



## Participatory Risk Assessment of Nong Han Wetland, Thailand

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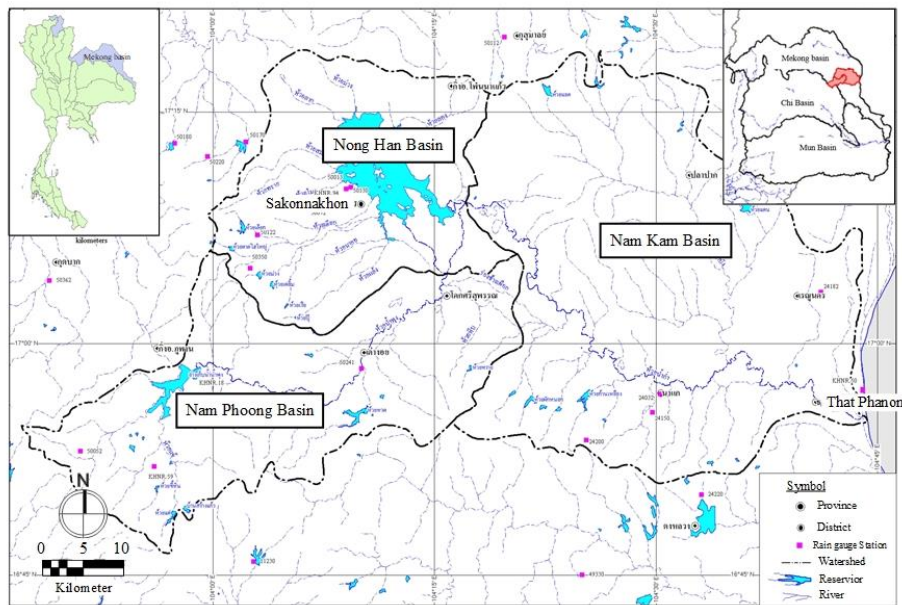
**Abstract** Recognised as a Wetland of International Importance, the Nong Han Wetland (NHW), in Sakon Nakhon, Thailand, was selected as a study site for a risk assessment, which is an integral part of wetland management planning. The study demonstrated the process and presented the results of a risk assessment adopted in the NHW. The research postulates a simple risk assessment framework, where stakeholder participation is the key element. Following Ramsar's guideline, tailored to suit the objectives of the study, the risk assessment framework involved (1) identifying problems and risks; (2) quantifying risks; and (3) proposing prevention and mitigation measures. Data were collected *via* focus group and questionnaire. The total number of participants was 217 stakeholders from 49 villages in the NHW. Eleven issues were identified, namely: (1) an increase in aquatic plant growth; (2) sedimentation; (3) degradation of water quality; (4) reduction and extinction of indigenous fish species; (5) non-existence of water laws; (6) land-rights; (7) conflicts of joint natural resource utilization; (8) sufficiency of data and information; (9) flooding; (10) draught; and (11) climate change. Risks were evaluated and ranked in terms of risk perception, and participants from different locations perceived degrees of risk rather differently. Nonetheless, when all the participants were analysed integratedly, the highest common risks shared were an increase in aquatic plant growth, sedimentation, degradation of water quality, and reduction and extinction of indigenous fish species. In addition, a set of risk prevention and mitigation measures was also drawn from the participatory risk assessment process. The results could be employed as a guideline for future plans and interventions of the wetland management following the bottom-up approach adhered to the Integrated Water Resources Management (IWRM) principles. The process not only drew conclusions and recommendations regarding risk management, but also created risk awareness and enhanced the degree of stakeholder engagement.

**Keywords** Nong Han Wetland, participatory risk assessment, risk perception, Integrated Water Resources Management

## INTRODUCTION

Nong Han Wetland (NHW), in Sakon Nakhon Province, Thailand, has been recognized as a Wetland of International Importance (MNRE, 2009). It is the largest natural lake in the northeast of Thailand and the country's second largest after Bueng Boraphet, Nakhon Sawan Province. The NHW connects to the Mekong River *via* the Nam Kam River, approximately 123 kilometres in length. The location of the NHW is shown in Fig. 1. The Nong Han Basin covers the area of 583 km<sup>2</sup>, where the wetland covers the area of 123 km<sup>2</sup> with an average depth of 1.9 m., composing paddy fields, grass lands, and village communities (Chaturabul and Pongput, 2013). Abundant in natural resources, Nong Han is a complex and important ecosystem and is vital to the livelihoods of the local communities (MRC, 2017).

