The People and Their River

A Survey of River-Based Livelihoods
in the Xe Bang Fai River Basin
in Central Lao PDR

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EXECUTIVE SUMMARY

1. Introduction and Background

The Mekong River and its many tributaries are the essence of the natural wealth of the Lao PDR. These rivers and associated ecosystems are the foundation of the means of livelihood security and economies of local communities throughout the country, and the importance of rivers and wetlands are reflected in the knowledge and belief systems, stories, music, and arts of the people.

This report describes research about the river-based means of livelihood of communities living along, and in the vicinity of, one of the great rivers of Laos, the Xe Bang Fai River in the provinces of Khammouane and Savannakhet. The research was undertaken by Bruce Shoemaker, Ian Baird and Monsiri Baird (hereafter referred to as the 'survey team') in early 2001 as part of the Canada Fund for Local Initiatives project identification and review investigations. All members of the survey team speak the Lao language. Collectively they have more than twenty years of experience living and working in Laos.

This report is published with the hope that it will be of interest to officials and decision-makers of the Government of Lao PDR, local and international development workers, and other individuals and organisations interested in issues related to environment and development in Laos, and will contribute to the development of a more holistic and sensitive approach to development in the Mekong River Basin.

Field research was conducted in February and March of 2001. In each district the study team first went to the district administration office to explain the purpose of the study and to receive official permission to visit villages in the Xe Bang Fai River Basin. Officials in the district offices provided overviews of development issues in their districts, as well as population estimates and other statistics related to the livelihood of local people living in the basin.

The study team visited a total of twenty-four villages and also talked with people from at least another 10 communities. These semi-structured interviews related to livelihood issues but did not exclude other issues that villagers felt were important and wanted to discuss. Women were often the primary sources of information regarding the importance of rivers and associated ecosystems for the livelihood security of families and entire communities.

The Xe Bang Fai is one of the major rivers of central Laos and the Xe Bang Fai basin's catchment area totals approximately 9,500 square kilometres (IUCN, 1997). Areas of the basin are within seven districts of Khammouane province — Nong Bok, Xe Bang Fai, Tha Khek, Mahaxay, Nyommalat, Xaibouathong, and Boulapha — and the three districts of Xaibouli, Vilabouli, and Atsaphone in Savannakhet province. The river and its many tributaries flow through a variety of ecosystems and geographical features. The Xe Bang Fai flows from its headwaters in the Say Phou Louang mountain range (along the Lao-Vietnam border) down to the river's floodplain and into the Mekong River.

During the dry season , from January to early May, the flow volume of the Xe Bang Fai is approximately five to seven cubic metres per second (m^3/sec) at Mahaxay (SMEC, 1996 p.38). But during the peak of the rainy season in August and September, the rains of the monsoon contribute to a greatly increased flow — often reaching over 2,000 m^3/sec at Mahaxay and over 3,000 m^3/sec in the Xe Bang Fai floodplain.

2. The People of the Xe Bang Fai River Basin

According to statistics from district offices, recent research, and the study team's interviews with villagers, an estimated 120,000 to 150,000 people are currently deriving significant and

important livelihood benefits from the Xe Bang Fai River. This population includes approximately 50,000 people living in at least 125 villages located directly adjacent or very close to the Banks of the mainstream Xe Bang Fai from its headwaters to its confluence with the Mekong River. Many other villages are located along the eight main tributaries of the Xe Bang Fai and smaller permanently flowing and seasonally flowing tributary streams within the basin. The study team was able to estimate that 20,000 people live in villages along four of the major tributaries. There are villages located along other major tributaries but these populations could not be reliably estimated.

The population of the Xe Bang Fai basin includes many thousands of ethnic minority (non-ethnic *Lao*) people, including the *Brou* and several other ethnic minority groups. Living along the Xe Bang Fai and its tributaries, and oftentimes far from these rivers, these communities derive important livelihood benefits from the river.

People from communities located at distances up to 20 kilometres from the Xe Bang Fai travel to the river to fish on a seasonal basis. Some keep their own boats along the river near the houses of relatives, and have fruit orchards and cultivate vegetable gardens near the river. According to local people living in riverside villages, people from many villages located far from the Xe Bang Fai come to the river to fish, collect other wildlife and plants, or to garden. Many communities living even further away from the river have important trading relationships with communities along the Xe Bang Fai.

3. River-based livelihoods

From place to place and from season to season, the people living in the Xe Bang Fai River Basin derive diverse benefits from the river and its wetlands. Different ethnic groups take advantage of the natural wealth of the basin in different ways, in the same way that women and men in these communities undertake a diverse range of responsibilities in managing and harvesting this wealth. Many of these livelihood activities are inter-related and they are not always easy to separate from each other. For the purposes of this report, the inter-related aspects of local people's livelihoods are divided into several categories.

4. Fisheries

Fisheries are one of the most important livelihood activities in the Xe Bang Fai basin, and many villagers devote much of their time and energy to fishing. Fishing activities in the mainstream Xe Bang Fai River are most prevalent in the dry season, while people generally fish in wetlands, streams and inundated rice fields during the rainy season. The best fishing areas in the Xe Bang Fai and its large tributary, the Xe Noy River, are rapids, where the river's flow over a stratum of rock is relatively quick and shallow, that connect deep-water pools and stretches of seasonally-inundated forest. There are a wide variety of fishing methods and fishing gears utilized by villagers in the Xe Bang Fai basin.

Seasonal fish migrations between the Mekong and Xe Bang Fai rivers, and through the Xe Bang Fai River and its tributaries, are an important characteristic of the river basin and are essential to the fisheries and livelihood security of the communities living in the Xe Bang Fai basin. The first major fish migration of the year commences at the beginning of the monsoon season. When the rains begin in May or early June, seasonal streams begin flowing, and the water level and flow volume of the Xe Bang Fai River begin to rise. At that time, according to villagers, a large number of fish species begin migrating up the Xe Bang Fai River from the Mekong River, while other fish species are believed to move from deep-water pools in the Xe Bang Fai River. At around the same time that fish move up the Xe Bang Fai River, they also begin to migrate up its larger tributaries.

The *pa doke keo* fishery takes place at the beginning of the rainy season. The *pa doke keo* fish migrates up the Xe Bang Fai River from the Mekong River. These fish are not seen during any other season. After the fish migrations at the beginning of the rainy season have taken

place, there is considerable fishing activity in wetlands for the duration of the rainy season, and no important fisheries in the large rivers during this time of the year.

In October, as the rainy season ends, an important fishery based on migrating fishes of the *cyprinid* family takes place. Many small species of cyprinids identified collectively by villagers as *pa soi* are caught along the Xe Bang Fai and Xe Noy rivers using lift nets. Women are the main participants in this fishery.

