

Strategic actions to enhance environmental regulation and management of a coastal community to mitigate climate effects

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Abstract: Bearing in mind that global climate change is a rising issue, the coastal community of Prek Thnaot, Cambodia has been put on severe effects about natural disasters caused from poor infrastructure and agriculture dependence. This paper proposes to provide and guide a strategic action for the sustainable development path of coastal community in a more continuous manner including a robust resilience to impacts of climate change, natural disasters, and other risks. In doing so, this paper will help environmentally sound management and coastal resources sustainability being sound for socially and economically inclusive development. Proposed fourteen strategic actions for the research should be accompanying with the participation of and cooperation from the local coastal community. Based on the proposed strategic actions, it is critical that the local authorities and other key stakeholders need to accomplish. Providing a good insight for the central government, the strategic action is expected to integrate and prepare a management strategy plan for the local coastal community level. Therefore, this information can be applied to other coastal areas to promote and ensure sustainable protection and management of coastal resources.

Keywords: Strategic action, Climate effects, Natural disaster, Inclusive development, Coastal resource

1. Introduction

Climate change, which will result in sea level rise, will have a number of different physical and ecological effects on coastal systems, including inundation, flood and storm damage, loss of wetlands, erosion, saltwater intrusion, and rising water tables. Rising surface water temperatures, for example, are likely to cause increased coral bleaching and the migration of coastal species toward higher latitudes. Kampot Province is one of the four coastal provinces of Cambodia, all of which are located in the southwestern part of the country, and has a total coastline of 66.5 km [1]. A coastal community is located in Prek Thnaot commune, Toeuk Chhou district of Kampot Province. The Prek Thnaot environment is rich in natural resources including upland forests, mangrove forests, and fishery resources and other marine life, thanks to its favorable geographic location [2] [3]. There are about 150 aquatic animals including 84 fish species, 6 shrimp species, 6 squid species, 19 crab species, and 32 other species [1]. The amount of productive agricultural land in the community is relatively small, and the community is

vulnerable to climate change impacts and other natural disasters because of low incomes, poor infrastructure, and dependence on agriculture, such as rice farming, and fishing, and so forth. Moreover, the community has experienced severe impacts from erosion, which is defined as the permanent loss of land along the shoreline and is observed as the landward movement of the shoreline vegetation [4]. Over the past 30 years, the area has eroded at least 10 meters, destroying coastal vegetation including mangroves, and the rate of erosion doubled over the last 10 years after the mangrove forests were encroached and destroyed [5][6]. In the past, Prek Thnaot was bigger in land area than it is today and there were many houses along the coast [5]-[7]. Villagers cultivated rice on the farming land around the houses or along the road. Because of erosion, water expands onto many parts of the encroached-upon land, leading to loss of agricultural and residential land [6][7]. Therefore, it is time to propose an appropriate strategic action for the protection and management of the Prek Thnaot coastal community. The main objectives of this study were to review the existing national policies and strategies related to coastal zone management and

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to propose strategic actions to protect and manage the Prek Thnaot coastal community.

2. Overview of Prek Thnaot Coastal Community

Prek Thnaot village is one of the four villages of Prek Thnaot commune, Toeuk Chhou district of Kampot Province, Cambodia. The village is about 30 km from the provincial town of Kampot along National Road No. 3. It is adjacent to the Preah Monivong National Park, Prek Kreng village, the sea, and Kdat village to the north, west, south, and east, respectively. Prek Thnaot village is populated by 326 families (approximately 1,705 people) and about 49 percent are female. The population has increased, on average, by 3.46 percent annually [8]. Commune-level statistics (2006–2010) indicated that there were more in-migrants than out-migrants. About 90 % of the Prek Thnaot villagers are farmers (rice farmers) and fishermen, whereas the rest engage in craft work, services, and other industries. The village has a very limited amount of agricultural land for rice farming compared to other lowland communities. Each family owns less than 1 hectare of farming land, and the average annual rice yield is about 2 tons/hectare. It has been argued that rice farming alone cannot feed all the villagers; therefore, some engage in fishing activities as an alternative livelihood option. Short-term and long-term crops, vegetables, and livestock are some other livelihood activities.

