Challenges to and Potentials of Cross-Scale Linkages for Environmental Conservation: A Focus of Natural Resource Management Network in Kuraburi Estuary

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Abstract

Estuary and lagoon ecosystems pose a special challenge to commons theory and common pool resource management by making the exclusion and subtractability problems more difficult to deal with. Together with climate variability, these areas are physically subject to various influences not only from the coastal and brackish environment but also the adjacent marine and terrestrial areas including the watershed. The regional resources in the ecotone spaces raise cross-boundary issues so that elaborations are required to move beyond a community-based resource management situation within a limited area. Under this circumstance, cross-scale institutions, which are in tune with the scales where ecosystems function, shall be taken into account. Given that multiple and heterogeneous resource users are involved in the ecological-social-economic system, building a natural resource management (NRM) network consisting of various resource user groups is essential to deal with the exclusion and subtractability problems.

On this recognition, the paper aims to identify challenges to and potentials of cross-scale linkages, in terms of NRM network building in a case study of Kuraburi estuary, Thailand where two NRM networks have already been formulated by the initiatives of the local people and non-governmental organizations (NGOs). This study emphasizes the assessment of actual and potential effects of NRM network building. It highlights the significance of NRM network building to mobilize collaborative relationships among relevant stakeholders. Furthermore, the research identifies several challenges in developing cross-scale linkages at the horizontal level across space and at the vertical level among the stakeholders, in order to ensure the legitimacy of cooperative and collaborative works for the wise use of natural resource. Based on these analyses, this paper draws some implications on the role of cross-scale linkages, and identifies positive strengths and pressing constraints toward integrated common pool resource management in the wider ecotone spaces.

Key words: *cross-scale linkages, network, legitimacy, ecotone, Kuraburi Estuary*

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1. INTRODUCTION

The commons theory has so far been developed against a sensational antithesis (‘*Tragedy of the Commons*’) presented by Hardin (1968). His argument used a simple example of an imaginary pasture in a commons, where each cattle herder has free and open access. As a rational being, each resource user ignores the costs imposed on others, resulting in the degradation of the pasture. This leads to the tragedy. The argument is very simple and straightforward in the natural resource debate. It attracted a pivotal idea that the tragedy will occur in the absence of privatization or centralized governance. However, the extreme scenario has aroused criticisms from many scientists who pointed out that Hardin’s herders were operating not under common property but under an open-access regime. They (especially anthropologists) highlighted, through empirical narratives, the understanding of common property resource or common-pool resource (CPR) management in the commons in many parts of the world. These findings put higher emphasis on ensuring the wise use of natural resources in a collective manner, in contrast to Hardin’s scenario. Tracing back to historical sketches in the commons, it was observed that resource users succeeded to develop a set of rules to sustain the availability of natural resources (for purposes of reference, see Ostrom 1990; Ostrom et al. 2002). What is important is that the origin of the ‘commons’, dating back to medieval English or even before, seems to correspond to a collective institutional mechanism, more or less. In the Middle Ages, the term commons used to be regarded as a tract of land owned collectively or by one person, but be over which other people (commoner) have certain traditional rights to sustain their livelihoods. Apart from the open-access regime, the medieval English commons were generally used under locally devised regulations (Berkes 2005) in order not to overexploit natural resource beyond the border of environmental capacity. This became the growing counterargument with regard to ‘*the tragedy of the commons*’ and led to the study of the commons from the perspective of community-based natural resource management. Many community-based management systems thus coevolved with resource and ecosystem dynamics where communities developed capacity in terms of knowledge and skills to live with change and uncertainty (Berkes et al. 2001; Olsson et al. 2004). On this account, McCay coined a term ‘comedy of the commons’ which took objection to Hardin’s scenario that describes a tragic flaw in the commons (McCay 1996).

However, the study of the commons in recent decades often explored the simplicity of community-based natural resource management cases. In other words,

the links between the various scales of CPR management have not been given much attention (Berkes 2002). As Berkes (2005) argued, the research is usually focused on a small number of homogeneous resource users and single natural resources within a limited area. The limited scope provided an easier way to develop theory with regard to CPR management. With the approach, Ostrom (1990) made great endeavors to derive long-enduring CPR institutions from a set of seven principles that characterize all of these robust CPR institutions[2]. The design principle, underpinned by in-depth analysis in several case studies, is considered useful in assessing the enabling environment that benchmarks the institutional performances of CPRs in a limited arena. Together with the seven principles, however, she also found it necessary to include an additional eighth principle, the so-called '*nested enterprises*', which is used in larger and more complex cases. On the whole, there is often a mismatch in scale between institutions and ecosystems, resulting in resource mismanagement (Berkes 2005; Dietz, et al. 2002). The spatial scale of ecosystems and their resource use are directly or indirectly influenced by the interlinked ecological sphere, and vice versa. Particularly, ecotone spaces including lagoon and estuarine ecosystems pose cross-boundary issues where the heterogeneity of resource and resource users increases. Growing globalization in the form of an ever-increasing movement of people, goods and services, money and information across territorial borders further exacerbates the simplicity of CPR management in the earlier debate. Due to this, research has to move beyond exploring the limited scope at a single level. Instead, there is a growing argument that cross-scale conservation and management is crucial to assess the enabling environment in CPR management (Berkes 2002, 2004, 2005; Stern et al. 2002). It requires linking institutions horizonatally (across space) and vertically (across levels of organization (Berkes 2004, 2005).

Based on these, cross-scale institutions that are in consonance with ecosystem functions shall be taken into account in the commons. With this recognition, the paper explores the cross-scale linkages that are appropriate for CPR management in a case study of Kuraburi Estuary. Firstly, this paper describes the profile of the study site and explains the research methodology. Secondly, the research examines the evolutionary perspective of natural resource management (NRM) network building which consists of various resource user groups at coastal and watershed levels. Thirdly, it identifies challenges to and potentials of cross-scale linkages for environmental conservation by highlighting the NRM network activities and

[2] Seven principles presented by Ostrom (1990) are as follows: (i) clearly defined boundaries, (ii) congruence between appropriation and provision rules and local conditions, (iii) collective choice arrangements, (iv) monitoring, (v) graduated sanctions, (vi) conflict resolution mechanisms, (vii) minimal recognition of rights to organize and (viii) nested enterprises.

perceptions of network members. Lastly, this paper draws some implications on the positive strengths and pressing constraints to sustaining cross-scale conservation and management in the commons.