As the *pa soi* fishery is taking place, fish are also moving out of rice fields, streams, ox bow lakes and inundated natural depressions to return to the main rivers. At this time many villagers make barrier traps (*tone*) at the edges of rice fields and on streams to catch fish, and in some cases large quantities of fish are caught. Fishing in ox bow lakes, natural depressions and streams is extremely important for people living in the Xe Bang Fai basin, particularly for those communities situated away from the Xe Bang Fai River and other major rivers as it is only during this period that many of these fish can be caught in locations away from the major rivers.

Ethnic *Lao* villagers have a number of traditional practices for catching fish including the trapping of wild fish in ponds when flood waters recede (*nong sa*) and communal taking of fish in wetland areas (*pha nong*). These systems are dependent on the seasonal flood cycle of the Xe Bang Fai river system.

Wild capture fisheries are clearly one of the most important livelihood resources in the Xe Bang Fai basin. While fisheries have always been important to local people, their relative importance to society may actually be increasing. In areas where rice production does not provide families with a supply of rice sufficient for an entire year, wild capture are their main means for getting rice — either through direct barter trade with other villages or through selling fish and using the money to buy rice.

Fish are a significant component of the local economy. Fish traders from Khoua Xe (the trading centre at the Route 13 bridge crossing the Xe Bang Fai River) and other population centres travel to riverside villages to buy fish on a regular basis, some villages selling tens of kilograms or more per day. In some areas, villagers sell their own fish at district centres. Marketing patterns differ from place to place.

Besides fish, many other living aquatic resources are gathered from rivers and wetlands by villagers, although the amounts and types of resources harvested can vary widely from village to village. These aquatic resources include shrimp, snails, earthworms (used for fish bait), frogs, crabs and aquatic insects. These resources are especially important in villages with a small area of wet rice fields or fields that are particularly vulnerable to flooding. While many non-fish living aquatic resources are utilized as food within individual households, some people realize substantial income from their sale. Women and children often play the major role in the collection of these resources.

5. Dry season riverbank vegetable gardens

The cultivation of gardens along the banks of the Xe Bang Fai River and many of its tributaries is a very important livelihood activity throughout the study area. In many villages, produce from the riverbank vegetable gardens are a major contribution to family food supplies. Surplus produce is also sold at market. The gardens are of particular importance for women, as they often determine the crops to be grown and how the produce — and income from its sale — is to be used.

There are two overlapping seasons for riverbank gardening, the first season from August or September to December, the second beginning in December with crops harvested by March. A survey of gardens done at just one point in the dry season may easily underestimate the total production. Some vegetable gardens are located directly in front of the houses of the owners, while other gardens may be located several kilometres from a household. Some villagers live

far from the Xe Bang Fai River, but nevertheless have dry season vegetable gardens along the river Bank. Many of these crops are consumed within the family and are an important source of nutrition for families. Other crops are grown mainly for sale.

6. Forests and Livelihoods

Forests surround many of the villages and rice fields in the Xe Bang Fai basin. These include both seasonally flooded forests dependent on the natural flooding cycles of the Xe Bang Fai River and associated floodplains and tributaries, and forests outside the normal seasonal flood zone or situated in areas flooded for only relatively short periods each year.

The seasonally flooded riverine forests of the Xe Bang Fai River Basin are an essential component of local livelihood security and the health of the Xe Bang Fai and its tributaries. There are large areas of this forest-type along the edge of the mainstream Xe Bang Fai, especially the middle and upper stretches of the river. These forests include many edible perennial and annual plants that are collected by local people, as are edible insects and aquatic animals that rely on these flooded forests. All of these plant and animal species are highly adapted to the seasonal rise and fall of the rivers' water levels. These forests are an extremely important habitat for fish and other aquatic animals, for maintaining a vibrant aquatic ecosystem, and for preventing excessive and damaging erosion of riverbanks.

Wetland forests surrounding the seasonal and year-round wetlands are to be found in various parts of the Xe Bang Fai basin. While many wetland forests have been cleared and the land used for rice cultivation, wetland forests still exist in many areas. Edible plants and herbal medicines grow in these forests and are harvested by villagers. When inundated during the rainy season, wetland forests are an important habitat for fish and other aquatic animals.

Forests not subject to seasonal flooding, or only infrequent flooding usually of short duration, are generally evergreen and semi-evergreen forest-types. These forests provide local people with many livelihood resources, and villagers collect a large number of non-timber forest products (NTFPs) for use and sale, including bamboo, rattan, mushrooms, insects, honey, resin, etc. Some villages have established protected forests that are used, managed and conserved by these communities. In some villages, these community-managed forests have been established through community forest projects supported by NGOs and district forestry departments. In other villages, there are spirit forests in which logging and hunting are prohibited by these communities due to a belief that they are inhabited by spirits protecting the village.

In many places the area of natural forest has decreased and remaining forests are under threat. In the vicinity of some villages there has been a steady, if gradual, expansion of rice fields and grazing areas. Extensive areas of forest have also been intensively logged and damaged by logging — most of this logging has been done by people who are not members of near-by local communities — and logging continues in some areas. In some villages, industrial tree plantations are being promoted and established. Logging concessions and tree plantations are increasingly seen by villagers as threats to their livelihoods.

7. Rainy Season Rice-based Agriculture

Villagers mainly engage in lowland rice cultivation, although upland swidden cultivation occurs in some areas. All of the villages situated along the lower and middle sections of the Xe Bang Fai River are engaged in lowland rice farming and people in many villages identify lowland rice cultivation as their main livelihood activity. The size of rice fields varies widely from village to village, but is generally between one and three hectares per family.

The success or failure of rainy season rice farming is closely tied to the natural flooding cycle of the Xe Bang Fai River. The lowland rice fields of many villages — particularly in Nong Bok, Xaibouli, Xe Bang Fai, Mahaxay, and Nyommalat districts — are located in the river's flood

plain. Every year, the rice crop is damaged by floods. In years of heavy flooding, such as occurred in the rainy season of 2000, a large per centage of the entire crop was destroyed. However, the negative impacts of floods are somewhat balanced by the richness of the soil in the flood plains. When farmers are able to raise a crop that is not damaged by flooding, high yields often provide families with a harvest of rice that can feed a family for more than one year. Farmers report that very tight flooding margins are involved in growing rice in the rainy season, and relatively small additional amounts of water in years when flood-water levels are slightly higher or of longer duration than normal can make the difference between having a large or small harvest.

8. Domestic Livestock

In many villages, livestock is a major source of income, particularly in the lower Xe Bang Fai basin. Water buffaloes, cows and pigs act as *de facto* 'banks' for many families; animals are raised and can be sold for cash during times of particular need, such as during rice shortages or illness of a family member, or to pay the costs of wedding and funeral ceremonies.

