization, the participating communities, to all involved other institutions and civil society organisations.

# Foreword

In order to support coastal communities in their adaptation efforts to changing environmental conditions, CARE Deutschland-Luxemburg e.V. in cooperation with Raks Thai Foundation (RTF) and CARE International Indonesia is implementing this three-year project funded by the European Commission. ***"The Building Coastal Resilience to Reduce Climate Change Impact in Thailand and Indonesia"*** *project (BCR CC)* aims to strengthen the capacity of coastal authorities and civil society organizations in order to enhance resilience to the negative aspects of climate change in the target areas. The project has been implemented with active consultation among partners at the policy and provincial levels, including local administrative organizations in four Southern provinces of Thailand (Chumphon, Trang, Nakhon Si Thammarat, Krabi).

One component of the project is to build community understanding on the local impact of climate change and help affected communities to implement strategies for adapting to a changing environment. CARE has developed a methodology of "Climate Change Vulnerability and Capacity Analysis" (CVCA) which guides communities to identify climate change related changes and actions which already have been taken.

This analysis report compiles findings from the interviews and discussions in individual, household, community, sub-district, provincial and national levels as prescribed in the handbook, and also presents guidelines for building capacity of communities to adapt to climate change. These guidelines may be of use for study by relevant individuals and for project planning and implementation as appropriate in the months and years ahead.

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# List of abbreviations

| | |
|---|---|
| ADPC | Asian Disaster Preparedness Centre |
| BAAC | Bank of Agricultural and Agricultural Cooperatives |
| BCR CC | Building coastal resilience to reduce climate change impact |
| CBA | Community Based Adaptation |
| CCD | Community Development Department |
| CDD | Community Development Department |
| CVCA | Climate Vulnerability and Capacity Analysis |
| DDPM | Department of Disaster Prevention and Mitigation |
| DLA | Department of local administration |
| DMCR | Department of Marine and Coastal Resources |
| DOF | Department of Fisheries |
| DRR | Disaster Risk Reduction |
| GISTDA | Geo-Informatics and Space Technology Development Agency |
| HAII | Hydro and Agro Informatics Institute |
| IUCN | International Union for Conservation of Nature |
| KII | Key Informant Interviews |
| LAO | Local administrative organization |
| MOAC | Ministry of Agriculture and Agricultural Cooperatives |
| MOI | Ministry of Interior |
| MONRE | Ministry of Natural Resources and the Environment |
| NCCC | National Coordination Committee for Climate Change |
| NDWC | National Disaster Warning Centre |
| NEV | Natural Resources and Environmental Protection Volunteer |
| NREB | National Resources and Environmental Board |
| NSTDA | National Science and Technology Development Agency |
| ONEP | Office of Natural Resources and Environmental Policy and Planning |
| OPS-MONRE | Office of the Permanent Secretary for Ministry of Natural Resource and Environment |
| RID | Royal Irrigation Department |
| RTF | Raks Thai Foundation |
| SDF | Sustainable Development Foundation |
| SEA START RC | South East Asia START Regional Center |
| SEI | Stockholm Environment Institute Asia Centre |
| TAO | Tambon Administrative Organisation |
| THAI Health | Thai Health Promotion |
| TMD | Thai Metrological Board |
| TEI | Thailand Environment Institute |
| TRF | Thailand Research Fund |
| UNDP | United Nations Development Program |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WWF | World Wildlife Fund |

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# Executive Summary

CARE Deutschland Luxemburg e.V. is implementing the 3 year project ***"Building coastal resilience to reduce climate change impact in Thailand and Indonesia"***, which is funded by the European Commission, in cooperation with its partners, Raks Thai Foundation (RTF) and CARE International Indonesia. The overall goal of the project is to strengthen the capacity of coastal authorities and civil society organizations in Indonesia and Thailand in order to enhance community resilience to the adverse impacts of climate change in the target areas.

One output of the BCR CC project is the implementation of a participatory "Climate Vulnerability and Capacity Analysis" in 16 coastal sub-districts in Southern Thailand. Governmental representatives and members of civil society organizations were trained by RTF to conduct the CVCA on community level. The project expects that the use of acquired community knowledge combined with available scientific data will lead to greater understanding about local impacts of 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 analytical framework, which is based on CARE's CBA framework, presents a range of "enabling factors'" which must be in place at household/individual, community/local and national level in order for effective community-based adaptation to take place. These enabling factors are linked to the four following strategies:

1) Promotion of climate-resilient livelihoods
2) Disaster Risk Reduction
3) Capacity development for local civil society and government institutions
4) Addressing the underlying causes of vulnerability.

The CVCA findings are separated into three parts. The first part presents the findings at national level from secondary data review and qualitative research from policy coordinating meetings. The second part illustrates the results from provincial, local and community level from key information interviews and output of focus group discussions in collaboration with government agencies and civil society organizations. Findings from the household level are based on primary data, which was gained in the quantitative baseline and is described in the third part of the findings section.

***Findings at the national level:*** Climate change poses significant uncertainties and risks to the environment and development in the country through the expected impact of higher temperatures, changes in rainfall patterns, sea level rise, shift of seasons and increasing number of extreme natural events. This will mainly affect the primary economic sector (fishery and agriculture) and food security, health and coastal infrastructures. In response to that, the international dialogue within UNFCCC Thailand has appointed representatives from 19 ministries to participate in the National Coordination Committee for Climate Change (NCCC) chaired by the Prime Minister. This Committee is currently drafting the master plan in this area in collaboration with all related sectors and the civil society.

Knowledge on impact of climate change and experiences to deal with it are still at the beginning. Further research is needed to get to know more about regional climate change. This has to be combined with socio-economic data in order to estimate the impact of climate change on livelihoods of local population and to develop suitable strategies to support them.

National economic development policies do often not take into account the effects of climate change on the livelihood of the local population, which are additionally threatened by climate

variability, there is a need for involvement of representatives from multiple disciplines and administrative levels to ensure that local interests are considered in the decision making.

***Findings at provincial and local level:*** The provincial and local agencies have limited capacity to support the community in dealing with natural disasters and in adaptation to the impacts of climate change. They need to improve their capacity related to environmental management, planning, technical expertise and monitoring the enforcement of laws and regulations. These limitations are expected to hinder the rollout of the national climate change strategy, including the formulation of local adaptation priorities and action plans. There is a strong need for improved coordination of partners to improve efficiency of operations, especially in the community for activities such as rehabilitation of forested watershed areas, conservation of natural waterways and rehabilitation of disaster affected areas.

***Findings at household and individual level:*** Livelihoods of coastal communities in the South facing negative impacts of climate change, which forces the population to find new ways to adapt to these changing circumstances, such as finding alternative lifestyle or work in sectors outside of agriculture and fishery. This counts especially for communities, which rely on traditional fishing methods. Poverty and limited access to land make them most vulnerable towards the consequences of climate change impact. Local and provincial level have shown more interest in this issue and started to support building the capacity of communities to prepare for and respond to natural disasters. However, there is still a limited knowledge and understanding of "what to adapt to" and "how to adapt to."

Communities in the project area, which have experienced natural disasters associated with loss, are well aware of the importance of access to information and data such as local weather forecasts to prevent disasters. They recognize the value of preserving natural resources on which their livelihoods depend on. The communities are supported by external agencies and learn from exchanging data and consultation with partner communities. Government agencies are helping with occupational development such as the Community Development Department is running several schemes to promoting the extra jobs and alternative livelihoods for the women groups such as selling dry fishes, shrimp paste and so on. After a disaster occurred, networks of volunteers can be mobilized to provide assistance. Micro-credit and financial institutions also provide help, along with temples, mosques and government-managed relief shelters.

Thailand started to develop a framework for climate change adaptation. Nevertheless this is a crosscutting issue, which has to be systematically integrated into the strategic development plans of government and civil society organizations at different administrative levels.

# 1. Background and Objectives

Climate change is a global phenomenon with local impacts such as more frequent and severe climate related disasters and changing seasonal patterns, which hampers communities in their development efforts to improve their quality of life. 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. Thailand and Indonesia are forecasted to be highly prone to the effects of climate changes. They are among the most disaster-prone countries in the world, given the number of human lives lost during the past years.[1]

To support coastal communities in their adaptation efforts to changing environmental conditions, CARE Deutschland-Luxemburg e.V. in cooperation with Raks Thai Foundation (RTF) and CARE International Indonesia is implementing the 3 year project "Building coastal resilience to reduce climate change impact in Thailand and Indonesia" (BCR CC) which is funded by the European Commission. The BCR CC project was launched in February 2011 and is scheduled to run for 36 months. The overall aim of the project is to strengthen the capacity of coastal authorities and civil society organizations in Indonesia and Thailand in order to enhance resilience in the target areas to the adverse impacts of climate change. There are two specific objectives:

1) Coastal authorities and civil society organizations are progressively integrating climate change adaptation into sub national development, environment and disaster risk reduction strategies and plans
2) Coastal authorities and civil society organizations collaborate to design and implement innovative community based adaptation activities that reduce risks from coastal hazards

In order to achieve its objectives, the project is implemented by using the following four components:

1) Differential vulnerability to climate change is assessed in 20 coastal sub-districts in Indonesia and 16 coastal sub-districts in Thailand. Activities include participatory Climate Vulnerability and Capacity Analysis (CVCA), a participatory learning process and other baseline studies.

2) Capacity of different stakeholders to integrate climate change adaptation activities in sub-national development, environment and disaster risk management strategies and plans is enhanced in the coastal regions. Activities include assisting local authorities in application of the CVCA tool for further assessments, training on integration of climate change in planning and budgeting process, assist governments to plan and implement adaptation projects and to mainstream the action through government budget and planning.

3) Capacity of different stakeholders to develop and implement sustainable community based adaptation activities has been strengthened in four provinces in Thailand and four districts in Indonesia. Activities will include workshops to strengthen localized adaption strategies, selection of priority actions, and development of Monitoring and Evaluation tools.

[1] CARE Deutschland-Luxemburg e.V., 2012

4) Regional network of coastal climate change adaptation practitioners are established among stakeholders in five countries in the Asian region. Activities will include development of an electronic platform, organizing of inter-country cross-visits between stakeholders, and organization of an international conference.

In Thailand, the project sites were selected based on the following six main criteria, which were:

- Depletion of marine and coastal resources, less livelihood security and ecosystem services;
- Exposure to weather related natural hazards i.e. Typhoon, Storm surges, etc.
- Adaptation capacities of coastal communities
- Enabling national and local policies for adaptation
- Willingness for cooperation

The BCR CC project is implemented in four coastal provinces in Southern Thailand, Chumphon, Nakhon Si Thammarat, Krabi, and Trang. **"Climate Vulnerability and Capacity Analysis"** (CVCA) implementation handbook was introduced for participatory data collecting and analysis of information at national, local and household/individual levels. This handbook provides guidance on facilitating a participatory process for multi-stakeholder analysis and collaborative learning. It prioritizes local knowledge on climate risks and adaptation strategies in the data gathering and analysis process. The main objectives of the CVCA are: 1) Analysis of vulnerability and adaptive capacity at the community level; and 2) Combination of community knowledge and scientific data to yield greater understanding about local impacts of climate change. This will help local stakeholders to understand the implications of climate change for their livelihoods, so that they are better able to analyze risks and plan for adaptation.

The CVCA process was conducted at national, provincial and sub-district/village level through the methods of secondary data collection, institutional mapping, key informant interviews and at the village level through focus group discussion by using 6 participatory tools, such as hazard mapping, seasonal calendar, historical timeline, vulnerability matrix, Venn diagram and daily activity schedule. The results of the CVCA will be presented in this report. It gives detailed information on the impact of climate change on vulnerable groups in the project areas. The CVCA report will be shared with local and national governmental and non-governmental organizations and other actors to help them with integrating climate change adaptation issues into their work

## 2. Methodology and Tools

The CVCA process consists of secondary and primary data research. Secondary data research was conducted in form of analysis of policy documents, statistics and climate related research papers to get an overview before going into the communities. Primary data research consisted of qualitative research on national, provincial and community level in form of interviews with key informants and focus group discussions. Additionally quantitative empirical research on household level was conducted. The data collected from the various levels is triangulated and analysed to identify existing capacities and gaps regarding to community resilience. The following table provides an overview of CVCA analytical framework, including methods and tools.

**Table 1: Analytical framework, methods and tools**

| Level | Framework | Methods and tools |
|---|---|---|
| **National policy** | Climate-Resilient Livelihoods, Disaster Risk Reduction, Capacity Development and Addressing underlying cause of vulnerability | - Study and review of secondary data from existing documents and Internet-based data sources;<br>- Analysis of, policies and plans of agencies and organizations;<br>- Conduct meetings for policy coordination at the national level by the Project Policy Advisory Committee |

| Level | Framework | Methods and tools |
|---|---|---|
| **Provincial, Local and community agencies** | Climate-Resilient Livelihoods, Disaster Risk Reduction, Capacity Development and Addressing underlying cause of vulnerability | - Study and review of secondary data from existing documents and Internet-based data sources;<br>- Key informant interviews with local leaders and representatives of government organizations, LAO, schools, NGOs, and community network support groups in the project area;<br>- Conducting focus group discussions with stakeholders at the community level using rural appraisal participatory approach;<br>- Analysis of local climate change impacts in collaboration with technical specialists from SEA START RC<br>- Conducting meetings to coordinate policies at the provincial level by the Project Policy Advisory Committee |
| **Household and individual** | Climate-Resilient Livelihoods, Disaster Risk Reduction, Capacity Development, and Addressing underlying cause of vulnerability. | - Implementation of a quantitative household survey in the target communities of the project areas |

The CVCA process contains the following 5 steps:

1. Building stakeholder participation at all levels; national, provincial, and sub-district level
2. Forming CVCA working group in the project areas
3. Implementing CVCA data collection
4. Analysis and synthesis of CVCA data
5. Documenting CVCA process and presenting results to project stakeholders at all levels

## 2.1 Secondary data research

Data and information from existing documents, policy statements, research reports, technical reports and electronic media from the Internet websites of government agencies, civil society, educational institutions and international organizations was screened and summarized.

## 2.2 Qualitative data collection

As preliminary activities meetings with policy makers at the national, provincial, sub-district and community levels were conducted to ensure participation and support of stakeholders. Afterwards coastal communities were selected for the CVCA assessment in close cooperation with the stakeholders. In the next step an implementation task force was formed to oversee the CVCA process in the field and development of CVCA activity plans in each sub-districts. Training sessions were held to familiarize stakeholders such as governmental, village and civil society representatives with the concept of climate change and the CVCA methodology.

**Key informant interviews (KII):** Often policy documents present an optimistic scenario, which does not reflect the reality. Therefore it is necessary to speak with key informants who can provide information on the status of implementation of relevant policies. The CVCA handbook provides guiding questions for KII, which were conducted with representatives from LAOs, leaders of community organizations for supporting agriculture, potable water, sanitation, savings, women's affairs, and community rights in resource management. Further KIIs were conducted with NGO staff and technical specialists from schools and research institutes.

**Focus group discussions:** This activity is a key process in gaining qualitative data on the capacity and vulnerability of the community in coastal areas. Project staff facilitated the group meetings in the community in collaboration with government staff, each group consisted of 5-10 people that have been selected from local leaders, representatives of community organization networks and representative of different livelihood. The participants formed groups, segregated by age, gender, and their types of livelihood. Project staff informed members about the project, the objectives of the discussion and the process of the meetings. The following participatory tools were applied in the groups:

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 livelihoods resources in the community, and individuals or institutions that have access and control over them
   - To identify areas and resources at risk from climate hazard
   - 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[2]

The results of the discussion were reflected back to participants for validation, discussion and revision.

Focus group discussions were conducted during January to April 2012 in 32 coastal communities in the project areas. A total of 1,750 persons participated in the meetings, including 584 males and 491

[2] CARE International, 2009

females. After the discussions, the results were presented to the community to validate the information. The results from all focus group discussions were structured as following:

1) Observations of incidents related to adverse effects of climate change
2) Essential resource base for livelihoods
3) Strategies for responding to disasters and effects of climate change
4) Capacity in community management
5) Social support networks
6) Power relations related to the community and development activities

Raks Thai staffs drafted this information and consulted the result with the CVCA facilitators in each province. After that, the teams on the ground feed the synthesized information back to the targeted communities, with presentations to the policy advisory committees at various levels, which emphasis on how to put adaptation plans into the sub-districts and provincial levels.

## 2.3 Quantitative Data collection

**Household survey**: A baseline survey, which was conducted in November-December 2012 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 behaviour. 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.

The two specific objectives of the baseline study were:

- to design a quantitative household survey which is complementary to CARE's CVCA and produce baseline data from which change/impact in relation to 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 impact 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.

In total 720 household interviews were conducted in Thailand. 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, and 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 could be allocated accordingly. Sampling was done randomly amongst coastal villages. Each day was concluded with a review and data processing.[3]

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

## 3. CVCA Findings

This section is separated into three parts. The first part presents findings at the national level from the review of secondary data and qualitative research from policy coordination meetings. The second part presents findings at the local/community level from qualitative data collection in form of focus group discussions and KIIs in collaboration with government agencies at the central and local level and civil society organizations, including partners from schools and technical resource persons related to coastal areas. The third part presents findings at the household level based on data from the baseline survey.

### 3.1 National Level

Policy and organizational institutions addressing climate change in Thailand are linked with international regulations such as UNFCCC accord (2007) and the Kyoto agreement (2002). The government has appointed the National Coordination Committee for Climate Change (NCCC) with the Prime Minister as chairperson and the Minister of Natural Resources and the Environment as first deputy. The committee members are representatives of 19 ministries and related agencies. Each of these has appointed a coordination official for climate change.

The Office for Natural Resources and Environmental Policy and Planning (ONEP) is the coordination focal point for national policy on climate change and is currently preparing the master plan in this area in collaboration with all related sectors and the population. It is estimated that the draft will be completed and approved by the Cabinet by the end of 2012. The NCCC and the various ministry

coordination staff assist with the master plan development and the integration of policy and strategy into their respective institutions.

### 3.1.1 Relevant Policies

The relevant policy papers that define Thailand's strategies to deal with climate change issues are the 11th National Economic and Social Development Plan (2012-2016), National Strategic Plan on Climate Change 2008-2012 and the Thailand Climate Change Master Plan 2012 – 2050 (draft).

***Eleventh National Economic and Social Development Plan (2012-2016):*** The 11th National Plan defined six strategies as a direction of development of Thailand. Strategy number five "Managing natural resources and environment toward sustainability" covers the climate change issues. The relevant guidelines are; (1) Shift the development paradigm and direct the country to low carbon and environmentally friendly economy and society; (2) Upgrade capacity in adaptation to achieve climate-resilient society; (3) Ensure preparedness for natural disaster response. Maps and priority list of areas under risk will be prepared at the national, regional and provincial levels. Moreover, encouragement will be given to private sector, enterprises, schools and local authorities to be well-prepared and to develop action plans for disaster response ; and (4) Foster resilience towards trade related measures associated with environmental conditions and climate change impacts. Efforts will be made for surveillance and monitoring measures related to environmental conservation that may have effects on international trade and investment.[4]

***National Strategic Plan on Climate Change 2008-2012:*** There are six strategies identified under the National Strategic Plan on Climate Change 2008–2012: 1) Build capacity to adapt and reduce vulnerabilities to climate change impacts; 2) Promote greenhouse gas mitigation activities based on sustainable development; 3) Support research and development to better understand climate change, its impacts and adaptation and mitigation options; 4) Create awareness and participation of problem solving on climate change; 5) Build capacity of relevant personnel and institutions and establish a framework of coordination and integration; 6) Support international cooperation to achieve the common goal of climate change mitigation and sustainable development.[5]

***Thailand Climate Change Master Plan 2012 – 2050 (draft):*** Thailand Climate Change Master Plan is a framework of integrated policies and action plans related to climate change. Its purpose is to support climate change preparedness initiatives so that they are in line with Thailand's economic and socio-cultural contexts as well as sufficiency economy philosophy. The plan is currently reviewed by technical experts and will be endorsed by the cabinet afterwards. At the same time a budget will be developed for adaptation activities. The ONEP will create a distribution key, which regulates which amount of money will be allocated to the sectoral ministries for adaptation activities.

It can be seen that these two plans were developed in alignment with the 11th National Economic and Social Development Plan. Climate Change Adaptation is one main strategy of the National Strategic Plan on Climate Change. The Thai Climate Change Master Plan is an action plan for various agencies to help them implement climate change related activities in ways that are consistent with the national framework. But the Office of Natural Resource and Environmental Policy and Planning which the coordination focal point for national policy on climate change does not have the authority

[4] Office of the National Economic and Social Development Board (NESDB), 2012
[5] Office of Natural Resource and Environment Policy and Planning (ONEP), 2012

to insist on compliance and implement the national plan, so the prospects for a coordinated and effective response are unclear.