2. PROFILE OF STUDY AREA AND METHODOLOGY

Kuraburi Estuary is situated between 8°50' and 9°21 ' North latitude and 98°14 and 98°31' East longitudes according to Google Earth (F igure 1). The estuary is located in Phang Nga province, southeast Thailand along the Andaman Sea. It covers two districts (Kuraburi and Ta Kua Pa), six sub-districts and forty-seven villages. The area was one of the most tsunami-affected areas in Thailand when the Indian Ocean Tsunami occurred in 26 December 2004. Thirteen villages in the estuary were under vulnerable conditions (DTRAC data). In 2007, the total number of population is approximately 33,000 with households approximating to 12,000. Livelihoods vary from place to place but the major occupations include fisheries and rubber and oil palm plantations.

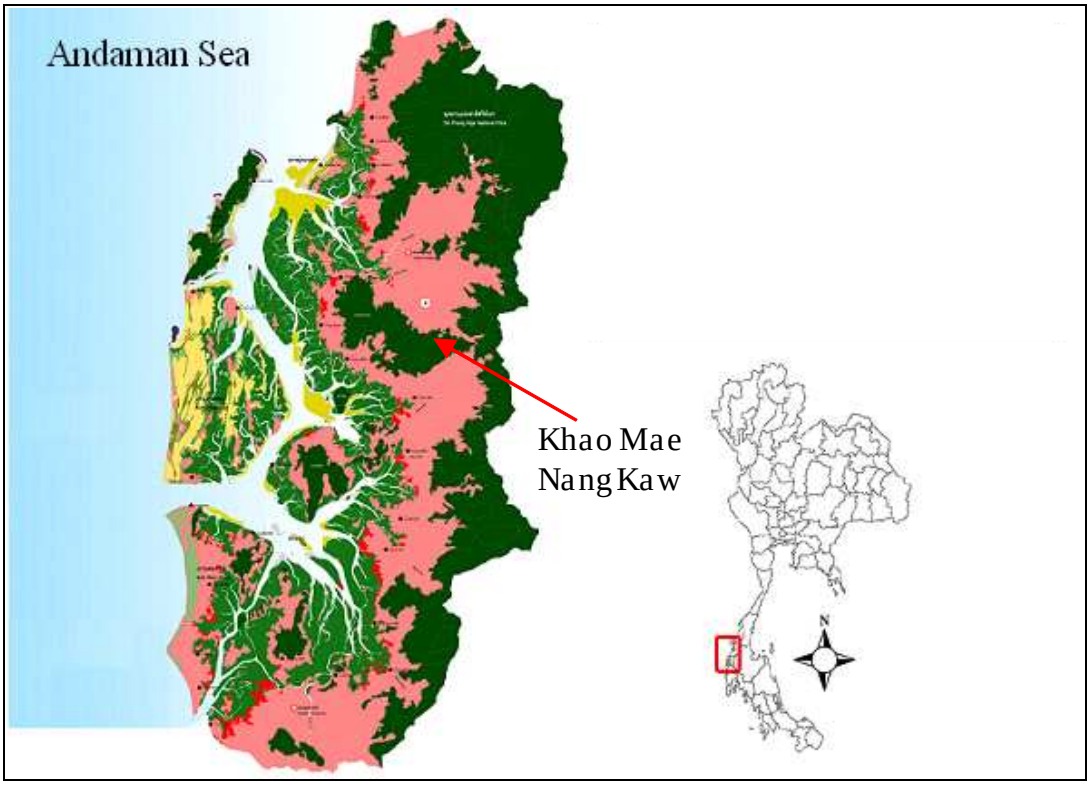


Figure 1 Map of Kuraburi Estuary Watershed
Source: modified from IUCN-Thailand data

The coastal vegetation is greatly dominated by mangrove forests except in two islands (Koh Ra and Koh Pra Thong); evergreen forests are almost distributed on the

entire land in the former while grass lands are distributed on the coast in the latter. The mangrove forests, together with sea grass beds and coral reefs, provide a unique and dynamic ecosystem that contributes to highly productive natural resource for local people and rich biodiversity including a wide variety of rare flora and fauna species like water onion (*Crinum Thaianum*) and dugong (*Duong dugon*). In addition, important features of Kuraburi Estuary include a steep range of hills adjacent to the estuary and extending to the mountains which are protected areas designated as national parks and wildlife sanctuaries. A series of steep hill and mountainous zones bring a large amount of sediments into the downhill areas. Because of this, the estuary environment is prone to soil erosion as well as water pollution from upstream. In fact, terrestrial forest areas are at very high risk. This is because many are located in the hills outside the protected area where there is low enforcement and control of land clearing by the Royal Forest Department (IUCN-Thailand 2008). The lack of forest management by the government and the expanding commercialization pose severe threats of habitat loss and subsequent poor livelihood conditions. In particular, the conservation of Mae Nang Kaw mountain, which is the largest locally managed forest among seven villages and outside a protected area, is critical in adapting to the adverse impacts experienced by the estuary ecosystem. Faced with the danger of losing natural resources, two NRM networks, namely the Kuraburi Environment Network (KEN) and Khao Mae Nang Kaw Network (KMNKN), were established to respond to actual and expected environmental problems.

With this recognition, field work was carried out in Kuraburi Estuary and the surrounding areas in October and November of 2008. The research used both qualitative and quantitative tools, including structural questionnaires, semi-structured interviews with key informants and secondary data. The questionnaire survey was conducted in four villages in Kuraburi district, of which two villages are located in the island and two are in the coast along the Andaman Sea. Primary data from structural questionnaires were collected from more than 10 per cent of households in each village, with total of 88 household samples. The questionnaires used a multiple-choice format and were primarily compiled into eight sections: (i) basic information, (ii) economy, (iii) social cohesion, (iv) risk perception, (v) impacts of climate and environmental change, (vi) problem identification, (vii) coping mechanisms and (viii) NRM network building. The main purpose of the study is to identify the needs and evaluate the effectiveness of NRM network building in Kuraburi Estuary and its surrounding areas at the watershed level as well as understand the ecological-social-economic dynamics in Kuraburi Estuary at the community level. Furthermore, semi-structured interviews were conducted on fourteen affiliated network group leaders (nine villages in KEN and five villages in KMNKN) and five non-network

group leaders (three villages in Kuraburi Estuary and two villages in Mae Nang Kaw mountain). The semi-structured questionnaires aimed to evaluate the actual and potential effects of network formation. Based on these analyses, the research examined potential clues to developing cross-scale linkages for environmental conservation at the horizontal level across space (watersheds) and at the vertical level (among relevant stakeholders). In the following, the paper starts by giving an overview of estuary livelihood conditions which provides a meaningful rationale for building NRM network in Kuraburi Estuary.