As far as energy consumption is concerned, more than 70 percent of the villagers access to electricity through either electricity grid or battery light. Villagers also use firewood for cooking. The Prek Thnaot community is well equipped with educational facilities, including 7 primary schools, 2 lower secondary schools, and 1 upper secondary school. The health care system is good because of the easy and convenient accessibility via National Road No. 3 to the provincial town, where health care services are located. Another important indicator of health and sanitation is the accessibility to clean water. The sources of water include purified water systems, wells (ring or pumping wells), pond water, and rainwater. However, water availability during the dry season is also a main concern. In this season, more than 70 percent of the population has access to safe and clean water, whereas 27 percent has access to unsafe water sources only. About 35 percent of the population drinks filtered water, whereas more than half (65 percent) of the population boil water for drinking. Approximately 41 percent of the total population did not have

their own latrines. Waste management has not been in place and varies from household to household. Most families throw rubbish sparsely all over the place; however, a number of families dispose of their rubbish properly. Because many villagers dispose of their solid and liquid wastes improperly, water sources are affected and the surrounding environment is polluted. The Prek Thnaot community is rich in natural resources including forests, mangrove forests, and fishery resources and manages around 2,006 hectares of forest in the sustainable use zone of Preah Monivong National Park [3].

Prek Thnaot village was classified into nine administrative zones as follows. (1) Village areas where settlement land is found are mainly referred to as town. This represents less than 10 % of the total Prek Thnaot village area. (2) Rice field refers to the farming land of the village, which covers about 15 % of the total village area. (3) Cropland, orchard, and orchard mixed with crop constitute about 15–20 % of the total village area. This includes villagers' plantations (fruit trees, annual crops, or long-term agro-industrial crops, etc.). (4) Fish or prawn ponds are located along the beach of Prek Thnaot. The area is seasonally flooded, especially during high tide. The elevation of the area is about 150–200 cm above sea level. (5) Clear up land refers to the land where no plants are grown or other crops are cultivated. This could be the area where villagers cleared forests for their settlements. (6) Grasslands are also found in the village and distributed with the rice field. (7) Natural forest constitutes a large area of the village that connects croplands and rice fields to the forest inside Preah Monivong National Park. About 30 % of Prek Thnaot village is forested. (8) Intact mangroves are located along the coast of the village. (9) Degraded mangroves are found along the coast of the village as well. These degraded areas need to be restored, as they can be used as a protective wall to reduce the effects of natural disasters, to prevent coastal erosion, and to revitalize marine species populations.

3. Existing Relevant national Policies related to Coastal Zone Management

Cambodia has ratified a number of International Conventions related to coastal zone protection and management including the United Convention on Law of the Sea (UNCLOS) on December 10, 1982; International Convention for Prevention of Pollution from Ships of 1973 and subsequent Protocol of 1978, generally referred to as the Convention on Marine Pollution (MARPOL 73/78); Convention of International Trade in

Endangered Species (CITES) (signed in 1973 and ratified in 1997); Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar, 1971 (signed in 1999); United Nations Framework Convention on Climate Change, 1992 (signed in 1992 and ratified in 1995); International Plant Protection Convention (IPPC), the aim of which is to secure common and effective actions to prevent the spread and introduction of pests of plants and plant products and to promote measures for their control; and so forth [9].

On November 1, 1993, His Majesty King Norodom Sihanouk issued a Royal Decree on the Creation and Designation of Protected Areas, for 23 areas that covered about 3.3 million hectares (18.23% of the country's total land area) with the main objective to address natural resources management. The Royal Decree declared the Ministry of Environment (MoE) to be responsible for supervising development planning and managing the incorporation of these natural protected area systems with the protection of terrestrial, wetland, and coastal environments. The Royal Government of Cambodia (RGC) adopted the Law on Environmental Protection and Natural Resources Management (2006), which is the supreme legal instrument that indicated clearly on purposes towards the environmental and natural resource protection and management [10]. This law is formulated to protect and promote environmental quality and public health through the prevention, reduction, and control of point and nonpoint sources of pollution; to assess the environmental impact of all proposed projects prior to the issuance of a decision by the RGC; to ensure the rational and sustainable conservation, development, management, and use of the natural resources of Cambodia; to encourage and enable the public to participate in environmental protection and natural resources management; and to suppress any acts that cause harm to the environment. Additionally, the Law on Protected Areas (2008) was passed in order to manage and effectively implement the conservation of biological resources and the sustainable use of natural resources in protected areas; to define the jurisdiction and responsibilities of the natural protection and conservation administration in the management of protected areas; to determine standards and procedures for managing protected areas; to determine the responsibilities and participation of local communities, indigenous ethnic minorities, and the public; and to implement regional and international conventions, protocols, and agreements regarding the protection of biodiversity and

