

Flood control—environmental and socio-economic issues: case study of a diversion area in Vietnam

PHAN THI ANH DAO & TAKARA KAORU

Disaster Prevention Research Institute, Kyoto University, Uji, Kyoto 611-0011, Japan
daopat@yahoo.com, takara@rdp.dpri.kyoto-u.ac.jp

Abstract Flood control is an important issue in Vietnam and appropriate policies, strategy and action to control floods and mitigate its damage, and to help people to recover after floods, has always been the government's great concern. The Day River basin is a flood diversion region, which is an important region in practicing flood protection in Vietnam. Understanding environmental and socio-economic problems caused by floods in the inundation area of the Day River basin is the focus of this paper. Analysis of flood impacts and adaptations made by local people in flood-endangered areas is another major part of the paper. Findings presented here could be helpful for determining appropriate flood control plans.

Key words adaptation; environment; flood control; impacts; socio-economic development

INTRODUCTION

Vietnam has large systems of rivers and is one of the most flood-prone countries in the world. Farms in the Day River region in particular, and in the lower Red River basin in general, have been subject to flooding. The Day River is diverted off from the Red River some 25 km upstream of Ha Noi at Hat Mon in Phuc Tho District of Ha Tay Province. In 1937, the Day River region was protected against flooding by the Day Dam, located about 10 km downstream from the point where the Day River is diverted off the Red River. In order to protect the area between the Red River and the Day Dam, a dike and the so-called Van Coc sluices were constructed along the Red River in 1966 (Fig. 1). Because of the flat topography of the areas next to the rivers and the diversion, this region is vulnerable to flooding in the rainy season. As there is no complete protection against floods, societies must live with them (Kundzewicz & Takeuchi, 1999). The ways of living with floods are naturally different in different regions as natural environments, people's living pattern, national economy and social structures are different (Takeuchi, 2002). In order to understand socio-economic situations in flood-endangered areas, surveys related to these issues were conducted in Hat Mon Commune, Phuc Tho District, Ha Tay Province during June–September 2002. The methods of Rural Rapid Appraisal and Participatory Rapid Appraisal were used to collect data in this study. These include: (a) collecting and analysing secondary data; (b) mapping; (c) interviewing authorities, elderly people and 30 households using semi-direct questionnaires. This paper focuses on the following question: How do floods affect the living conditions, socio-economic development and environment in the commune? How does the local society respond and adapt to floods?

The findings provide useful information for further planning of the flood control, and reasonable use of water resources, in this region.

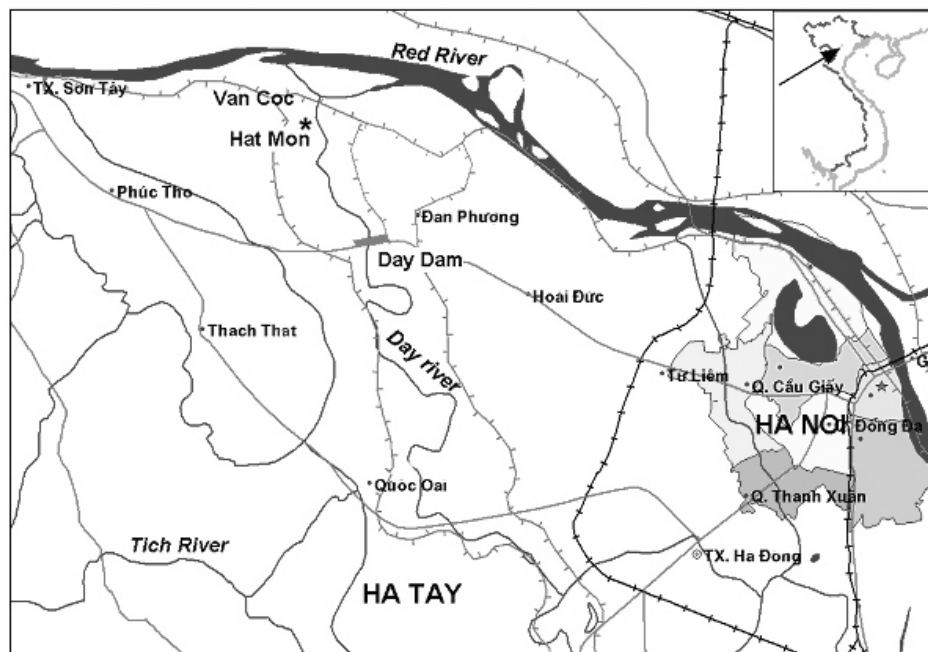


Fig. 1 Location of study area.