3. NRM NETWORK BUILDING IN KURABURI ESTUARY WATERSHED

3.1 Livelihood situation in Kuraburi Estuary

Communities in Kuraburi Estuary tend to be largely dependent on natural resources. The rich ecosystem in the estuary forms various livelihood supporting systems in which fishery resources present attractive benefits in addition to rubber and oil palm plantation. In 2007, households number 229, on average, per village in Kuraburi district ranging from 23 to 966 with family numbers averaging 3.91 per household. The major of the village population is Buddhist and Muslim. The basic information of the sampled villages is described in Table 1.

Table 1 Information on Sample Villages in Kuraburi Estuary

Village	Area	Religion	Family Numbers	Network	Occupation		
					First	Second	Third
NN	Island	Buddhist	3.40	No	Tourism Service (59%)	Fishery (35%)	Rubber and Palm Oil Plantation (12%)
BW	Coast	Muslim	3.67	No	Rubber and Oil Palm Plantation (48%)	Labor (44%)	Fishery (25%)
TND	Island	Muslim	3.93	Yes (KEN)	Rubber Plantation (44%)	Fishery (35%)	Fish Cage Culture (12%)
BT	Coast	Muslim	4.50	Yes (KEN& KMNKN)	Rubber and Oil Palm Plantation (68%)	Fishery (36%)	Merchants (11%)

With regard to occupational characteristics, the range of annual household incomes in the sampled villages is Thai Baht (THB) 50,001 to 100,000 (approximate US$ 1,501 to 3,000), followed by THB 25,001 to 50,000 (approximate US$ 751 to

1,500) or THB 100,001 to 200,000 (approximate US$ 3,001 to 6,000), etc[3]. There amounts reflect a gap between income and expenditure since household income is not sufficient to cover living expenses given that the range of monthly expenditure is THB 5,001 to 10,000 (approximate US$ 151 to 300), followed by THB 2,501 to 5,000 (approximate US$ 76 to 150), and THB 10,001 to 20,000 (approximate US$ 301 to 600). The expenditure for food was regarded as the highest priority (89.9 per cent) while savings (60.5 per cent), housing (51.7 per cent), clothes (47.7 per cent) were identified as the lowest priority. Furthermore, 67 per cent of the households were in debt to sustain family as well as occupational business at an average of THB 63,881 (approximate US$ 1924) per household. The debt was borrowed from various sources (approximately 1.36 lenders), especially from the village revolving fund (51.1 per cent) and government banks (23.9 per cent). In this respect, the village revolving fund plays a leading role in obtaining immediate money to cope with any perturbations.

With regard to fishery resources, the villagers are aware of the danger of losing fishery resources, despite the very limited quantitative data on fish landing available in Kuraburi Estuary. Based on the results of the questionnaire survey, the villagers perceived the reasons of the decline of fishery resources as cutting of mangrove forests, followed by lack of awareness, illegal fisheries, and aquaculture, among others. (see Table 2). With respect to mangrove forests, it is obvious that the rapid loss of mangrove forests have been experienced in Thailand including Kuraburi Estuary. In the period 1961 to 1996, around 50 to 60 per cent of mangrove forests have been lost (Bechteler, et al. 2006). These mangrove forests were converted for alternative use such as tin mining, aquaculture, charcoal production and housing construction. As a result, large portions of mangrove forests have been reclaimed for purposes such as shrimp culture, leading to the degradation of ecological habitat. This also means that the multifaceted ecological and economic functions of mangrove forests have been lost (see the multiple functions of mangrove forests in Adeel and Pomeroy 2002; Bechteler et al. 2006; Kathiresan and Rajendran 2005; Vannucci 1989; Zorini et al. 2004). In the case study sites of Kuraburi estuary (four villages), mangrove forest concessions for the tin mining industry were granted to outside people in the years 1964, 1965, 1978 and 1991. Hence, the massive destruction of mangrove forests and its associated land use change had greatly contributed to the loss of fishery resources, resulting to higher risk perception due to the mangrove deforestation. In addition, the villagers placed high value on the negative impacts of indiscriminate fishery operations coupled with lack of environmental awareness. Fishery resources are originally *terra nullius* and not

[3] An exchange rate of US$1 = THB 33.2101 in 2008 is used.

subject to private property. Thus, rational self-interest, which makes demands on the resource until the expected benefits of their actions equal the expected costs, causes the tragedy of the commons as Hardin (1968) theorized. To provide a solution to the dilemma of the commons, enhanced environmental awareness-building through the use of a set of norms, institutions and varied networks is required.

Table 2 Risk Factors for Decline of Fishery Resources

Village	Cutting of Mangrove Forests	Lack of Awareness	Illegal Fisheries	Aquaculture	Pesticides and Fertilizers from Paddy Fields	Increase of Weeds	Decrease of Salinity	Waste Water from Factories	Sewage Contamination
NN	6 (3.75)	2 (3.00)	1 (3.50)	3 (2.17)	3 (2.17)	6 (2.00)	3 (2.17)	9 (1.33)	8 (1.40)
BW	2 (3.93)	1 (4.00)	4 (2.47)	3 (3.47)	6 (1.87)	5 (1.90)	7 (1.83)	9 (1.00)	8 (1.03)
TND	1 (4.00)	2 (3.44)	3 (2.44)	6 (1.72)	5 (2.06)	4 (2.06)	8 (1.56)	7 (1.67)	9 (1.33)
BT	1 (3.93)	3 (3.54)	2 (3.64)	4 (3.15)	5 (2.19)	7 (1.70)	6 (2.00)	8 (1.54)	9 (1.43)
Total	1 (3.75)	2 (3.64)	3 (2.97)	4 (2.88)	5 (2.04)	6 (1.87)	7 (1.85)	8 (1.98)	9 (1.26)

*The ranking is based on the total numbers of risk perception (Most risk – 4, Risk – 3, Less risk – 2, Least risk – 1). Information in brackets means the average number of risk perception.