Livestock are frequently to be found along, and in, the rivers of the basin. Along the Xe Bang Fai River, pigs forage for worms along the riverbanks, water buffaloes wallow in the river and eat large amounts of algae and other water plants, ducks swim and feed in the river, and chickens, goats and cows drink from the river and forage vegetation along its banks. These 'free' services provided by the Xe Bang Fai reduce the amount of resources that the owners of livestock would otherwise need to provide to these animals, reducing people's workloads and making the raising of livestock an efficient economic activity.

9. Local Economies

Villages located along the Xe Bang Fai River and villages located a substantial distance from the river or its main tributaries have long-established trading links and interdependent local economies. For example, many villages located away from rivers, particularly in the middle and lower basin, have rice fields outside of the flood zone while many of the rice fields of villages located near the major rivers are within the zone. Of the villages with fields outside of the flood zone, some are able to produce a substantial rice surplus on a regular basis. Therefore these families trade their surplus rice with villages situated closer to the river in exchange for barbecued fish (*pa ping*), smoked dry fish (*pa heng*), fermented fish paste (*pa dek*), betel nut (*mak khieou*), sweet tamarind (*mak kham van*) and various other goods.

Throughout the Xe Bang Fai River Basin, local economies are based on the trading, buying and selling of fish, rice, vegetables grown in swiddens and riverbank gardens, and non-timber forest products including edible and medicinal plants. The products of local artisans, including cotton cloth and rice wine, are also traded, bought and sold in local economies.

10. Public Services and Access

Many villages depend on the Xe Bang Fai River directly for their drinking water, especially during the dry season. Women and girlscarry water up from the river, making many trips a day. During the rainy season, river water becomes more turbid and so is much less useful as a drinking water source. At that time, villagers have many alternative sources of drinking water, including rainwater and seasonal streams and springs. However, some continue to use the river as their main source of water all year. Some villages in limestone karst areas obtain safer drinking water from the source of small streams emerging from caves in the limestone, but this is only available in some areas at some times. A small number of villages, particularly those located in the lower basin, have hand-powered water pumps for obtaining groundwater for drinking and other domestic uses.

In many villages, malaria and diarrhea are the main causes of illness, with people being particularly affected at the beginning of the rainy season. UNICEF and other donors have constructed health clinics in many areas of the basin but much remains to be done in the provision of health-care services to local people.

The quality of basic education and the number of schools varies widely in the Xe Bang Fai basin. Generally speaking, the quality and quantity of education is low in remote areas, and is certainly lower in the upper part of the basin than in the lower part. A number of NGOs have assisted with teacher training and school construction, but, as in the health sector, there is much that can be improved.

11. Rural Infrastructure

Villagers say that their use of the Xe Bang Fai River for transportation during the dry season is less than in the past, and there are only a few regular passenger boat services operating in the lower section of the river. Many roads have been recently improved although not all riverside villages are connected to usable roads. During the rainy season, the use of boats for transport increases greatly, since many roads become impassable due to flooding.

Although there are many villages in the Xe Bang Fai basin without electricity, the number of villages with electricity has increased rapidly in recent years. Now most villages located along the middle and lower stretches of the Xe Bang Fai River have access to electricity.

12. Other Sources of Income

Many villagers also have other sources of income that are not so closely linked to the Xe Bang Fai River. Some of these are traditional activities, such as weaving, while others have become popular more recently. Cotton is grown in some parts of the Xe Bang Fai basin, and village women then process it and weave it into various items. In some villages other small handicraft items are produced for sale.

Increasingly, local people are working outside of their villages for cash income. Opportunities for wage-labour include working at local sawmills or factories. However, wages are very low and working conditions generally difficult and/or dangerous. Increasing numbers of people go to work in Thailand, usually on a seasonal basis, as wages there are generally higher than in Laos.

In villages in the middle and upper basin, few if any people in a village work in Thailand on a regular basis. But in villages in the lower basin and located close to the Thai border a large number of people now travel regularly to Thailand to find wage-labour. In many villages, the total amount of wages received for labour in Thailand is the largest proportion of the total wages received for labour outside of the village. This has come at a cost — there are many reports of Lao people facing exploitation and risks in Thailand and of women lured into the sex trade. Many older villagers worry about the impacts of modern Thai culture on their children.

13. External Development Initiatives

Rural development initiatives in the Xe Bang Fai basin include the establishment of aquaculture using non-native fish species, eucalyptus tree plantations, and pumped-irrigation for dry season agriculture. The Government of Laos, assisted by donor agencies, has been actively promoting dry season rice production throughout the country, and in recent years has made large investments in dry season irrigation based on the use of both diesel- and electricity-powered pumps and construction of networks of canals and related water control structures.

Most villagers see dry season rice cultivation as a potential supplement — not as a replacement — to the main rice crop grown during the rainy season. But the expansion of pump-based irrigation, and the economic rationale for this expansion, are increasingly problematic and questionable. This is due in part to the loss of value of the Lao currency, the kip, making imports of fuel and chemical fertilizer more expensive. Electricity prices in kip are also increasing rapidly. The market price for rice, however, remains relatively low.

Installed only three to four years ago, all of the diesel-powered pumps along the Xe Bang Fai River are not in operation, most having been used for a single season. Based on interviews with villagers and on-site inspections, the survey team was unable to find a diesel pump that was operational during the 2001 dry season. The economics for the electric pumps are better but still marginal at best. Farmers are now being told to start repaying the costs of these government-provided irrigation systems. This added expense is contributing to disillusionment and frustration felt by many farmers regarding dry season rice cultivation. Farmers have also encountered other major problems with dry season rice farming including pest infestation. Continued use of the electrical pumps appears to be dependent on large government subsidies and the strong encouragement of district officials. While local officials continue to report an expansion of the area of dry season rice farming, villagers report that in fact it is declining.

14. Women, their river, and livelihoods

While women and men have different roles in the management and use of rivers, forests, wetlands and fields, the central role of women in the means of livelihood security of families and communities is abundantly clear in the Xe Bang Fai River Basin. Women have distinct roles in managing, using and conserving natural resources. Many if not all of the communities living in the lowlands, including the *Lao, Phou Thai* and *Kaleung* ethnic groups are matrilineal societies, and women have the primary responsibility for managing household financial resources; they do most of the selling of the marketable goods harvested and collected by family members, are responsible for the purchase of goods that satisfy the needs of their families, and are the managers of the cash reserves and financial expenditures in most families.

Women plant the rice seedlings and do most of the rice harvesting. Women generally make most of the decisions about which crops to grow in riverbank vegetable gardens, and much of the watering and tending of the gardens, and the raising of livestock such as pigs, chickens, and ducks. Women engage in fishing activities, often at the beginning and the end of the rainy season and during the dry season. It is women who harvest most of the non-timber forest products and living aquatic resources available to a community. And on a daily basis, women are usually the main economic actor in a family, marketing the products gathered from the forests, rivers and fields. Women often ensure that some of the revenue gained from the sale of these resources are used for their children — for medicines, school clothes, books, pens and other materials.