FLOODS, IMPACTS AND ADAPTATION

Flood situation

The Hat Mon commune (Phuc Tho District, Ha Tay Province) is located in front of the Day River diversion area and is a high flood risk zone. The total natural area of Hat Mon is 434 ha. In 2001, the total population of Hat Mon was 7111 people with 1609 households (Phuc Tho District People Committee (PDPC), 2000). Before 1966, the commune was flooded in every rainy season, normally from July to September, or sometimes in late June or early October (Table 1).

According to tradition, people moved to Hat Mon to settle over 2000 years ago. Initially, they settled in the higher altitude and less-inundated areas where they could

Table 1 Characteristics of some floods in the Hat Mon Commune.

Year	Main causes	Flood duration	Impacts
Before 1966	Dikes were very poorly constructed.	2–3 months	Flood 1–3 m deep. People could not cultivate during May–August. Disease.
1969	Flood diversion (water level of 13.4 m in the Red River).	1 month	Flood 2–3 m deep. Loss of all crop products. Disease.
1971	Flood diversion (water level of 14.4 m in the Red River).	20 days	Flood 2–3 m deep. Loss of all crop products. Disease.
1977	Testing flood protection systems.	7 days	Loss of crop products.
1986	A dike was broken.	1 month	Flood 2–3 m deep. Loss of all crop products. Disease.
2002	High water level in the Red River (nearly 14.4 m); about 3 m flooded in area outside main dike.	Not flooded	Local people (mainly dyke protection team) acted appropriately to protect dike on time.

plant rice. The main fields and houses in those areas were protected by small local dikes, of which the oldest dike was built more than 500 years ago. Many local people moved to the alluvial areas and built houses there during 1950–1960. Hat Mon was one of the low-lying areas in Phuc Tho District; therefore, they suffered high flood damages. The floodwater level often fluctuated between 1 m and 3 m in depth. In the historical flood of 1945, the floodwater level in Hat Mon was 4.5 m (DHV Consultants BV, 2002). In 1966, a dike along the Red River was constructed between Van Coc and Hat Mon, which effectively cut off the flow of water to the Day River, including in the dry season when it is most needed for irrigation. The Day River became a dead river, and its water quality deteriorated quickly. After 1966, people inside that dike protection zone no longer had to suffer floods every year, except for the years when floods were diverted to this zone (1969, 1971) or when a dike was broken (1986). In those years, the floodwaters were about 2–3 m in depth. Meanwhile, the people who live outside the main dike have to suffer more floods (such as in 2002). There were some tens of households of the Hat Mon Commune living outside of the dike and they experienced floods every year. During times when floods were diverted to the Day River, local people were provided with rice and wheat flour by the Government. In general, people in Hat Mon have had to live with floods for a long time.

Flood impact and local community adaptation

Because of having to live with floods, the community has strategies to adapt to it. The foundations of houses are generally made of soil and built about 1–1.5 m high, depending on the location of the house. Because of long inundation, they often had to repair their houses many times using poor materials. Later, local people tried their best to have their houses made of bricks. To cope with floods, they store rice, maize, sweet potatoes, and dry food. As the local people have a lot of experience, very few have died as a result of floods. During floods, old people, women and children moved to live at higher places. Meanwhile, the men stay in their homes to take care of their properties. In 2001, the proportion of people under 15 years of age was 24.5%, and of people over 60 years, 12.4%. (PDPC, 2001). These demographic characteristics should be reflected in the evacuation plans for the diversion. As in other communes in the Day River catchment area, there is a team of local people to take care of all the work related to dike protection, flood control, flood diversion. Local people contribute labour and materials to upgrade and protect dikes with enthusiasm.

