

**Case Study: Tonle Sap Biosphere Reserve
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1. 1. Introduction

The Tonle Sap Lake is one of the largest freshwater lakes in Southeast Asia, located in the central floodplain of Cambodia territory. It appears that the Lake originated about 5,000 years ago. The unique hydrological regime of Tonle Sap Lake is characterized by the annual flow of the Mekong waters into the Lake basin during the wet season, which changes the Lake's water level a great deal from about 1m to 8-9m. Consequently, the Lake's area increases from 2,500 km² to about 10,000 km², with the water volume varying from 1.3 billion m³ to 70 billion m³ respectively. This hydrological cycle support and maintain high productivity of biodiversity, particularly fish, plant communities, and wildlife, which are the resources base for national economy. Nearly half of Cambodia population depends on the Lake's resources, about one million of which is fish dependent community. Tonle Sap Lake plays a vital role in Khmer cultural identity, which is reflected in the traditions, livelihood, festivals, and taste. It is believed that the Khmer Angkor civilization and many temples could not prosper without the rich natural resources of Tonle Sap Lake as sources of wealth. Evidence of cultural influence of Tonle Sap Lake can be found in the bas-relief of Bayon temple.

Recognizing the ecological, economical, and socio-cultural value of the Lake, the Royal Government of Cambodia decided to designate the whole Tonle Sap Lake as Biosphere Reserve under the Man and Biosphere Programme of UNESCO in October 1997. The

Lake is divided into three zones, namely three core areas, a buffer zone, and a transition zone. The three core areas are unique ecosystem of high conservation value. The buffer zone is covered by flooded forest, where fishery activities are dominant. The transition zone is the farmland, where rain-fed rice and floating rice are cultivated.

Management of Tonle Sap Biosphere Reserve is a great challenge for Cambodian government, because the success of its management do not depend only on the national capacity and institution, it depends also on the international cooperation of Mekong riparian countries. Cambodia needs to improve the legal and institutional framework, to strengthen law enforcement, to build consensus among responsible agencies in integrated management, to empower community in resources development, to build up knowledge on Tonle Sap ecology...etc. In the international context, cooperation and political consensus over water development in the Mekong basin are crucial to ensure the minimal impact on the Lake's integrity.

2. 2. Tonle Sap Biosphere Reserve Nomination

According to statutory framework of the World Network of Biosphere Reserves, general criteria for an area to be qualified for designation as a biosphere reserve should be the following:

- It should encompass a mosaic of ecological systems representative of major biogeographical regions,
- It should be significance for biodiversity conservation
- It should provide opportunity to explore and demonstrate approaches to sustainable development on a regional scale,
- It should have an appropriate size to serve the three functions of biosphere reserves,
- It should include these functions through appropriate zonation to core area, buffer zone and transition zones, where the core area should be legally constituted and devoted to long term protection according to the conservation objectives of a biosphere reserve,
- Organizational arrangement should be provided for the involvement and participation of a suitable range of public authorities, local communities, and private groups in the design and carrying out the functions of biosphere reserve. In addition, provisions should be made for:
 - mechanism to manage human use and activities in the buffer zone
 - a management policy or plan for area as a biosphere reserve
 - a designated policy or mechanism to implement the policy
 - programmes for research, monitoring, education, and training.

2.1 Tonle Sap Biosphere Reserve Zoning

Based on present land use, vegetation cover and biological hotspots, the Tonle Sap Lake is divided into three core areas, a buffer zone and transition zone.

Core areas: are located in Prek Toal, Boeng Tonle Chhmar, and Stoeng Sen. The three

core areas are characterized by preserved flooded forests, rich river system and biodiversity. Nearly one hundred waterbird species are found in the areas, a dozen of which is considered as of international significance. Besides rich fish stock, the areas are known for other wildlife species such as crocodile, turtle, macaque, capped langur, otter, water snakes (including python and king cobra). The areas are currently used mainly for fish production, wildlife hunting, and firewood collection. Total population living inside the three core areas is about 2,000, mainly in Boeng Chhmar core area.

Buffer zone: is covered largely by flooded forest with high productivity of biodiversity, especially fish. The area is divided into fishing concessions, which are auctioned for every two years to the private businessmen. The area is also competed by other land use practices such as agriculture encroachment, human settlement, navigation, firewood production, aquaculture. The population is about 100,000.

Transition zone: is the agricultural belt surrounding the Lake, where a variety of rice farming is practiced. The rapid urban and agricultural development with the increased use of pesticide and fertilizer in the area pose a threat to the flooded forest and water quality.