15. Natural Resources Conservation and Management

As described in the above sections, the people of the Xe Bang Fai basin have a great deal of local ecological knowledge about natural resources. This sophisticated knowledge of the natural world has provided them with numerous opportunities for developing a variety of systems to manage, and benefit from, wetlands, fisheries, forests and other important natural resources. In many villages traditional beliefs and practices have protected forests and rare animal species. Villages have devised systems for protecting fisheries, drinking water sources, and aquatic resources. However, in some areas, over-exploitation of resources is occurring. Overall, there are many opportunities to support and assist communities in strengthening their initiatives and established systems for managing and conserving their natural resources.

16. Conclusion

River-based livelihoods involve a combination of many different linkages between people and their rivers. While rice fields, fisheries, livestock, and vegetable gardens are the most visible components of local livelihoods and economies, many other resources are perhaps less visible but no less important. Many of these less visible components of local livelihoods can only be appreciated and understood in the light of knowledge and experiences of local people living along, and with, the river. Together, aquatic and forest resources form the foundation of livelihood security for many of the people living in the Xe Bang Fai River Basin.

The Xe Bang Fai and its tributaries form a complex hydrological system that is not very well studied or understood by outsiders. But it is clear that the people living along the Xe Bang Fai have adapted to the specific environment of the area and have a sophisticated knowledge of the complex inter-relationships of diverse ecosystems in the basin. Consequently, local communities have long-established coping mechanisms that allow them to sustain and profit from their natural resources while living in balance with their natural environment. It should be noted however that this fragile balance is threatened by certain activities occurring in the basin — activities that are not undertaken, or in accordance with, the livelihood activities and natural resource management systems of local communities.

The complexity and breadth of these natural resource management and development issues, and the potential vulnerabilities of the 120,000 to 150,000 people whose livelihoods are linked to the Xe Bang Fai River and its tributaries, deserves more recognition and requires much more in-depth research. This research would inform decision-makers, NGOs and donor agencies considering involvement in the Xe Bang Fai River Basin and would contribute to a better understanding of river-based livelihood issues in river basins throughout Laos. An understanding and appreciation of these livelihood links is essential for informed decision-making about proposed development initiatives — from projects targeting a single local community to projects that can affect entire river basins.

Introduction and Background

The Mekong River and its many tributaries are the essence of the natural wealth of the Lao People's Democratic Republic. These rivers and associated ecosystems are the foundation of the means of livelihood security and economies of local communities throughout the country, and the importance of rivers and wetlands are reflected in the knowledge and belief systems, stories, music, and art of the people.

This report describes research about the river-based means of livelihood of communities living along, and in the vicinity of, one of the great rivers of Laos, the Xe Bang Fai River in the provinces of Khammouane and Savannakhet.

This report is published in the hope that it will be of interest to officials and decision-makers of the Government of Lao PDR, local and international development workers, and other individuals and organisations interested in issues related to the environment and development in Laos, and that it will contribute to the creation of a more holistic and sensitive approach to development in the Mekong River Basin.

The Mekong River runs the length of Laos and demarcates the country's western border with Burma and much of its western border with Thailand. The Mekong is one of the largest rivers in the world, and the Mekong River Basin covers an area of more than 800,000 square kilometres (km^2). But many of the Mekong's tributaries are major river systems in themselves. In Laos, these tributaries include the Nam Ou, Nam Khan, and Nam Tha in the north; the Xe Kong, Xe Kaman, Xe Done, and Xe Pian in the south; and the Nam Xong, Nam Ngum, Nam Theun, Nam Mang, Nam Hinboun, Xe Bang Hieng, and Xe Bang Fai in the country's central region. There are also many hundreds of smaller rivers and streams. (*Nam* and *Xe* are two Lao words for river. See Appendix 1 for a glossary of these and other Lao terms used in this report).

The Xe Bang Fai is one of the major rivers of central Laos and the Xe Bang Fai River Basin's catchment area totals approximately 9,500 km^2 (IUCN, 1997). Areas of the basin are included within seven districts of Khammouane province — Nong Bok, Xe Bang Fai, Tha Khek, Mahaxay, Nyommalat, Xaibouathong, and Boulapha — and the three districts of Xaibouli, Vilabouli, and Atsaphone in Savannakhet province. The Xe Bang Fai flows from its headwaters in the Say Phou Louang mountain range (along the Laos-Vietnam border) down to the river's floodplain and into the Mekong River. The river and its many tributaries flow through a variety of ecosystems and geographical features.

The research contained in this report was conducted under the auspices of the Canada Fund for Local Initiatives, a small-grants community-based funding program administered by the Canadian Embassy. The Canada Fund is presently supporting a variety of development projects — implemented through nongovernmental organisations (NGOs) and local departments of the Government of Laos — based on local community initiatives in many parts of Laos and is currently supporting projects in the Xe Bang Fai basin. The research was conducted as a component of the Canada Fund's project identification and review activities. The process was designed to monitor development projects already supported by the Canada Fund, as well as to identify projects that could be supported by the Canada Fund in the future. It was also done in preparation for an evaluation of the Canada Fund's activities in Laos conducted for the Canadian Embassy by Bruce Shoemaker.

While the work was conducted as part of the Canada Fund's on-going activities in Laos, the research and views presented in this report are solely those of the authors.

Methodology

Bruce Shoemaker, Ian Baird and Monsiri Baird (hereafter referred to as the 'survey team') conducted the field research described in this study in February and March 2001. All of the

researchers are fluent Lao language speakers. Collectively they have more than twenty years of experience living and working in Laos.

The survey team conducted field research in the districts of Mahaxay, Nong Bok, Nyommalat, Tha Khek and Xe Bang Fai in Khammouane province, and the district of Xaibouli in Savannakhet province, over a two-week period. In each district, the survey team first went to the district administration office to explain the purpose of the survey and to receive official permission to visit villages. Officials in the district offices provided overviews of development issues in their districts, as well as population estimates and other statistics related to the livelihoods of local people living in the basin.

The survey team visited a total of twenty-four villages and also talked with people from at least another 10 communities. Travel was done by boat, foot, and also by local vehicles, including pick-up trucks and tractors. In addition to villages located on the banks of the Xe Bang Fai River, the survey team visited communities located along smaller tributaries of the Xe Bang Fai, as well as some located considerable distances from the river. This was done to provide the study team with opportunities to discuss with local people the links between the mainstream Xe Bang Fai River and its tributaries and associated ecosystems. Due to time constraints, villages in the upper Xe Bang Fai basin — in Boulapha district of Khammouane province and Vilabouli and Atsaphone districts in Savannakhet province — could not be visited, although some secondary information was collected from local people familiar with the upper basin.