Furthermore, the National Strategic Plan on Climate Change 2008-2012 is merely a strategic plan on paper. The development of the Thailand Climate Change Master Plan 2012 – 2050 has been slow and remains in the draft stage. Main obstacles are difficulties in building a consensus with the general public and a lack of contributions from the relevant sectors. Thailand has integrated climate change adaptation into a national policy and draft master plan, but the plan cannot be implemented until finalized.

### 3.1.2 Institutional Mapping

At national level, there are many organizations which missions are directly and indirectly related to climate change and impacts. Those organizations can be divided into two main types such as state actors (Government agencies/ under government body) and non-state actors (non-government agencies and academic institutes) (see figure 1). The relevant agencies in each ministry have different responsibilities for climate change adaptation (see Appendix I). The major areas of responsibility can be summarized as follows:

***Source of climate information:*** The Thai Meteorological Department (TMD) is the principal source of climate information and forecasting, including issuing warnings about severe weather. Other agencies (e.g., Department of Agriculture) are responsible for issuing climate information for specific sectors such as agriculture and fisheries to help reduce risk.

***Policy and planning:*** The Department of Local Administration (DLA) conducts planning and supports implementation of local administrative organizations (LAO) to build their capacity to address local challenges. In addition, the Ministry of Natural Resources and the Environment (MONRE) and Ministry of Agriculture and Agricultural Cooperatives (MOAC) issue policy and plans in managing and conserving the natural resource.

***Promote and support the implementation:*** The Department of Disaster Prevention and Mitigation (DDPM) assists disaster victims and builds community capacity in risk management of effects of climate change. In addition, the Community Development Department (CDD) plays a role in promoting livelihood diversification among disadvantaged populations to support adaptive capacity. The Bank of Agricultural and Agricultural Cooperatives (BAAC) provides funding and loans in agricultural sectors impacted by climate change.

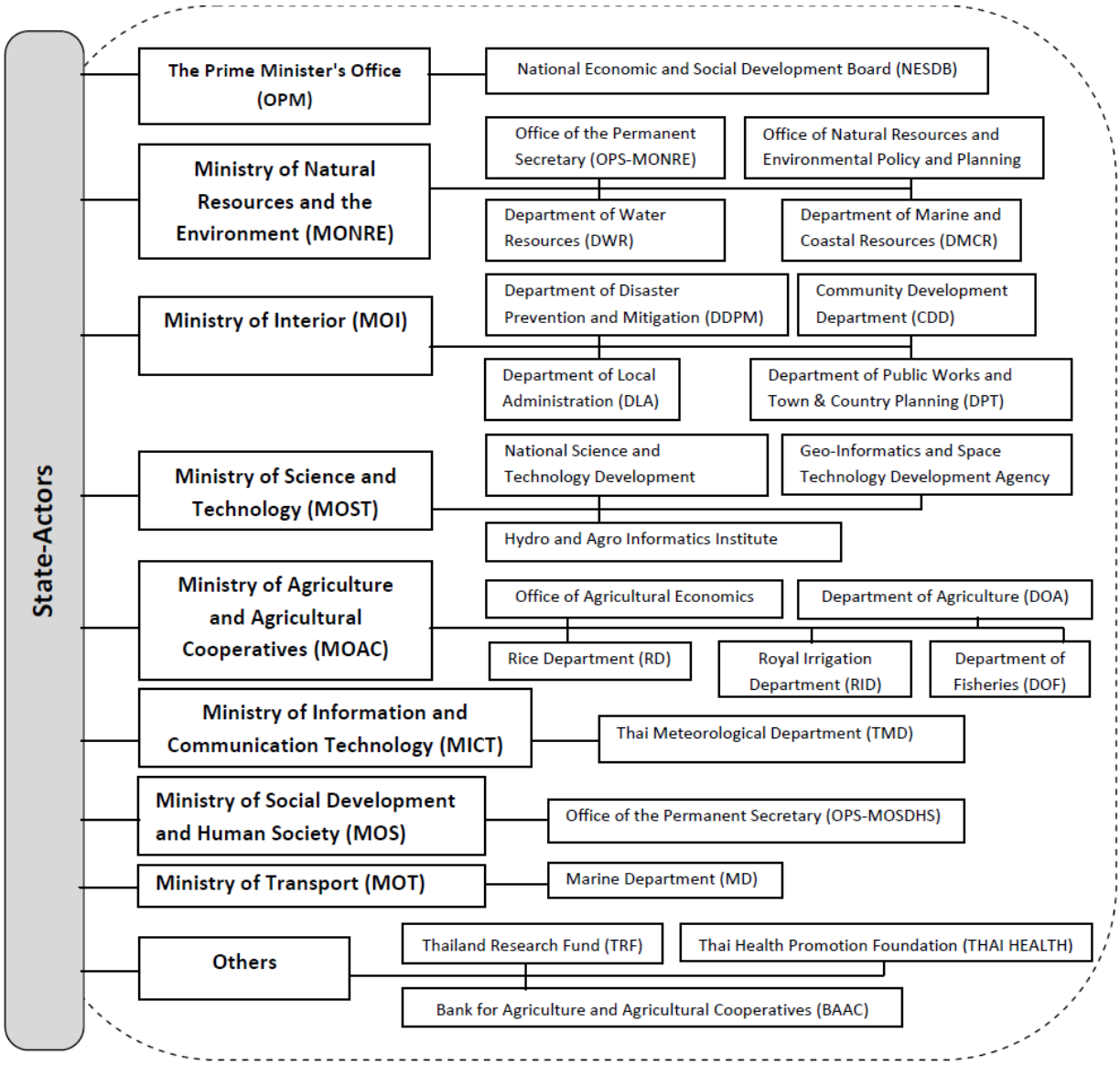
***Research and technology development:*** The key agencies in this area include educational institutions and government research agencies such as SEA START RC; the Climate Change Knowledge Management Centre, the National Science and Technology Development Agency (NSTDA) and Hydro and Agro Informatics Institute (HAII).

***Capacity building and networking:*** The key government agency which supports this and provides a platform for exchange is the Office of the Permanent Secretary for Ministry of Natural Resource and the Environment (MONRE). The Department for Marine and Coastal Resources stands out in networking and building capacity of coastal communities in managing their resource base and adapting to climate change.

Independent agencies such as the Thailand Research Fund (TRF) and Thai Health Promotion (THAI HEALTH) support research networking at the national level, and advocate local entities on

adaptation. Civil Society groups promote local participation to strengthen community capacity, and networking to exchange knowledge and skills. These groups include Raks Thai Foundation, Thailand Environment Institute (TEI), Sustainable Development Foundation (SDF), Thai Working Group on Climate Justice, the Stockholm Environment Institute Asia Centre (SEI), International Union for Conservation of Nature (IUCN), United Nations Development Program (UNDP), World Wildlife Fund (WWF), Oxfam GB Thailand Program and Asian Disaster Preparedness Centre (ADPC). In addition, many agencies are participating in the Adaptation Knowledge Platform in Thailand to build country capacity and resilience to climate change. The related missions and role on climate change adaptation of organisations at the national level are depicted in table 2.

**Figure 1: Climate change institutional mapping in Thailand**



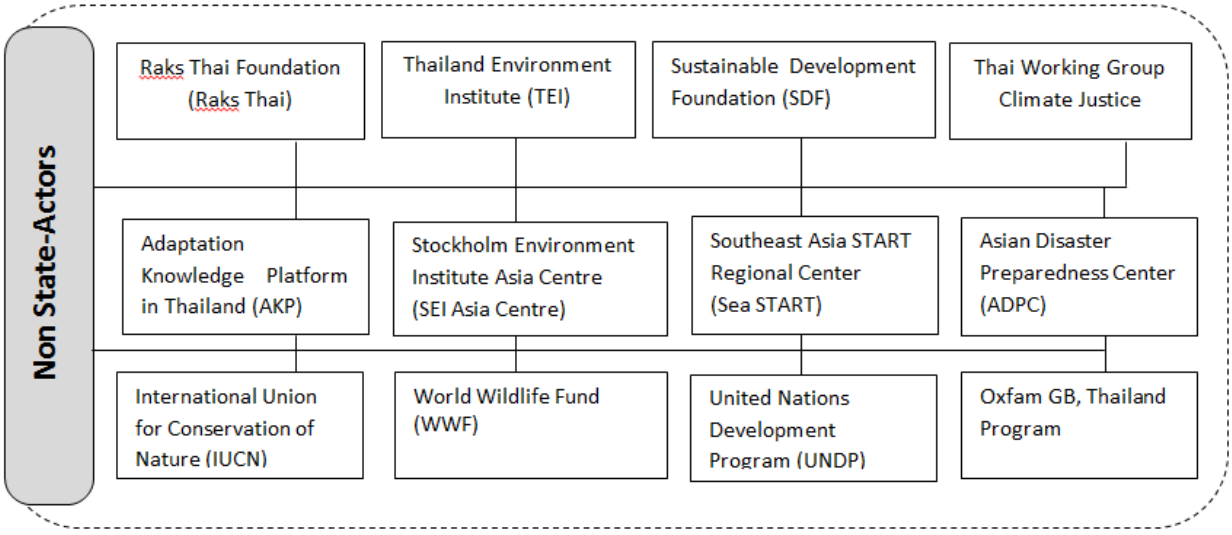



**Table 2: Organisation's Roles on Climate Change Adaptation at national level**

| Organizations | Source of climate information | Policy and planning | Promote, support the implementation | Research and technology development | Capacity building and networking |
|---|---|---|---|---|---|
| **The Prime Minister's Office (OPM)** | | | | | |
| National Economic and Social Development Board (NESDB) | | ✓ | | | |
| **Ministry of Natural Resources and the Environment (MONRE)** | | | | | |
| Office of the Permanent Secretary (OPS-MONRE) | | ✓ | ✓ | | ✓ |
| Office of Natural Resources and Environmental Policy and Planning (ONEP) | ✓ | ✓ | | | |
| Department of Water Resources (DWR) | ✓ | ✓ | | ✓ | |
| Department of Marine and Coastal Resources (DMCR) | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Ministry of Interior (MOI)** | | | | | |
| Department of Disaster Prevention and Mitigation (DDPM) | ✓ | ✓ | ✓ | | ✓ |
| Community Development Department (CDD) | ✓ | ✓ | ✓ | | |
| Department of Local Administration (DLA) | | ✓ | ✓ | | |
| Department of Public Works and Town & Country Planning (DPT) | | ✓ | | | |
| **Ministry of Science and Technology (MOST)** | | | | | |
| National Science and Technology Development (NSTDA) | ✓ | | | ✓ | |
| Geo-Informatics and Space Technology Development Agency (GISDA) | ✓ | | | ✓ | |
| Hydra and Agro Informatics Institute (HAII) | ✓ | ✓ | | ✓ | |

| Organizations | Source of climate information | Policy and planning | Promote, support the implementation | Research and technology development | Capacity building and networking |
|---|---|---|---|---|---|
| **Ministry of Agriculture and Agricultural Cooperatives (MOAC)** | | | | | |
| Office of Agricultural Economics (OAE) | ✓ | ✓ | | ✓ | |
| Department of Agricultural (DOA) | ✓ | ✓ | | ✓ | |
| Rice Department (RD) | | | | ✓ | |
| Royal Irrigation Department (RID) | ✓ | ✓ | ✓ | | |
| Department of Fisheries (DOF) | ✓ | | ✓ | ✓ | |
| **Ministry of Information and Communication Technology (MICT)** | | | | | |
| Thai Meteorological Department (TMD) | ✓ | | | | |
| **Ministry of Social Development and Human Society (MOS)** | | | | | |
| Office of the Permanent Secretary (OPS-MOS) | | ✓ | ✓ | | ✓ |
| **Ministry of Transport (MOT)** | | | | | |
| Marine Department (MD) | | ✓ | | | |
| | | | | | |
| **Others** | | | | | |
| Thailand Research Fund (TRF) | ✓ | | | ✓ | ✓ |
| Thai Health Promotion Foundation (THAI HEALTH) | ✓ | | ✓ | | ✓ |
| Bank for Agriculture and Agricultural Cooperatives (BAAC) | | | ✓ | | |
| **Non-state actors** | | | | | |
| Raks Thai Foundation (Raks Thai) | | | ✓ | | ✓ |
| Thailand Environment Institute (TEI) | | | ✓ | | ✓ |
| Sustainable Development Foundation (SDF) | | | ✓ | | ✓ |
| Thai Working Group Climate Justice | | | | | ✓ |
| Adaptation Knowledge Platform in Thailand (ADK) | ✓ | | | | ✓ |
| Stockholm Environment Institute Asia Center (SEI Asia Centre) | ✓ | | | ✓ | |
| Southeast Asia START Regional Center (Sea START) | ✓ | | | ✓ | |
| Asian Disaster Preparedness Center (ADPC) | ✓ | | | ✓ | |
| United Nations Development Program (UNDP) | | | | | ✓ |
| International Union for Conservation of Nature (IUCN) | ✓ | | | | ✓ |
| World Wildlife Fund | ✓ | | | | ✓ |
| Oxfam GB | ✓ | | | | ✓ |

### 3.1.3 Climate-Resilient Livelihoods

Thailand consists of a land area of over 513,120 $km^2$ with diverse topographies. The North of the country is mountainous whereas the Northeast consists of a plateau, bordered to the East by the Mekong River. The centre of the country is dominated by the predominantly flat Chao Phraya river valley, which runs into the Gulf of Thailand, while Southern Thailand consists of the narrow area that widens into the Malay Peninsula. There are six geographical regions, which differ from the others in population, basic resources, natural features, and level of social and economic development. The diversity of the regions is the most pronounced attribute of Thailand's physical setting. In the West Thailand is surrounded by Andaman and in the East by the Gulf of Thailand.

The Chao Phraya and the Mekong River are the lifelines of rural Thailand and its large scale rice paddy field crop production. The Gulf of Thailand covers 320,000 $km^2$ and is fed by the Chao Phraya, Maeklong, Bangpakong, and Tapi rivers. The Andaman Sea is regarded as Thailand's most precious natural resource as it hosts the most popular tourism sites, which - despite the Tsunami which occurred in 2004 - still attracts tourists from around the world.

The local climate is tropical and characterized by monsoons. A rainy, warm, and cloudy southwest monsoon occurs from mid-May to September and a dry, cool northeast monsoon from November to mid-March. The Southern isthmus is always hot and humid. In general the seasons can be classified as follows:

- ***Summer season:*** This occurs from February to May during transition between northeast monsoon and southwest monsoon, during which temperatures range from 35.0 – 39.9 degrees Celsius.
- ***Rainy season:*** This occurs from May to October during which the southwest monsoon blankets the country with wind and rains, until reversed by the northeast monsoon in October, when temperatures cool down and rainfall declines, particularly in the north and northeast regions. However in the south of the country, the rain continues through December and sometimes is so heavy that it causes flooding on the eastern side of the region.
- ***Winter season:*** This occurs from October to February when the northeast monsoon begins to cover the country. The transition period during October is marked by climate variability.

Total average annual rainfall is about 1,572.2 ml. During summer, the western coast of the south experiences more annual rainfall than the East with highest precipitation rates in September. During winter, the reverse is the case, with heaviest rainfall in November.

Thailand is located in the tropical climate zone and thus experiences high temperatures year-round with an average annual temperature of 27˚C, with a maximum daily temperature of 40˚ C during the summer season.

During winter, the central of Thailand primarily was buffeted by winds from the north and northeast. In the south the winds are coming from the northeast and east. During the rainy season most of the winds are coming from the west, southwest and south. During summer season, the direction of wind is unpredictable.

The Thai Meteorological Department (TMD) reports on current climate conductions and forecasts. This information is disseminated through the internet, radio, TV, and mass media outlets. Agencies

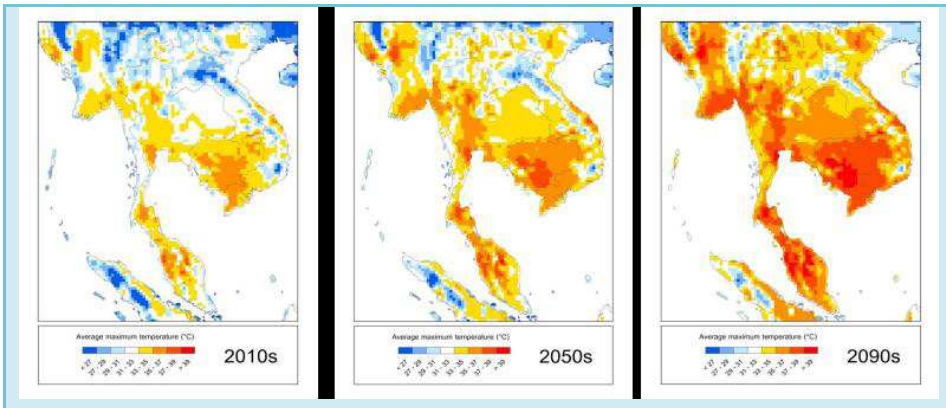
which collect scientific information about climate and trends are the Geo-Informatics and Space Technology Development Agency (GISTDA), which relies on satellite-based data and remote sensing and the Climate Change Knowledge Management Centre of the National Science and Technology Development Agency (NSTDA).

The "Future Climate Projection for Thailand and Mainland Southeast Asia Using PRECIS Climate Models", Southeast Asia START Regional Center Technical Report No. 18 (2009) indicates the following developments until 2049:

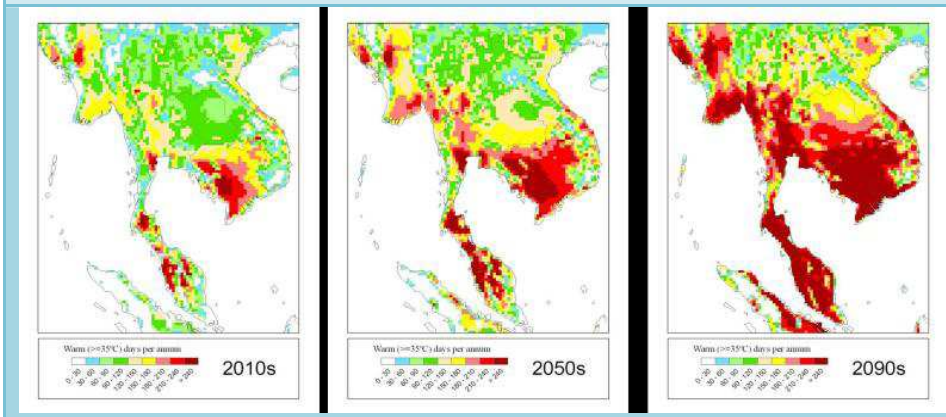
- The average temperature for Thailand will increase steadily over time
- The number of days with high heat (over 35 C°) will increase steadily in each region
- The number of days with cool weather (under 15 C°) will decrease
- The average annual rainfall will increase, but the number of days with rainfall will decrease, indicating that the rainfall will be heavier per episode
- The monsoon winds will become stronger and will increase in storm strength and frequency

In conclusion, rainfall in Thailand will become heavier which increases risk of flash flooding. At the same time, the duration of the summer season will lengthen with higher mean temperatures. This could increase incidence and duration of drought in all regions of the country. The direction and velocity of winds in the South region, which has geographic features of a peninsula, will certainly cause distinctive climate changes (see figure 2).

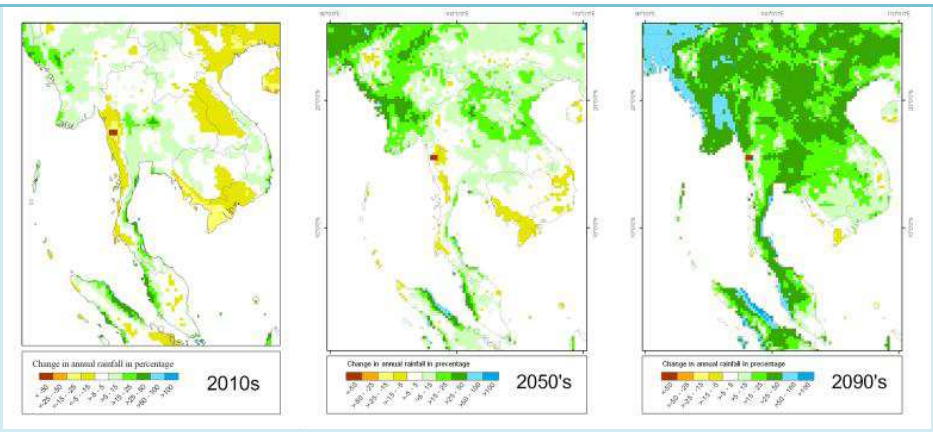
**Figure 2: Thailand climate projection information**




Estimates of high mean temperatures by decade showing increasing trends




Estimates of duration of the hot season by decade showing increased duration over time




Estimates of amount of annual mean rainfall by decade showing increased volume

Source: http: Climatechange.jgsee.org

Climate change poses significant uncertainties and risks to the environment and the development in Thailand through its expected impacts such as rising temperature, changes in seasonal rainfall patterns and extreme climatic events. Significant impacts from climate change are expected in many areas including ecosystem and biodiversity, agriculture, water resources, coastal development and tourism.[6] The National Economic and Social Development Board has synthesized the results of studies on the vulnerability of different communities. The findings of the studies show that the vulnerability of local livelihoods to climate change is generally quite high. The results can be summarized as follows:

- **Agricultural communities:** This refers especially to those in the Northeast region where the main livelihood is agriculture, which is heavily dependent on rainfall. The usual agricultural practice is planting single crop only. In case of crop failure, the farmers will lose everything. Families in this region are in debt because climate caused natural disasters (drought, flood) and also man-made disasters caused by deforestation (landslide) destroyed their harvest (see figure 3 and 4).