Furthermore, expected adaptive measures for fisheries management in Kuraburi Estuary which the respondents raised are shown in Table 3. According to the results of the questionnaire survey, environmental awareness building is the highest expected adaptive measures to sustain fisheries, followed by watershed conservation, creation of protected areas, and information exchange of best practices, among others (see Table 3). These results are largely tied to the process of natural resource management (NRM) network building.

Table 3 Expected Adaptation Measures for Fisheries Management

Village	Environmental Awareness	Watershed Conservation	Creation of Protected Areas	Exchange of Best Practices	Joint Fisheries Management among Fishers	Collaboration with Governments	Increasing political will and power
NN	1 (4.00)	6 (3.13)	3 (3.40)	3 (3.40)	7 (3.00)	8 (2.90)	2 (3.50)
BW	1 (4.00)	1 (4.00)	3 (3.70)	6 (3.27)	5 (3.33)	4 (3.60)	7 (3.07)
TND	1 (3.95)	3 (3.63)	2 (3.72)	6 (3.39)	8 (3.17)	5 (3.50)	7 (3.28)
BT	1 (3.61)	7 (2.93)	6 (3.04)	5 (3.15)	2 (3.31)	8 (2.74)	3 (3.15)
Total	1 (2.99)	2 (3.49)	3 (3.45)	4 (3.27)	5 (3.25)	6 (3.22)	7 (3.17)

*The ranking is based on the total numbers of people's perception (Most important – 4, Important – 3, Less important – 2, Least important – 1). Information in brackets means the average number of people's perception.

3.2 Process of NRM network formation

Two NRM networks have already been established in Kuraburi Estuary and the surrounding areas: Kuraburi Environmental Network (KEN) in August 2007 and Khao Mae Nang Kaw Network (KMNKN) in July 2008. These networks were formed through the initiative of the local people and some NGOs.

Kuraburi Environmental Network (KEN)

The formation of KEN was triggered by a fresh wave of environmental conservation movement starting 26 December 2004. On that day, the Indian Ocean earthquake occurred with epicenter off the west coast of Sumatra, Indonesia. It caused a series of calamitous Tsunami along the coasts of the Indian Ocean, extending from Southeast Asia to Africa. The tsunami brought a disastrous force which killed numerous people and destroyed properties. It swept through Thailand's coastal area along the Andaman Sea, affecting 58,550 people and 4,806 villages (DTRAC data) and causing 5,322 deaths, 3,144 missing and 8,457 injured (Bechteler et al. 2006). Phang Nga province was the most affected area in all of Thailand with thirteen villages suffering from its disastrous impacts (DTRAC data). The experience was a traumatic event for the villagers, particularly those who live in seashore areas. In this destructive event, the value of mangrove forests serving as natural break thereby reducing the devastating impacts on people's livelihoods to a great extent was acknowledged (Bechteler et al. 2006; Kathiresan and Rajendran 2005). This recognition instantly spread to all the world's tropical areas including Kuraburi estuary, leading to the increasing promotion of mangrove plantation activities.

In addition to mangrove plantation initiatives, a large number of aid agencies were

involved in tsunami relief, reconstruction and rehabilitation in Kuraburi estuary. Over 150 international agencies funded and provided substantial support in health care, housing construction, boat distribution, financial loan and training for capacity development (CDA 2007). From these, the formation of community-based conservation groups which take into account the wise use of natural resources was promoted to balance the interaction between coastal environment and people's livelihoods. However, research findings revealed that each conservation group did not cooperate together thus, less effective and efficient measures had been practiced toward improving the estuary and coastal environment.

Despite this circumstance, the Raks Thai Foundation (RTF), a non-governmental organization (NGO), played an important catalyzing role in putting these groups together. On 15 January 2006, RTF invited representatives from five coastal villages they support to discuss the progress of Tsunami project activities and share information among participants including other NGOs and Thai government agencies. During the meeting, these participants came to recognize the necessity of an environmental network because of the minimal cooperation among community-based conservation groups. Furthermore, conflicts of conservation activities between sympathetic versus non-sympathetic villagers or villages gave rise to the necessity of such network as well. Based on this recognition, the five villages strived to work together by way of plantation and release of juvenile aquatic animals, in collaboration with RTF. The representatives of each village made an effort to have good relationships among them. The RTF invited them to attend meetings every three month, facilitating proper sharing of information and practices. These efforts made them feel a strong sense of partnership for environmental conservation as the commons in Kuraburi Estuary. Consequently, these village representatives and the RTF decided to establish KEN, develop environmental agreements and plan in a collaborative manner with villagers, NGOs and governments. So far, the network group has increased to up to nine villages by the end of 2008, although one village out of the initial five villages decided to leave KEN.

Khao Mae Nang Kaw Network (KMNKN)

Following the formation of KEN in August 2007, the KMNKN was formed in July 2008 with strong leadership from two villages which largely depend on both ecosystem service and function in Kuraburi Estuary and Mae Nang Kaw mountain. Both villages have been members of KEN since the RTF meeting in 2006. In addition to participation in KEN's activities, the two village representatives were concerned about the ecological condition in the Mae Nang Kaw mountain. The mountain is the largest locally managed forest outside a protected area in Kuraburi Estuary

watershed. It is surrounded by six villages which depend on the watershed for non-timber forest products (NTFPs), drinking water, irrigation, fruits, herbs, mushrooms and vegetables. However, severe forest degradation had taken place in areas where illegal logging had prevailed. The felling areas usually were illegally converted into rubber and oil palm plantations which give high profits. These encroachments in the mountain were extensive and done mainly by outside investors who hired local peoples and migrants from Myanmar. These illegal practices continue due to the lack of law enforcement and control of forest clearing and for the reason that the location is outside the protected area (IUCN-Thailand 2008).

There has been a growing fear among the local people that they would not be able to benefit from the ecosystem services and functions of the mountain. In particular, two villages (BT and TR) between the estuary and the mountain which highly depend on the environment were increasingly concerned about environmental conservation. The two villages had built good relations with each other since participation at the RTF meeting in 2006, which led to their becoming members of KEN. Both representatives discussed on forest management in the mountain as well as natural resource management in Kuraburi estuary. Having experienced KEN activities and recognized the significance of network building as will be illustrated later, they planned the organization of a new NRM network in the Mae Nang Kaw mountain. The representatives requested IUCN-Thailand to set up meetings for the purpose of establishing KMNKN. IUCN-Thailand, recognizing the importance of estuary conservation as well as mountain restoration, decided to give their support by providing funds for meetings and coordinating with surrounding villages in the mountain for the formation of the network. On 24 July 2008, the first meeting was held at Suanwang temple with participants from five villages and IUCN-Thailand. It led to the establishment of KMNKN and the creation of forest management agreements and development plans. It should be noted, however, that not all surrounding villages are involved in KMNKN. So far, the network group has increased to five villages by the end of 2008.