In each village, the survey team met first with the headman (all village leaders met by the survey team were male) to make introductions and explain the issues being researched, to receive permission to stay overnight in the village, and to have a general discussion of issues of importance to the community. The survey team was also introduced to other members of the community for interviews and discussions regarding issues pertinent to local livelihoods.

These meetings usually took place in the evenings and the survey team then stayed overnight in the village, (informally continuing discussions in the morning), before moving on to the next location. Meetings in some additional villages occurred during day-visits. During these meetings, the survey team's semi-structured interviews were related to livelihood issues, but discussions did not exclude other issues that villagers felt were important and wanted to discuss.

In an effort to ensure village women had an equal opportunity to share their knowledge and opinions with members of the survey team, Ms Monsiri often conducted separate interviews with small groups of village women, as this was an easier way for them to communicate openly, since village men dominated most of the main meetings conducted in the villages. Village women were often the primary sources of information regarding the importance of rivers and associated ecosystems for the livelihood security of families and entire communities. In many cases village women provided essential information on key livelihood issues that were played down or not mentioned by village men.

All interviews were conducted in the Lao language. The survey team also spent time walking around villages, rice fields, wetlands, and forests, asking questions about, and observing, livelihood activities. These short trips helped establish good relationships with villagers, and proved extremely valuable in terms of collecting *in situ* information about livelihoods in communities.

This survey is mainly based on qualitative research to identify the main river- and nature-based livelihood issues in the Xe Bang Fai basin. While some data on fish and agricultural production are included, as well as some rankings of the relative importance of various natural resources and income sources, the researchers did not try to collect or summarize quantitative data. The research was undertaken to identify important livelihood resources and activities, and to provide an overall picture of development issues in the survey area.

The Xe Bang Fai River Basin and the Survey Area

The headwaters of the Xe Bang Fai River are located in the Say Phou Louang (Annamite Mountain Range) along the Laos-Vietnam border, in far southeastern Khammouane province. In its uppermost reaches, the Xe Bang Fai River's various branches flow through a heavily forested and mountainous area that is sparsely populated. The river then reaches the Hin Nam No National Biodiversity Conservation Area (NBCA). The river is the western boundary of the NBCA and its waters are clear, fast-flowing, and because of its many rapids, unnavigable (see WWF and WCS, 1999 p. 72-73; Kottelat, 1996). According to local people, this area of forest and limestone karst is the habitat of rare animal species including the *saola* (Vu Quang Ox, *Pseudoryx nghetinhesis*). There are few permanent settlements along the river in this area although some people visit seasonally for fishing and hunting (WWF and WCS, 1999). The Xe Bang Fai River then enters a natural cave and flows underground for approximately six kilometres (km) before re-emerging at Tham Khoun Xe (Khoun Xe Cave). Villagers living further downstream often refer to Tham Khoun Xe as the source of the Xe Bang Fai.

Two major tributaries join the Xe Bang Fai River in Boulapha district, Khammouane province — first the Nam Phanang, which flows northwest roughly parallel and southeast of the Xe Bang Fai until joining it near Ban Pak Phanang. The second is the Nam Ngo, which flows south from the Say Phou Louang mountain range and enters the Xe Bang Fai near Ban Pak Ngo.

After passing through Boulapha district, Khammouane province, the Xe Bang Fai flows west through the southern part of Nyommalat district, Khammouane province. The river passes through a deep channel characterized by seasonally inundated wetland forests and — in the dry season — by sandy beach areas, large boulders, and occasional rapids. The river then flows through another limestone karst area and, near Ban Naphong in Mahaxay district, it is joined by the Nam Nyom River (also called the Nam Kathang) that flows southeast from the Say Phou Ak mountain range and past the district centre of Nyommalat. The river turns southwest into Khammouane's Mahaxay district where, just downstream from Ban Na Kieu, it is joined by the Nam Pheet (often written as Nam Phit). From Boulapha to Mahaxay district, there are many villages located along both banks of the Xe Bang Fai and its tributaries. There are also large areas of intact seasonally inundated wetland forest on the edges of small islands and along the riverbanks. Below the town of Mahaxay, the Xe Bang Fai is joined by the westward flowing Nam Oula, on which there are at least ten villages. This area, and the stretch of the Xe Bang Fai down to its confluence with the Xe Noy River, is relatively less populated. Large expanses of wetland forests line the river in this area and there are fewer villages directly adjacent to the river. The Nam Piat, flowing in a generally westerly direction, joins the Xe Bang Fai near Ban Tha Hat, in Xe Bang Fai district of Khammouane province. The Xe Bang Fai then flows into a narrow V-shaped gorge through the Say Phou Xoy mountain range.

The Xe Bang Fai River's largest tributary, the westerly-flowing Xe Noy, with a catchment area of 2,225 km^2 (IUCN, 1997), enters the Xe Bang Fai just upstream of Ban Palay, in Xaibouli district, and eight km upstream from the Route 13 national highway bridge across the Xe Bang Fai. Downstream from the Xe Noy confluence, the Xe Bang Fai forms the provincial border with Xaibouli district of Savannakhet province on the southerly bank and Xe Bang Fai district of Khammouane province on the northerly bank. The river then reaches the Route 13 bridge, known locally as *Khoua Xe*, which is a major landmark and an important trading and transportation centre.

Below Khoua Xe, the Xe Bang Fai enters a lowland area with high population densities on both sides of the river. The southerly bank continues as part of Xaibouli district, and down river from Xe Bang Fai district, the river borders Khammouane's Nong Bok district on the northerly bank. Houay Vay, a year-round tributary flowing south through Nong Bok district from Tha Khek district, joins the mainstream Xe Bang Fai near Ban Dong Kasin in the southern-most part of Xe Bang Fai district. Another important tributary in the area is the Houay Sayphay, which flows into the Xe Bang Fai River in the western part of Xe Bang Fai district from Tha

Khek district. As the Xe Bang Fai grows, it meanders on west and southwest through the Xe Bang Fai floodplain, which is bounded to the west by the Mekong River and by upland forest areas to the south and east (Claridge, 1996). This area is a wide lowland area including numerous wetlands, including Nong Chao, Nong Kout Chap and Nong Khone/Nong Vai in Nong Bok district and many other wetlands on the Xaibouli side of the river. Finally, the Xe Bang Fai reaches its confluence with the Mekong River at Ban Dan Pak Xe. This is another trading and transportation centre and is directly across from the well-known That Phanom temple in Nakhon Phanom province of Thailand.

The Ebb and Flow of the Xe Bang Fai River

During the dry season, from January to early May, the flow volume of the Xe Bang Fai River is approximately five to seven cubic metres per second (m^3/sec) at Mahaxay. But during the peak of the rainy season, in August and September, the rains of the monsoon contribute to a greatly increased flow — often reaching over 2,000 m^3/sec at Mahaxay and over 3,000 m^3/sec in the Xe Bang Fai floodplain (SMEC, 1996 p.38).