Before 1966, local farmers could not plant anything during the flood season. However, the annual flooding left large amounts of alluvium (the alluvial layer can be up to 0.40 m thick), that made the soils of the fields and along the sandy riverbank very rich. At the end of the 19th century, local people started to exploit the fallow alluvial area along the bank of the Red River and the Hat River (an old branch of the Day River) to cultivate rice and other crops. The investigation showed that men in the village often caught fish using nets when floods occurred. Other people worked as hired labour in neighbouring villages or in upland areas. Most households had boats for transportation during the flood season. However, because there has been no flood since 1986, many households have not replaced or repaired old and broken boats. After 1966, when floods occurred unexpectedly, all cultivated products were lost. People moved domestic poultry/cattle to higher areas and

kept them inside bamboo cages. They usually minimized the numbers of domestic poultry/cattle or sold them before the flood season started. Diseases and the lack of clean water were serious problems during floods. People had to spend at least 1 month cleaning the environment after floods.

Despite such difficulties, when they were asked if they wanted to migrate to non-inundated provinces to live, 93% of total respondents declined (in spite of government support for migration). The main reasons are as follows:

- Floods take place periodically, and local people are used to floods. They are always ready to deal with floods. The experience also helped them to cope with difficulties during and after floods to minimize damage. Moreover, they have not suffered any floods since 1986.
- The Vietnam farmers love their motherland and the rice field is very important to them. The fertility of fields increases after flooding because of the sediment deposits. This is an advantage as it helps to increase productivity and reduce fertilizers costs.
- Respondents believe that they can cope with floods as others can cope with floods. The local people have a very high sense of community and they share many things to survive during flood periods.

According to Kundzewicz (2002), the importance of non-structural measures is also illustrated by the power of adaptation. Where a flood occurs twice in a short time period, losses during the second flood occurrence are typically far lower than during the first occurrence. The findings of surveys in Hat Mon demonstrate that principle. The local people have experienced many floods and they have found appropriate solutions to adapt to flood-endangered conditions.

ECONOMIC DEVELOPMENT AND FLOOD RELATED ISSUES

Economic situation

Agricultural land amounts to 77% of Hat Mon. A labour force of 2700 persons makes up 38% of the total population and for accounts 85% of labour in the agricultural sector. The average farm area is 0.05 ha per person. The intensity of land use is very high. They fallow land only when they cannot supply enough water or the fields are inundated.

The present crop schedule of the Hat Mon Commune by season is presented in Fig. 2. Crop patterns and crop diversification have gone through many changes to adapt to flood-endangered situations; these are also affected by market changes. This finding is similar to flood-endangered areas in the Me Kong River delta in Vietnam (Thai, 2001). At present, 61% of households grow more than three crops per year, and the remainder grow two crops. Paddy is a main crop (and staple food). Rice cultivation depends on water supply and the area used for summer rice crops is located higher than other crops. The area of winter cash crops is larger, 75% of the total area. Crop productivity is quite high (Table 2).

During the flood season, local people only cultivate rice and maize inside the main dike. Since pig rearing is widespread, potatoes and maize are cultivated mainly for livestock fodder. The number of poultry is 38 000, and of cattle, 233 (PDPC, 2001). Livestock sales contribute a large share to total cash income. Rice production is mainly

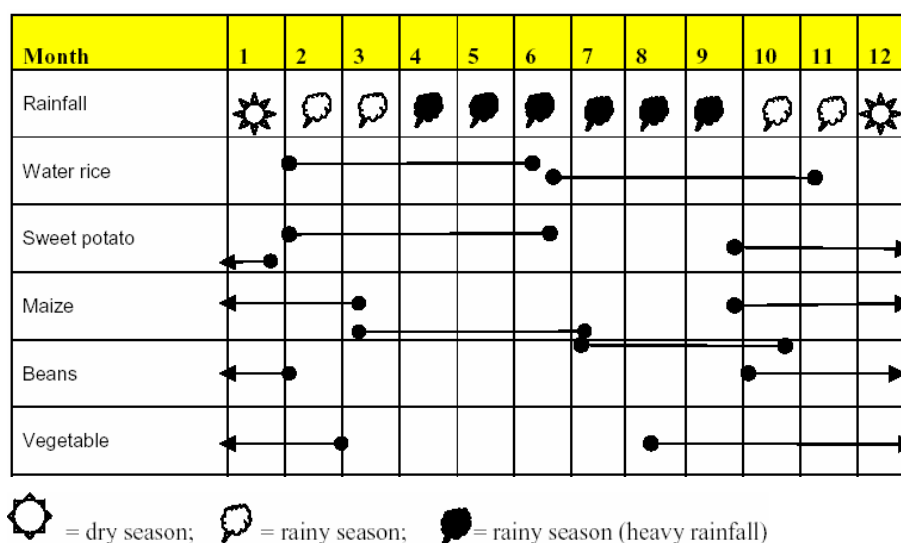


Fig. 2 Seasonal calendar (DHV Consultants BV, 2002).