3.3 NRM network activities

Network committee board

Both NRM networks have their own committee boards to manage conservation activities effectively. The committee board meeting is usually held every month. Together with staff of NGOs as coordinator, committee members selected in each network village discuss environmental rules and plan annual management and implementing activities. Other participants including Thai government agencies and

consultants also attend the committee board meetings in case there are important or technical matters to be discussed. They provide committee members with proper knowledge and skills on conservation activities in the meetings to enhance capacity on network management. These meetings provide a venue to share ideas and information on who is doing what and what is actually going on in the ecological sphere of Kuraburi Estuary and Khao Mae Nang Kaw. For the officials, these information sharing and discussions are of importance to identify and prioritize projects and secure their smooth implementation. Hence, the broad and flexible participatory system of the committee board enables all stakeholders to promote a collaborative partnership among them.

Once decisions are made in the committee board, these are conveyed to each villager through the village representatives (attendee). Although no special punishment related to a committee board decision is provided, each affiliated villager is expected to follow a set of environmental rules especially on prohibited matters and join collaborative works such as environmental awareness campaign, plantation and release of juvenile aquatic animals. However, it needs to be mentioned that the intention to join NRM network activities largely differ from village to village as will be discussed later.

Creation of conservation areas and these reinforcement measures

Under the umbrella of NRM networks, both KEN and KMNKN affiliated villages are encouraged to take part in environmental conservation activities at the community level. In addition to environmental awareness campaigns for the villagers, elaborations in the two networks are made on setting up conservation areas for mangrove forest and/or aquatic animals (KEN) and mountain forest (KMNKN). The creation of conservation areas designed to maintain or increase the population of native flora and fauna is supplemented and reinforced through the conduct of monitoring activities, plantation and release of juvenile aquatic animals.

With respect to KMNKN, it was decided that no one shall cut any trees in the mountain[4], but illegal logging still prevailed. These activities usually take place in the ambiguous boundary between private and public lands and deep mountainous areas where the villagers have difficulty in monitoring illegal logging. On this account, IUCN-Thailand with the support of KMNKN has endeavored to define boundaries clearly as well as conduct an ecological survey of the mountain. Apart from this, KMNKN has been encouraging each member including women organizations to report to the village leaders (*Pu Yai Ban*), police or national park rangers of incidents

[4] For the surrounding villagers, the mountain serves as a basis for supplying water sources for drinking and plantation and non-timber forest products including vegetables, fruits, mushrooms and medicinal plants.

of cutting trees in the mountain. In addition, the village leader (*Pu Yai Ban*) and sub-district headman (*Kam Nun*) carry out monitoring activities in order to observe condition of the forest. However, these efforts are irregular and rather individual-based so that further systematic attempts are required with involvement of relevant stakeholders to eradicate illegal loggings in the center of KMNKN.

On the other hand, with respect to KEN, it has promoted the setting up of conservation areas in each network village. BT village, for instance, applied a zoning system in mangrove forests (6,000 rai[5] in total). The conservation areas are divided into four zones; plantation area (3,000 rai), restoration area (1,300 rai), non-commercial forest area[6] (1,700 rai) and research area (1,000 rai). In addition to the mangrove forest conservation area, the village set up another conservation area for mud crabs to maintain and increase resource stocks. Meantime, a specific conservation area close to a Buddhist temple in TR village has been integrated into the religious custom called '*Aphayathan*'. The area is traditionally regarded as a sanctuary where no one shall cut trees and do hunting and fishing[7]. Diverse forms of conservation in each affiliated villages are encouraged. The network offers effective tools to upgrade the function of conservation areas through releasing of juvenile aquatic animals, planting trees and promoting monitoring activities. Juvenile aquatic animals are released and mangrove plantation is implemented in the conservation areas in collaboration with various stakeholders including government agencies, NGOs, researchers, and civic society (especially children to convey the significance of lake conservation to future generations). At the same time, monitoring groups have been organized specifically to address and eradicate illegal practices in their own conservation areas. Oftentimes, conflicts over access to natural resources in conservation areas take place between the villagers and outsiders. Thus, further elaboration is required to reinforce the monitoring groups on encroachments and promote an understanding of the value of network-based conservation activities to non-affiliated villages. This is largely relevant to cross-scale linkages in environmental conservation. Furthermore, the Department of Marine and Coastal Resources (DMCR) provide trainings for environmental management and monitoring to those who are interested in the monitoring activity. These participants are expected to take an important lead in regularly monitoring coastal environment and illegal practices in the center of their villages.

[5] The term 'rai' is a traditional unit of land area in Thailand. The rai corresponds to 1,600 square meters, which is 0.16 hectare or approximately 0.3954 acre.

[6] Villagers can cut the mangrove trees in the non-commercial forest area in case the village leader (Pu Yai Ban) permits them to do it for non-commercial purposes. In this case, those who cut the trees with the permission from the village leaders are required to join plantation activities with a rule that ten tree seedlings per a cut tree shall be planted.

[7] The religious custom combined with forest protection can be observed in other areas of Thailand close to buddhist temples (see Salam et al. 2006).

4. CHALLENGES TO AND POTENTIALITIES OF NETWORK ACTIVITIES

4.1 Actual effects of NRM network activities

This section sets out to assess the actual and potential effects of NRM network building. On the whole, NRM network activities are considered effective in environmental conservation according to a self-evaluation assessment by affiliated village representatives. In particular, plantation received the highest score, followed by the establishment of conservation areas (Table 4). The self-evaluation results in KEN exhibited higher scores than KMNKN. The difference is likely due in part to the fact that KEN has started conservation activities since 2007, a year more than KMNKN which started in 2008- the longer experience may have contributed to more a positive perception of NRM network activities among the village representatives of KEN.