ecosystems of protected areas [11]. The country also approved the Law on Forestry (2002) to ensure the sustainable management of forests for their social, economic, and environmental benefits, including conservation of biological diversity and cultural heritage [12]. Moreover, the Law on Fisheries (2007) was adopted with the goal of establishing a framework for management, protection, conservation, utilization, exploitation, inundated-reforestation, and development of fisheries to ensure sustainability of the fishery resources for the interest of society, the economy, and the environment in accordance with the national fisheries policy [13].

Additionally, numerous policies, strategies, and programs, including the National Poverty Reduction Strategy; National Strategic Development Plan (NSDP), aimed at building the capacity of the Government's institutions, developing a strategy dealing with the anticipated impacts of climate change, and strengthening disaster management capabilities and other development activities [14]; the Strategic Framework for Decentralization and Deconcentration (D&D) reform, developed to achieve broad-based and sustainable development and strengthen the vibrant local economic foundation for every citizen to provide equal opportunities to participate in local development, effective natural resource management, and delivery of quality public services to meet the needs of citizens and improve their livelihoods, have been developed and mainstreamed into different technical ministries and institutions to address emerging issues [15]. This reform avails commune councils to plan and manage the construction of roads, the renovation of schools, and the establishment of sanitation infrastructures; National Coastal Zone Management and Development Strategy; Cambodia Shoreline Management Strategy, aimed at raising awareness among Cambodian people, officials at all levels, students, professors, teachers, and national and international agencies regarding Cambodia's shoreline management issues, related laws and regulations, and making recommendations for good management of the shoreline, ensuring sustainability of coastal natural resources and the environment of Cambodia [9]. It is also designed to support planned sustainable development along the shoreline, to control and manage coastal defenses, and to protect the shoreline through appropriate zoning and development guidelines; National Strategic Plan for Land Based Pollution Management, aimed at developing basic information and a database related to

the sources of land-based pollution management, to develop and implement a plan for preventing land-based pollution and strengthening institutional arrangement and management, and to develop and strengthen the management of funding programs [9]; National Policy and Guideline on the Use of Dispersants in Cambodia, aimed at providing technical support for strengthening the implementation of the contingency plan for oil spill response in Cambodia through the development of this national policy and guidelines for the use of dispersants for oil spills [16]; Commission on Monitoring and Assessing for Suppressing Encroachment into Mangrove Land and Coastal Reclamation, aimed at monitoring and assessing for suppressing encroachment into mangrove land and coastal reclamation in order to stop the encroachment, to rehabilitate encroached and reclaimed land, and to order the reforestation of cleared mangrove areas [9]; National Committee for Maritime Security Management, aimed at assisting the government in leading and implementing the protection of Cambodia's territory and its neighboring states from any threats that may occur and exploit the beneficiaries of the sea and marine sectors [9], which will also assist the government in leading, managing, and coordinating law enforcement to effectively prevent and protect from threats of any kind as well as to assure the safety and security of economic development and cooperation with neighboring countries both in bilateral and multilateral agreement [9]; Navigation Coordination Committee (NCC); National Committee for Land Management, Urban Planning and Construction with the main objectives to prepare land use planning, including urbanization, protect patrimony, environment, economic development and natural resources, control over construction works and installation, and prosecute, stop working and seizure construction materials in accordance with the level of violation [9]; Strategic Planning Framework for Fisheries; Cambodian Climate Change Strategic Plan (CCCSP), aimed at developing Cambodia towards a green, low-carbon, climate resilient, equitable, sustainable, and knowledge-based society [17], and so forth. Furthermore, the government introduced an Eco-villages concept for integrating a supportive social environment with a low-impact way of life, which includes various aspects of ecological design, permaculture, ecological building, green production, alternative energy, community building practices, and much more [18]. It is suggested that the existing strategic plan for coastal zone management be implemented to ensure that the tourist areas do

not degrade but remain attractive for visitors. There is also a need to monitor the implementation of all public infrastructure projects to ensure that it is environmentally sound. Promoting public participation in environmental protection and natural resource management is encouraged, so that people are informed and can participate in decision-making processes regarding their environment [18].