[6] Adaptation Knowledge Platform for Asia, 2010

**Figure 3: Areas at risk of climate change impacts on rice production: 2030-2039**

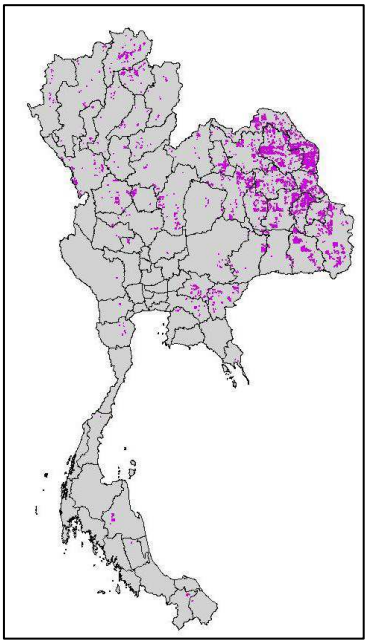
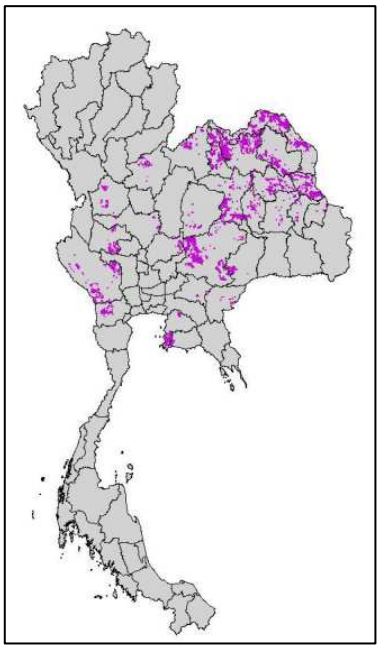


**Figure 4: Areas at risk of climate change impacts on cassava production: 2030-2039**



Source: SEA START RCRC, 2010

- **Coastal communities:** While there is diversity of livelihoods in these areas such as working in agricultural sector or tourism, most vulnerable to climate change are fishing communities. Their knowledge and skills are narrowly related to fishing and they are overly dependent on this occupation and the coastal environment. The climate change effects that most directly impact these communities include strengthening of the monsoons and tropical storms which reduces the number of days on which fishermen can go out to the sea due to high tide, which means less income for them. Other impacts include degradation of mangrove forest, which among other factors (e.g. overfishing) contributes to depleting of fish stocks and coastal erosion. Due to erosion some houses have to be re-located further inland.
- **Urban communities:** The effects of climate change can impact on city dwellers in multiple ways through heavy monsoon rains, which cause flooding of streets and roadways. Saltwater contamination of underground freshwater resources can also affect the piped water systems in these urban communities.

In addition, tourism is an example of an economically important sector with significant infrastructure and livelihoods potentially vulnerable to climate change. Many tourist destinations in Thailand are located in low-lying coastal areas. Sea-level rises, increases in storm surges or cyclone intensities, and river-based flooding could all have serious impacts.[7]

Based on the projection scenario of climate change information indicates that the impact will most affect the following three dimensions: (1) Physical infrastructure, settlement development and tourism – especially in coastal areas. Rising sea levels, high tides, erosion, severe monsoons, floods

[7] Atsamon,L.; Sangchan, L.; Thavivongse, S., 2009

and unpredictable weather patterns lead more and more to destruction of coastal infrastructures. (2) The primary economic sector (agriculture and fishery) accounts for 40% of economic production and is an important component of the food supply and economic development of the nation over the long-term (3) Health and health services: poor sanitation areas are most at risk from climate-related disaster, for example, increasing risk of food and water-borne diseases, including changing rates and patterns of dengue epidemics. [8] This information shows that the government, civil society and technical specialists are already monitoring and analysing potential vulnerability towards climate change and its impact on livelihoods of people across a variety of sectors and levels. Agriculture, fisheries and tourism, which are key components of the national economy, are the most vulnerable sectors towards climate variability. The planning in these sectors does not explicitly consider coherence with climate change adaptation strategies.

The national plan on climate change mentions the link between climate change and poverty but climate change adaptation strategies are not specifically mentioned in the poverty reduction strategy.

### 3.1.4 Disaster Risk Reduction

Thailand is located in a monsoon region of Southeast Asia and, thus, is particularly vulnerable to adverse impacts of climate change:

- Meteorological effects include higher waves, tropical storms, and drought and shortage of rainy seasons
- Hydrological effects include water run-off, flash flooding, stagnant flood waters, and higher tides;
- Ecosystem effects such as salinization of freshwater and a reduced number of fishes

In average, three to four serious tropical storms strike Thailand each year. These storms most commonly pass through the North and Northeast from November. During September to October, violent storms may occur anywhere in the country, whereas the strongest of the year occurring in October. Most of the storms affecting the North of the country are tropical depressions, and damage from these is limited when compared to the South which has exposure to sea effects. Tropical storms cause landslide in the South from the Gulf of Thailand, which can be very destructive (e.g. tropical storm Harriet in Nakhon Si Thammarat on October 25-26, 1962, typhoon Gay which hit Chumphon on November 4, 1989 and typhoon Linda which hit Prachuap Kirikan on November 4, 1997).[9]

Thailand is located in a tropical zone which is subject to the influences of monsoons and tropical hurricanes resulting in natural disaster impacts, such as floods, landslides, droughts, wildfires, etc. Thailand suffers quite often from these disasters; the occurrences of which are becoming more often and more severe than before. The disasters related to climate change situations are as follows:

**Floods:** Although very huge floods occurred in Thailand in 1917 and 1942, flooding typically happens every year; with big floods in some years and very minimal floods in some years. However, recently, floods have become a common disaster phenomenon. In 2001, severe damage resulted when the country was flooded 14 times: 60 provinces have been affected with

[8] Ming San, K.; Kopkun, R., 2010

[9] Metrological Department, 2012; http://www.tmd.go.th/

[10] Ministry of Transport, 2009; http://www.otp.go.th/pdf/2552/MOT_SafetyOperation.pdf

244 people were killed and damage costing 3.6 million baht (EUR 90,000). [10] The six floods, which occurred in 2005 affected 48 provinces and resulted in 27 people killed and financial loss amounting 4.7 million Baht (EUR 117,000).

**Storms:** Summer storms usually occur in the summer and tropical storms during the rainy season, causing much damage where they pass through. Each year, Thailand feels the impact from storms suffering massive losses. In 2001, when 1,061 storms which occurred in 70 provinces resulted in 6 people killed and financial losses amounting 501 million Baht (EUR 12.4 million). [11]In 2004, 3,834 storms in 76 provinces caused 73 people killed and financial losses amounting 398 million Baht (EUR 9 .9 million).

**Droughts:** Droughts were caused by delayed start or earlier-than-usual end of the rainy season, impacting upon the water volume in the water storage areas and resulting in water shortage problems for consumers. Drought occurrences in Thailand appear to be increasing in severe. In 2001, drought occurred in 51 provinces and impacted 18.9 million people from 7.3 million households and damaged 1.7 million rai of agriculture land, amounting 72 million Baht (EUR 1.7 million). In 2005, drought in 71 provinces impacted 11.4 million people in 2.7 million households, and damaged 13.7 rai of agriculture land amounting 7.5 million Baht (EUR 187,000).

Other natural and manmade disasters which are not climate related are earthquakes, tsunamis with adverse impacts on oceanic and coastal ecosystems, industrial pollution from tourism, agriculture, fisheries, cottage industry, petroleum and large-scale energy enterprises (SEA START RC, 2009). The projections indicate climate change increases the frequency and severity of extreme natural events such as flooding, landslides, tropical storms, monsoons, seasonal variation, rainfall and drought. The flood risk areas are scattered throughout the country while the drought risk areas are mostly in the north-eastern part of the country (see figure 5 and 6).

**Figure 5: Flood risk areas**

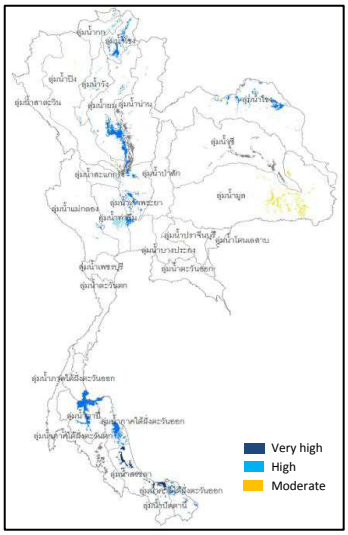
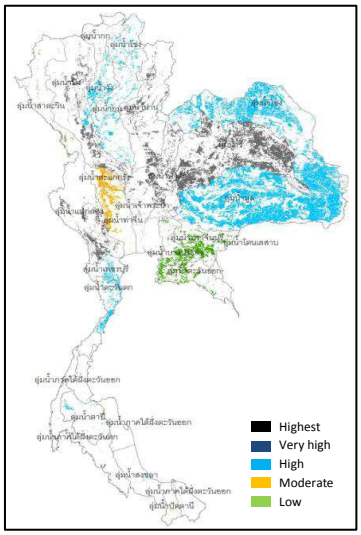



**Figure 6: Drought risk areas**



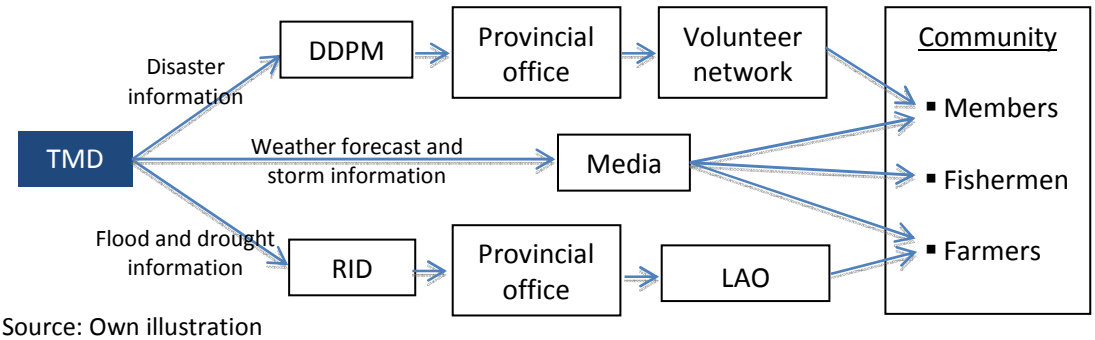

Source: SEA START RC, 2010

[11] Ministry of Transport, 2009; http://www.otp.go.th/pdf/2552/MOT_SafetyOperation.pdf

Climate change affects a broader dimension of social, economic, ecological aspects and leads to increased frequency of disasters due to the intensified monsoon. Communities at risk of flooding are located in the eastern and southern coasts of the country, including major cities like Bangkok. The National Disaster Prevention and Mitigation Plan (2012 – 2014) indicated that flash floods might occur if the drainage system is not efficient enough. Sea level rising can result in more serious consequences in the coastal central Gulf of Thailand. Climate change will aggravate the problem of sectors that are sensitive to the fragile coastal ecosystems such as agriculture, including health problems and the increasing spread of infectious diseases such as malaria and dengue fever. When combined with population migration for various reasons, it will lead to the spread of disease and social problems.

The Thai Meteorological Department (TMD) issues warnings of severe weather resulting from variable climate in Thailand and the region. The information will be disseminated to the national TV stations and will be uploaded on a website (www.ndwc.or.th). The information is shared with the Royal Irrigation Department (RID) and its branches on provincial level. The warnings of flood and drought are issued through the RID and forwarded to the irrigation station in the affected area and shared with the LAO in the respective area. The LAO will inform the community. Another agency which issues climate-related warnings is the Department of Disaster Prevention and Mitigation (DDPM), they forward this information to the provincial unit. From there, the information is directly disseminated to the local volunteer network. General weather forecast and storm formation information will be disseminated via national and local media directly to community members, including fishermen and farmers (see figure 7).

**Figure 7: Disaster warning process**




Source: Own illustration

Key agencies of risk management are the National Disaster Prevention and Mitigation Committee (NDPMC) with the Prime Minister as the chairperson and the Department for Prevention and Mitigation of National Disasters (DDPM) as the secretariat. The DDPM under the Ministry of Interior (MOI) is the principal focal point for coordination, policy and planning for disaster prevention and mitigation. In the event of a national disaster the provincial committee for disaster prevention and mitigation will be in charge for response in own responsibility. They have the authority to support affected communities with a budget of 50 million Baht (EUR 1.2 million). The local administrative organizations (LAO) are the legal entities at the local level to formulate policy, plans and budgets for

emergency assistance, including support for defence volunteer networks and communities to reduce risk of disasters throughout the country.[12]

The key government agencies responsible for analysis, monitoring and disseminating information on disaster risk, including evaluation of systems are the Thai Meteorological Department (TMD) under the Ministry of Technology and Communications, the National Disaster Warning Center, and the Water Resources Information Center. Other agencies are linked with these groups including the Department of Mineral Resources, the DDPM, the Natural Disaster Research Center of Rangsit University, the International Environment and Energy Research Center and SEA START RC. The key agencies for disaster warning include the DDPM, the National Disaster Warning Center and their provincial branches, including the national network of volunteers and civil society agencies.[12]

Under the MOI the DDPM established a committee structure for disaster prevention and mitigation, which is reaching down from the central to the community level. Collaborating agencies include the Institute for Medical Emergency Response (Narenthorn EMS Center), the Ministry of Public Health, the disaster relief unit of the Ministry of Defense, the Thai Red Cross Society, the Network of Businesses for Society and the Environment, the mass media, the network of development volunteers, and the general public, with support from international agencies.

After the 2004 Tsunami, a lot of efforts were put in strengthening disaster preparedness. Nevertheless, the level of coverage of communities and LAO with preparedness support was estimated to be only 25% as targeted by the DDPM and the Department of Local Administration of the MOI. The early warning system is not optimally efficient and has inadequate coverage. Local people are constantly trained on how to behave in case of an early warning and have to develop a routine for the emergency case. The government is currently trying to fill these gaps with the involvement of related ministry such as the Thai Meteorological Department and the Department of Technology and Science and related ministries for greater efficiency.

Some agencies can provide financial support to affected communities (e.g. Bank of Agriculture and Agricultural Cooperatives). The government has discretionary budget to provide financial assistance after natural disaster on a case-by-case basis and channels this through such agencies as the Ministry of Agricultural and Agricultural Cooperatives (MOAC) and Ministry of Interior (MOI). Some agencies support technology, knowledge, equipment and supplies. Government agencies, which provide in-kind support, include the Department of Disaster Prevention and Mitigation (DDPM), the Community Development Department (CDD), Royal Irrigation Department (RID), and the Department of Fisheries (DOF).

The government agencies spent more budgets in assisting the disasters' victims and affected people. It was almost 10,000 million baht (EUR 248 million) in 2008. During the year 2006-2008, the average increasing rate of budget that the government allocated to help disaster victims is approximately 20% per year. Most of the government spending contributes to flood and drought as 59.92 % and 25.55 % of total respectively.

[12] www.ndwc.or.th

### 3.1.5 Capacity Development

The government, civil society and educational institutions are playing a key role in supporting communities to become better prepared for adverse consequences of climate change, as described below.

#### Building capacity of communities and agencies

Although the agencies at national level do not have direct mandate on building capacity of communities, they have indirect influence by conducting plans and provide a framework for local agencies to implement adaptation activities at local level. Some agencies also have the sub agencies at both provincial level, district level and local level. As it can be seen from the table 2, there are especially some agencies of MONRE and MOI that play a role in providing capacity building as well. For instance, the ONEP has developed the Thailand Climate Change Master Plan 2012–2050, which includes adaptation strategies. However the plan does not contain a section on capacity building activities.

The Natural Resources and Environmental Management (NRE) Office at provincial level would draw its action plan and implementation of adaptation activities following the mentioned master plan. DDPM has the mission to develop the National Disaster Prevention and Mitigation Plan 2010 – 2014 that identifies the management and adaptation strategies for DDPM unit at provincial and local level to implement. Furthermore, the DDPM at national level also support capacity development of their units at provincial and local level.

The Department of Local Administration (DLA) supports the LAO to have greater capacity and ability to deal with local challenges. The Community Development Department (CDD) supports planning and community development. The Ministry of Social Development and Human Security works to build capacity of disadvantaged and low-income population, which are adversely affected by climate change.

Persons who are working in agricultural sector are receiving assistance from different organizations such as the Office of Agricultural Economics (OAE), the Department of Agriculture (DOA), Rice Department (RD), and the Department of Fisheries (DOF). This assistance consists of providing support related to crop cultivation and fishing to help reducing risk from effects of climate change.

Increasing knowledge and sharing lessons learned are important ways to help communities to adapt. An important agency, which supports this kind of activity both national and local levels is the Thailand Research Fund (TRF). TRF provides funding for research and shares the results with publics and also the vulnerable populations. Numbers of private and international organizations are involved in climate change research including the Stockholm Environment Institute Asia Centre (SEI Asia Centre), Southeast Asia START Regional Center (SEA START) and Asian Disaster Preparedness Center (ADPC). These organizations provide scientific information, research, scenarios of climate change impacts rather than implementation.

#### Networking

Many public and private agencies are involved in creating a forum and platform for knowledge exchange, coordination support, networking, and community mobilization. There is horizontal coordination for networking, and coordination for management and advocacy on guidelines for adaptation at the national and local levels. A key national agency at the forefront of this effort is the

Office of the Permanent Secretary for Ministry of Natural Resource and Environment (OPS-MONRE), which actively promotes networking to natural resource management and environmental protection by setting the Natural Resources and Environmental Protection Volunteer (NEV) Network at community level in each province. The objective of establishment of NEV is to appoint a contact person at the community level for working on natural and environment conservation and protection. The NEV-Net gathers all NEV contact persons together to build a network at provincial level. The NRE Office of each province would provide training, build capacity and support both knowledge and fund to NEV contact persons in working for their communities.

Disaster preparedness and disaster risk reduction are also areas of NEV. At the provincial level there is the Department of Marine and Coastal Resources (DMCR), which stands out for its support of networking and strengthening coastal communities in preserving the resource base and adapting to climate change. DMCR also sets up the Mangrove Conservation Volunteer Network at local level. For example, the Mangrove Development Station, local unit under DMCR, promotes this network at community level and support knowledge and fund for local activities such as mangrove patrolling and mangrove replanting.

### 3.1.6 Addressing Underlying Causes of Vulnerability

Present government policies for development of coastal regions focus on the construction of deep-sea ports, oil and gas exploration in the sea, construction of electricity generating plants such as coal-fired power plants, establishment of petro-chemical industry zones, agro-industry, rubber/palm farming, commercial fisheries and tourism which has direct impacts on the degradation of marine ecosystems and the coastal environment. This largely affects the livelihoods and lifestyles of the local communities in a negative way. Neglecting local concerns results in conflict among many different groups on issues related to access and preservation of marine resources and the coastal areas. For example, the practice of encroaching watershed forest to plant rubber trees due to weak enforcement, energy resource exploration in the Gulf of Thailand without comprehensive environmental assessment, impacts of proposed construction of deep-sea port in important marine ecological area inside a marine national park in Satun Province. Market-driven practice and policy to promote rubber/palm plantations resulting in conflict between government and private interests in land use and the resulting risk of flash floods, pollution of rivers and ocean in the coastal areas, declining marine production which threatens food security local livelihoods and small-scale agricultural enterprises. These kinds of policy decisions often lead to environmental degradation and reduce local adaptive capacity for external threats such as climate change.

The government policy and plans specify the importance of “green” economic development and stress environmental friendly development and response to climate change but no actions have been taken at this point. Attempts to improve the management of marine and coastal resources such as community-based conservation areas have not progressed as well as it should because of the lack of continuity and institutional support, in form of a particularly high turnover rate of executives at the DMCR and other government organizations. This increases the vulnerability of the coastal communities and neglected minorities. Especially vulnerable towards climate change are women since they take care of the household and nutrition and health of the family members. They are the first who will notice food insecurity and lack of potable water. Ethnic minorities such as Moken and Orang Laut, whose local environment and ecosystems are threatened, face limited ability to collect and cultivate food sources.