Table 4 Self-Evaluation of NRM Network Activities

Activities	KEN (N=10)	KMNKN (N=7)
Network Activities*[1]	3.6	3.4
Compliance of Network Activities*[2]	3.4	2.9
Meeting*[1]	3.6	3.4
Rule-Making*[1]	3.6	3.1
Conservation Area*[1]	3.7	3.6
Monitoring*[1]	3.5	3.1
Environmental Awareness Campaign*[1]	3.1	3.1
Plantation*[1]	3.9	3.9
Release of juvenile aquatic animals*[1]	3.6	

*[1] The figures are based on a self-evaluation of network activities by each group village representative (Most effective – 4, Effective – 3, Weak – 2, Very weak– 1).

*[2] The figures are based on a self-evaluation of network activities by each group village representative (Very strong – 4, Strong – 3, Weak – 2, Very weak– 1).

However, the study also revealed that the village representatives pointed out several challenges (see Table 5). The respondents from KEN raised such issues as loow participation and cooperation among members, little incentive to join network activities, low rule compliance, inadequate planning of network activities, limited member affiliation, lack of information sharing among members, low cooperation by the government and conflicts over conservation areas between members and

outsiders. Likewise, several problems related to KMNKN were raised by the affiliated village representatives such as low collaboration between government and villagers, unclear boundaries in KMNK conservation areas, low rule compliance among members, inappropriate planning of network activities, lack of information sharing among members, entry of people from outside for illegal tree cutting, low participation and cooperation among members and weak leadership among some of Pu Yai Ban.

Table 5 Ranking-Based Problem Identification Raised by Affiliated Village Representatives

KEN (N=10)	KMNKN (N=7)
1. Low participation and cooperation among members (12)	1. Low collaboration between government and villagers (11)
2. Little incentive for members in network activities (10)	2. Unclear boundaries in KMNK conservation areas (8)
3. Low rule compliance (9)	3. Low rule compliance among members (8)
4. Inappropriate planning of network activities (9)	4. Inappropriate planning of network activities (5)
5. Limited membership affiliation (7)	5. Lack of information sharing among members (4)
6. Lack of information sharing among members (6)	6. Entry of outside people for illegal tree cutting (3)
7. Low cooperation by the government (4)	7. Low participation and cooperation among members (2)
8. Conflicts between network members and outside people in conservation areas (3)	8. Weak leadership among some of Pu Yai Ban (1)

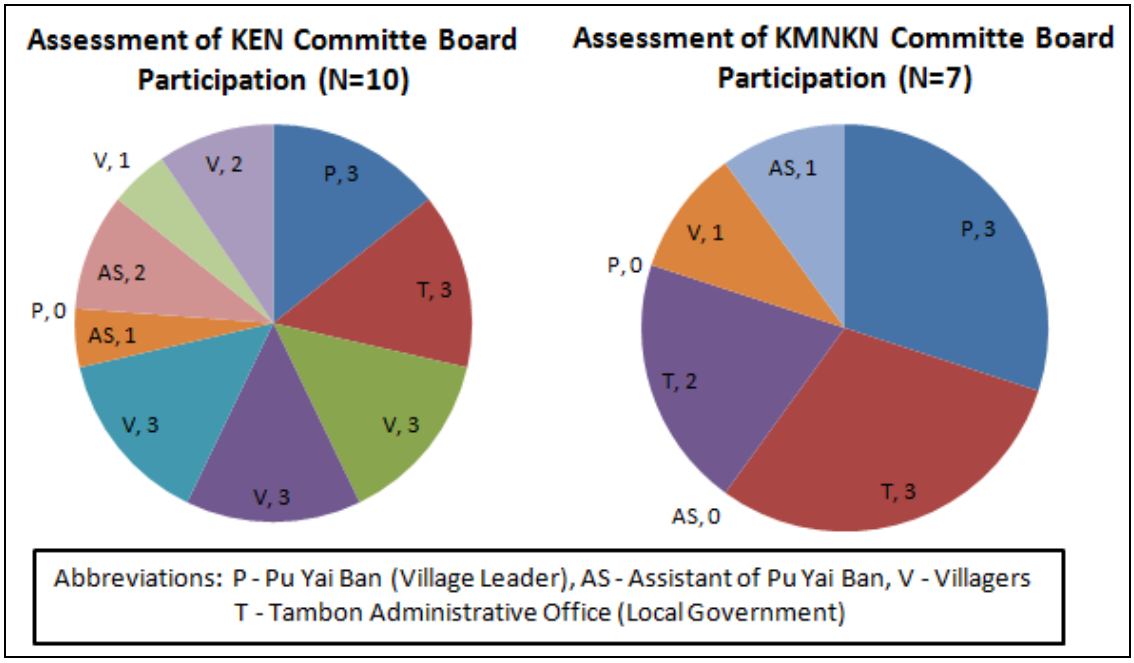
Note: the ranking figure in brackets is based on the total numbers of risk perception (1st problem – 3, 2nd problem – 2, 3rd problem – 1).

Apart from technical issues (e.g. unclear boundaries in KMNK)[8], it can be said that most of the challenges, more or less, arose from two components. First, NRM network activities are not necessarily homogeneous among the affiliated villages. Some have taken a significant lead in managing conservation activities that is commensurate to the network's objective. However, other affiliated villages have not been involved in these activities well. The difference is largely tied to the leadership in each affiliated village representative. The representatives are ideally eligible based on his or her personal magnetism and ability to lead villagers. The NRM network has encouraged these leaders to regularly attend the NRM committee board. However, many of the representatives who attend the NRM committee board meetings were

[8] In this regard, IUCN-Thailand with the support of KMNKN has been trying to define the boundary clearly as well as to conduct an ecological survey in the mountain.

assistants of the village leaders or villagers who became interested in the conservation activities: six villages out of ten villages in KEN and two villages out of five villages in KMNKN were identified as such persons other than the village leaders (see Figure 2). There is a tendency that those village leaders are less concerned about NRM network activities or environmental conservation activities. In other words, the low involvement in network activities from the bottom may be attributed to the lack of strong leadership. Thus, there is an urgent challenge to create incentives in participating in NRM network activities especially for village leaders and related persons. Based on the semi-structured interviews with these affiliated village representatives, the possible incentives in participating at NRM network activities were identified as support for travel to meetings, training for environmental conservation, promotion of savings activities and alternative jobs, and legal empowerment of network activities. Apart from enhancing their motivation, these representatives also indicated the need to involve youth groups in effective promotion of community-based environmental conservation under the NRM networks.

