School Network for River Conservation and Ecosystem Monitoring in Northern Thailand

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Abstract
Depletion of water quality in Thailand has become a serious problem in recent years. The objective of this study was to mobilize river conservation and monitoring activities in Ngao River, a Mekong tributary in northern Thailand by involving elementary and junior high schools. The project was divided into four activities: i) field survey, ii) illuminating workshop and network stimulation, iii) students activities on river conservation, and iv) presentation of school and student activities.

The research found that use of actual situations in the district and outdoor training programs are effective to educate children and increase their awareness on river water quality issues. Students are keen to participate in the project; many of them investigated simple water quality indicators such as temperature, water velocity, transparency, total solids and diversity of aquatic life. Some schools arranged an awareness raising program to promote river conservation in the community. Some volunteered to dredge and collect waste from the river. The results clearly revealed that the schools and the students can play a major role in measuring simple water quality indicators and monitoring the river ecosystem. Further, they can convince other children, residents and local organizations to be more interested in and responsible for conservation and monitoring of the river environment. This could eventually establish a strong community network, driven by the schools, for rehabilitating and monitoring the river and ecosystem in this watershed.

Keywords: School Network, River Ecosystem, Monitoring

Introduction
Wiang Kaen District, Chiang Rai, Thailand, is a landlocked area adjacent to Lao People’s Democratic Republic. The north is bordered by the Mekong River and the east by the Doi Prae Muang and Doi Pha Mon mountains. The land is mountainous with an elevation ranging from 310 to 1,625 meters above mean sea level (Sang-Arun et al., 2006). The area has one main river called the Ngao River which flows from the high land in the south to the Mekong River (Fig. 1).

Local people have had a close relationship with the river for a long time. Most of them use the Ngao River as the main source of water for their daily consumption, crop cultivation, and so on. However, the ecosystems of the Ngao River have changed a great deal in more recent times. Many organizations in the Wiang Kaen District now pay close attention to the river
ecosystems; however, the problems of low water quality and degradation of the ecosystem have not been solved. The government tried to dredge the river, though this can also impact the ecosystem negatively, and organized an event to promote the use of traditional practices to conserve the river.

Figure 1. Study area in Wing Kaen District, Chiang Rai Province Thailand.

The objective of this study was to mobilize river conservation and monitoring activities in Ngao River, a Mekong tributary in northern Thailand by involving elementary and junior high schools.

Project activities
The project comprised four activities: i) field survey, ii) illuminating workshop and network stimulation, iii) students and school activities on river monitoring and conservation, and iv) presentation of schools and students’ activities. The field survey was conducted in June 2006. An investigation into local practices which affect water quality was carried out. The illuminating workshop was organized in August 2008. The workshop invited dialogue on the role of each sector in solving the problems of the river. The target groups were elementary and junior high school students in the district. These schools are located not so far from the river’s tributaries thus there is high potential for them to monitor the river quality and its ecosystem. Also there is a high potential to encourage them to build up an active river monitoring network. Relevant stakeholders and Government officials were also invited to participate in the workshop. This workshop aimed to improve the communities’ knowledge and understanding of the current environmental situation, natural resource management principles and the positive role that local communities can play in environmental management. The workshop activities included i) a presentation of water quality and the river ecosystems of the Ngao and Mekong River, ii) identification of factors inducing degradation of river quality and ecosystem, iii) outdoor training of simple water quality measurement and ecosystem observation, and iv) brainstorming session and drawing activities. The workshop involved school teachers and trained junior-high school students to facilitate the workshop.
After completion of the workshop, each school was given responsibility for monitoring water quality in their area. Equipment was distributed for students to conduct the measurements. After six months, in February 2007, a program to evaluate the success of the project was undertaken. Students were requested to present and share experiences.

Results and discussion

**Impacts of activities on river ecosystems**
The results of field surveys showed that there were four main activities that induced degradation of water quality and river ecosystem in Wiang Kaen District. These activities were identified as the main causes for poor water quality, drop in river depth, high river bank erosion rates, and water scarcity even in the rainy season due to high turbidity of the water.

i) Deforestation and land use change
An increasing population has directly affected land use and deforestation rates. In Wiang Kaen District there are at least nine minority groups: Lanna, Lue, Mong, Lahu or Muser, Myan, Khu, Chinese, Akha and Yao. Most of them base their farming practices on shifting cultivation in mountainous areas which is well recognized as a cause of deforestation. Another cause is land use change from forest to cultivated land for staple and cash crops. This pressure has an affect on the headwater forest area and the water quality in the Ngao River. Sang-Arun et al (2006) estimated that over 40% of the reserved forest area in Wiang Kaen was encroached for the cultivation of annual crops and the planting of orchards (Fig. 2a).