Encouraged by these challenges, community networks related to fishing, land use, forests, human rights and minorities started to cooperate with NGOs and educational institutions to advocate for policy review and to address, inequalities in the application of laws which often leads to conflict regarding land use, forests and fishing. This networking activity resulted in the formation of the Thailand Climate Justice network, which lobbies for considering the input of the community and local sectors in the planning process.

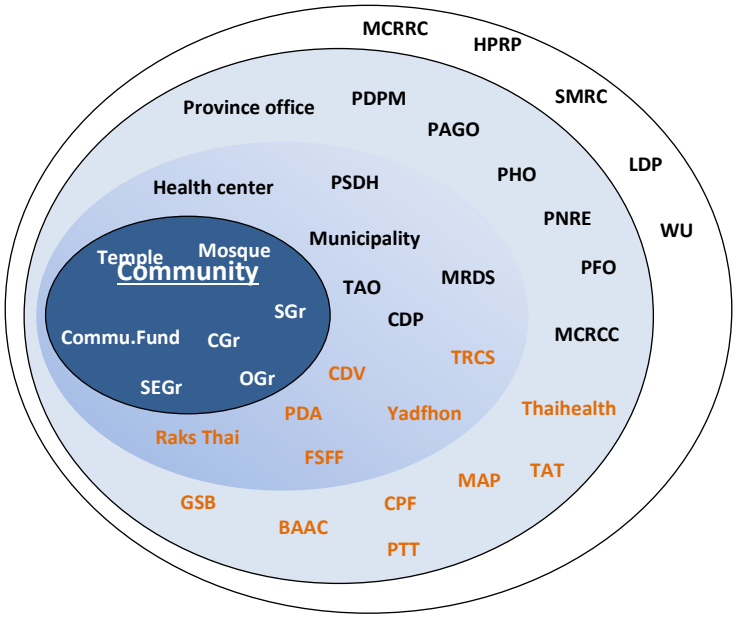
## 3.2 Provincial/Local Government and Community Level

The analysis of all agencies at the provincial and community is based on data gathered from interviews and focus groups discussions with staff of various agencies about the current environmental situation and impacts of climate change. The analysis showed that the agencies responsible for building community capacity to prepare for and respond to natural disasters related to climate change can be categorized in governmental, local administrative organizations (LAO), community groups, external agencies and development NGOs. (See details in the appendix II).

1) ***Governmental agencies:*** Most of these agencies are provincially based whereas some have district and sub-district branch offices working closely with communities. These agencies are responsible for policy formulation and planning. The Provincial Administrative Office functions as coordinator of provincial policies and planning. The assistance agencies and community groups are in charge of prevention and mitigation of the impacts of natural disasters and conduct regular capacity building; for example the DDPM and NRE Office at provincial level. The involved agencies cover the fields of agriculture, health, community development and mangrove forest conservation and have branch outlets at the sub-district level. Some governmental agencies and technical institutions furthermore provide data and serve as technical resources to consult community on their climate change awareness.
2) ***Local administrative organizations/community groups:*** These groups include the Tambon administrative organization (TAO), municipality institutions, religions institutions, volunteer groups, loan fund cooperatives, occupational support groups, conservation groups, and other social organizations. These groups can operate independently and in collaboration with external agencies which provide assistance to the locality. In some communities, the LAO (i.e., the TAO and municipality) does integrated disaster planning which is reflected in the community development plan; whereas in other communities, disaster response plans are developed as standalone plans.
3) ***External agencies:*** These include private companies, and NGOs. Most of the agencies operate on national level with branches on the provincial level. They provide community support on an ad hoc basis. Some work closely with communities over a three to five-year period. Most of them play a role in natural resource conservation, building local leader capacity, occupational development and community fund establishment. They also support networking to improve knowledge and collaboration between communities and with relevant agencies.

The agencies at the provincial and local levels and external agencies play different, but complimentary roles, in promoting the goals. Some improve awareness whereas others provide funding and equipment, conduct capacity building and planning or establishing information resources (see figure 8).

**Figure 8: Organizations in the provinces, locals and communities relevant to the capacity development on climate change adaptation**




| | Abbreviation |
|---|---|
| Government Organizations | |
| PDPM | Office of Provincial Disaster Prevention and Mitigation |
| HPRP | Hydrological Center, Provincial Irrigation Project |
| MRC | Meteorological Regional Center |
| CDP | Community Development Provincial/ District Office |
| PSDH | Provincial Social Development and Human Security Office |
| PHO | Provincial/District Health Office, Health Center |
| LDP | Land Development Provincial Office |
| PARO | Provincial/ District/ Sub-district Agricultural Office |
| PFO | Provincial/ District Fisheries Office |
| PNRE | Provincial Office of Natural Resources and Environment |
| MRDS | Mangrove Resources Development Stations |
| MCRRC | Marine and Coastal Resources Research Center |
| MCRCC | Marine and Coastal Resources Conservation Center |
| WU | Walailax University |
| TAO | Tambon (Sub-district) Administrative Office |
| Others | |
| CDV | Civil Defense Volunteers |
| SEGr | Sufficient Economy Group |
| SGr | Social groups |
| CGr | Conservation groups |
| OGr | Occupation groups |
| TAT | Tourism Authority of Thailand |
| BAAC | Bank of Agriculture and Agricultural Cooperatives |
| PDA | Population and Community Development Association |
| FSFF | Federation of Southern Fisher Folks |
| MAP | Mangrove Action Project |
| TRCS | Thai Red Cross Society |
| GSB | Government Savings Bank |
| PTT | PTT Public Company limited |
| CPF | CP Food Public Company limited etc. |

Source: Own illustration

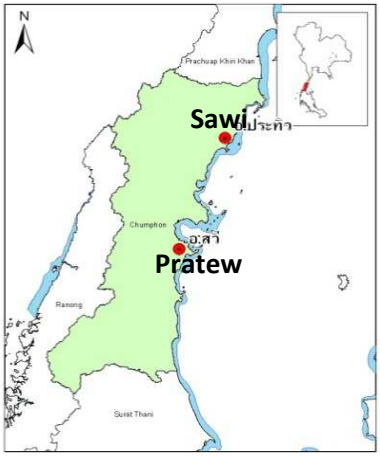
### 3.2.1 Climate-Resilient Livelihoods

The following information derives from literature review, statistics and a climate projection, which was conducted by SEA start for the 4 provinces Chumphon, Nakhon Si Thammarat, Krabi, and Trang. The climate scenario used in this report compares climate of 2 periods, 1990-2009 and 2030-2049, which is a result of a climate model simulation. In general, the future climate projection does not show extensive change in climate pattern in the future. However, climate change is yet noticeable. The section gives an overview about observed and predicted impacts of livelihood, sources of livelihood and vulnerability towards climate change.

***Climate projections and impact on livelihood:***

***Chumphon Province*** is located in the North of the Southern region**.** The East consists of a 222-kilometer coast with beaches. The coastal area has scattered bays of different sizes, with narrow mangrove forested segments, which limits erosion to some extent. However, the province is highly exposed to monsoon-driven waves from the Gulf. The hills are covered with forest, which slows the rainwater run-off during the wet season. The target areas in Chumphon Province are located in two districts; Pratew (sub-

**Figure 9: Map of Chumphon Province**




Source map: SEA START

district Chumkho and Bangson) and Sawi (sub-district Pak Plaek and Darn Sawi).

The main livelihood resources of both districts in the area are aquatic animals and mangrove forest. The main concern for communities is the land encroachment by shrimp farming and road construction along the coast line. Environmental challenges are coastal erosion and severe storms during the monsoon such as Typhoon Gay in 1989, Linda and Zita tropical storm in 1997, and Ketsana tropical storm in 2009 hit these sub-districts. In March 2012 flash flooding occurred. This impacted the aquaculture farming since the level of salinity in the ponds changed which caused the death of the sensitive aquatic animals which are used to a certain grade of salinity.

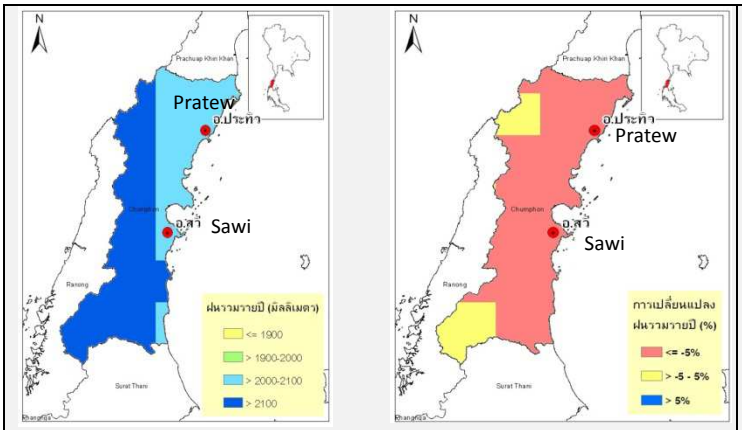
Nowadays, the community has shown some awareness about mangrove forest conservation and reforestation. As a result, many networks, groups and associations have been established, e.g., fisheries networks, preservation groups, and environmental associations which focus on the reforestation of the mangrove forest and youth groups to rehabilitate and care for the mangrove forest as to be a habitat of aquatic animals and to protect the community in the monsoon season.[13]

Chumphon's climate is influenced by the Northeast and Southwest monsoons, which cause heavy rainfall during October to November and a total annual rainfall of 1,900 ml. Temperatures range from 23 ˚C to 31.8˚C.[14]

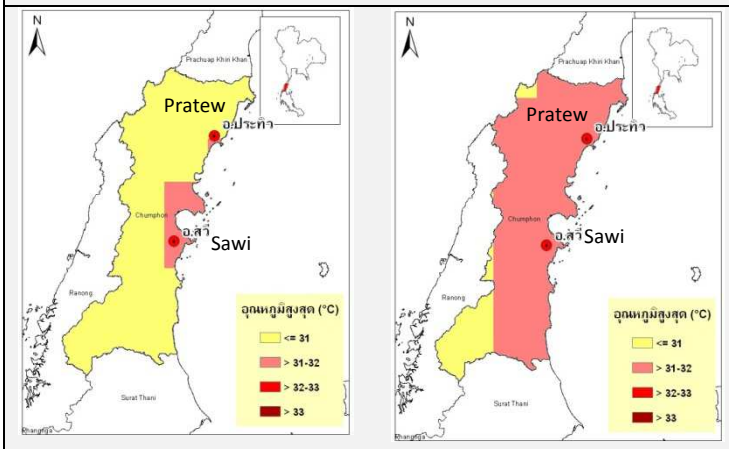
[13] Chumphon Provincial Administrative Office, 2009

[14] Metrological Department, 2012

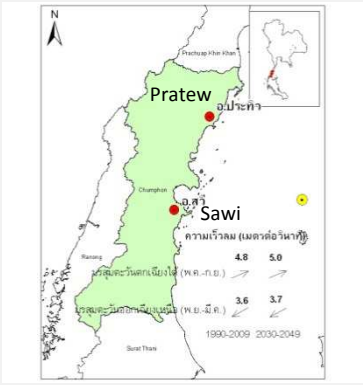
**Figure 10: Climate projection of Chumphon Province**




Left: Average rainfall volume (mm.) from1990-2009
Right: Projection on % of change on rainfall volume from 2030-2049




Left: Average highest temperature (°C) from 1990-2009
Right: Projection on average highest temperature(°C) from 2030-2049




Wind : Southwest monsoon (May-Sept)
1990-2009 = 4.8 m/sec
2030-2049 = 5.0 m/sec
Northeast monsoon (Nov-Mar)
1990-2009 = 3.6 m/sec
2030- 2049 = 3.7 m/sec

Source map: SEA START

The projections for climate patterns by SEA START indicate that the total annual rainfall tends to be reduced by approximately 7% for the period 2030-2049 compared to the period 1990-2009, which is noticeable throughout the rainy season (see figure 17). Daytime and night time temperature may increase slightly by 1-2°C throughout the year (see figure 18). The velocity of winds will strengthen from 3.6 to 3.7 meters per second (mps) during the northeast monsoon and from 4.8 to 5.0 mps during the southwest monsoon (see graphic below), but the climate projection does not show

noticeable change in wind direction. It is forecasted that, during 2030-2049 the monthly mean sea level will increase by 12 cm (see figure 19).[15]

***Nakorn Si Thammarat Province*** is the second largest province in the South with a total coastline of 225 kilometers**.** The terrain of the province varies due to the Nakorn Si Thammarat mountain range that spans from North to South of the peninsula and divides the provincial area into three parts: mountain range in the middle, plain area at the Eastern coast and plain area in the West. The target areas in Nakhon Si Thammarat Province are Muang (sub-district Tasa and Tarai) and Sichon Districts (sub-districts Tungsai and Sampao). The coast in Muang District consists of mud flats with mangrove forest. This area receives water run-off from Kho Luang mountain ranges, which extends from the Western part of the sub-region. Si Chon District faces problems of severe coastal erosion. Both districts are adversely exposed to monsoon-driven waves.

**Figure 11: Map of Nakorn Sri Thammarat Province**


Source map: SEA START, 2012

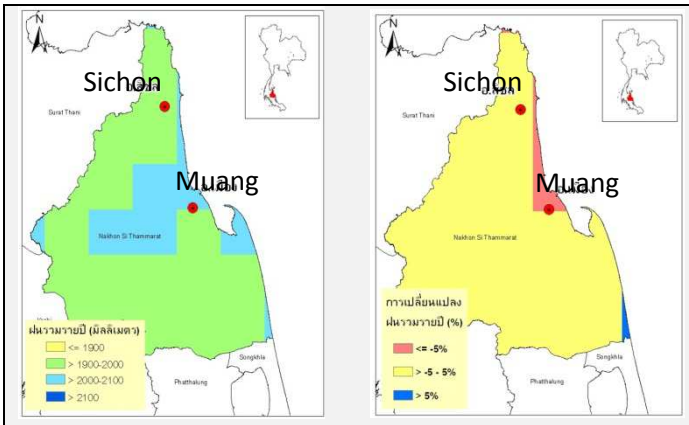
The project communities in Tasak and Tarai sub-district are located at the river mouth near the urban area. Most of the inhabitants practice traditional fishing and natural shrimp farming. Both sides of the canal are covered with mangrove forest. During the rainy season these communities are impacted by the flow of freshwater run-off from the higher ground which contaminates the marine life cultivation because freshwater dilutes the salinity of sea water. The project communities in Tungsai and Sampao sub-district are located at and along the coast, where most of the residents practice traditional fishing by catching fish at the river mouth and on the coast. At present, these communities are affected by problems of coastal erosion and reduction of aquatic animal life as the results of various factors such as deforestation, raising high tide and use of destructive fishing gears.[16]

Nakhon Si Thammarat is adversely affected by the Northeast and Southwest monsoons, especially during October to December. Average annual rainfall is about 2,500 ml, with high-low temperatures ranging from 32.3 to 23.0 degrees Celsius.[17]

SEA START RC projections for Nakhon Si Thammarat do not show noticeable change in annual rainfall (see figure 17) and wind speed as well as wind direction for the period 2030-2049 even though there tend to be slight shift of rainfall towards the end of the rainy season. However, both daytime and night time temperature may increase slightly by 1°C (see figure 18). The mean monthly sea level is expected to rise by 14 cm (see the projection in the figure 19).[18]

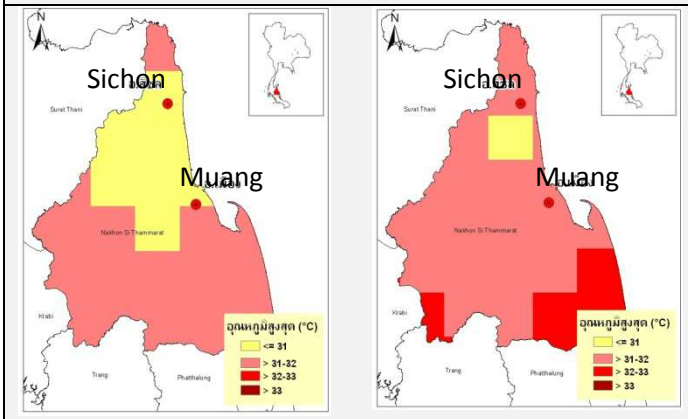
[15] SEA START, 2012
[16] Nakorn Sri Thammarat Provincial Administrative Office, 2012
[17] Metrological Department, 2012; http://www.tmd.go.th/
[18] SEA START, 2012

**Figure 12: Climate projection of Nakorn Si Thammarat Province**




Left: Average rainfall volume (mm) from 1990-2009

Right: Projection on % of change on rainfall volume from 2030-2049




Left: Average highest temperature (°C) from 1990-2009

Right: Projection on average highest temperature(°C) from 2030-2049

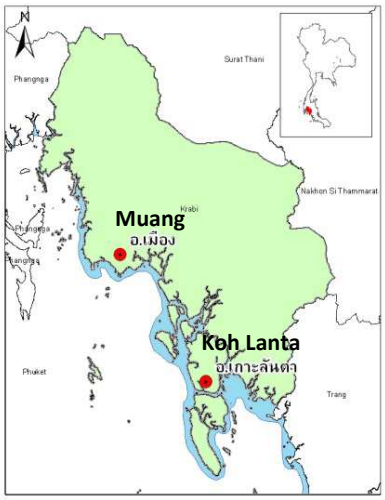

Wind: Southwest monsoon (May-Sept)
1990-2009 = 2.9 m/sec
2030-2049 = 2.9 m/sec

Northeast monsoon (Nov-Mar)
1990-2009 = 3.9 m/sec
2030- 2049 = 3.9 m/sec

Source map: SEA START, 2012

***Krabi Province*** is located on the Western side of the Southern part of Thailand. The mountainous terrain extends from the Northern part of the province to the South, whereas the west coast is characterized by plains. Krabi Province has an abundance of natural resources and scenic views of the ocean with a 160 km-long coast facing the Andaman Sea. The target areas in Krabi Province are Muang (sub-district Klong Prasong and Kao Kram) and Koh Lanta Districts (sub-districts Koh Klang and Klong Yang). Muang District is located at a river mouth with mangrove forest. In this area, accumulating sedimentation block the way of water flow. One of the problems of the area is the encroachment for property development and excessive use of land for shrimp farming, which causes changing in the fishery habitat. Main livelihoods are small-scale fishing along the coastline and cultivation of oil palms and rubber trees. Fisher folks are forced to go further and spent longer to catch fewer fishes. Longer dry periods endanger the harvest of rubber and palm oil. Another issue is coastal erosion, which severely affects areas at the Southern and Eastern parts of the province; most of fisher folk are facing a problem of losing their land. Villagers consider planting more mangrove forest to protect the coasts and as protection from tidal waves.[19] Koh Lanta District is an off-shore island, which is exposed to monsoon-driven waves from the West, but scattered islands in the West of the district help to minimize the impact of these forces.

