CASE STUDY 2-5

IMPLEMENTING ADAPTATION MEASURES

Ecosystem-based Water Management in Upper River Basins in Thailand

Photo courtesy of GIZ

Lessons Learned and Policy Recommendations

- Efforts for stakeholder communications through quantitative assessments and other measures such as visual aids are important for expanding EbA.
- Developing and sharing a set of problems and solutions based on expertise incorporating indigenous knowledge are important for effectively implementing and sustaining EbA projects.

Outline

Background

The land-use conversion of forests into crop farms in the upper river basins has caused a drastic increase in population and water demand in Thailand. Decreasing water storage capacity, due to outflowing sediment from forests into rivers and reservoirs, has also made those problems severe. Human activities degrade the ecosystem in the area and thereby make it more vulnerable. Increases of extreme events related to precipitation and temperature due to climate change have aggravated the situation, and immediate actions are needed. In response, projects based on the concept of ecosystem-based adaptation (EbA) have been launched by the government. Also, it is suggested that relevant agencies incorporate this concept in their policy-making process. The pursuit of ecosystem-based adaptation approaches in the water sector has been included in the Climate Change Master Plan (CCMP) 2015-2050.

Effectiveness of ecosystem-based adaptation

Ecosystem-based adaptation refers to increasing the adaptation capacity of societies and ecosystems of an area by preserving and making use of ecosystem services. For example, extreme events that result from climate change can be prevented by storing water in vegetation, soil, and aquifers.

Biodiversity preservation is an additional positive side effect.[1]

Geographical Characteristics[2][3]

The ecosystems of the three project sites are similar in that they have been deteriorating due to human activities and are vulnerable to the impacts of climate change. The characteristics of the sites are as follows:

- IHuai Sai Bat Basin: The basin is characterized by severe droughts, continued intrusion of sedimentation into water reservoirs, and water supply and safety.
- ITha Di Basin: The basin is characterized by steep terrain and has one of the highest rainfalls in Thailand. Flooding (flash floods), water scarcity, and water quality have become pressing issues facing the region.
- ILam Pa Chi River Basin: The basin is characterized by high mountains and steep river valleys. Because the area belongs to the tropical wet and dry or savanna climate (Aw) group, flooding by increased monsoons and tropical cyclonic storms, droughts, and erosion and sediment transport are issues in the area.

Figure 2-5-1 Locations of the 3 project sites

Objectives

Overall goal

- Improving the entire ecosystem of the subject area and contributing to climate protection and sustainable development of Thailand by promoting green and grey measures to reduce the impact of climate change.
- Designing and facilitating implementation of suitable measures in each area and enhancing resilience to climate change and improving local capacity for water management.

Sub-goals

Establishing stakeholder platforms in the pilot areas for:

- Improving local people's general education and awareness of climate change and water management.
- Supporting local water departments and staff of relevant water authorities to plan, design, and evaluate possible measures.
- Reflecting these EbAs experiences in the national adaptation strategy.

Institutional arrangements

Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds (ECOSWat) started in July 2013 as an IKI financed project in the Thai-German initiative by GIZ. The Department of Water Resources (DWR) of the Ministry of Natural Resources and Environment (MNRE) is the main government organization of this project. GIZ supports DWR to develop the plan and monitor measures. The Royal Irrigation Department (RID) of the Ministry of Agriculture and Cooperatives (MoAC) is also an important agency. Several ministries (about 33 different local stakeholders) are involved because of the wide range covered by the water sector. This project will end in 2017.