Compared to other rivers in Laos, the Xe Bang Fai appears to be particularly flood-prone and the basin includes an extensive flood plain. These natural floods inundate large areas, particularly in Mahaxay, Nong Bok, Xe Bang Fai and Xaibouli districts. The river and many of its major tributaries overflow their banks as a result of the heavy rains of the monsoon season captured by the Xe Bang Fai basin, and, in the river's lower reaches, because the higher water levels of the Mekong River flow into the Xe Bang Fai River. This is a common phenomenon in the lower reaches of most Mekong tributary rivers. The duration of peak flood levels can continue for just a few days up to as long as a month or longer each year. The landscape of the lower and middle Xe Bang Fai basin is characterized by natural depressions and oxbow lakes that are seasonally replenished by the floods. These lakes, ponds and wetlands are important features of the floodplain.

In 2000, the seasonal inundation of the lower Xe Bang Fai basin occurred for approximately one month. Although floods of this duration are not unusual, flooding of one to two weeks is reported to be very common in many areas of the basin. A study conducted in 1995 found that Ban Tha Bo village, located along the Xe Bang Fai in Xaibouli district, Savannakhet province, experienced a pattern of extended floods (some lasting 30 to 45 days) every three to five years (Somphone *et al*., 1995). Floods that could be termed 'normal' or 'average', according to the natural flows in the Xe Bang Fai basin and that of the Mekong, are both of benefit and disadvantage to the livelihoods of local villagers, some of which are discussed below. However, floods of long duration are widely considered by people living along the Xe Bang Fai River to be a serious constraint on the potential of their livelihood security.

The People of the Xe Bang Fai Basin

Based on statistics obtained from district administrative offices, past research, and interviews with villagers, the survey team estimates that there are 115 villages populated by approximately 50,000 people located on, or very close to, the banks of the mainstream Xe Bang Fai River between its headwaters and its confluence with the Mekong River. There are many other villages located adjacent to the seven or eight main tributaries of the Xe Bang Fai and along smaller seasonally flowing and permanently flowing tributary streams within the basin. Obtaining precise population data is difficult, and the survey team often found discrepancies between the population figures provided by district offices and those reported by village leaders. In many cases official statistics significantly underestimate the present number of people living in villages. (See Appendix 2 for an explanation of the basis for the survey team's calculations of the population relying on the Xe Bang Fai River and its tributaries, and see Appendix 3 for a list of village names and population statistics.)

The survey team compiled a list of the names of villages located along some of the main Xe Bang Fai tributaries, but this list does not include the names of all villages located along these tributaries. On the Xe Noy River and its tributaries, including the Xe Bai and Nam Meng, the survey team recorded the names of 74 villages. Population figures and estimates were available for 55 of these villages and totalled 17,000 people. It is very probable that there are more villages, and that the population is significantly higher than the survey team's figures. For example, based on an examination of available maps, there are at least nine villages located along the Nam Phanang and another nine along the Houay Vay in Nong Bok district, Khammouane province.

The number of families per village involved in livelihood activities directly related to the Xe Bang Fai River and its main tributaries is difficult to estimate. However, the Xe Bang Fai is significant to the livelihoods of communities situated directly adjacent to the river, as well as to those located living many kilometres from it. The best way to characterize village dependence on the Xe Bang Fai is to break down the communities into two main groups. The first includes all the villages situated either directly adjacent or within a few kilometres of the river and its largest tributaries. The second includes communities situated in the Xe Bang Fai River Basin, but not adjacent to the main river or within a short walk from it. While the second group of villages clearly relies on the river less than those communities situated directly adjacent to it, they do also have close links and it would be a mistake to discount the importance of the Xe Bang Fai to their livelihoods. People from these outer villages rely on the Xe Bang Fai in various ways. Based on anecdotal evidence it appears that for every village located right along the Xe Bang Fai and its major tributaries, there is at least one more village located further away in which many people have such links. Therefore, it appears that in addition to the minimum of 67,000 people noted above, at least another 60,000 to 70,000 (living along smaller tributaries or elsewhere in the basin) are also at least partially dependent on the Xe Bang Fai for their livelihoods.

Population statistics provided by district officials in four of the ten districts in the Xe Bang Fai basin — Nong Bok, Xe Bang Fai, and Mahaxay districts in Khammouane province and Xaibouli district in Savannakhet province — indicate that the total population of these districts is 135,000 people. Based on the above framework, it appears that at least 67,700 people have their livelihoods directly linked to the Xe Bang Fai River and its major tributaries. A conservative estimate of the number of people in the Xe Bang Fai basin who rely on the Xe Bang Fai River and its tributaries to a lesser, but nevertheless significant extent would be 60,000 people. Therefore, the total number of people directly or indirectly linked to the Xe Bang Fai for at least part of their livelihood security is conservatively estimated to be 120,000 people.

It is very likely that 120,000 people is an underestimate of the actual number of people whose livelihoods are linked to the rivers of the Xe Bang Fai basin. However, this estimate is much larger than those reported in previous studies and reports regarding the Xe Bang Fai River

Basin (Scudder *et al*., 2001 states that over 50,000 people live in Xe Bang Fai basin and IRN, 1999 reports that there are over 40,000 people along Xe Bang Fai River.)

Thus, of the 120,000 people who derive much or a substantial part of their livelihoods from the rivers of the Xe Bang Fai River Basin, a large proportion of this population live in villages that are not adjacent to rivers; many of these are located many kilometres from rivers. According to people living in some riverside villages, people from many villages located far from the Xe Bang Fai come to the river to fish, collect other wildlife and plants, and to garden. For example, Ban Na Khom Thong in Xe Bang Fai district is located 10 km from the Xe Bang Fai. Many people from the community travel to the Xe Bang Fai River for fishing on a seasonal basis. In this village, fishing nets used in the Xe Bang Fai are visible at many houses. Some keep their own boats along the Xe Bang Fai River near the houses of relatives, and have fruit orchards and vegetable gardens near the river.

At Ban Pheet Si Khai, in Nyommalat district, near the headwaters of the Nam Pheet, villagers named more than 20 other villages, many located far from the Nam Pheet, whose residents come to fish in the seasonally flooded forest during the rainy season (see box: The Nam Pheet Wetlands).

Villagers in Ban Tha Hat — an ethnic *Brou* village in Xe Bang Fai district — stated that people from Ban Houay Lang Meu, Ban Na Khone, Ban Sang, Ban Na Beung, and other villages, all regularly come to the Xe Bang Fai for fishing, and some families from these villages also have vegetable gardens on the banks of the river. Similar arrangements were also described to the study team by people living in villages located along tributary rivers of the Xe Bang Fai.
Villagers in Ban Na Khom Thong and many other communities living in the Xe Bang Fai basin but far from the Xe Bang Fai River also catch fish that migrate up tributary streams near their villages during the rainy season.