**Figure 13: Map of Krabi Province**



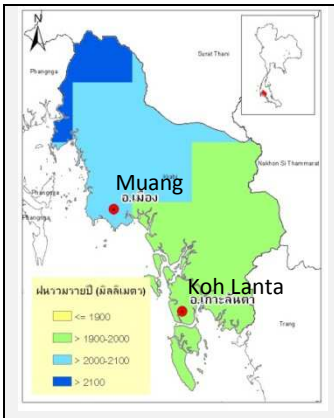

Source map: SEA START, 2012

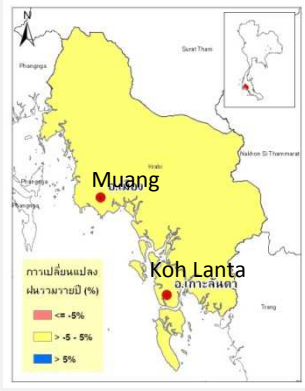
Krabi has a tropical monsoon climate, which is influenced by the Northeast and Southwest monsoon winds. These winds cause heavily rainfall during August to October with an annual average of 2,100 ml. The temperatures range from 22.8˚C 32.2˚C and respectively.[20]

SEA START projections for Krabi indicate that annual rainfall will remain constant (no more than 5% variation in coming decades) (see figure 17) and average temperatures will increase by 1 C°, especially in the central and Southern part of the province (see figure 18). The velocity of the winds will increase: during the Northeast monsoon, the increase will be from 3.1 to 3.3 mps and from 4.0 to 4.3 mps during the Southwest monsoon, whereas wind direction may remain unchanged. The sea level rise is expected to rise by 20 cm in the period 2030-2049 (see figure 19).[21]

[19] Krabi Provincial Administrative Office, 2012
[20] Metrological Department, 2012; http://www.tmd.go.th/
[21] SEA START, 2012

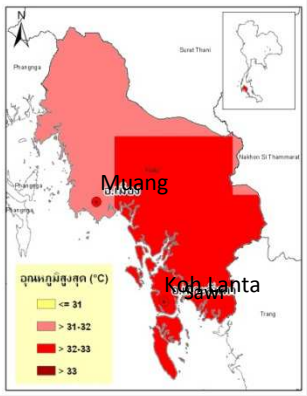
**Figure 14: Climate Change projection of Krabi Province**

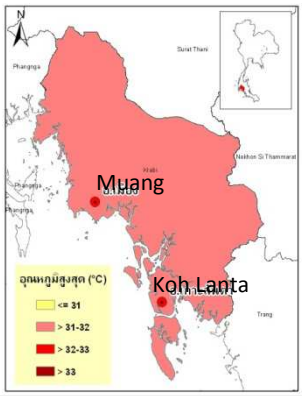



Left: Average rainfall volume (mm) from 1990-2009

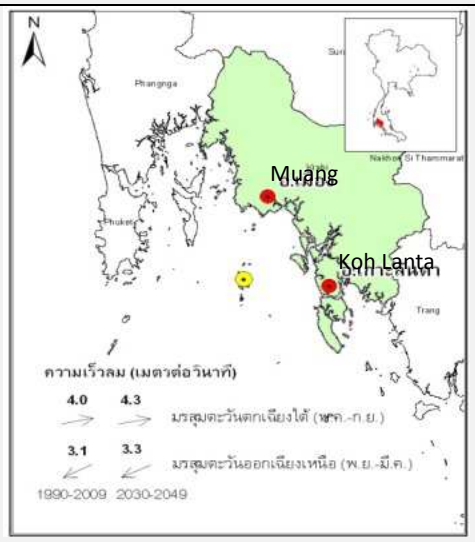
Right: Projection on % of change on rainfall volume from 2030-2049




Left: Average highest temperature (°C) from 1990-2009

Right: Projection on average highest temperature(°C) from 2030-2049



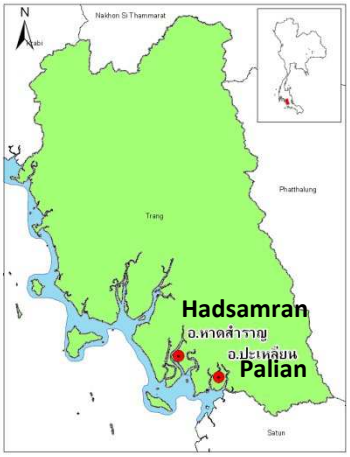

Wind: Southwest monsoon (May-Sept)
1990-2009 = 4.0 m/sec
2030-2049 = 4.3 m/sec

Northeast monsoon (Nov-Mar)
1990-2009 = 3.1 m/sec
2030- 2049 = 3.3 m/sec

Source map: SEA START, 2012

***Trang province*** is located on the Western coast with a 160 km coastline facing the Andaman Sea. There are hills and mountains scattered all over the province. The Bantad Mountain Range spans from the Eastern side of the province down to the South of the peninsula. The target areas for this project in Trang Province are in Palian (sub-districts Suso and Takam) and Had Samran Districts (sub-districts Tasay and Hat Samran). Palian District is located at the river mouth with mangrove forest. Had Samran District is a sandy beach area of the coast which is experiencing coastal erosion. Both districts are vulnerable to impacts of water run-off and soil erosion from the surrounding eastern hillsides and mountainous areas. Neighbouring small off-shore islands help limit impacts from high wave and strong winds.

**Figure 15: Map of Trang Province**




Source map: SEA START, 2012

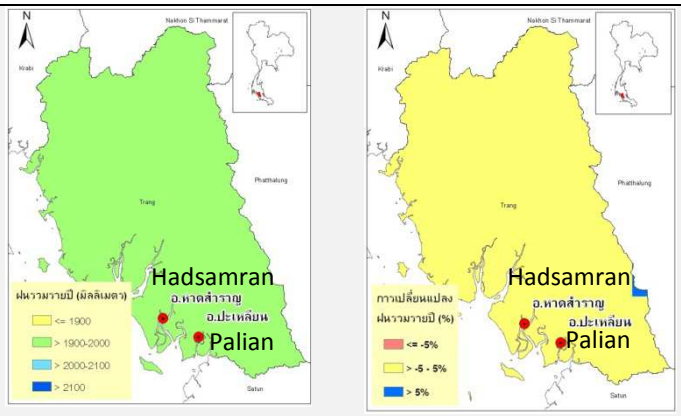
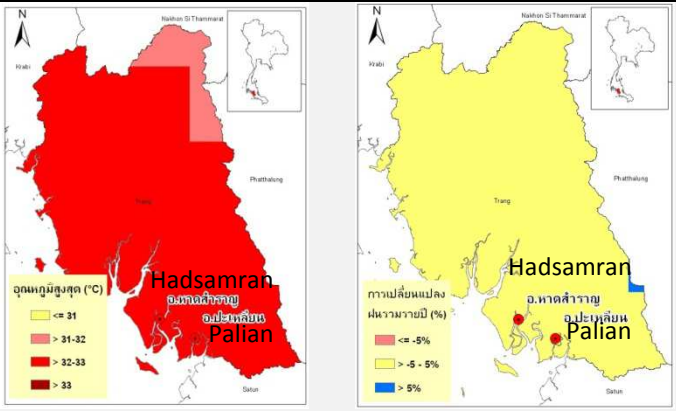
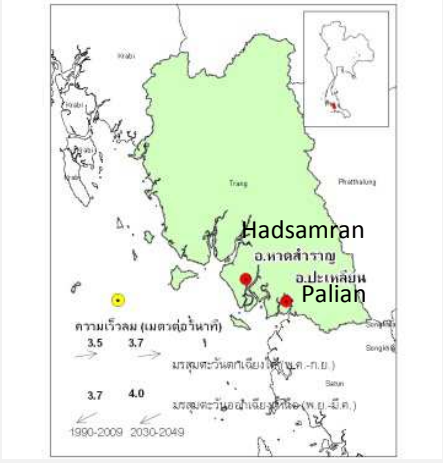
The natural resources of Trang Province are mangrove, coral reef, seaweed and endangered aquatic animals. Aquaculture and small-scale fishing is widely implemented in the project areas. The major problems for natural resources and the environment are: loss of mangrove forest area, coastal erosion, high tide, and depletion of the stock of aquatic animals, such as fish, crabs, shrimps and mussels.[22]

Trang is impacted by the Northeast and Southwest monsoons, which generate heavy rainfall throughout the year, but mostly during August to October. Average annual rainfall is 2,150 ml and the range of high to low temperatures in Muang District is 32.8 to 22.6 degrees.[23]

SEA START projections for Trang indicate that annual rainfall for the period 2030-2049 tend to be the same as present (see figure 17). Temperature may increase slightly by about 1°C (see figure 18). Wind speed tends to increase in both northeast monsoon season and southwest monsoon seasons, but wind direction may remain unchanged. The sea level is expected to raise 20 cm (see figure 19).[24]

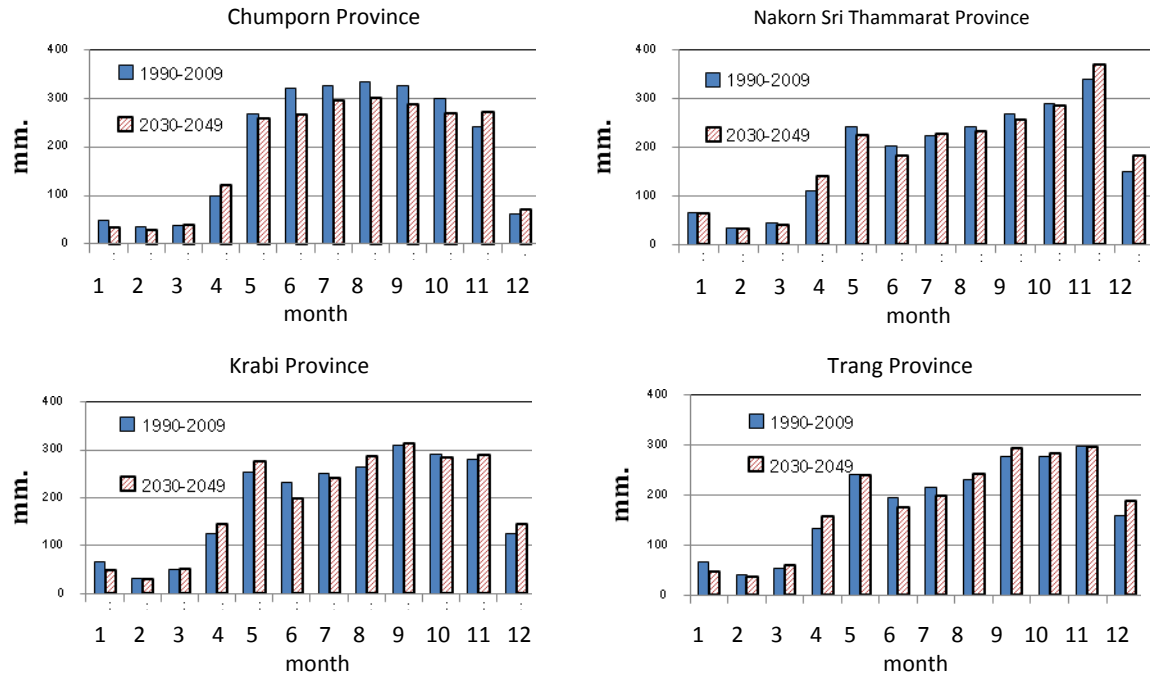
[22] Trang Provincial Administrative Office, 2012
[23] Metrological Department, 2012
[24] SEA START, 2012

**Figure 16: Climate projection of Trang Province**

| | |
|---|---|
|  | Left: Average rainfall volume (mm) from 1990-2009<br><br>Right: Projection on % of change on rainfall volume from 2030- 2049 |
|  | Left: Average highest temperature (°C) from 1990-2009<br><br>Right: Projection on average highest temperature(°C) from 2030-2049 |
|  | Wind: Southwest Monsoon (May-Sept)<br>1990-2009 = 3.5 m/sec<br>2030-2049 = 3.7 m/sec<br>Northeast Monsoon (Nov-Mar)<br>1990-2009 = 3.7 m/sec<br>2030- 2049 = 4.0 m/sec |

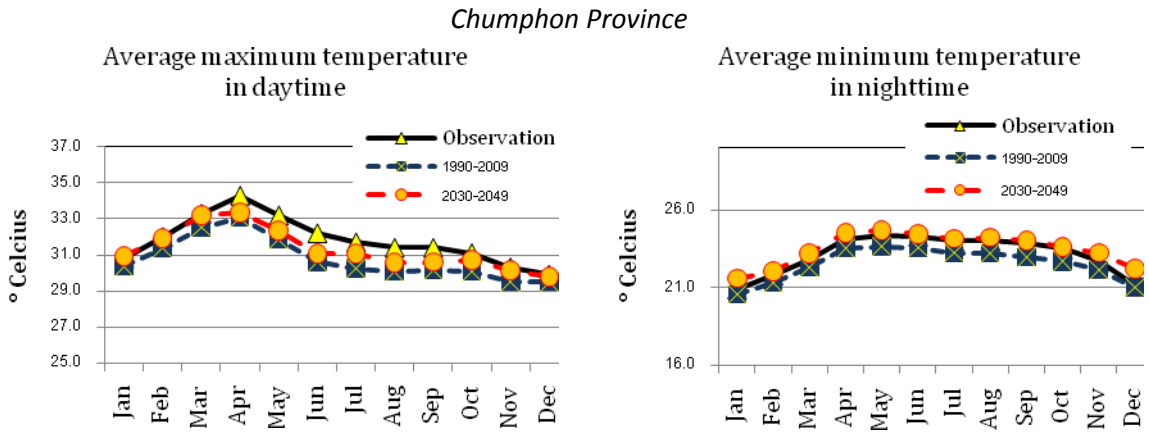
Source map: SEA START

## Figure 17: Change in monthly average rainfall in target provinces

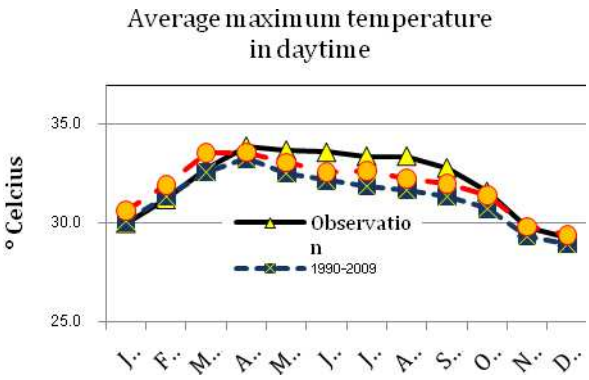


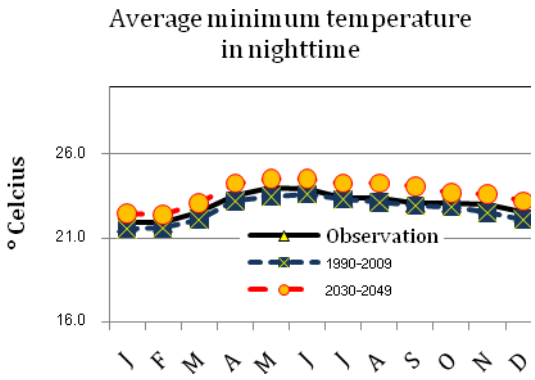

Source: SEA START, 2012

## Figure 18: Change in monthly average temperature in target provinces

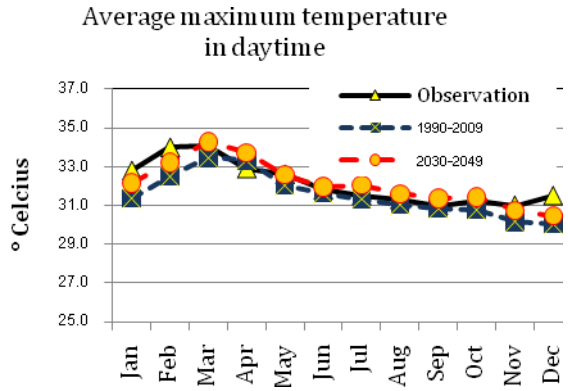


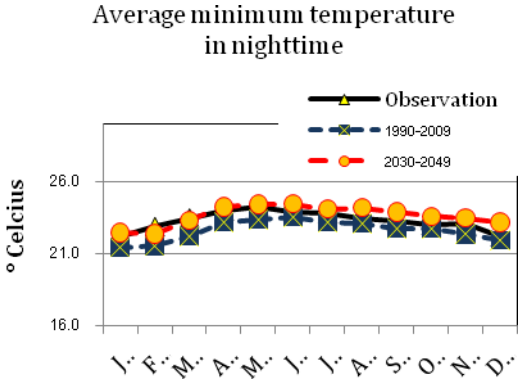
*Nakorn Si Thammarat Province*



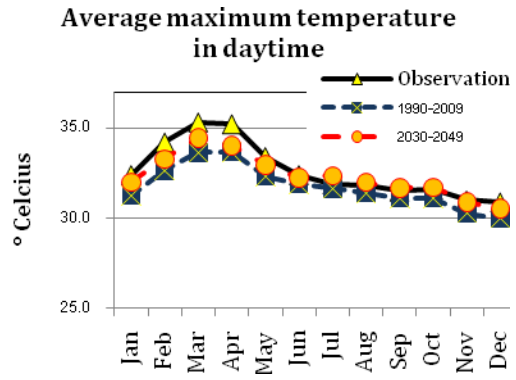



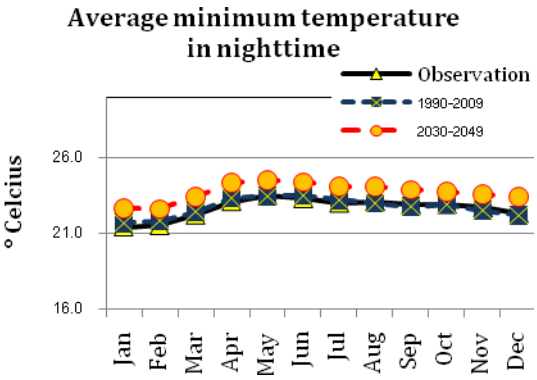

*Krabi Province*




*Trang Province*



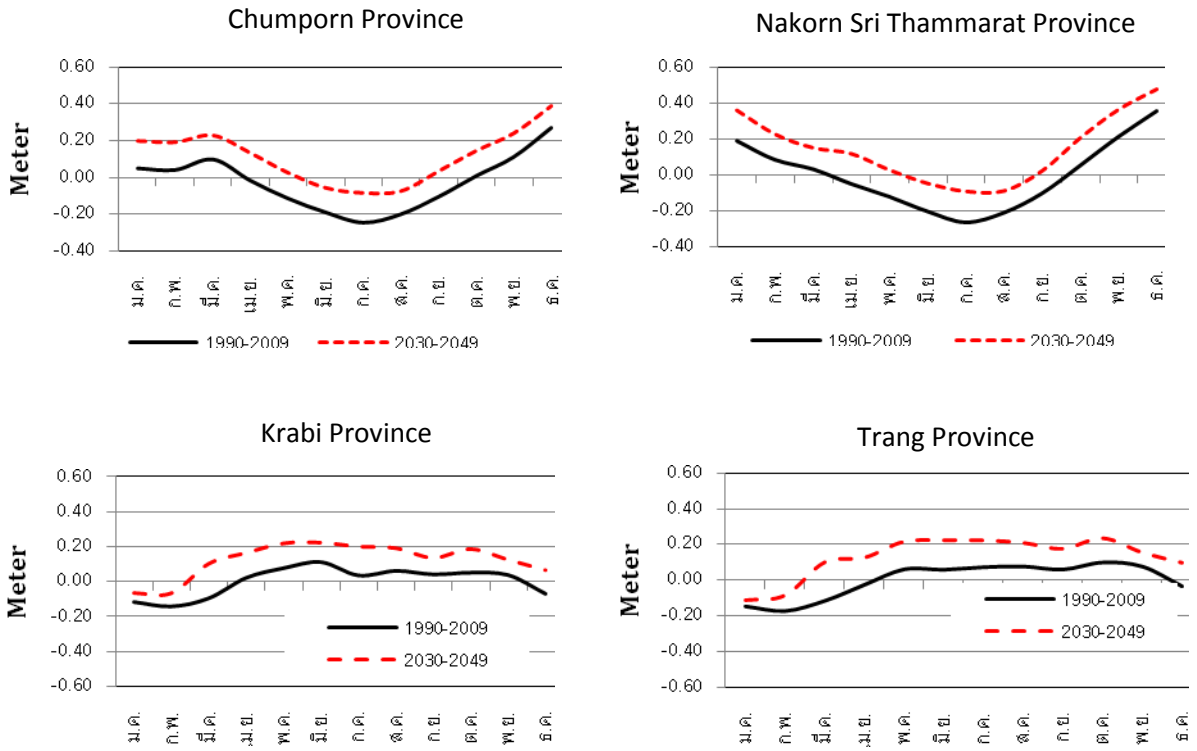




Source: SEA START 2012

*Remark: Please note that there is discrepancy between baseline simulated data and observation data, especially in the daytime temperature (average maximum temperature). This discrepancy is due to the model bias in the simulation, the global dataset used in the bias adjustment and also as the summary of the simulation data is based on the whole area of the province but the observation data is based on a single point at the weather observatory station within the province. In this*

*regards, the relative change between baseline simulated data and future may be used to assess future risk from climate change.*

**Figure 19: Average sea level compare to mean sea level in target provinces**




Source: SEA START 2012

***Sectoral impact of Climate Change:*** In order to plan for climate change adaptation, future climate change need to be considered from the context of sector as each sector may be threatened by climate change differently. Some of the key climate concerns can be summarized from key sectors' perspective as follows:

- In-shore fishery: The subsistent in-shore fishery using small fishing boat is limited by the wave activity. Especially in the Western coast i.e. Krabi and Trang provinces, where Southwest monsoon tends to be stronger this hampers fishermen to go out of the sea.
- Agriculture: Main crops, oil palm and rubber, may not be seriously affected by future change in climate pattern as total annual rainfall and monthly distribution of rainfall will not significantly change. Moreover, number of rainy days in some provinces, e.g. Chumphon, Nakhon Si Thammarat may reduce which will be positive for the rubber production.
- Coastal settlement: Every province in this study tends to experience sea level rise in the future, which will threaten coastal erosion to be more severe. Moreover, stronger wind during the Southwest monsoon may also induce stronger wave, which will be an additional driver for more severe coastal erosion.[25]

[25] SEA START, 2012

In general, future climate under this scenario may not be of prominent change. This climate change scenario can give broad view of the future and be used as initial information to assess changes in risk of the community in these provinces, however, please note that this is only single scenario and use of additional scenarios is recommended in the future activity. Moreover, climate change is not the only driver that may drive change in climate risk in the community, but change in socio-economic condition may also alter the way community or sector is exposed to climate threat and/or alters the coping capacity of the community. Using this climate change scenario in combination with consequences of socioeconomic change in order to formulate climate change adaptation strategy under an integrated assessment framework is highly recommended.