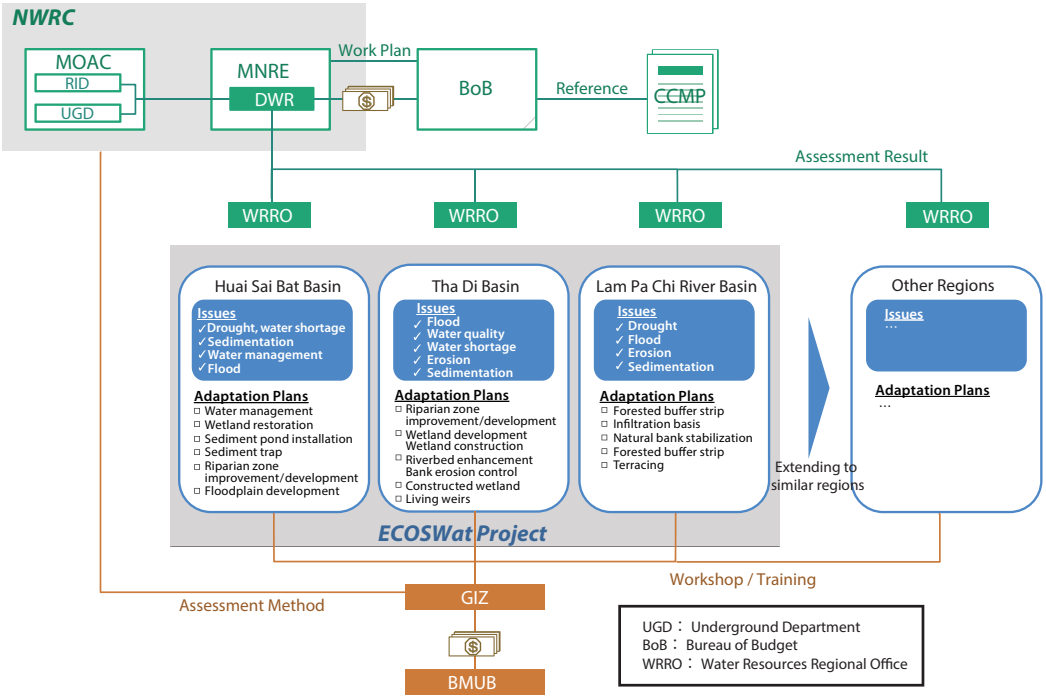


Figure 2-5-2 Institutional Arrangements

Activities

Involve a wide range of stakeholders to establish stakeholder platforms

The project involved the existing River Basin Committee from the very early stages of the process.[4] The River Basin Management Committee includes regional officials and local society groups, and helped to make a base of stakeholder platforms for further activities.

Vulnerability Analysis (VA) and assessment for understanding the current situation of the local ecosystem and sharing information with local stakeholders

Each river basin was modeled by aggregating data from different institutions (for example, hydrological network, geology, groundwater aquifers, land use, and crop pattern). Each basin's hydrological analysis was conducted by experts and the effects of climate change were identified.

After identifying vulnerabilities, all stakeholders in each basin worked together to learn how climate change impacts the area and understand how the EbA works.

Economic Analysis to assess the cost-effectiveness of EbA

Because measures taken by EbA do not necessarily bring the best results to the area, a cost-benefit analysis of green measures, grey measures and hybrid of green and grey measures is implemented in the process of VA. Results showed that the hybrid option was expected to be the best option in terms of the cost-benefit ratio.[5][6]

Capacity-building of Thai partners and stakeholders to solve water and land issues by EbA

To attain support from the public, workshops and training on the current situation of the ecosystem, the impacts of climate change, and the concept and effectiveness of EbA were held four to five times a year at the Water Resources Regional Office. Stakeholder platforms for further education, training, dialogues, and networking were also established in the project. To provide professional education for local experts, EbA project experts offered education and training to personnel from government bodies and universities on how to utilize their knowledge and experiences.

Study tours, discussions, and information-sharing about water issues contribute to improving capacity-building in the regions.

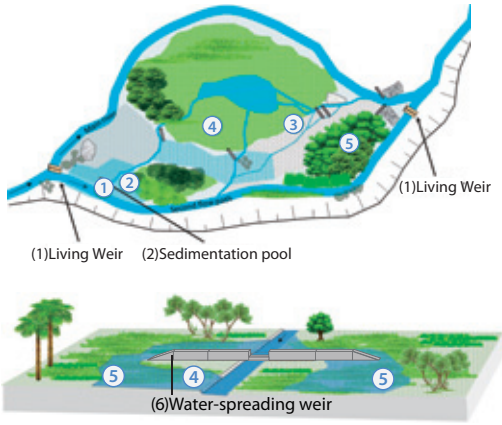
Through the capacity-building process, the locals have more integrated into the community, playing active roles in working groups.

Arranging and adopting appropriate adaptation measures in each area

After conducting a vulnerability study and an economic analysis, a working group for a feasibility study was set up to survey the potential of pilot areas and to create a detailed design of pilot measures. They also discussed possible and suitable EbAs (including both green and grey measures), referring to the opinions of experts.

Discussion results about suitable EbAs, along with indigenous knowledge, were referred to when producing a catalogue of the areas' potential measures.[6] Potential green measures for each issue are provided **(See Figure 2-5-3)**. The drawings are indicated with numbers which refer to different vegetation zones. Local plants were prioritized over others.