The NHW has been managed by various governmental agencies. Due to various factors, mainly anthropic disturbance, various issues have been reported, namely, floods, draught, degradation of water quality, increases in aquatic plants, sedimentation, and the reduction and extinction of indigenous fish species (MRC, 2017). This demands a well-integrated plan for the wetland management, whereas risk assessment is an integral part of the management-planning processes for wetlands (Ramsar, 1999). In addition, prior to this study, a risk analysis had never been conducted on the NHW. This research therefore is a first attempt at a risk analysis of Nong Han by employing a participatory risk assessment methodology, which is a bottom-up approach involving local communities in identifying, deciding solution measures, and implementing and evaluating interventions. It is well noted that participation from stakeholders is important to the success of policy implementation (see for example Erftemeijer and Bualuang, 2002; Trisurat. 2006).



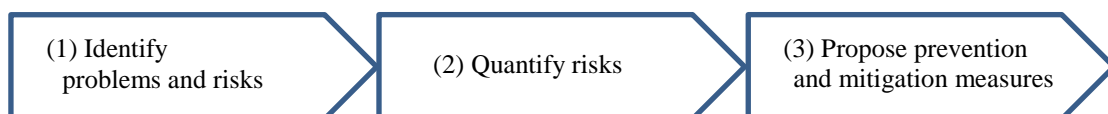
**Fig. 1 Location of Nong Han Wetland**

**OBJECTIVES**

The objectives of this study are: (1) to present a comprehensive risk analysis of the NHW; (2) to determine the pressures and impacts on the environment and community livelihoods in the NHW; (3) to propose prevention and mitigation measures of the risks elicited by the participants; and (4) to promote a community participatory approach and capacitate stakeholders with integrated water resource methodology.

**METHODOLOGY**

The study adopted the risk assessment framework of the Wetland Risk Assessment proposed by the Ramsar Convention Secretariat (1999) tailored to suit the scope of the study, as shown in Fig. 2 below.



**Fig. 2 Risk assessment framework**

The analysis combined both qualitative and quantitative methods. Qualitatively, in order to gather primary data, focus groups were organised. Quantitatively, the information drawn was quantified in terms of risk ranking. Stakeholder participation was key in all steps. The process is outlined herewith.

### 1. Identify Problems and Risks

Closely related, problems and risk identifications were carried out hand-in-hand. Problems can be defined as undesired incidents, whereas associated risks are the corresponding consequences and likelihoods. Problems and risks were initially formulated in a series of workshops, held by a civil society in Sakon Nakhon called the Chomrom Song Serm Kon Dee, consisting of direct stakeholders, including civil servants, business owners, and community residents.

Eleven issues were identified: 1. an increase in aquatic plant growth; 2. sedimentation; 3. degradation of water quality; 4. reduction and extinction of indigenous fish species; 5. lack of water laws; 6. land-rights issues; 7. conflicts of joint natural resource utilization; 8. existence of and sufficiency of data and information; 9. floods; 10. draught; and 11. climate change. These issues were later introduced to the other four workshops organized in the NHW in order to gather agreements and additional issues from the participants.

### 2. Quantify Risks

Risk perception methodology was employed. Risk perception refers to human subjective judgments about the likelihood of negative occurrences such as hazards and threats to the environment or health (Paek and Hove, 2017). In other words, it indicates the extent to which people know, and what they feel, about threats and likelihoods, and gives a general overview of the status quo of risks pertaining to environmental settings.

There are various methods for quantifying risk perception (see e.g. Weber et al., 2002; and Janmaimool and Watanabe, 2014). This study devised a simple, straight-forward and low-cost method. First, the questionnaire was designed around the issues identified in the previous step. Eleven close-ended questions required the respondents to subjectively evaluate the degree of risks and the likelihood of the issues to occur. Second, response options were coded as “High = 3,” “Moderate = 2,” and “Low = 1.” Then, risk and likeliness were arithmetically averaged, and scaled to the range of 0 to 1.