***Climate Data:*** Thai Meteorological department (TMD) is the umbrella organization of all agencies which are involved in forecasting and reporting on climate. The Meteorological Regional Centre (MRC) is running climate stations at the west and east coast of southern regions that are located in the project implementation area. These agencies have a crucial role in terms of issuing warnings of potential disaster events which impact agriculture and fishing. The Hydrological Centre (HPRP) which is operating under the umbrella of the Provincial Irrigation Office, started to collect and disseminate information on water level, rainfall, drought and flooding. Much of the information from these agencies is posted on the Internet, aired on TV and radio, or published in the local newspapers. They also have direct communication links with the head of villages for informing communities through the local public address system, sending phone SMS, and through word of mouth diffusion. Communities use this information for their short term planning to evacuate in case of flood warning or to stay onshore in case of heavy rain prediction.

***Policy and planning to support climate proof community livelihoods***: In this area, there are mainly practical activities that support community livelihoods and promoting income diversification at the provincial, district and community levels, such as establishing a home-stay program for eco-tourism or providing access to land. They can get loan from the government bank to grow cash crops such as palm trees. However, the issues of climate proof livelihoods are not yet considered in the development plans of the province, LAOs, and communities.

***Knowledge about the climate impact on community's livelihoods:*** The CVCA showed that the staff of relevant agencies is aware of climate change. They access information from a variety of channels described above since they are personally interested in this topic. Additionally, they participate in training and seminars on climate related topics. Most of the interviewed person face difficulties to interpret the provided climate data since the information is rather technical and uses scientific terms that are not easily to understand. The local agency's staff is generally better informed about socio-economic status and livelihoods of the local communities than the provincially-based staff. A high staff turnover rate on provincial level might be the reason behind.

Provincial and local officers understand the impact of natural disasters on the community, but do not have a clear understanding of the impact of climate change on the livelihoods in the community. Local research institutions such as Walailak University (Nakhon Si Thammarat ), King Mongkut's Institute of Technology Ladkrabang (Chumphon Campus) and the Marine and Coastal Resources Research Center (MCRRC) already shared information about these phenomena, but this information is still too general for the communities to take it seriously while they are facing the current problems such as land rights, conflicts between commercial fishing and small-scale fishing, pollution from industries and so on.

### 3.2.2 Disaster Risk Reduction

***Climate related hazards:*** Hazards and natural disasters related to climate phenomena affect the livelihoods of households in these areas. Some hazards occur in all four provinces (area specific risks), while others are site-specific. Area-wide risks of increasing severity and frequency include strong waves, heavy and continuous rainfall, higher tides. Site-specific hazards include drought in Chumphon and Krabi, flash flooding in Nakhon Si Thammarat, soil erosion and sedimentation in Nakorn Si Tammarat and Krabi, saltwater contamination of groundwater in Chumphon and epidemics of mosquito borne disease including hemorrhagic and Chikungunya fevers in Trang. The changing to higher temperature will increase mosquito spread out (see details in the appendix III). Areas, which are located along the coast of the Gulf of Thailand faced more extreme monsoons and higher waves in recent years. Some areas have annual flooding, which is accelerating erosion. These phenomena lead to increasing awareness and concern among the provincial and local staff.

***Understanding of risk:*** Agencies on provincial and community level in the project area are aware of natural disasters since the 2004 Tsunami hit Southern Thailand´s West coast (Andaman Sea). In any event, this awareness and concern is not yet emphasizing in mobilizing the prevention and mitigation action that will be needed in the future. Indeed, some activities have adversely effects, such as building sea walls and wave breakers on the coast; this merely diverts seawater to adjacent areas and accelerates erosion there. Also, dredging of canals has destroyed the ecosystem in some locations.

***Vulnerable groups:*** Most of the involved agencies agree that the most vulnerable groups in the event of a disaster are children, women, elderly and disabled persons. Many of the elderly and children do not have relatives to directly support them since many working-age villagers have left to seek work outside the community. The most vulnerable occupation group is fishermen which conduct coastal fishing, fish cultivation and deep-sea fishing. Palm orchard and rubber tree farmers are also quite vulnerable to natural disasters and climate change.

***Warning systems and risk management:*** The agencies on provincial and community level receive Tsunami and monsoon warnings, which are issued by the Thai Meteorological department (TMD). At the same time this information will be forwarded to the Community Defense Volunteer Network which disseminates information via various means of communication such as radio to the community members. They also activate the sirens on the ground in Koh Lanta, Muang District of Krabi, Palian and Had Samran Districts in Trang in case of a Tsunami early warning.

The Provincial Disaster Prevention and Mitigation (PDPM) agency developed provincial plans for disaster prevention and mitigation. Related response plans at sub-districts level are a disaster prevention and mitigation plan for Klong Prasong and Koh Lanta. Some communities have regulations on managing coastal resources and community mangrove forests. The use of these resources is monitored by local conservation groups such as in Koh Klang Village in Koh Lanta sub-district, Bo Mao Village in Chong Kho sub-district and Thong Tom Yai Village in Dan Sawi sub-district. Most villages in the project area have own mangrove forests protection and restoration scheme as a means of controlling winds and waves, even in the absence of formal plans, and continue to plant more mangroves.

***Capacity of provincial and local agencies in Disaster Risk Reduction:*** There are provincial committees of the Department of Disaster Prevention and Mitigation (DDPM), in which the provincial governor functions as chairperson and the Provincial Disaster and Mitigation Office functions as secretariat. The purpose of this department is to formulating policies and plans and to conducting training exercises as stated in the disaster prevention and mitigation plan. Chumphon, Nakhon Si Thammaratand and Krabi have formed a network for risk management at provincial level. Some communities have community emergency preparedness plans in which they defined management structures and emergency preparing activities, which includes procurement of communications equipment and establishing relief shelters in the community e.g. in Koh Lanta sub-district at Krabi province.

It can be concluded that there are some isolated actions going on in the field of DRR but most of communities still do not have formal disaster management plans yet, which require assistance from the government. The government played a reactive role after a disaster occurred by providing resources for immediate relief and rehabilitation rather than for prevention and preparedness. This is clearly reflected in the provincial budgets for assisting affected communities. Normally, each province would receive EUR 1.2 million (50 million Baht) after being declared as a disaster area. This amount can only be used for emergency response and not for prevention and preparedness.

### 3.2.3 Capacity Development

Impacts of natural disasters and climate change consequences are noticed on local level at first. Due to these fact agencies on local level have to be able to deal with this challenge – their capacity is the most important factor. The state of the art of the institutional capacity is described in the following section.

***Analysis of data and planning:*** Problems on the ground are analysed without taking into account the comprehensive context within they occur. Thus, the resulting plans consist of a compilation of isolated, unlinked responses to specific issues in certain localities. The proposed solutions in a given area are not linked or inconsistent with one another. For example is the provincial plan of promoting mangrove forest rehabilitation and the construction of weir and dams to reduce water flow in the wet season conflicting and contradictory with the provincial plan for promoting rubber trees planting. The expansion of rubber trees planting in high slope areas increases soil erosion, and reduces water absorbing ability. In addition, the plans of various provincial agencies are not integrated together and are implemented independently of each other. Often the government agencies involved in natural resources and environment work set goals which are contrary to the goals of other agencies involved in economic development. This especially counts for the tourism promotion in coastal areas in Ta Sae Sub-district, Had Samran District of Trang Province and Koh Lanta District of Krabi Province. Infrastructure development projects drain freshwater resources and deposit waste into the environment, which adversely affects the ecosystem and quality of life of the coastal communities.

***Human resource management and implementation:*** Most of the local government agencies have limitations of staff, command over limited skills on how to integrate climate change into their plans and on implementing participatory planning and budget. At present, however, external agencies are becoming more interested in this area and are providing support for capacity building of communities to adapt to climate variability. This support includes budget in support training courses.

Important actors are commercial banks and large private enterprises implementing corporate social responsibility projects (see Appendix II).

These external agencies mobilize resources and work closely with communities to build capacity in the area of training for fishermen and farmers such as the training on how to protect coastal resources, mangrove forest expansion and management, including education in Disaster Risk Reduction. With support from governmental agencies such as the Department of Community Development, external agencies are also providing occupational training and natural resource conservation through revolving fund mechanisms. Most of the funding was set up by both government schemes such as Bank for Agriculture and Agricultural Cooperatives (BAAC) and external agencies such as Raks Thai, Oxfam GB, which provided the revolving fund after the Tsunami.

Moreover, there is exchange of experience and knowledge between external agencies such as non-state actors to improve methods of integrated agriculture and alternative occupations to distribute risk. Vulnerable fishing communities reduce their vulnerability with income diversification through crop cultivation and wage labour as supplemental sources of income. These developments can be observed in almost all communities in the project area. The community loan funds and savings cooperatives are key interventions to reduce vulnerability of communities towards climate related disasters. Some communities initiated their own emergency funds such as the existing revolving fund for helping people resume their occupations after disaster strikes.

***Need for further capacity development:*** Agencies at the provincial, local and community level need to improve their database system such as socio-economic data or natural resource data by applying simple modern technology as their tools for gathering information. It should be considered that the information is gathered in a consistent format to ensure data exchange and comparability to create a base for coordinated planning for decision making processes.

The provincial government agencies need to continue with capacity building of their staff in a systematic way. Skills in reading raw data and combining spatial data with socio economic data and related statistics are crucial for the establishment of development plans which take into account the comprehensive context. Furthermore, relevant partners should participate in the planning processes in a coordinated manner. This way of planning prevents conflicts between different sector departments. This is especially needed in the area of planning and mobilizing the community for activities such as rehabilitation of forested watershed areas, conservation of natural waterways, and restoring and rehabilitation of disaster affected areas.

### 3.2.4 Addressing Underlying Causes of Vulnerability

In order to reduce vulnerability of coastal communities there is a need for a clear definition of vulnerable groups. There needs to be specific support for their consideration in planning and implementation, including policy formulation for resources management and resolution of problems and obstacles. The result of focus group discussions shows the following practices in addressing underlying cause of vulnerability:

***Vulnerable groups:*** As mentioned above, the most vulnerable groups in the project areas include children, women, elderly and disabled persons. The village leader commands over data on households and reports this to the LAO for special care and welfare (e.g. stipend for the elderly and disabled). The group of traditional fishermen and their families are also vulnerable. The District

Fisheries Office has compiled a registry of these households for use in planning for assistance in the event of natural disaster.

***Participation in planning and implementation:*** Participation of the various groups in planning and implementation can be seen more clearly at the community level rather than at the provincial levels. Examples include the formation of community action groups such as conservation groups with the leaders of these groups actively share information via networks. Especially women play an important role in the establishment and management of savings and occupational support groups since they manage the household and take care of the family members in nutrition, health and education. They are the first who experience impact of climate change such as food insecurity. After the 2004 Tsunami the women's role increased in the planning process. Many of the communities already have social capital through networks of relatives and mutual support. The exception are communities in which residents are becoming more independent of each other and have little spare time to be involved in community activities. Despite increasing individual lifestyles, religious institutions– Buddhism and Islam –are still the social magnet of the community. This provides an opportunity to work together as a community during important religious days and festivals.

***Policies for managing natural resources:*** Natural resource management policy is part of the strategic development plan of the province, which is in line with superior national policy. The policy for mangrove forests provides clear guidelines for local reforestation and control of encroachment on the mangrove forest. This made local communities becoming more aware of the importance of these forests. They formed community conservation groups in many locations such as Pak Pron Village in Had Samran District, Pak Duat Village in Si Chon District, Bo Moh and Laem Thaen Villages in Pratiu District, and Aw Tong Tom Yai Village in Sawi District who monitor compliance with regulations. However, converting policy into action always faces limitations at the local implementation level due to a lack of experience and technical guidance.

***Factors which impede adaptation of the vulnerable groups:*** Expansion of tourism areas, construction of ports and docks for boat travel to various islands (e.g., Sukorn and Samui Islands) and increasing aquaculture leads to release of waste water and destroys aquatic animal habitat, which results in a reduced number of fishes. These developments increase the vulnerability of the traditional fishermen who have to go further out to the sea to have a productive catch, which means a high risk for them (high tide, strong winds).

Even though agencies have tried to work with the communities to help them identify alternative livelihoods for the fishing communities, these families have little land to work with, and this limits the possibility to engage in agriculture. As a result, members of these communities seek wage labor in agribusiness or in other areas of employment during the monsoon season.

The implementation of agencies at the provincial, local and community level is isolated and lacks of coordination. Many agencies work directly with the target communities, while others are coordinated through the LAO in the locality. This resulted in lack of integrated planning and resources sharing.

## 3.3 Household and Individual Level

The study of livelihoods and impacts of climate change and the ability of households to adapt to and manage these impacts stems mainly from the baseline study, which contains results from interviews with 720 households and focus group discussion results.

### 3.3.1 Climate-Resilient Livelihoods

Most households in the project area are involved in fishery and agriculture. Their livelihoods depend on the natural resources in the area. The traditional fishermen (small-scale fisher-folk) catch aquatic life along the coast, in the canals and mangrove forests. Agricultural products are heavily dependent on rainfall (rain fed agriculture). The main sources of income that provide the local population in the coastal areas with a livelihood (except subsistence farming) are mostly related to agriculture, fishing and to a minor extent, aquaculture. These three sources account for about 69% of the primary income source and for 25% of all households earnings from agriculture, fishing or aquaculture are the secondary income source. Again, based on the prevailing discourse of development research and climate change vulnerability studies, all three sources of income are highly sensitive to climate variability and extremes and to the ongoing consequences of climate change.

Poverty rates differ in the four provinces. While Chumphon province has a poverty rate that is only slightly higher than ten percent (11.1%), it is more than double in Nakhon Si Thamarat (24.4%). The average poverty rate in the project areas is 17.5%. Meanwhile decreasing levels of income are reported in almost equal proportions across all places.

Baseline study findings show that the overall local population living in the coastal area is mostly gender balanced 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 found in those coastal villages where agriculture and other non-fishing based activities provide the main source of livelihood.

Interviewees indicated that in the last 2-3 years, seasonal weather patterns have changed and floods occurred more frequent than in the past. The household interviews showed that the natural phenomena described above have the following impacts on the households and individuals in these communities:

***Fishing:*** Fishermen are directly impacted by rain, storms and high waves. Most of the fishermen practice traditional small-scale fishing. They cannot fish during periods of heavy rain. In the last 2-3 years, the storms and heavy wave action is increasing in frequency and duration.

***Aquaculture:*** This is done in coastal and in-land fish ponds, which are fed by brackish water. If high tidal waters and rainwater run-off from the hills and inundate the ponds the aquatic life dry off since the aquatic animals cannot adjust to radical changes in the salinity of the water. Also, intense sunlight and high heat reduces the growth rate of the aquatic life in the ponds.

***Agriculture:*** This activity is directly related to the amount of rainfall. The crops include rice, palm and rubber trees. Periods of drought affect the cultivation of all crops, resulting in loss and reduced harvest. Periods of long rainfall reduce the ability to milk the rubber trees for latex.

***Household Settlement:*** Many of the households in these communities are located in vulnerable coastal areas or on the banks of canals to improve convenience in docking boats, and moving equipment from fishing activity and catchment. Many of these houses are threatened by tidal waves, higher tides, flooding and coastal erosion.[26]

Household interviews and focus group discussions (FGD) showed that increasing frequency and severity of climate variability is adversely impacting livelihoods. Accordingly action is taken to limit these impacts in the following ways.

[26] BCR CC Baseline study in Indonesia and Thailand, 2012

***Climate resilient practices:*** Some of the households in these areas switched occupations to reduce risk:

- Fishermen switched from ocean fishing on the coast to canal-based fishing in-land and in the mangrove forest areas
- Some fishermen who raise aquaculture in ponds sell their products before their maturity, even if they get lower prices in order to reduce the risk of natural phenomena destroying the production
- Rice farmers adjusted planting schedules to accelerate harvesting well in advance of the monsoon rains. Some have switched back to traditional rice seed species, which they believe are more durable and adaptive

***Distribution of risk by occupational modifications:*** This study showed that households in the project area are reducing risk by diversifying their livelihoods and taking up alternative occupations in case their primary sources of livelihood are threatened. Some fishing families bought land for cultivating palm trees, rubber, and rice farming. Others sought out wage labour jobs in the agriculture and service sectors during the monsoon season. The baseline data survey showed that in Thailand less than a third of all households in the project area rely on one single income source. Around 60% of households have access to a second source of income, and around 13.2% of all households even have access to a third source of income.

***Avoiding risk:*** Some households in Tambon Koh Klang in Koh Lanta District had to quit traditional fishing practices because of the variability of the climate and reduced fish stocks. Some families in Muang District of Krabi have had to move in with relatives because of erosion damage to their coastal dwellings, while others in Nakhon Si Thammarat have had to re-locate their coastal houses further in-land to flee erosion.

These approaches show that people already started to adapt to the changing conditions. According to the baseline survey, less than a third of the interviewed households stated that they do not know how to deal with the given challenges.

Respondents came up with ideas that are closely related to disaster preparedness measures. It can be assumed that those people participated in trainings in the aftermath of the 2004 Tsunami. Typical responses were monitoring of weather forecasts, evacuation preparation, “saving money for hard times”, “keep equipment and vehicles ready”. Some of the respondents mentioned income- and livelihood-related response including diversification of livelihood sources, to change occupation and to find new and alternative ways of income generation. The baseline showed that the majority of the households (around 60%) has access to a second source of income, and around 13.2% of all households even have access to a third source of income.

### 3.3.2 Disaster Risk Reduction

In coastal Thailand particularly people from those areas that were affected by the 2004 Tsunami are afraid of a potential natural disaster. As the Tsunami mostly affected the Western coastal zone, results from the survey illustrate the differences in people’s perception across the Eastern and the Western coastal zone of the project area. In Trang province, almost every second interviewee states that experiencing a severe natural disaster is the worst that could happen to his/her household. The high proportion of people that feels threatened by such a risk in Nakhon Si Thammarat province (which is located in the eastern coastal zone and has not been affected by the Tsunami) comes

unexpected, but is not surprising given the rising levels of awareness and consciousness about these risks.

Against this background data from the baseline survey tells us that the high level of risk perception towards natural disasters can be best explained by a high exposure to natural disasters in the project area. Almost all households in Thailand have been affected by a natural disaster (mostly by a storm, flood, and the Tsunami) over the past ten years. Even though there is no indication of frequency or severity within the ten years, based on people's perception of environmental risks it can be concluded that a high exposure to these risks persists. The majority of people indicated that they have been affected by a natural disaster within the last two years, while poor households are among those that have suffered the most from previous natural disasters over the past years and most of them have received support from their families or social networks.

***Use of equipment and simple technology to protect assets:*** Some villagers are using the following appropriate technology methods to reduce primary risk:

- Villagers who cultivate fish in ponds have erected sun shading to reduce heating of the water and insolation
- Villagers living in coastal areas of Muang District in Krabi are using canvas material to protect external parts of houses from damage from exposure to salt and its consequences
- Some villagers in Tambon Klong Prasong, Muang District of Krabi have built earth dams to prevent saltwater from contaminating rice fields
- In Tambon Klong Prasong, villagers have built concrete and bamboo dams to combat erosion
- Villagers in Si Chon District of Nakhon Si Thammarat, whose houses were destroyed by coastal erosion have adapted by raising new houses on higher stilts and using more durable construction material for the foundation

***Accessing assistance from the government:*** Some affected households received government assistance in the aftermath of a natural disaster. In the project areas most of the interviewed fishermen received financial compensation**.**

The findings show that awareness regarding natural disasters is quite high and people apply disaster mitigation activities by their own whereas they receive assistance from the government after a disaster occurred.

### 3.3.3 Capacity Development

The household interviews showed that households in the project areas are already taken actions on preparing and adapting to the consequences of climate variations, which will be described in the following section.

***Household savings:*** Most of the affected households have voluntarily reduced expenditures and tried to increase systematic savings for essential needs during an emergency. The savings mechanisms include accounts with commercial banks and through community savings fund cooperatives.

***Accessing information and data:*** In addition to print media, radio and TV, households in affected areas get news from community leaders, community forums, social groups such as associations of women or the elderly, savings groups, and occupational groups. The local administrative organizations are also a source of information such as they provide weather forecast and

information from government sources. However, the available weather forecast is not useful for the local population since the information is too vague and too technical for them. In the past, fishermen used their own traditional methods to predict the weather as the following examples illustrate: whenever a blue crab swam away from canals, the heavy rain will come, or when a stingray turned its head to one direction, this meant that the strong wind will come from that direction. Based on the weather, they use specific fishing methods suitable for the certain environmental conditions. Since 2-3 years ago they cannot apply these methodologies anymore due to unpredictable weather phenomena.

***Access to funds, loan mechanisms for livelihood:*** Most of the occupations in the area rely on natural resources. In the context of climate variability, occupations are disrupted and income is irregular. This inhibits investment in occupational development. Thus, occupational loan funds have emerged to help affected families, including community-based funds, savings groups, and loans from the Bank for Agriculture and Agricultural Cooperatives, etc.