While a large proportion of the people living in the Xe Bang Fai basin are ethnic *Lao*, there are also many thousands of people who are of different ethnicities. Each group has their own linguistic and cultural characteristics. Many of these people are ethnic *Brou*, who speak a language in the Katuic sub-group of the eastern branch of Mon-Khmer. They are often referred to in Laos as *Lao Theung* (midland Lao), *Mangkong* or *Makong*, *So*, *Salouy*, or *Chalouy*. There are a number of *Brou* villages situated along the Xe Bang Fai mainstream below the *Tham Khoun Xe* in Boulapha district, in Nyommalat, Mahaxay, Xe Bang Fai and Xaibouli districts, and one *Brou* village in Nong Bok district. Many more *Brou* villages are located on tributaries and elsewhere in the Xe Bang Fai basin. Some *Brou* people, like those at Ban Dang, Ban Vat That and Ban Na Phong, Mahaxay district, no longer practice Animism and have taken up Buddhism, indicating the strong influence *Phou Thai* people living near them have had over time. The *Brou* communities further upstream have maintained Animist and/or cultural practices, and were referred to by the *Brou* in Ban Dang as *Brou Kha*, (Brou slave), so as to distinguish themselves from their upstream neighbours, who they consider to be "less civilized". Nevertheless, many people in Ban Dang continue to speak their language. In some mixed *Phou Thai*/*Brou* villages, like Ban Palay, *Brou* children are now mainly speaking Lao.

There are two villages of *Ngouan* people in Boulapha district. They speak a language in the Vietic language group (Pers. Comm., James Chamberlain, 2001). There is also another Vietic language speaking group, the *Cheut*, who live in Ban Xe Neua in Boulapha district. However, these people are mainly forest dwellers, and they may have already abandoned the village that the government established for them along the upper Xe Bang Fai River (Chamberlain, 1997; Pers. Comm., James Chamberlain, 2001).

Apart from the ethnic *Lao*, there are a number of other Tai speaking ethnic groups in the lower, middle and upper parts of the Xe Bang Fai basin. These include the *Phou Thai* (many sub-groups found throughout the basin, of which the *Thai Vong* sub-group is the largest), the *Kaleung*, a little known Tai language-speaking group believed to be found only in Nyommalat and Boulapha districts of Khammouane province, and the *Sek*, who inhabit two villages away from the Xe Bang Fai River in Nyommalat district. Unlike the other Tai language speakers, the

Sek are unique for central Laos in that they speak a language in the northern branch of the Tai language group (Pers. Comm., James Chamberlain, 2001).

Phou Thai villages in Xiang Khai sub-district reported that apart from speaking a slightly different dialect of Lao from the ethnic *Lao*, they also have a number of different customs, although some of these have been gradually losing popularity in certain villages. *Phou Thai* people once relied on *mo phi yao khon chep khon khai* (spirit doctor) for curing illnesses believed to be caused by spirits, but many villages have apparently stopped consulting *mo phi*. *Phi mahaysak* is a spirit commonly referred to by most communities living in the lowlands of the Xe Bang Fai basin. This spirit's place of abode is usually a small area of forest, a *pa mahaysak*, in which a village's spirit house, or *ta ho*, is located. Cutting of trees in these spirit forests is strictly prohibited. Local people consider *phi mahaysak* to be a not particularly benevolent spirit, and transgressions of community beliefs and cultures by villagers require ceremonies to pay respect to, and appease, the spirit. Other aspects of community life also include *phi mahaysak*. For example, a *Phou Thai* woman wishing to marry must conduct a ceremony in which a chicken is offered to the spirit and the woman asks the spirit for permission to marry. If a woman becomes pregnant before being married, the family of the child's father must sacrifice a buffalo to receive forgiveness from *phi mahaysak*.

Many ethnic communities share similar beliefs relating to spirits of place. In Ban Pheet Si Khai, Nyommalat district, *Kaleung* people worship at the village's spirit house (*ta ho*) during the full moon of the twelfth Lao month (lunar month, November or December) each year. Each family in the village is obliged to contribute one chicken or one jar of rice wine (*lao hai*), as well as one piece of bamboo filled with cooked rice (*khao lam*). However, only one man from each household is allowed to attend the ceremony. A male elder (*pho cham*) conducts the ceremony and chants to the spirits as part of the ritual. Once every three years the women participate in a similar ceremony along with the men. At that time the *pho cham* has strings tied around his wrists by all the villagers to bring him good luck, and is presented with a pig by the villagers.

The *Phou Thai* and the *Brou* were traditionally the dominant ethnic groups in the middle and upper parts of the Xe Bang Fai, while the *Lao* were the main group in the lower part of the basin. However, a small number of people from various other ethnic groups have also moved into the basin in recent decades, largely as a result of war-related migrations. Therefore, the ethnic composition of many villages has become increasingly complex and diverse, especially in districts like Mahaxay and Nyommalat (Pers. Comm., James Chamberlain, 2001).

Given the large numbers of villages involved, the general ethnic and linguistic complexity of Laos, and the substantial geographical area included, obtaining more accurate data on ethnicity would require extensive research beyond the scope of this survey.

River-based Livelihoods

From place to place and from season to season, the people living in the Xe Bang Fai River Basin derive diverse benefits from the rivers and floodplains, wetlands and forests of the basin. "Rivers are of critical importance to the livelihood of the human population living along, and near their banks. Rivers are vital for fishing, sanitation, cooking, irrigation, transport and water" (WWF and WCS, 1999). Different ethnic groups take advantage of the natural wealth of the basin in different ways, in the same way that women and men in these communities undertake a diverse range of responsibilities in managing and harvesting this wealth. Many of these livelihood activities are inter-related and they are not always easy to separate from each other. For the purposes of this report, the inter-related aspects of local people's livelihoods are divided into several categories.

1 . Fisheries

Fisheries are one of the most important livelihood activities in the Xe Bang Fai basin, and many villagers devote much of their time and energy to fishing. Most fishing activities in the Xe Bang Fai River occur during the dry season. During the rainy season, people generally fish in seasonally flooded forests and wetlands, streams and inundated rice fields.

Fish Migrations and River Fisheries

Fish migrations in the Xe Bang Fai River Basin are probably the most important ecological characteristic of the river basin for the livelihood of local people, most obviously in relation to local economies, and as a source of family income, food and nutrition. Based on evidence provided by local people living along the Xe Bang Fai River, its tributaries and associated wetlands, the major fish migrations and periods of fishing activity are described below. The survey team was not able to study fish migrations in great detail during the survey, and such a study would require months or years of research. It should be also noted that most identifications of fishes under the Western scientific taxonomy system are provisional (although some fish species were observed and identified by the survey team) as they are based mainly on information received from local fishers, who refer to these fishes with names according to the local taxomomic system. Kottelat (1996, 1997) provides a more detailed list of fish species from the Xe Bang Fai basin.