2.2 2.2 Management Challenge for Tonle Sap Biosphere Reserve

Core Areas

In the biosphere reserve context, the core area is defined as national park or wildlife sanctuary, where conservation and protection is the priority management option. But the core areas of Tonle Sap Biosphere Reserve are demarcated within the concession areas called fishing lot, which is sold to the private for fishing rights. By nature the fishing lot is a kind of development that harvest fish for market. This management category is no doubt contradictory to conservation concept of the core areas. However, the present Cambodia economic and institutional conditions do not allow translation of the concepts to immediate practice. In the case of the Core areas of Tonle Sap Biosphere Reserve, conservation programmes would be introduced step by step along with fishing lot practices without causing rivalry feeling among stakeholders concerned. The first step is to elaborate a legal and institutional arrangement, which enables relevant agencies to work together in a coordinated and cooperative manner. Meanwhile more research and monitoring activities will be conducted to build knowledge for proper decision making. Some risks are identified as follows:

- When the fishing lot is allowed within the core area as stated above, there is a fear of disputes or uneasy working relationship between fishery department and conservation department. The fishing lot owner may be reluctant to cooperate with conservation team for protection of resources because of economic interest.

- The research and monitoring activities may be hampered by limited access to the core area during the fishing operation. The result of research or monitoring efforts produced by conservation team may not be accepted by fishing lot owner or fishery department.
- The integrated management plan incorporating conservation regulations and fishery law may take long time to be adopted before consensus is reached between agencies concerned.

Buffer zone

- The buffer zone covering about 540,000 ha can be divided into two zones: the flooded forest and the open lake. Fishing concession is the major land use in the buffer zone. Because of the seasonal flooding, some part of the buffer zone is also used for farming such as dry season rice, lotus plantation, mung bean, vegetables and other crops. Conflicts between stakeholders over land use competition and practices often occur, because of the lack of inadequate land use policy or integrated management.
- The lake bottom is believed to be filled up by siltation from the Mekong waters and Tonle Sap catchment, due to logging, resulted in change of water regime. Such environmental change would have ecological effects on biodiversity and flooded vegetation of the lake.
- The current fishery law was written since the beginning of 20 century for the purpose of tax collection for the colonial administration. Since then the law has not been changed and is now too old to address the emerging problem like environmental change, population increase, development needs...etc. The fishing lot boundaries are demarcated with disregard to traditional rights of local communities. In addition, the inadequate salary and unskillful government staff led to inefficient law enforcement and overfishing.
- Uncontrolled trade with neighbor and poor market system put added pressure on The Tonle Sap Lake's natural resources, especially fish and wildlife.
- Inequitable sharing of the resources is the main reason causing conflicts among stakeholders. Most of the rich fishing grounds are granted to concessionaires for exclusive fishing rights (fishing lots), leaving a little space with poor fish productivity for local community to maintain the livelihood. To subsist their basic needs, people exploit other resources including wildlife, forest, and farming, which contribute to the reduction of fish stock itself. Some fishermen illegally fish in fishing lot, which result in conflicts with fishing lot owners. With the general population increase, the diminishing fishing stock for the local population would further worsen the living standard, causing social unrest and instability.
- Unclear land tenure practice is another issue within the buffer zone. Because of the

seasonal flooding, the same area is subject to different land use namely fishing in the wet season until the soil dry up, which then is followed by rice or upland crop farming. The alternate ownership with no sense of responsibility can be regarded as the tragedy of the commons. Indeed, during the ownership people try to maximize the benefit by over exploiting the resources, knowing that the resources would be transferred to another owner.

- The low education level and poor social organization of local community are the main obstacle for promoting community-based management of resources. Normally, each individual family acts in the interest of its own benefit, has little sense of personal accountability before the common property. No community committee or association is established for the interest of a group of stakeholders. The reason is not only the capacity of community itself, but also because of the lack of support from the government. Community based management needs a strong commitment of community members and high ranking decision-makers. For example, to allocate a fishing lot for community management, the community should have the skill to plan resources development, equitable resources sharing, collection of revenue for government tax, conflict resolution among themselves, resources control and monitoring...etc. And at the same time community should get the rights to manage this area with clear provision from the lawmakers.

Transition Zone

- Land encroachment for agricultural purpose from the transition zone onto the buffer zone pose serious threats on flooded forest, and the fish stock of the great lake. Moreover, intensive agricultural production would lead to the increase in fertilizer and pesticide use, resulting in water quality deterioration. Control over the land use practice is difficult because of the lack of regulations, human and financial resources for land management.
- A lot of people in the transition area seasonally migrate to the buffer zone for firewood collection, wildlife hunting, and fishing to subsist consumption needs during the dry season after rice is harvested. These people compete with the local community for the dwindling resources.
- Lack of environmental consideration and poor coordination among government agencies and provincial authorities may lead to uncontrolled development such as irrigation, dam construction, agriculture, navigation facilities, infrastructure, factories, oil and gas exploitation around Tonle Sap region, which would have adverse effects on the lake's ecology.