***Membership in local groups or associations:*** Participation in social action groups has been strongly supported in Thailand, especially in the past decade. This offers more households an opportunity to participate in projects that are implemented within communities. These groups include saving group, occupational support groups, and conservation associations. This helps in sharing information among households and mutual assistance among members such as funding, knowledge, advice, or equipment for one's occupation and has improved the capacity of families to survive and thrive in the face of challenges from climate change.

### 3.3.4 Addressing Underlying Causes of Vulnerability

***Policy for natural resource management:*** The current direction of national development is focusing on natural resource management, with changing from seeing natural resource as a source of exploitation to one that needs to be sustained indefinitely. This is combined with the expanding social movement to care and protect for the environment. Thus, the national policy aspiration follows "sustainable production and consumption". Economic tools, legal measures, and motivational strategies are being applied to promote the policy of natural resource management so that it is effectively translated into concrete practice. This trend is also reflected in the mass media. But there remain some sectors which are not yet following this policy, such as coastal tourism, industry and agro-business whose development activities often encroach watershed areas.

***Women and marginalized groups:*** In times of economic hardship women have to seek for an extra income additionally to their household related activities. This means a higher workload for women. Access to funds and training, which enables them to gain a better income reduces the stress of the women significantly and makes them more confident - an essential background for participating in community activities.

***Communication and network:*** In coastal communities traditional family structures still exist and have an important function in informing and supporting its members. Networks such as fisher folks and conservation groups also benefit from these structures since family members often participate in the same groups.

# 4. Conclusion and Recommendation

## 4.1 Climate-Resilient Livelihoods

Thailand's climate is influenced by the monsoon, which will occur more severe in the course of climate change. The stronger wind causes high tides and limits the possibilities of fishermen to catch fish and leads to a reduced income. Climate projections indicate that annual rainfall will increase and at the same time the rainy season will shorten until 2049. This means that heavier rainfall will occur which increases the risk of flooding. The dry season is expected to prolong and temperatures will slightly rise on the long run, which negatively impacts the agricultural sector especially in the Northeast. These developments could affect food security in a negative way since the availability of fish and agricultural products and the affordability of offered food due to reduced income decrease. The government is already aware about the impact of climate change and the need to develop strategies to tackle this but did not design specific climate change adaptation strategies within sectorial context yet. Existing national development plans do not explicitly contain climate adaptation strategies yet.

The main environmental problems the southern provinces face are coastal erosion, severe storms, and flooding. Underlying factors for this are reforestation of mangroves, rising sea level and more

intense rainfall .The latter results in fresh water run-off from the mountains in the canals which lead to changes of the salinity level in the water and dying off aquatic animals which require a constant level of salinity for survival. The sea level is expected to rise by around 20 cm for the decade 2030-2049 and economic activities such as increasing encroachment of coastal land for property development and shrimp farming will increase the future flood risk. Climate information and warnings are provided by different agencies such as the Metrological Regional Centre (Thai Metrological Department) and the Hydrological Centre (Royal Irrigation Department). They issue information via media (TV, radio, internet) and directly inform the heads of villages. The climate data is too general for the planning of activities of fishermen and farmers. The provided data is too scientific and technical, therefore it has to be interpreted within the local context and formulated in messages which can be understood by the villagers. Climate change is still an abstract term for governmental staff and they are not aware about the impacts of climate change yet. Considering this background it isn't astonishing that the promotion of climate proof livelihoods is not considered in provincial, district and sub-district development plans yet.

The different natural disasters and threats in the project area (e.g. tidal waves, erosion, and degradation of coastal resources such as the mangrove forest) are major issues for the interviewed respondents in this survey. These people are well aware that many of the problems are natural phenomena, while others are man-made. In any event, the study showed that households are adjusting and adapting to the threats, especially the traditional fishermen. They recognize the need for long-term approaches to the problem such as planting of mangrove forest and establishing mangrove forest preservation associations among traditional fishermen to protect the natural resource base. In addition, there are groups in the community such as occupational support groups to foster exchange of information, knowledge and techniques to maximize their vocational skills. This has resulted in an increased sharing of information and participation of members of the community to address the challenges as a collective.

## 4.2 Disaster Risk Reduction

The main climate related disasters Thailand faces are storms, high tide, drought and flooding, whereas the most economic loss is caused by storms. These extreme natural events are going to increase in frequency and intensity in the course of climate change. Disaster warnings are issued by different agencies, which do not all share the information between each other. Some information reaches the community via the sub-district administration authority (LAO) (issued by RID) or goes directly to the local volunteer network (issued by DDPM). The government is focusing more on emergency relief than on long-term disaster prevention.

Government staff is well aware about the Tsunami risk but lacks of a comprehensive understanding of cause and effect of environmental interventions. Some disaster mitigation activities are not being implemented successful since they do not take into account the complete context and lead to unintended adverse effects. The construction of sea walls to stop erosion for example causes sedimentation in nearby areas. The promotion of tourism, ports, and factories can actually increase community vulnerability by such actions as construction of roads through natural waterways and which can cause flooding after periods of heavy rainfall.

Next to fishermen and farmers who are specially exposed to disasters, elderly and children are vulnerable if they are depending on their own in cases the parents seek work in a different city and cannot provide immediate support in an emergency.

Many communities still lack plans for prevention and mitigation of natural disasters. Villagers have a distinctive awareness regarding risk due to natural disasters. They started to reduce their risk with own precautions using simple methods such as building dams to prevent flooding, raising the house foundation etc. The capacity of governmental staff is more advanced in terms of emergency preparedness and emergency relief compared to the reduction of disaster risk.

## 4.3 Capacity Development

The national government sets the framework for adaptation with the Climate Change Master Plan, input will be provided from all relevant sectoral ministries. Communities will receive support via sectoral departments' e.g. agricultural department following the different administrative levels. The OPS-MONRE established the Natural Resources and Environmental Protection Volunteer (NEV) Network to set up a structure on community level to work on environmental issues and train the community representatives accordingly.

Ministries on provincial level mainly plan isolated and do not consider the "big picture of climate change". Reason for this might be conflicting interests between departments (encroachment of coastal land for e.g. shrimp farming vs. mangrove protection) or a lack of understanding of climate change impacts. Climate and disaster information, which is disseminated to the communities, is too vague and not ready to use for the planning of activities of the coastal population. Scaled down information which is translated into the local context is needed.

Through the participation of individuals in community groups like fisher and saving groups, community members can exchange information and get information about access to funding and projects they can participate in.

## 4.4 Addressing Underlying Causes of Vulnerability

Local populations who are affected by the result of national development strategies do not have the possibility to express their concerns towards these strategies. Development of coastal infrastructures such as the expansion of coastal areas for tourism leads to increasing water pollution and destroys marine resources. Coping strategies of vulnerable people are limited due to limited assets such as land, which would offer them the possibility to conduct agriculture or education. The only solution for adaptation to them would be to become unskilled labours in the informal sector.

Community members started to join themselves in networks to advocate for their rights on national level as the formation of Thailand's climate justice network shows.

Supporting activities for affected coastal population are offered by various sectorial governmental agencies but implemented isolated and in an uncoordinated manner which limits their effectiveness. Some activities are implemented via the TAO whereas others are implemented directly in the villages.

# 5. Recommendations

The following recommendations for "Building capacity of communities to adapt to climate change" need to be integrated into the strategic development plans of related government agencies at different levels. They should be advocated as a package with consideration of participation in the policy and planning process. Implementation of these activities in cooperation with civil society organizations is one possibility for filling the gap on capacity of staff and budget limitations.

## 5.1 Climate-Resilient Livelihoods

Climate variability hampers coastal communities to pursue their livelihoods, which mainly depend on natural resources. Understanding the big picture of climate change impact on livelihoods is an important requirement for successful tackling climate related problems. A deeper look into cause and effect of impacts reveals the need for coherent planning from different sectors. Therefore the establishment of a local platform or use of an existing one like TRF platform, where representatives from different sectors can exchange climate change information and share their knowledge and develop joint strategies, is highly recommended.

"Ready to use" climate information such a local weather forecasts with recommended procedures for fishermen and farmers would help coastal population to better plan their livelihood activities. Therefore the provided climate data from national and provincial agencies has to be interpreted within the local context and translated into messages. In order that district agencies are able to deal with the raw data, they should receive a specific training on how to link the data with the socio-economic conditions in the respective district.

Climate change is a global phenomenon with local consequences: individuals in affected areas are the first who feel the impact of climate change and have to start to react to that. Since affected communities already started to adapt to their changing environment, these lessons learnt and best practices should be systematically and documented in a learning centre. Communities can share their experiences and learn from each other. The BCR CC focal points at the LAO could facilitate this kind of learning process and could create a network of at least the 16 BCR CC sub-districts.

Best practices for adaptation should be brought up via the provincial to the national level. It should be analysed if there are structures in place, which allow these kind of bottom up information flow. To ensure that these ideas are considered in the national planning such as within the formulation of the Thailand Climate Change Master Plan, a Monitoring and Evaluation body with representatives from different sectors and different administrative levels including the local government (LAO) should be established.

## 5.2 Disaster Risk Reduction

Climate variability will lead to a higher frequency and intensity of natural disasters. Therefore efficient disaster risk reduction has to be in place. So far, disaster risk reduction activities focus more on actions such as preparation for a disaster and support after a disaster occurred, but preventive measures only play a minor role. Disaster prevention and climate change adaptation activities do often overlap. Mapping of regulations, policies and activities from both areas should be done to identify common areas of work. The line ministries in charge such as the Ministry of Interior for DRR and the Ministry of Natural Resources and the Environment in charge for Climate Change with their

subordinated ministries could therefore collaborate, share their expertise and resources in both disciplines and issue joint regulations.

Climate change information is channelled in different ways to the community. Whereas some information is distributed via the LAO and some information reaches the head of the village directly. It is recommended to involve the LAO in the information flow, especially the climate focal point to ensure that this person is updated on recent developments to be able to function as a resource person.

A comprehensive understanding of disaster risk reduction interventions, which includes the long-term consequences is missing, therefore a feasibility study which carefully analysis the impact of these actions should be mandatory. Environmental interventions should be monitored by a team of representatives of different sectoral ministries and multiple administrative levels as well as from affected population.

Governmental support mechanisms in emergency times should specific focus on children whose parents are absent and elderly who do not have somebody on the ground to take care for them.

Coastal population is already implementing simple disaster prevention mechanisms. Guidance from the local government to do this in a coordinated way could improve the efficiency of the so far mostly isolated actions. Therefore a further training of local governments in disaster prevention is recommended.

## 5.3 Capacity Development

Policy planners should begin to recognize that climate change adaptation needs to be planned as an integral part of development at multiple levels, from community to regional up to national level. It is not necessary that climate change adaptation is always planned by the central government and then implemented by a top-down approach; adaptation planning can also be effectively mainstreamed into the community development planning process. The latter addresses the specific needs and vulnerabilities in the community more effectively.

The CVCA showed that there is a lack of knowledge on “what to adapt to” and “how to adapt to.” The development of local climate scenarios is still in the beginning but adaptation activities already taking place on the ground. This provides the chance to learn from affected communities. A local knowledge platform with best practices and all kinds of climate information should be established on LAO level and the respective climate change focal points should be in charge for administration of the data. Regarding access to climate information, future scenarios which consider the local context and local forecasts are essential for coastal communities to develop strategies which are climate proof and will sustain in the face of climate change. Therefore staff of agencies such as the Thai Metrological Department, Royal Irrigation department and Department of Disaster Prevention and Mitigation on provincial level needs to gain skills to translate messages into local understandable messages considering the local background.

## 5.3. Addressing Underlying Causes of Vulnerability

Communities and external agencies see the importance of protecting their natural resource based livelihood through natural resource conservation and appeal to responsible agencies to apply laws and permits related to economic development more rigorously.

Community based adaptation always depends on the specific context. Therefore community members should be enabled to express their problems in qualified, evidence based statements and be able to develop community based adaptation strategies. This should be in the decision making process. Thus, the access to climate related information on local level and the ability to collect traditional and scientific data, which is organized in a knowledge management system should be given. A way to integrate this knowledge into the formal education would be to consider this in the curricula.

In the course of vanishing family networks, community working groups gain a more and more important role for support and knowledge sharing. Involving this community groups in adaptation activities is highly recommended.

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# Appendix I

## National organizations and relevant missions

| Organizations | Related missions |
|---|---|
| **The Prime Minister's Office (OPM)** | |
| National Economic and Social Development Board (NESDB) | - Play role as the strategic unit to formulate the development strategies at the national level and also be a knowledge organization of the country to search and develop new knowledge required for national development<br>- NESDB includes climate change as part of the current national strategy |
| **Ministry of Natural Resources and the Environment (MONRE)** | |
| Office of the Permanent Secretary of MONRE | - It is a coordination unit to provide supports and integration on natural resources and environmental management in all provinces in Thailand. There are the regional offices and provincial offices represent to work at the local level |
| Office of Natural Resources and Environmental Policy and Planning (ONEP) | - The Office of Climate Change Coordination under ONEP is the national focal point for coordination with regard to the UNFCC and Kyoto Protocol<br>- It is responsible for coordination with regard to climate change co-operation at state and international level |
| Department of Water Resources (DWR) | - Has assigned the Research and Development Office to work on the climate change adaptation issues |
| Department of Marine and Coastal Resources (DMCR) | - Define policies and plan in conserving and managing marine and coastal resources and mangrove resources<br>- Promote a better understanding and local participation in conserving and restoring the marine and coastal resources<br>- Provide knowledge and be an information center on marine and coastal resources<br>- Develop Integration Strategy on Coastal Erosion Prevention and Mitigation Management for Thailand's Coastal Regions |
| **Ministry of Interior (MOI)** | |
| Department of Disaster Prevention and Mitigation (DDPM) | - Coordinate for inter-agency planning following the 2007 Disaster Prevention and Mitigation Act. DDPM works on climate change adaptation according to National Disaster Prevention and Mitigation Plan<br>- Formulate the provincial disaster prevention and mitigation plan<br>- Disseminate the information and knowledge on disaster prevention and mitigation to the public<br>- Provide emergency responds and recovery the affected areas and people from disaster |

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| Community Development Department (CDD) | - Develop mechanisms to empower knowledge, occupations, funding management in order to strengthen communities in Thailand<br>- Build capacity of the communities' leaders<br>- Support in making a community plan<br>- Provide information system supporting to community development |
| Department of Local Administration (DLA) | - Promote the development of local plans that are in line with national strategic plans, provincial plans and respond to the needs of people<br>- Improve the local administrative system and develop effective finance systems and legal system in management capacity of the local government organizations<br>- Improve the public services delivery of the local government organizations |
| Department of Public Works and Town & Country Planning (DPT) | - Provide land use planning and an advice for spatial development at all levels of Thailand |
| **Ministry of Science and Technology (MOST)** | |
| The Climate Change Knowledge Management Center, The National Science and Technology Development Agency (NSTDA) | - Collect, synthesize and disseminate knowledge on climate change to support strategic planning of government agencies, private sector as well as the local community, to strengthen coping capacity to climate risk |
| Geo-Informatics and Space Technology Development Agency (GISDA) | - Develop the satellite data base and the derived natural resources information center<br>- Provide data services relating to space technology and geo-informatics<br>- Conduct researches and development related to space technology, including the development of small satellites for natural resources survey |
| Hydro and Agro Informatics Institute (HAII) | - Assist in improving water resource management in Thailand<br>- Propose the importance of assessment of risks to be included in planning and developing water resources<br>- Provide research, relevant information system and technologies in managing agriculture and water resources |
| **Ministry of Agriculture and Agricultural Cooperatives (MOAC)** | |
| Office of Agricultural Economics (OAE) | - In 2009 OAE established a committee to study climate change related to emissions, impacts and adaptation issues |
| Department of Agriculture (DOA) | - Work on species selection and variety improvement; for example, related to drought or flood tolerance is important for adaptation |
| Rice Department (RD) | - Promote and support conservation of local plant varieties tolerant to variable conditions |

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| Royal Irrigation Department (RID) | - Manage water resources for agriculture in Thailand and flood protection for many cities and towns that is an important foundation for considering climate change and needs for adaptation |
| Department of Fisheries (DOF) | - Promote and develop all occupations related to fisheries<br>- Manage aquatic and fishery resources<br>- Develop fishery researches and technologies |
| **Ministry of Information and Communication Technology (MICT)** | |
| Thai Meteorological department (TMD) | - Supply weather forecasts for the entire country and publicize disaster warnings to fulfill the requirement from administration and management in natural disaster mitigation<br>- Build the people's awareness toward natural disasters; enable them to perform correct surviving practices; and reduce effects from natural disasters by using modern technologies together with IT services<br>- Become the meteorological IT data and service center at the national level for users in any ventures |
| **Ministry of Social Development and Human Society (MOSDHS)** | |
| Office of the Permanent Secretary of MOSDHS | - Generate a welfare system to support a security life for all people<br>- Promote society and human development in coping with changing situation<br>- Build participation and support knowledge and capacity of all parties to drive a society development |
| **Ministry of Transport (MOT)** | |
| Marine Department (MD) | - Conduct the study and control for the development of water transport infrastructure |
| **Others** | |
| Thailand Research Fund (TRF) | - Build a capacity of the research community<br>- Support research significant to national development<br>- Promotes dissemination and use of research findings<br>- Support a climate change assessment activity with working groups on climate, energy and adaptation |
| Thai Health Promotion Foundation | - Promote the local network and knowledge sharing in order to coping with the affect of disasters related to health |
| Bank for Agriculture and Agricultural Cooperatives (BAAC) | - A state enterprise under the jurisdiction of the Ministry of Finance<br>- Provide credit more widely, directly to individual farmers as well as through farmer institutions |

| Non State-Actors | |
|---|---|
| Raks Thai Foundation | - Focus on assisting poor and disadvantaged communities. In 2008 the foundation began introducing climate change adaptation into its disaster preparedness work with local communities |
| Oxfam GB, Thailand Program | - Has undertaken some work on climate change adaptation with local communities in Yasothon Province. The starting point has been on improving risk management with respect to climate variability, in particular, droughts |
| Thailand Environment Institute (TEI) | - Works in partnerships with private and public actors on environmental issues and conservation<br>- Has been active on climate change issues since establishment in 1993, with its studies contributing to the National Action Plan in 2000 and to the 2007-2008 National Strategy on Climate Change<br>- With technical support from the Asian Disaster Preparedness Centre, it is leading an initiative to help cities in Thailand adapt to climate change as a contribution to the Asian Cities Climate Change Resilience Network (ACCCRN) funded by the Rockefeller Foundation |
| Sustainable Development Foundation (SDF) | - Focus on empowering non state actors and their networks to pursue sustainable development.<br>- In contributions to the 2nd Roundtable a strong recommendation was made to the Platform to target capacity building activities in support of networks of vulnerable groups. Three types were highlighted: the Sustainable Agriculture Network, Community Forestry Networks in particular in upland areas in northern Thailand, and Small-scale Fisher Associations, primarily in southern Thailand |
| Thai Working Group Climate Justice | - Monitor policy advocacy on climate change to meet justice.<br>- Promote a participation and collaboration among civil society sector to address climate change issues with equity |
| Adaptation Knowledge Platform in Thailand | - A collaboration and contribution to the newly formed national Climate Change Knowledge Management Centre under MOST<br>- It links with many different government agencies in Thailand, could be conceived given cross-cutting nature adaptation. At a minimum the Knowledge Platform should also create links with key departments in MONRE (e.g. ONEP), MOI (e.g. DDPM) and MOAC (e.g. RID and DOA). Links with non-state actors are also needed and should be selected based on target locations and sectors (e.g. Oxfam, Raks Thai, TEI) |
| Southeast Asia START Regional Center (Sea START) | - Develop integrated scientific and socio-economic approaches to reduce uncertainties of forecasting and assessing impacts of environmental change for the Southeast Asia region<br>- Provide recommendations and expert advice to governments and the private sectors to cope with long-term environmental changes<br>- Encourage and support the sharing and exchange of environmental data and information within and between regions |

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| Stockholm Environment Institute Asia Centre (SEI Asia Centre) | - Plays a key role in sustainable development issues such as energy, water resources, atmospheric pollution, sustainable livelihoods and climate change<br>- Provide research in focused issues and knowledge sharing platform |
| Asian Disaster Preparedness Center (ADPC) | - Development of capacities and promotion of learning<br>- Dissemination of information and knowledge management<br>- Provision of technical and advisory services<br>- Support for inter-agency coherence and coordination |