At the subnational level, the Provincial Working Groups (PWGs) were established and are chaired by the respective governors of each province [9]. The PWGs are responsible for establishing priorities for coastal and marine management activities in their particular provinces, coordinating on coastal zone projects with provincial departments and institutions regarding coastal issues, providing advice on all coastal issues via the Chairman of the PWG, and establishing technical groups in connection with the planning and implementation of different project activities. These groups may include staff from different provincial departments, districts, communes, villages, and nongovernmental organizations (NGOs); representatives from local communities; and other stakeholders [9]. Additionally, Coastal Resource Centers (CRCs) were constructed and acted as environmental centers for maintaining and updating the environmental information systems and managing the environmental monitoring along with management activities [9]. These centers play very important roles in the sharing of information with the central government and the monitoring of activities conducted in the coastal provinces and sometimes are used as meeting halls. They can also be used as information service and learning centers because they are the information and data storage locations for coastal zone projects and activities. However, the country has not developed any concrete plan to enhance coastal zone protection and management at the local levels. Therefore, the next section of this paper explains the proposed strategic actions for coastal zone management at the community level, namely for the Prek Thnoat coastal community.

4. Strategic Actions for Prek Thnoat Community Management

The strategic actions provide for the future development of the Prek Thnaot coastal community in a more sustainable manner with socially inclusive development, environmentally sound management, natural resource sustainability, and a strong resilience to climate change effects and natural disasters. The

strategic actions are broad in goals and objectives, with a number of activities proposed based on existing data and consultative meetings with stakeholders and community members. The strategic actions are aimed to ensure sustainable Prek Thnaot community protection and management and to build more resilience to climate change effects, natural disasters, and other risks. For the purpose of this study, fourteen strategic actions, supported by the key stakeholders and approved by the leader of Kampot province during a consultative workshop in 2013, (STA) are proposed as follows.

A. Protect and enhance biodiversity and the ecological system of the Prek Thnaot community via maintenance and improvement of existing natural reserved areas and creation of new ones

Prek Thnaot village is adjacent to a long coastline, providing a special ecological system characteristic. Various aquatic resources are found, including sea grass and fish. Flooded/Mangrove forests are a crucial spawning ground for fish and other aquatic species, which, in turn, offer food for the local people. The recommended actions include protecting biodiversity to stabilize the ecosystem in the area. Protection and conservation of endangered aquatic species and the initiative to reduce pollution that severely affects the resource stocks in the areas shall be taken into account. Mangrove is a typical species that grows in this area and has faced severe degradation. Hence, activities to support the rehabilitation and reforestation of mangrove forests are required to maintain forest cover and biodiversity conservation, as indicated by the government.

B. Ensure sustainable utilization of coastal resources

The coastline borders almost half of the Prek Thnaot community and is what a majority of the villagers depend on for their livelihoods in addition to their agricultural work. Whereas extraction of the coastal resources (mangrove forests, aquatic resources, etc.) serves as a basis for livelihoods, ensuring that the sustainable utilization of such resources is very important. The recommended actions include improving land management within the coastal community and protecting and managing sea grasses and coral reefs sustainably.

C. Maintain a resilient community via raising awareness about climate change and building on concepts, new

approaches, and innovative technologies for coastal and marine management

This strategy is designed to improve understanding and awareness of the local people. Participation by Prek Thnaot villagers is important, so they can prepare for the future adaptation program.

D. Ensure sustainable forest management

The Prek Thnaot community is currently managing more than 2,000 hectares of forest of Preah Monivong National Park through a Community Protected Area (CPA) scheme. Institutional capacity of the CPA needs to be strengthened to combat illegal land encroachment and forest logging. Moreover, actions should be taken to protect the CPA from forest fires and other related illegal activities. In addition to this CPA, there is a significant forest area outside the national park that is accessed and used by the villagers for their subsistence. Recommended strategies include those that aim to encourage the expansion of the CPA management and protection concepts into this area.