![Figure 2. Main causes of degradation of water quality and river ecosystem of the Ngao River Watershed and their impacts: (a) unsustainable farming practice in high mountainous area, (b) river bank erosion, and (c) gold mining in the river.](image)

ii) Unsustainable farming practice
Thai farmers use a number of agricultural practices which were found to have negative environmental impacts. The farmers in the Ngao River watershed prefer to plant monocrops such as corn and ginger. The cultivation of such crops can readily cause soil erosion because their root systems are weak and shallow. Further, overuse of herbicides and pesticides polluted the river.

iii) Non-ecological friendly riverbank management practice
Due to high erosion rates, the depth of the river has decreased. The Government decided to increase the depth and width of the river by dredging. The riverbanks ecosystems were destroyed by the dredging and there were very few restoration programs. Further, surrounding
the river and the headwaters is an area where slash and burn agriculture practice is common. Therefore, every time it rains there is a high level of sediment in the river turning it red in color. Additionally, the river bank suffers from high erosion rates (Fig. 2b). The result is that infrastructure such as roads and bridges and cultivation areas adjacent to the river were destroyed.

iv) Gold mining
A part of the district in the hilly area has gold deposits. Local residents conducted traditional gold mining in the river (Fig. 2c). This practice caused high turbidity of the river and increased the accumulation of downstream sediment.

The students’ awareness of river ecosystem problems
Nineteen schools located in the district participated in the workshop which included presentation of the results of field surveys on river quality, river ecosystems, and practical field training on simple river quality monitoring techniques (Fig. 3). The results of the workshop show that the participating students could understand simple water quality measurement techniques using local materials available in the district. They were also able to identify the current problems of the Ngao River such as high sediment load, river bank erosion, and potential chemical contamination.

Figure 3. Outdoor training activities for simple river quality measurement and monitoring techniques.

After a brainstorming session, several methods were identified to solve the many problems facing the river ecosystem, for example, reduction in the use of chemicals and pesticides during cultivation, the planting of more trees in the highland areas to reduce soil erosion and subsequent sediment loads in the river. To encourage the children to understand the need for a clean and healthy river they were asked to imagine the river as it was in their dreams and to sketch what they imagined.

The parameters and the condition of the river that schools are observing and measuring are average rainfall, types of land utilisation near the river, river colors, smells, water level, river velocity, temperature, transparency, total solids and aquatic life. The students proved to be very active and enjoyed using the equipment for the monitoring of the river (Fig. 4). Huay Han School, Ban Muang Yay School and Ban Thakham School actively introduced the simple water quality measurement into their science education program. A preliminary study on water quality in river and reservoirs was carried out by students who investigated the causes of water pollution. Khunkwak Pittaya School, Ban Saithong School and Ban Thakham School were very keen to monitor aquatic life in the river. Students in Ban Huay Ian School monitor
the Mekong Riverside ecosystem regularly and have protested illegal rock trafficking. Ban Thakham School, Poh Wittaya School and Pang Hud Sahasad conducted an awareness raising program to promote river conservation in the community and organized an event to clean and collect waste from the river.

Figure 4. Student activities for monitoring water quality and river ecosystems.

The school network for water and river monitoring
In February 2007, eleven schools presented their activities on river conservation and ecosystem monitoring at Khunkwak Pittaya School (Fig. 5). This activity provided evidence that the schools and students can be effective in monitoring the river quality and its ecosystems. They are able to use simple equipment effectively and carry out basic scientific observation reliably. They are able to identify correctly the many land use types which have an impact on the river. Further, they can convince other children, residents and local organizations to be more interested in and responsible for conservation and monitoring of river environment. This could eventually establish a strong community network, driven by schools, for rehabilitation and monitoring of the river and ecosystem in this watershed.

Figure 5. School exhibitions.

Another result of the student presentation and school exhibitions is that schools can help plan the monitoring and future restoration of the river. Through collaboration with all stakeholders in the area, it has been agreed to set up a schools’ river and environmental monitoring network which will be supported by local government and the private sector. Ban Saithong School volunteered to coordinate this network to ensure momentum of these activities in the district.

Community environmental management by school network mobilization
Inspired by the outcome of students’ activities, Ban Saithong School proposed to build a river conservation network and continue the activities. The School Principal volunteered to coordinate the network. The schools’ network will prepare the local environmental curriculum
in Ngao watershed and mobilize the development of the local community plan which is to be set up by local government. This could help convince related stakeholders in the area to pay more attention to river conservation from a broader perspective than merely dredging the river channel. The research indicates the benefits of involving students in measuring and monitoring river water quality and ecosystems. The students are a valuable and important resource that can make a vital contribution to conservation and restoration of the river and its watershed. The students can serve as a catalyst for participation from other sectors in the community for the creation of a strong network for conservation and monitoring of water quality and river ecosystems in the watershed.

Conclusion
The participation of local schools in water quality and ecosystem monitoring in Wiang Kaen District was a successful and novel way to make them aware and understand the values and importance of environmental conservation. In addition, students provided a service to the community as a monitoring group. They can further pass on this knowledge to their families and broader communities.

Schools proved resourceful in soliciting funding and formulating proposals for river conservation to the relevant stakeholders, government and private sectors. The initiative of these schools can lead to further collaboration, development of monitoring plans, and mobilization of community involvement in river conservation. Other sectors can play an important role by setting up planning and policies to support the required budget and equipment needed.

Acknowledgement
The authors would like to express their gratitude to the Japan Society for the Promotion of Science which provided financial support to this project. We are also grateful to Dr. Henry Scheyvens of the Institute for Global Environmental Strategies for his kind advice and proof reading of the manuscript.

Reference