# Appendix II

## Organizations in provinces, local and community group that are relevant to the capacity development on climate change adaptation

| Organization | Related missions | Activities in the project area |
|---|---|---|
| **Government Organizations** | | |
| 1. Province | - Develop plan and allocate budget for province development<br>- Supervise and coordinate the implementation of the provincial organizations<br>- Establish plan and set up Provincial Disaster and Mitigation Administration | - Collaborate the operation of the provincial organizations<br>- Cooperate and disseminate information of the disaster warning<br>- Chumphon Province has the policy and plan on disaster prevention and Mitigation as well as forest restoration |
| 2. Office of Provincial Disaster Prevention and Mitigation | - Serving as a secretary of the administrative general staff and operating the provincial disaster prevention and mitigation Plan<br>- Develop the disaster monitoring and warning systems<br>- Rescue people in risk areas | - Support the work of Civil Defense Volunteer<br>- Support on all rescued equipment, disaster warning and setting up training for emergency preparation |
| 3. Hydrological Center Provincial Irrigation Project | - Water resource management<br>- Develop information network, Measuring and monitoring sea water levels, rain variability, flood, and drought | - Disseminating information via media and website |
| 4. Southern Meteorological Regional Center (West and East Coast) | - Forecasts and report weather conditions<br>- Warning the impact of weather on agriculture in advance | - Disseminating information via medias and website |
| 5. Community Development Provincial/ District Office | - Support and encourage communities to make community plan<br>- Develop funding and promote community economy<br>- Capacity development for the community leaders | - Developing of the community fund<br>- Promoting income generation to women groups in communities |
| 6. Provincial Social Development and Human Security Office | - Driving toward social welfare<br>- Support vulnerable group<br>- Strengthening social participation development. | - Promoting community funds |
| 7. Provincial/District Health Office, Health Center | - disseminate knowledge on health care<br>- Develop the disaster management system on emergency response<br>- Preparation on medical support | - Promote village's public health volunteer group |

| Organization | Related missions | Activities in the project area |
|---|---|---|
| | for health care center at emergency response | |
| 8. Land Development Provincial Office | - Support the soil conservation and sustainable agriculture<br>- Support agricultural practices that resilient to impacts of climate change | - Develop the capacity of community advisor on knowledge of soil quality and protection in the community |
| 9. Provincial/ District/ Sub-district Agricultural Office | - Development on agriculture, agricultural products and farmer's livelihood<br>- Set up agricultural data base<br>- Provide early warning to farmers regarding to natural disaster<br>- Provide support to affected farmers from the natural disasters.<br>- Support farmers according to the government policy | - Operating on a registration of farmers<br>- Promote and develop agriculture<br>- Operating on compensation process for agricultural damaged from natural disasters as the government policy |
| 10. Provincial/ District Fisheries Office | - Develop fishery products<br>- Promote the cooperation and sustainable fishery resource management<br>- Support fishermen who got affected from natural disaster | - Develop local fishery group<br>- Set up workshop on aquaculture<br>- Allocate budget and fishery material for fishermen who got affected from natural disaster |
| 11. Provincial Office of Natural Resources and Environment | - Coordinate between related provincial organizations<br>- Making the operational plan for provincial environmental quality management | - Coordinate between relevant organizations on coastal resources restoration and rehabilitation |
| 12. Mangrove Resources Development Stations | - Conserve, restore, and protect mangrove forest resource<br>- Promote the community participation on sustainable mangrove forest management | - Promote mangrove forest restoration and protection<br>- Set up workshop to the volunteer staff who work on mangrove forest conservation<br>- Promote mangrove forest monitoring |
| 13. Marine and Coastal Resources Research Center, The Central Gulf of Thailand | - Research and monitoring of Oceanography, Marine and coastal resources for implementing participatory management | - Develop the mangrove forest and coastal resources conservation groups and their activities<br>- Research and monitoring impacts on coastal resources |
| 14. Marine and Coastal Resources Conservation Center, 3rd, 4th and 6th | - Conserve, restore, monitor and protect coastal resource and marine ecosystem<br>- Coordinate with other organizations<br>- Support community participation in order to conserve coastal resource and marine ecosystems | - Set up conservation groups in order to protect and restore coastal resource and marine ecosystem, including creating conservation activities |

| Organization | Related missions | Activities in the project area |
|---|---|---|
| 15.Walailax University | - Develop curriculums for the south of Thailand<br>- Develop knowledge and provide educational service to other organizations<br>- Set up workshop about the appropriate technology | - Support information and technical knowledge |
| 16.Civil Society | - Strengthening civil society | - Dissemination ofdata and information and raising public awareness on the risk and effects from climate change |
| Local Administrative Organizations and community groups | | |
| 17.Tambon (Sub-district) Administrative Office and Municipality | - Develop local development plan<br>- Provide the public service to communities<br>- Acting as a Local Civil Defense Volunteers | - Some LAOs has develop coastal resources management and mitigation plan e.g. Klong Yao sub-district<br>- Some LAOs has made water resource management plan and a plan to respond to drought e.g. Koh Klang sub-district<br>- Some LAOs has allocated budget for responding to the disasters e.g. Chum Ko sub-district<br>- Set up various community groups<br>- Tha Kham sub-district coordinates external networking and organizations for continuing activities |
| 18.Civil Defense Volunteers | - Prevention and mitigation risks<br>- Maintain peace and order<br>- Relief for disaster victims<br>- Rescue operation | - Rescue the disaster victims |
| 19.Religious Units | - Temple and mosque are the area for operating social activities and being supporting center during the emergency response | - Has a role in every community |
| 20.Sufficient Economy Group | - Operate production and consumption activities that are based on capital and knowledge<br>- Help and support the operation of members | - Ban Na Chum Hed, Ta Sae sub-district<br>- Ban Pak Pron, Had Sam Ran sub-district<br>- Restore the Rice farming in order to secure food security |
| 21.Social groups | - Operating activities according to the group's work plan | - Some communities have mosque committees<br>- Most communities have elderly group, youth group, village welfare group, and funding groups<br>- Youth group e.g. Ban Pak Duad, Sao-Pao Sub-district |

| Organization | Related missions | Activities in the project area |
|---|---|---|
| 22.Community fund and other community financial groups | - Financial service for members of the Fund<br>- Allocate profits to the members and community development | - Every community has village fund and almost every communities have saving groups<br>- Saving group will much help on financial support during the crisis |
| 23.Conservation groups | - Operate activities on conservation, restoration and rehabilitation<br>- Protect community natural resources and environmental | - Ban Ta Klong Community group for natural resources management and emergency response , Koh Klang sub-district<br>- Mangrove forest conservation groups e.g.<br>Ban Pron, Had Sam Ran sub-district<br>Moo 7, Tha Kam sub-district<br>Ban Pak Duad, Sao Pao sub-district<br>Ban Pak Nam Pak Phraya, Tha Sak sub-district<br>Ban Bor and Ban Leam Tan, Chong-Co Sub-district<br>Ban Don Takean, Bang Son sub-district<br>Ban Tong Tom Yai, Darn Sawee sub-district<br>Ban Rai Lang, Pak Preak sub-district<br>- Set up volunteer groups who work on mangrove forest conservation<br>- Set up district conservation network and network at watershed level, e. g Pa Tew district, Sawee Num and Sawee Tao Watershed, Watershed Network in Chumphon Province |
| 24.Occupation groups | - Support the members on Occupational, Marketing, and financial activities | - Fishery group in every community e.g. soft shell crab farming group, fish-cage farming group, giant tiger prawn farming group, shrimp paste producing group, etc.<br>- Tourism Gorup/ Home Stay e.g.<br>BanTa Kam, Pa Lean sub-district<br>Ban Fai Ta and Ban Tung Sai , Tung Sai sub-district<br>Ban Tong Tom Yai, Darn Sawee sub-district<br>- Other occupational groups and women group can be found in almost every community |
| 25. Community | - Establish action plan, raising awareness and understanding, including preparation of coping with the climate change situations | - Mostly of the community members do not have knowledge and understanding about climate change and its effects<br>- Due to the urbanization, most |

| Organization | Related missions | Activities in the project area |
|---|---|---|
| | | communities have less activity for creating closed relationship between villagers. People are tending to live independently<br>- Some communities are gathering for mutual benefits between communities such as providing safe docking area for small fisher-folks during monsoon season, set up emergency shelter during facing natural hazards<br>- Most of the community leaders are reliable and trustful<br>- Groups in the community have voluntary mind to work for community at large<br>- Having community broadcasting information by community leaders or community religious leader(Sheikh)<br>- Communities mostly have local political issues that lead community to disharmony |
| External agencies and Non-government organizations | | |
| 26. Tourism Authority of Thailand | - Promote management and development on the quality of tourism by the community | - Support Home Stay Groups |
| 27. Bank of Agriculture and Agricultural Cooperatives (BAAC) | - Financial aid as loan and management of the group for farmers/fisherman<br>- Promote self-dependent program and develop community learning center<br>- Postpone the loan settlement for farmers/fisherman who has low incomes<br>- Operating CSR activities for getting aid fund for affected people emergency response | - Provide grant/loan for agriculture and fishery<br>- Support other occupational groups |
| 28. Population and Community Development Association (PDA) | - Strengthen community capacity in order to develop the quality of life and community financing | - Support materials<br>- Develop the revolving fund and occupational groups |
| 29. Yadfhon Foundation | - Strengthen community capacity on natural resource management, Trang Province and nearby area | - Create knowledge sharing platform for conservation group |

| | | |
|---|---|---|
| 30. Federation of Southern Fisher Folks | - Monitor government policy that will affect small scale fisher folks<br>- Develop the cooperation network | - Building up learning and expand network to members |
| 31. Mangrove Action Project (MAP) | - Support vulnerable coastal communities in the south on resources management and restoration | - Support data and academic information to the communities, Krabi and Trang Province |
| 32. Thai Red Cross Society | - Carry on relieve operation, response phase, recovery phase, mitigation phase, and preparation phase | - Strengthening the capacity of Vulnerable Coastal Communities to Address the Risk of Climate Change and Extreme Weather Events, Nakorn Sri Thammarat Province |
| 33. Thai Health Promotion Foundation | - Strengthen community preparing capacity to cope with disasters<br>- Mainstreaming support to children and vulnerable groups.<br>- Allocate budget to the community for disaster restoration | - Build capacity for volunteers of community primary health care |
| 34. Cooperate Social Responsibility(CSR) of other organizations such as Government Savings Bank, PTT Public Company limited<br>CP Food Public Company limited etc. | - Operating CSR aid activities vulnerable coastal communities<br>- Support community on coastal resources restoration and protection | - Promote community saving group and community funds<br>- Support the additional occupational development<br>- Support activities on mangrove forest planting, sea-grasses conservation, and introducing artificial coral reef<br>- Support materials for example; Drinking water vending machine, boat, and etc. |

# Appendix III

## Household livelihood status in the project areas in the context of environmental change

| Issue | Situation |
|---|---|
| Noticeable changes in climate/ risk and impact | **Chumphon**<br>- Frequent heavy wave action up to two meters high. This reduces the possibilities for fishermen to go out to the sea. Income has declined by half. In the past two, three years, the monsoon winds show increased intensity and frequency, causing damage to household structures.<br>- Increased ocean temperature results in coral bleaching, which contributes to migration of sea life elsewhere, and increases the distances fishermen must travel out to sea.<br>- Changing seasonal patterns: In the "dry" season there is sudden, intense rainfall accompanied by monsoon winds. Extended monsoon periods result in increased sea levels.<br>- Tidal variations: At high tide, sea water contaminates fresh water resources and threatens coastal areas. In some locations, there is flooding which extends inland by 15 to 20 meters. This influx of sea water can kill palms, coconut trees and fish being held in coastal holding pens.<br>- Dry season: Extended periods of drought affects palm tree cultivation which is heavily dependent on rainfall. This results in reduced output (in some cases by over 50%).<br>- Saltwater contamination of the underground fresh water table: This reduces the availability of natural consumable water.<br>- Coastal erosion: This can lead to destruction of coastal infrastructures.<br>**Nakorn Si Tammarat**<br>- Almost all households in Tambon Sao Pao and Thung Sai have been adversely impacted during the annual monsoon. The Yor Pik traditional fishermen's equipment has been almost completely destroyed. In addition, off-season storms strike without warning about two to three times per year. Off shore fishing is not possible during those storms.<br>- The increased temperature of the ocean and canals, combined with the varying salinity of the water for consumption affects aquaculture because of the dying off of food sources. Shrimp and crabs sicken, turn orange, and die. This phenomenon occurs mostly in the months from June to September each year.<br>- The higher-than-normal tides prevent some fishermen from going out to sea. Palm orchards and other areas of land cultivation are destroyed. Other parts of the community are also damaged each year, including household property, coconut orchards, and roads.<br>- Floods are damaging over half of houses and property in coastal fishing communities in Sichon District. Muang District has reported annual flooding in the past five years. |

| Issue | Situation |
|---|---|
| | - The size of the sand barrier at the mouth of rivers to the sea as accumulated over time. Occasionally, the size of these sand bars prevents fishing boats from leaving shore and this causes hardship and loss of income.<br>- There is increased coastal erosion in Sichon District at a rate of one meter per year; in some parts of Muang district the rate is two meters per year.<br>- Increased intensity of winds damages housing and property of coastal fishing communities.<br>- Forest rainwater run-off during the monsoon damages coconut plantations near the water channels; the run-off damages or kills palm trees. The extent of the damage is about 20%, and mostly occurs during October and November. |
| | **Krabi**<br>- Monsoon-driven wind and waves outside the traditional monsoon season prevent fishermen from going out to sea, thus reducing their income.<br>- Residents of Koh Lanta have observed changes in the average water temperature, similar to the findings in Muang District. The high temperatures from January to April have caused an increase in the sea level, and this has resulted in the out-migration of certain species of fish, thus reducing the catch. In response, the fishermen have to go out further to the sea to deeper waters. This takes more time and increases the risk of accidents.<br>- Sedimentation of the sea during the dry season in Koh Lanka Island, combined with the strong winds, causes the underwater fishing nets to trap the sedimentation and thus become more visible to the target fish, reducing the catch.<br>- In addition, the sedimentation of the waterways leading to the sea reduces the flow of water and increases the risk of flooding.<br>- Higher-than-normal tides kill fish being cultivated in holding pens and, in some cases like Tambon Khlong Yang, over half the fish die. Rice farmers from Koh Lanka can no longer plant and harvest rice ever since the 2004 Tsunami destroyed their rice fields.<br>- The progressive coastal erosion presents future risks for nearby communities and potential destruction of property.<br>- Sporadic rainfall in the past five to six years has reduced the average volume of agricultural water; palm production has declined, especially in Tambon Khlong Yang in Lanka Island. During periods of extended dryness, some of the rubber trees which have been ready to harvest died.<br>- By contrast, when there are abnormal amounts of rainfall, the rubber farmers cannot tap the trees. Farmers in Tambon Khlong Yang estimate that they have lost about half the income from harvesting the latex that they could obtain in the past. Rice farmers in Khlong Prasong District have lost farm income due to the reduced amount of land for planting rice, largely attributable to higher tidal levels, longer rainy seasons, and |

| Issue | Situation |
|---|---|
| | unseasonal rainfall. The reduced harvesting of the rubber trees results in growth of pathogens which destroy the trees. High winds can break the taller rubber trees, resulting in the trees' death. |
| | **Trang**<br>- Variable weather patterns prevent the fishermen from going to sea on schedule.<br>- Waste water from shrimp farms is not dispersed or diluted in times of sparse rainfall. The waste accumulates in the canals and kills water life and threatens mangrove forests - resources which the local residents depend on.<br>- Heavy rainfall results in increased run-off and sedimentation. This threatens the fish being raised in shore-line holding pens by fishermen in Tambon Tha Kham.<br>- During periods of intense sunshine (March and April) the water heats up and fish got infected with pathogens.<br>- Heavy rainfall causes rubber trees to contract bark diseases and lose leaves, reducing the potential income of the rubber farmers. The heavy unseasonal rainfall threatens other agriculture such as watermelon plots and rice paddy.<br>- Many families in areas of heavy rainfall experience health problems, epidemics of illness, mosquito-borne disease (e.g. dengue and Chikungunya fevers).<br>- Major coastal erosion at Had Samran sub-district. |
| **Strategies of households in addressing challenges related to climate change** | **Chumphon**<br>- Some households pursue alternative occupations during periods when fishing is not possible |
| | **Nakorn Si Tammarat**<br>- Some fishermen seek out wage labor jobs when they cannot fish. Others cultivate fish in fish ponds while conducting rice farming. Still others catch wild fish and crabs in the canals and mangrove forests during periods of high sea.<br>- Some families who are building new homes raise the house stilts to a higher level than normal. Others move their houses to higher ground or move out of the community to less risk-prone areas. |
| | **Krabi**<br>- Villagers have established a community fund for use during disasters.<br>- Some fishermen have quit fishing to pursue alternative occupations. Others have switched from deep-sea fishing to local fishing in the canals.<br>- When they cannot go out to sea, some fishermen catch crabs, cockles/mussels, or place fish nets in the local canals and mangrove forests. Others seek agricultural wage labor in local rubber or palm |

| Issue | Situation |
|---|---|
| | plantations. Otherwise they will leave the area for wage labor elsewhere.<br>- Fishermen who raise aquatic life in Tambon Khao Khram have erected a series of sun roofs to protect the fish in growing pens. This has reduced fish mortality.<br>- Some farmers received financial compensation for losses from natural disasters, but this was not enough to invest and start over. |
| | **Trang**<br>- Some fishermen in Tambon Suso quit fishing as an occupation because of the steadily reducing catch. Only about ten fishermen remain. Some of the others have turned to rubber farming.<br>- The fishermen who raise fish in coastal pens in Tambon Tha Kham sell the fish when they are still young to protect against die-off when the fish are larger. Others have built sun roofs to protect the fish in the pens from the intense sun light. |
| **New models of agriculture as an adaptation to climate change** | **Chumphon**<br>- Agrarians in Sawi District are deepening drainage ditches as part of crop cultivation. |
| | **Nakorn Si Tammarat**<br>- - |
| | **Krabi**<br>- Some local residents with their own land are attempting to diversify the use of the land by planting crops, vegetables, and building fish ponds. In Tambon Khlong Yang there is a common area for animal husbandry and this increases income-generating options.<br>- Some villagers in Tambon Khlong Prasong have erected earthen dikes to prevent saltwater contamination of the rice fields. |
| | **Trang**<br>- Rice farmers attempt to harvest the rice before the rains resume to reduce crop loss.<br>- Farmers in Tambon Ta Sae are returning to traditional rice seed which is more resistant to effects of climate change. These rice varieties include Hoi Sang, Jampa, Rachinee, and Lep Nok. |
| **Strategies for diversifying occupations as an adaptation to climate change** | **Chumphon**<br>- There is a strategy of distributing risk across a range of occupations such as fishing, crop cultivation, palm farming, coconut farming, etc. These alternative sources of income can complement each other.<br>- Other residents are pursuing secondary occupations to fishing such as working as hired labor on large, private palm plantations, or general wage labor jobs.<br>- In Sawi District, villagers came together to establish a home stay program for eco-tourists, but this is progressing slowly. |

| Issue | Situation |
|---|---|
| | **Nakorn Si Tammarat**<br>- Some villagers have distributed the risk by pursuing dual occupations such as fishing and palm farming, as these complement each other.<br>- Others look for short-term wage labor when they are unable to go to sea or pursue local agricultural endeavors. |
| | **Krabi**<br>- Some agrarians in Tambon Koh Klang are able to generate income from renting their land to shrimp farmers.<br>- Other occupations such as merchandizing, wage labor and working in the service/tourist sector are some of the alternatives that villagers are pursuing to reduce risk when their primary occupation is threatened.<br>- Some of the fishermen have distributed risk by combining deep sea fishing with coastal fisheries cultivation.<br>- Most of the fishermen do not own land for cultivation. These individuals are the most vulnerable to climate impacts. Some of these individuals try to find jobs as contract laborers when they are not able to fish. |
| | **Trang**<br>- Residents of Tambon Ta Sae have reduced risk by pursuing the alternative occupations of animal husbandry, production of community crafts, and weaving material from local reeds.<br>- When rubber farmers are not able to tap the latex they pursue other forms of crop farming with good returns. |
| **Risk management and planning for prevention** | **Chumphon**<br>- Households in Tambon Chum Komee have joined together to plant mangrove forest to prevent impact from coastal winds and reduce erosion.<br>- A savings group has been formed to provide emergency loans to repair fishing equipment that is damaged during the monsoon season. |
| | **Nakorn Si Tammarat**<br>- Local residents can join the village loan fund; however some members are not able to re-pay the loans in full due to depressed incomes. |
| | **Krabi**<br>- Some residents have taken out loans from the Bank for Agriculture and Agricultural Cooperatives or from revolving funds to use for re-investment.<br>- Some communities in Tambon Koh Klang have loan funds. Tambon Khlong Yang has agricultural revolving loan funds. Others have non-formal lending practices.<br>- Some families reduce household expenses and increase savings on a systematic basis in order to reduce their risk.<br>- Most of the families participate in reforestation along canal banks to |

| Issue | Situation |
|---|---|
| | prevent erosion, strengthen the waterways and banks, and increase the area with mangrove forest. |
| | **Trang**<br>- Villagers participate collaboratively dedicate themselves to planting mangrove forest.<br>- Some agrarians have registered with the district agriculture office so that, in case a natural disaster strikes, they are eligible for government assistance.<br>- The agrarians still give emphasis to the importance of savings. Most have accounts with the Bank for Agriculture and Agricultural Cooperatives. |