E. Promote opportunities for alternative livelihoods

Effort to promote alternative livelihoods for the local people is very important to ensure that they are not trapped in lifestyles greatly affected by unavoidable climate change impacts and other natural disasters. The introduction of new technologies should be taken into account, to increase the value of local products such as handicrafts and those from raising livestock and maricultures.

F. Ensure sound coastal spatial planning that contributes to sustainable natural resource and land management

Effort is needed to prepare land use plans for the existing structure, in which investment is available. They should be designed to ensure that land and natural resources are used in an efficient and effective way, which can contribute to ensuring sustainable and equitable socioeconomic development.

G. Integrate and promote the concept of coastal erosion management

Coastal erosion affects the Prek Thnaot community in various ways, including, for instance, a shorter beach and degradation of coastal resources. Efforts to deal with coastal erosion include the rehabilitation of the coastal and marine resources such as sea grasses and coral reefs. Activities to promote the restoration

of the marine ecosystem and biodiversity that have been damaged by human activities over the past years are important.

H. Support the establishment of a natural disaster risk management system for the local people

Natural disasters were identified as main challenges for the Prek Thnaot community to achieving their enhanced livelihoods. Effort to set up an early warning system for storms and other disaster risk prevention measures in the community would help villagers avoid emerging natural disasters such as storms and sea waves. In addition, an emergency system for villagers to respond to floods as well as a sound water system management for droughts is also recommended for the community.

I. Promote community-based climate change adaptation

Building on the existing assets of the villagers (e.g., residences) and the experiences of the implementation of adaptation measures in the past and promoting a robust system for adaptation with participation from the villagers was deemed an effective means to adapt to climate change.

J. Enhance water resource management for household consumption and agricultural needs

Water is important to the villagers for both household consumption and agricultural use. The improvement of water consumption and sanitation is in part responded to the climate change adaptation, especially ensuring that the scarcity of water is not the matter. Furthermore, irrigation system for agriculture is needed to restore and construct to ensure sufficient water supply. In addition, the water harvesting system should be improved and installed at the household level within the community.

K. Build climate change resilience for agriculture

Improvement of the irrigation system as described in strategy J partly contributes to addressing the issues in this strategy. In addition, there is a need to identify crop species that grow well with less water as well as are resistant to flooding. Furthermore, the establishment of home gardens at the household level is a good strategy for adapting to loss of agricultural products resulting from the changing weather and climate conditions.

L. Develop, improve, and manage infrastructures

Although physical infrastructure is good in the village, there is a need to address the issue of preventing salt water from spilling over the land. The actions to be taken under this strategy are constructing a salt water intrusion prevention system and envisaging and introducing technologies and good practices for sustainable agricultural management (e.g., soil management, water management, and organic fertilizer), and so forth.

M. Enhance human resource development and capacity building

Formal education in the village is in better-off condition; however, technical and vocational training is limited. Such training is needed in the community. This will contribute to the development of human resources and to increasing the chance for the villagers to engage more actively in various livelihood skills (raising animals, growing vegetables, home gardening, garment production, and technical and general education).

N. Establish and strengthen cooperation and collaboration and active engagement in climate change processes

The promotion of community collaboration and cooperation regarding climate change response within and outside the community is considered paramount for effective implementation of climate change related projects and actions. This concept is related to the encouragement of the participation by all stakeholders, including the public and private sectors, civil society, and community people, for sharing of good practices and technology transfer among the villagers. Private sectors' investment, especially in climate change adaptation technologies, will contribute to increasing production that will help to ensure better livelihoods and reduce poverty of the community people, which leads to sustainable development and a resilient community.

5. Conclusions

Cambodia has developed a number of national regulations, policies, strategies, and actions for coastal zone protection and management at the national level [19]. However, these are limited to the subnational level (provincial level). In this context, this study provides good insight for the government to integrate and prepare coastal zone management strategies at the community level in order to ensure and promote sustainable coastal resource protection and management. Moreover, further

actions must be taken, including in-depth research and study on coastal erosion (e.g., root causes and effects) and other coastal risks to ensure effective and appropriate prevention and management; capacity building and awareness raising at the community level to ensure better understanding of the necessity of marine biodiversity and a marine ecosystem; and country-wide financial resource mobilization and allocation for coastal resource protection and management as well as alternative livelihoods for the coastal community.

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