Second, the total numbers of both NRM network have remained unsatisfactory. In particular, the affiliated villages in KEN are in only Kuraburi district; not any village in Ta kua Pa district has been involved in KEN. The range of ecological sphere in Kuraburi Estuary includes not only Kuraburi district but also Ta Kua Pa district. In order to sustain the estuary and coastal ecosystems which are dynamic and complex, collaborative partnership among resource users is critical at the estuary, coastal and watershed levels, irrespective of administrative boundaries. Furthermore, broader membership through KEN and KMNKN is required to promote the environmental management movement and the wise use of coastal resources at the community level.



Note: The figure ranging from "3" to "0" is equivalent to the attendance rate (Most frequent – 3, Sometimes – 2, Rarely – 1, Nothing – 1).

Figure 2 Assessment of NRM Network Committee Board Participation

4.2 Potential effects of NRM network activities

As with the good evaluation of NRM network activities in KEN and KMNKN, it is worth noting that NRM network linkages are potentially considered effective: both affiliated village representatives in the two networks found a positive potentiality of interactions between KEN and KMNKN (see Table 6). Although frequent interactions between the two networks have not taken place, their collaboration is expected to build a stronger unity among the network members and augment NRM network activities from the watershed perspective. In particular, it is important to note that KEN became more interested in linking the two bodies more than KMNKN did. This may give a hint of two important messages: it is critical for coastal and estuary villagers to integrate their environment at a larger scale and KEN members give more value to the NRM network linkage because of their longer experience in the network's activities.

Furthermore, many of affiliated village representatives, irrespective of membership with KEN or KMNKN, supported the formation of a new NRM network called 'Kuraburi Watershed Network (KWN)' which IUCN-Thailand intends to set up (Table 6). The questionnaire survey in the four villages indicated that villagers exhibit different attitudes in their willingness to join KWN activities on the basis of whether they are involved in NRM network or not. 100 % and 82.1 % of the villagers who

belong to KEN expressed their willingness to participate in KWN while 60 % and 40 % villagers who do not belong to KEN or KMNKN did. On this account, it can be pointed out that involvement in the NRM network enabled the villagers to perceive actual or potential effectiveness in environmental conservation. It promoted an attitude of higher willingness to further NRM network linkages. The NRM network building might be a desirable response that creates a potential solution to environmental conservation in the estuary and its surrounding areas. In this sense, KWN, which IUCN-Thailand aims to formulate as a new NRM network at the watershed level, is strongly recommended in the near future.

Table 6 Potentiality of NRM Network Linkages at the Watershed Level

Activities	KEN (N=10)	KMNKN (N=7)
Network Activities with KEN or KMNKN*[1]	3.7	3.0
Information Exchange*[1]	3.3	3.0
Rule-Making in Kuraburi Watershed*[1]	3.1	2.9
Conservation Areas*[1]	3.9	3.7
Monitoring*[1]	3.3	3.3
Environmental Awareness Campaign*[1]	3.8	3.4
Plantation*[1]	3.8	3.9
Cooperative Marketing*[1]	3.1	3.1
Ecotourism*[1]	3.5	3.6
Potential Effects of KWN*[1]	3.8	3.9
Participation of KWN activities*[2]	3.7	3.4

*[1] The figures are based on an evaluation by each group village representative (Most effective – 4, Effective– 3, Less effective – 2, Least effective – 1).

*[2] The figures are based on evaluation by each group village (Most interesting – 4, Interesting – 3, Less interesting – 2, Least interesting – 1).

5. CONCLUSIONS

Putting them all together, the process of NRM network building in the case study of Kuraburi Estuary and its surrounding areas can be shown in Figure 3. The dynamic and complex character of estuary areas is highly exposed to such environmental and climatic factors as sea-level rise, increase level of inundation and storm flooding, seawater intrusion, soil erosion and water pollution. The estuary environment is highly diverse and variable that the people living there have to adapt to the changes in its ecological-social-economic system. Under these circumstances, two NRM networks were established through the initiatives of the local people and NGOs. These are rather new networks but members provided a positive response to NRM network building. The formation of the NRM network offers an arena for discussions

which enable relevant stakeholders to share common ideas with regard to problem identification and the expected countermeasures in a holistic way. Each NRM network discusses environmental rules, annual management planning and activities in their own committee boards every month. These monthly meetings are able to secure the regular participation of stakeholders and ensure the legitimacy of budget and project priorities for implementation. The legitimacy can provide a significant rationale behind cross-scale linkages at the horizontal level across space (Kuraburi Estuary and Khao Mae Nang Kaw) and at the vertical level among stakeholders. In effect, the diverse types of environmental collaborative works have been initiated beyond village boundaries while community-based conservation approaches under the banner of NRM network have taken action. The creation of conservation areas combined with reinforced measures which are community-based but necessitate involvement of various stakeholders is expected to contribute to the maintenance, sustainability and preferably improvement of the ecological-social-economic system. These elaborations are reflected in the positive response to the self-evaluation of NRM network activities in KEN and KMNKN.

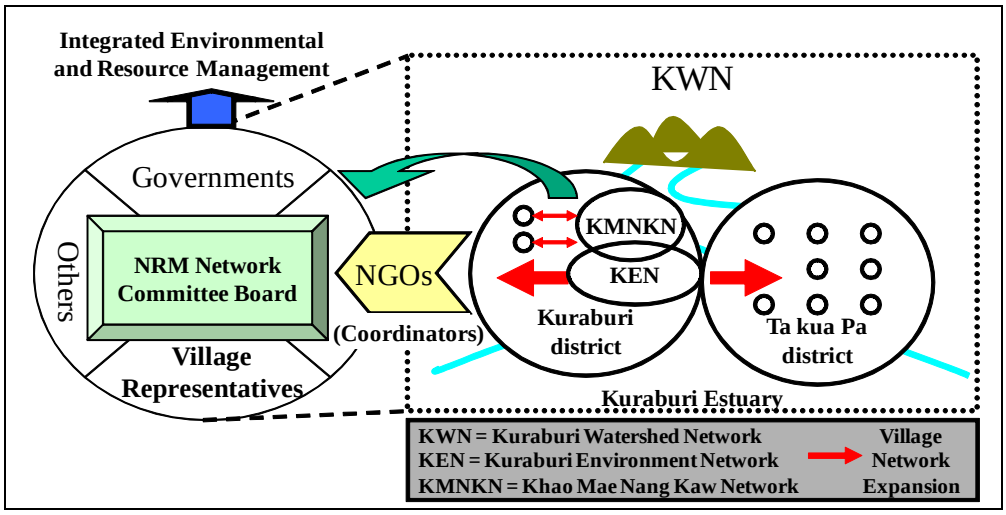


Figure 3 Diagram on NRM Network Building in Kuraburi Estuary Watershed

However, there were several challenges in developing the two NRM networks. Both network activities are voluntary-based and no legal punishment is enforced when affiliated villagers undertake illegal activities. The intention to join network activities or/and follow the collective institutional agreements differ from village to village. For instance, three affiliated villages of KEN have yet to set up conservation areas and two villages have yet to organize monitoring groups. The responses to NRM network activities are not necessarily homogeneous and the management ascendancy is, more or less, based at the village level. On this account, some