### 3. Prevention and Mitigation Measures

During the workshops, the participants were asked to participate in a group discussion and to actively participate and exchange their ideas on the related prevention and mitigation measures.

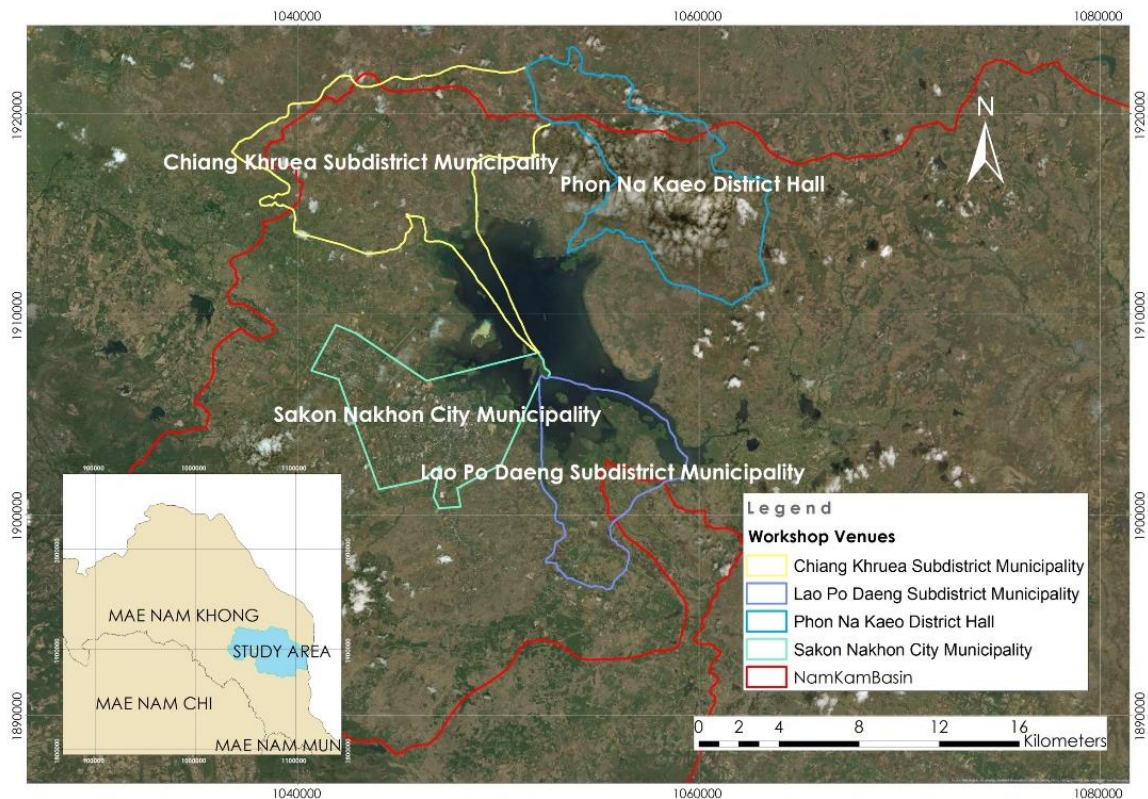
**Table 1 Workshop participants and venues**

Venue (all in Sakon Nakhon Province)	Respondent	Village	Sub-district
Phon Na Kaew District Hall, Phone Na Kaew District	50	11	3
Lao Po Daeng Sub-district Municipality, Muang District	57	16	4
Chiang Khrua Sub-district Municipality, Muang District	49	12	3
Sakon Nakhon City Municipality, Muang District	61	10	1
Total	217	49	11

### 4. Risk Analysis Workshop

Four workshops were organised to collect data from the communities in four different locations around Nong Han during 2016. Table 1 and Fig. 3, respectively, illustrate and report the numbers of participants, villages, and sub-districts they represented. The total number of participants was

217, including direct stakeholders, such as sub-district headsmen, village chiefs and assistants, and village committees.



**Fig. 3 Study site and workshop venue**

## RESULTS AND DISCUSSION

This section presents the results; namely, risk logs, prevention and mitigation measures, and discussion.