3. 3. Recent Achievement

Legal Issues: A draft royal decree for Tonle Sap Biosphere Reserve is developed as a legal basis for the implementation of biosphere reserve concepts. The critical elements of

the draft decree are the formulation of directions and management objectives for each zone, inter-ministerial coordination body, and institutional arrangement for implementation. The draft decree is still under discussion by an inter-ministerial working group. The major points of the draft decree have been revised as the following:

- The core areas are defined likewise national park or wildlife sanctuary, which are devoted to long term protection and conservation of natural resources and ecosystem, in order to preserve flooded forest, fish, wildlife, hydrological system, and natural beauty. Scientific researches, monitoring, and ecotourism are allowed here in the core areas. Management activities that would cause degradation and destruction of biodiversity are not permitted.
- Fishing lots within the core areas of Tonle Sap Biosphere Reserve shall continue to function in accordance with the Fishery Law, while the fishing lot owner must be committed to the long-term conservation objectives as defined above. These fishing lots are then subject to a periodic review every four years in order to develop a viable management plan that allows fishing lot functioning in a complementary manner along with the protection and conservation objectives of the core areas.
- The buffer zone surrounding the core areas is covered by flooded forest of a variety of species. Activities are managed to be consistent to the protection and conservation plan of the core areas. Fishery activities and other development plans will be managed based on existing law and regulations in a co-ordinated and cooperative manner. The buffer zone is also subject to experimental research and discovery of method for the management of flooded forest, fishery, agriculture, housing settlement, land use, and navigation to ensure their sustainability, increased production, while preserving the environmental quality and fish.
- The flexible transition area is the integrated economic zone, which is managed for the sustainable agriculture, human settlement and land uses, without having adverse effects on the flooded forest, water quality and soils of the region around Tonle Sap Lake.

Institutional arrangement: The most difficult elements of the Tonle Sap Biosphere Reserve are the arrangement of responsibility among different agencies, especially between MAFF and MoE. According to the last version of draft decree, MoE should be the leading agency in the preparation of protection and conservation plan for the core areas, while the buffer and transition zones are managed according to line-agencies.

Inter-ministerial coordination: The Technical Coordination Unit for The Tonle Sap (TCU) has been working since her establishment in 1996 at technical level for the promotion and development of Tonle Sap Biosphere Reserve. Based on this coordination mechanism, it has been proposed under the draft royal decree to create a secretariat (or sub-committee) for Tonle Sap Biosphere Reserve under CNMC, which would further promote coordination at the decision making level. The major task of this secretariat is to

coordinate with all stakeholders for involvement in the management of Tonle Sap Biosphere Reserve, to facilitate adoption of strategic policy towards sustainable development, and to play facilitation role in conflict resolutions. The secretariat through CNMC would also help build partnership with regional bodies such as MRC for incorporation of Tonle Sap Biosphere Reserve into regional planning.

Incentives for conservation and sustainable use: Some initial activities, including identification of community natural resources use, participatory workshops, and conservation of critical resources have been undertaken at the provincial and local level. At the same time alternative livelihood system is also developed in the form of credit, aquaculture, animal raising, and ecotourism for one of the communities living adjacent to Prek Toal core area. The latter initiative aims to encourage local community to practice alternative options (though not so many) and opportunity cost which are more environmental friendly and economically viable than harmful activities such as forest cutting and waterbirds hunting. A good success has been achieved. For example, illegal activities such as waterbird hunting, forest felling are significantly reduced in Prek Toal Core Area. According to three year census, the number of important bird species increase significantly. This offer opportunity for ecotourism promotion. Ecotourism was initiated by TCU and a local NGO Osmose in 1999, which already brought additional income to the local population. So people can see immediately the benefit and incentive for wise use of natural resources. However such programmes, though are useful, would not guarantee the long term success if access rights to land and water resources are not duly addressed. Equitable sharing and decision-making role of community are encouraging factors for sustainable practices, because the people would feel that they are also important actors and have the rights to voice any concern about wrong decision. So community empowerment should be regarded as important step if one wants to see the robust achievement of sustainable use.

4. 4. Conclusion

There is a large agreement among government agencies over the importance of Tonle Sap Lake and the need for wise use and management, but it seems little progress has been made on how to deal with the issues. Tonle Sap Biosphere Reserve nomination gets large endorsement from almost all agencies, but obstacle still exists. Preparation of legal and institutional framework is the important step to guarantee long-term promotion and development of Tonle Sap Biosphere Reserve. Although difficulties are encountered at this step, the establishment of the inter-ministerial working group signifies the interest of the concerned agencies for consensus building and further cooperation. Meanwhile, satisfactory success has been achieved at local level in the involvement of local community in the conservation, research, and wise management of selected area - Prek Toal Core Area. The success of TSBR would also depends on the ability to build partnership with key stakeholders, particularly fishery and agriculture, for devising management regime incorporating key factors of sustainability concepts, namely social, cultural, economic, and environment. If this step passed, the next plan would be concentrated on development of integrated management plan for the core areas, research and monitoring programme, and environmental awareness, community empowerment.

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