villages which lack strong leadership tend to ignore the NRM network rules. In order to promote network-oriented conservation, it is necessary to ensure incentives for villagers especially village leaders (*Pu Yai Ban*) in joining NRM network activities. Developing strong leadership is imperative in the pursuit of people's participation beyond villages and districts toward environmental integrity. In addition, possible incentives raised in the Section 4-1 shall be taken into account. This perspective will enhance people's participation and allow for new affiliations of NRM network including Ta Kua Pa district.

Based on the above, the case study highlighted the significance of NRM network building which is largely equivalent to the scope of cross-scale linkages for environmental conservation. It revealed that the NRM network made great contributions to partnership linkages among relevant stakeholders (villagers, NGOs, government agencies, etc.) by conferring a kind of legitimacy on institutional agreements in the committee board. The network linking horizontally across scale and vertically across institutions was highly appreciated by the affiliated village representatives. In this regard, however, the study also shed light on the importance of issues surrounding people's interests (especially villager leaders) in network-oriented activities. Enhancing cross-scale linkages will strengthen capacity to adapt to the changes in the estuary-cum-watershed ecosystems which are dynamic and complex environmental characters. Finally, a new NRM network called Kuraburi Watershed Network will be set up through the initiative of IUCN-Thailand and is expected to take leadership in environmental management and conservation at the watershed level. Further research is called for in understanding the process of extending NRM network building in the Kuraburi watershed and assessment of positive strengths and pressing constraints toward integrated resource management in the ecotone sphere.

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Literature cited

Adeel, Z., and Pomeroy, R. 2002. Assessment and management of mangrove ecosystems in developing countries. *Trees* 16**:**235–238.

Bechteler, A., Pilkama, A., Permana, E., Poellath, J., Prasanai, K., Rahaju, S., Pessala, S., and Alam, A. S. 2006. *Coastal zone management in Southeast Asia. Case: mangroves and tsunami effects in Thailand*. Helsinki: University of Helsinki, Department of Forest Science. http://www.helsinki.fi/vitri/research/Educational_Projects/forrsa/RE_1_Proceedings/Forrsa_RE_1/RE_1_proceedings_pdf/Report_Gr3.pdf.

Berkes, F. 2002. Cross-Scale Institutional Linkages: Perspectives from the Bottom Up. In *The Drama of the Commons*, eds. E. Ostrom, T. Dietz, N. Dolšak, P. C. Stern, S. Stonich, and E. U. Weber, 293-321. Washington, D.C., USA: National Academy Press.

Berkes, F. 2004. Rethinking Community-Based Conservation. *Conservation Biology* 18(3):621–630.

Berkes, F. 2005. Common Theory for Marine Resource Management in a Complex World. *Senri Ethnological Studies* 67:13–31.

Berkes, F., Mahon, R., McConney, P., Pollnac, R., and Pomeroy, R. 2001. *Managing Small-Scale Fisheries: Alternative Directions and Methods*. Ottawa: International Development Research Centre.

Dietz, T., Dolšak, N., Ostrom, E., and Stern, C. P. 2002. The Drama of the Commons. In *The Drama of the Commons*, eds. E. Ostrom, T. Dietz, N. Dolšak, P. C. Stern, S. Stonich, and E. U. Weber, 3-35. Washington, D.C., USA: National Academy Press.

DTRAC data. Unknown. Tsunami Affected Areas. Thailand: Disaster Tracking Recovery Assistance Center.

Hardin, G. 1968. The Tragedy of the Commons. *Science* 162:1243–1248.

IUCN-Thailand. 2008. BMZ Quarterly Report January–March 2008. Kuraburi, Thailand: International Union for Conservation Nature.

Kathiresan, K., and Rajendran, N. 2005. Coastal Mangrove Forests Mitigated Tsunami. *Estuarine, Coastal and Shelf Science* 65:601–606.

McCay, J. B. 1996. Common and Private Concerns. In *Rights to Nature: Ecological,*

Economic, Cultural, and Political Principles of Institutions for the Environment, eds. S. S. Hanna, C. Folke, and G. K. Maler, 111-126. Washington, D.C., USA: Island Press.

Olsson, P., Folke, C., and Berkes, F. 2004. Adaptive Comanagement for Building Resilience in Social-Ecological Systems. *Environmental Management* 34(1):75–90.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. New York, USA: Cambridge University Press.

Ostrom, E., Dietz, T., Dolšak, N., Stern C. P., Stonich S., and Weber U. E. eds. 2002. *The Drama of the Commons*. Washington, D.C., USA: National Academy Press.

Salam, A. M. D., Noguchi, T., and Pothitan, R. 2006. Community Forest Management in Thailand: Current Situation and Dynamics in the Context of Sustainable Development. *New Forests* 31:273–291.

Stern, C. P., Dietz, T., Dolšak, N., Ostrom, E., and Stonich, S. 2002. Knowledge and Questions After 15 Years of Research, In *The Drama of the Commons*, eds. E. Ostrom, T. Dietz, N. Dolšak, P. C. Stern, S. Stonich, and E. U. Weber, 445-489. Washington, D.C., USA: National Academy Press.

Vannucci, M. 1989. *The Mangroves and Us: A Synthesis of Insights*. New Delhi, India: Indian Association for the Advancement of Science

Zorini, O. L., Contini, C., Jiddawi, N., Ochiewo, J., Shunula, J., and Cannicci, S. 2004. Participatory Appraisal for Potential Community-Based Mangrove Management in East Africa. *Wetlands Ecology and Managemnet* 12**:**87–102.