### 1. Risk Log

The risk log summarized the results of the risk analysis in terms of likely impacts on the environment and community of the NHW.

**Table 2 Ranked risk log**

No.	Issue	Impact	Likelihood	Rating
1.	Increase in aquatic plant growth	0.94	0.96	0.90
2.	Sedimentation	0.93	0.94	0.87
3.	Degradation of water quality	0.92	0.93	0.85
4.	Reduction and extinction of indigenous fish species	0.88	0.90	0.79
5.	Land-rights issue	0.88	0.88	0.78
6.	Climate change	0.87	0.88	0.77
7.	Draught	0.85	0.87	0.74
8.	Conflicts of joint natural resources utilization	0.83	0.84	0.70
9.	Nong Han's data and information sufficiency	0.83	0.83	0.69
10.	Lack of water law	0.80	0.82	0.66
11.	Flood	0.80	0.80	0.64

The first four highest-ranked issues were all closely related. Issues such as sufficiency of data and information about Nong Han, lack of water law, and flooding were ranked last, but they were still considered high both in terms of impact and likelihood.

## **2. Prevention and Mitigation Measures**

The proposed prevention and mitigation measures were the result of stakeholder participation in collectively eliciting solutions to the common problems shared. The measures are classified herewith as structural and non-structural. On the one hand, structural measures are fixed or permanent physical constructions for preventing and mitigating risks. On the other hand, non-structural measures do not involve physical facilities. Due to the limited space, the measures are only briefly summarised as follows.

### **2.1 Structural Prevention and Mitigation Measures**

- Build more wastewater treatment plants (at the present, there are only two plants in the NHW).
- Build adequate drainage systems and improve the existing drainage systems.
- Build an embankment/dike, construct more reservoirs to increase water storage, and construct roads surrounding Nong Han.

### **2.2 Non-Structural Prevention and Mitigation Measures**

These non-structural prevention and mitigation measures are grouped into 1) regulatory measures; 2) awareness and education measures; and 3) non-structural modifications.

#### **Regulatory measures:**

- Enact and enforce water laws or water resources agreements, namely, Nong Han agreements/laws to conserve fish species and to prescribe penalties for violations.
- Amend the existing law, the Royal Decree of Demarcation of Restricted Land in Muang District, Sakon Nakhon Province B.E.2484 (1941), to solve land rights conflicts in the NHW.

#### **Awareness and education measures:**

- Create awareness and involvement, and disseminate knowledge of integrated water resource management and how to use water wisely and equitably.
- Campaign stakeholders to prevent pollution of the NHW.
- Promote organic farming, stop/reduce using chemical fertilizer and pesticides.
- Promote reforestation and preserve the existing natural resources.
- Create awareness and conserve the population of indigenous fish species, and campaign for sustainable fishing.
- Organise discussions between the government and the people in order to improve common understanding.
- Create a data-management centre in order to organise studies and data collection, and to publicise accurate data and information.

#### **Nonstructural modifications:**

- Employ natural methods to treat wastewater, e.g., use mosquito fern or water fern to absorb heavy metals and phosphates, and increase herbivorous fish species that feed on aquatic vegetation.
- Remove and control aquatic weed for example through dredging operations and weed removal machines.
- Plant and maintain an appropriate vegetative buffer on the shoreline to prevent soil erosion and sedimentation.

## CONCLUSIONS

In addition to the measures introduced above, the participants also recommended developing a Nong Han management plan, which should include draught protection and relief, and flood prevention, protection, and mitigation. On the one hand, engineered structures may eliminate the risk to some degree. On the other hand, non-structural measures are less costly and require participation through a process of behaviour influencing, usually *via* stakeholder capacity building (Taylor and Wong, 2002). Both structural and non-structural measures recommended from this study can be employed as a part of wetland management planning. Importantly, the two measures should be balanced; for structural measures to be effective, stakeholders should be aware, prepared, and duly trained (Bons, 2013). The participatory risk assessment procedures proposed can be employed in different environmental management planning settings. The study not only drew conclusions and made recommendations regarding risk management, but also created risk awareness and enhanced the degree of stakeholder engagement.

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