Table 2 Productivity of main crops in Hat Mon ($t\ ha^{-1}$). Source: Statistics data of Hat Mon Commune People Committee, 2001.

Crop	Rice	Sweet potato	Maize	Beans	Fruit trees	Vegetable
Spring	5.9	6.9	4.6	1.4		No information
Summer	6.1	Non crop	4.5	1.9	Bananas, Apple	No information
Winter	No crop	8.3	4.5	1.4		13.9

used for home consumption. Most vegetables and a major share of soybean production are sold in the market.

The average annual income in Hat Mon, 3 million VND per capita in 2001 (US\$1 \approx 15 500 VND (Vietnamese dong) in 2001) is quite high compared to other communes in the diversion region (DHV Consultants BV, 2002). In Hat Mon, only 5% of the households are considered as poor families (income lower than 960 000 VND per capita per year). Poverty is usually a result of poor health or specific situations. Since 1990, employment has become increasingly diverse. The local economy is quite diversified with an agricultural share of 68%, trade around 10%, construction 10%, and other 12% (PDPC, 2001). Pensions and other allowances also represent a significant part of the income. In Hat Mon, according to the authorities, about 40% of households are engaged in seasonal work in cities such as in construction, carpentry or driving motorbikes. Overall, the economy of the Hat Mon Commune mainly depends on the agricultural production. The risk of flood occurrence hence has a significant effect on the living conditions of the local people.

Towards sustainable economic development in the flood-endangered area

All respondents express feelings of insecurity since their assigned areas are located in diversion areas. When floods occur, they lose most of their cultivated products. It takes 3–5 years to completely recover. At present, most of the seedlings are short-term with

short stems which are more easily inundated. Another concern of the local people is related to the environment, especially during the flood season. There are crop diseases, and problems of water shortage, waste treatment and pollution due to the use of pesticides. People in Hat Mon also have to face other difficulties in developing their economy. The water supply and drainage are not well developed either: during winter there is water shortage yet water-logging tends to occur during excessive rainfalls. Funding shortage is another difficulty for the local people; this is also a difficulty for authorities when improving extension services and irrigation systems (DHV Consultants BV, 2002). Because of their location in the flood-prone region, local people get support from the government to improve their living standards. Vietnam has been recognized as a country with appropriate policies and social structure to mitigate floods. This structure has been established and developed for some centuries because of the history of economic development based on agriculture in large deltas. There are many preferential policies to help local farmers when floods occur (Do, 1996). The Vietnamese government makes great efforts in flood control and in integrated approaches to manage water resources. The authorities focus not only on the structural measures but also on non-structural measures. The government has taken into account the issue of improving agricultural production in the Day River area; this can be done by improving irrigation systems. Thus, a project on "Flood diversion and water resources development" in the Day River region was approved in 1999. This is a new shift of strategy for flood control in Vietnam. From our point of view, the following suggestions are made in order to ensure the success of the project:

- Local people should be encouraged to get involved in this project. An in-depth analysis of historical experience related to floods would be helpful to discover other non-structural measures to abate floods. Therefore, it is essential to carry out more research on adaptation of local people to prepare for future evacuation, security and economic development.
- Research on changes in agricultural ecology and vegetation should be conducted to find the optimal patterns of crops to achieve sustainable development in a flood-prone context.
- Diversification of stable jobs for farmers is very important in order to minimize dependence on agricultural production, which can be completely at risk when floods occur.

CONCLUDING REMARKS

People in flood-endangered regions are usually prepared to cope with regular flood occurrence so as to minimize flood damage. Production activities also reflect their experience of living with floods. Dependency on agricultural production should be considered in socio-economic development plans and non-structural measures in flood control in this region. Further improvement of the irrigation systems, research on agricultural ecology to find appropriate crop patterns, crop periods, and an increase of non-farm occupations could help the local people to minimize flood damage and develop their economy.

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