Measure	Effect	Issues which are expected improvement
(1)Micro-dam, barrier, weir	Reduction of flow velocity Creates areas of stagnant water Sediment settlements	Land erosion River bank erosion Loss of biodiversity
(2)Sediment pond	Specifically made for sediment deposition	Water supply safety Water quality
(3)River channel modification	Rise of water level Increase of biodiversity Facilitates self-cleaning capacity	Drought, Water supply safety Water quality Loss of biodiversity
(4)Riparian zone development	Sediment and nutrient buffer	Water quality River bank erosion Loss of biodiversity
(5)Floodplain + wetland development	Retains water Increase of biodiversity	Flood Water quality, Water supply safety Loss of biodiversity
(6)Water- spreading weir	Increase of groundwater recharge Flood peak reduction	Water supply safety Flood
(7)Bank erosion prevention	Stabilises river banks Reduction of sediment load Enrichment of vegetation	River bank erosion
(8)Water management	Wide-ranging effects on various resources and socio-economic issues	Water supply safety
(9)River bed enhancement	Restores degraded hyporheic zones Improvement of self-cleaning	Water quality
(10)Constructed Wetland (CW)	Depending on the type of CW, ability to reduce BOD, suspended solids and/or nitrate or other components Horizontal flow (HF) or vertical flow (VF) types are possible	Water quality River bank erosion



Vegetation zone	
①	River bed, permanently submerged
②	River banks, lower terrace, wet conditions, transition river bed and river bank
③	River banks, upper terrace, frequently submerged
④	Riparian zone, rarely submerged, some events each year
⑤	Adjacent area close to river with the potential to be submerged during large flood peaks

Figure 2-5-3 List of potential measures for issues and drawings of application examples

Adoption of innovative technologies

This project collects data from aerial and terrestrial photos using Autonomous Unmanned Aerial Vehicles (UAV), also known as drones. These data are used for VA and M&E.[7]

Walailak University surveyed and gathered aerial images and generated 3D models. These models were useful for designing effective ecosystem-based adaptation measures.

These aerial data and 3D models were also used in explainingissues of water scarcity and climate change to relevant stakeholders, in order to deepen their understanding of such issues.

Photo courtesy of GIZ

Figure 2-5-4 M&E: drone and 3D model

Lessons Learned and Policy Recommendations

1 Efforts for stakeholder communications through quantitative assessments and other measures such as visual aids are important for expanding EbA.

● Understanding EbA

EbA has advantages such as relatively small initial and maintenance costs, low barrier for participation of local communities, smaller environmental impacts, and improvement of ecosystem services as a side-effect, if properly installed Ecosystem-based measures, coupled with grey measures, are expected to be effective also in monsoon Asia, where water-related hazards are especially dire.

However, there are some obstacles in spreading ecosystem-based approach. The time required to confirm effects of EbA projects, for instance, is relatively long, lasting as long as several years. According to the DWR, the lack of concrete evidence of the effects of EbA measures is one of the reasons why the measures are not widely adopted. Evidence is needed to allocate budget to implement and spread these measures.

It should be noted here that the perception of EbA that it takes longer time until effects appear than grey measures due to time for plants to grow is not always supported by evidence. Some of the measures considered in ECOSWat were effective immediately after installation.

● Cost-benefit analysis

Rigorous cost-benefit analysis such as the one conducted in ECOSWat project provided quantitative information which was useful during negotiations on budget allocation and stakeholder involvement. Results of the cost-benefit analysis[6] showed that the hybrid of green and grey measures was expected to be the best option in terms of the cost-benefit ratio. One of the challenges in conducting such prior assessments is collecting data necessary for the analyses: the central and local governments need to collaborate in order to identify and collect such necessary data.

● Adoption of new technologies

Aerial images from drones and 3D models were used to explain the issues of water scarcity and climate change to relevant stakeholders. The same technologies can be used to monitor the effectiveness of the implemented measures.

2 Developing and sharing a set of problems and solutions based on expertise incorporating indigenous knowledge are important for effectively implementing and sustaining EbA projects.

● Developing options suitable to the situation

Indigenous knowledge should be incorporated when designing EbA projects in order to address the situations of the regions. Doing so was effective for encouraging cooperation and understanding of local committees and residents in relation to climate change issues. Consequently, it reduced the time required for project participation and implementation with the locals.

Green measures can be combined with grey measures for preparation to a range of hazards anticipated in monsoon Asia. It is important to consider a hybrid option combining green and grey measures in keeping a balance between sustainability and effectiveness in meeting local needs.

Successful selection of options suitable to the situation geographically and economically enhances sustainability of the project. In ECOSWat, the Government of Thailand and the Government of Germany agreed that GIZ should take on the role of developing the project plan and Thailand should cover the cost of construction and maintenance. This cost sharing approach would be effective for countries such as Thailand, where the level of development is relatively high and is therefore capable of sustainably managing and deploying the project in the long run.

● Sharing knowledge and experiences

Regions where their ecosystems are severely degraded share similar geographical conditions and problems. Organizing problems and solutions learned through related past and similar projects — as it was done when creatingthe stock-taking measurement list as shown in **Figure 2-5-3** — and sharing it among parties engaged in similar projects would be effective for future project development. In ECOSWat, DWR takes the initiative of the project and the experiences will be shared between their local offices.

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