The first main fish migration of the year starts at the beginning of the monsoon season. When the rains begin in May or early June, seasonal streams begin flowing, and water levels and flow volumes in the Xe Bang Fai River begin to increase. According to local fishers, it is at this time that a large number of fish species begin migrating up the Xe Bang Fai River from the Mekong River, while other fish species move out from deep-water pools in the Xe Bang Fai, in which they live during the dry season. Together, the species of these two groups of migrators include the species listed in Table 1.

Table 1

Local taxonomy names	Western science taxonomy names
pa hou mat	*Pangasius larnaudei*
pa i-tou	*Morulius* sp. or spp.
pa ka	*Pristolepis fasciata*
pa khao	*Wallago attu*
pa khap khong	*Parambassis siamensis*
pa khe	*Bagarius* sp.
pa kheung	*Hemibagrus wyckioides*
pa khi lai	*Labiobarbus* sp.
pa khoun	*Wallago leeri*
pa kot	*Hemibagrus nemurus*
pa mak mang	*Sikukia gudgeri*
pa nou	*Helicophagus waandersi*
pa nyone khi none	*Laides* sp. or spp.
pa nyone thamada	*Pangasius macronema*
pa nyone thong khom	*Pangasius pleurotaenia*
pa pak	*Hypsibarbus* sp or spp.
pa phan	*Schistura or Nemacheilus* sp. or spp.
pa phia	*Morulius* sp. or spp.
pa sakang	*Puntioplites* sp.
pa sa-nyeng	*Mystus* spp.
pa yang	*Pangasius bocourti*

Other species, known locally as *pa doke keo*, *pa phan sai*, and *pa ka thai* are said by local fishers to migrate at the same time as the above species, but the western scientific names of these species could not be identified by the survey team in the absence of personal observation. Of fish caught, according to local fishers, *pa mak mang* and *pa sakang* are the most abundant.

The furthest extent of the migrations of the above species in the Xe Bang Fai River is not yet known. However, Kottelat (1996 p. 54) reported that many of the fish species migrating up the Xe Bang Fai River from the Mekong River (including a freshwater stingray and 20 types of catfish) are able to get all the way to Ban Pak Phanang, located near *Tham Khoun Xe*, the limestone cave from which the Xe Bang Fai emerges, in Boulapha district. Kottelat's findings confirm the statements of local fishers along the Xe Bang Fai River that many fish species migrate at least as far upstream as *Tham Khoun Xe* cave. Opinion is divided, and there is

insufficient research to conclude one way or another, as to whether fish migrate further upstream than *Tham Khoun Xe*.

There is at least one catadromous fish species found occasionally in the Xe Bang Fai River. The anguilla eel, *Anguilla marmorata* (*pa lai fai fa*), is known to local fishers living along the Xe Bang Fai River. As a catadromous species, this eel spawns in the South China Sea but spends most of its life in the fresh waters of the Mekong River and most of its large tributaries before migrating back to the sea to reproduce.

At around the same time that fish move up the Xe Bang Fai River, they also begin to migrate up the river's larger tributaries. For example, villagers from Ban Dong Kasin, Nong Bok district, said that fish migrate up the Houay Vay from the Xe Bang Fai at the beginning of the rainy season, and at that time each family is able to catch large amounts of fish that, when sold, provide an average income of 200,000 to 300,000 kip (US$24-36) per family. Villagers are also able to catch fish as they move down the Houay Vay to the Xe Bang Fai River at the end of the rainy season in October and November. The main species caught at both the beginning and end of the rainy season are *Morulius* sp. or spp. (*pa phia* and *pa i-tou*), *Puntioplites* sp. (*pa sakang* or *pa chakang*), *Hemibagrus nemurus* (*pa kot*), and *Micronema* sp. (*pa nang*), although there are certainly other species caught by local fishers as well.

An important fishery is found at the Tat Khanik rapids/waterfall on the Xe Noy River about 25 km upstream of its confluence with the Xe Bang Fai. It appears to be at least a partial bio-geographical barrier to fish migrations. During the period of highest water levels at the height of the rainy season, when Tat Khanik is submerged, fish can swim over the falls. However, during the rest of the year fish cannot move upstream past the falls. For example, in May and June, water levels are rising and fish are migrating up the Xe Noy, but cannot pass Tat Khanik, while in October villagers have observed large numbers of *pa soi* at the bottom of the rapids/waterfall, trying to ascend it. Some fish are apparently able to pass the falls during the highest water period, as all of the species of fish found below the falls are reportedly to be found above them as well.

As water levels in the rivers of the basin increase at the beginning of the rainy season, the flooding of natural depressions, oxbow lakes, ponds and rice fields in the floodplains is quickly followed by many other fish species entering these areas in search of food and habitat suitable for spawning. Predominant amongst these fish species are the 'black fishes', including those species listed in Table 2.

Table 2

Local taxonomy names	Western science taxonomy names
pa douk	*Clarius* sp.
pa ian	*Monopterus albus*
pa kadeut	*Trichogaster trichopterus*
pa kang	*Channa gachua*
pa khao	*Systomus* sp.
pa kheng	*Anabas testudieus*
pa kho	*Channa striata*
pa kot	*Hemibagrus nemurus*
pa lot	*Macrognathus* sp.
pa mat	*Trichopsis* sp.
pa pak	*Hypsibarbus* sp.
pa sa nyeng	*Mystus* sp. or spp.
pa sieu	*Rasbora and Esomus* sp.

The non-native species *Cyprinus carpio* (*pa nai*) and *Oreochromis* sp. (*pa nin*) also move up small streams and into the floodplains. Villagers in Ban Som Sa-at, in Xaibouli district, reported that historically neither *pa nin* nor *pa nai* were found in the area but that these species have now been established in the wild for more than 10 years.

Another fishery also takes place at the beginning of the rainy season. The unidentified *pa doke keo* fish migrates up the Xe Bang Fai River from the Mekong River. According to villagers from Ban Palay in Xaibouli district, small hand seines (*nyeng*) are used to catch *pa doke keo*, the catch of which also includes a 'by-catch' of shrimp. One small bowl of the fish (and some shrimp) sells for about 1000 kip. Apparently, the *pa doke keo* fish is not seen at any other time of the year.

After the main fish migrations at the beginning of the rainy season have occurred, there is considerable fishing activity in wetland swamps for the duration of the rainy season, but there are not any important fisheries in the large rivers.

In October, as the rainy season ends, there is an important fishery based on migrating cyprinids (family of scaled fishes, including carps and minnows). Many small species of cyprinids approximately five to 20 centimetres (cm) in length, identified collectively by local fishers as *pa soi,* are caught all along the Xe Bang Fai and Xe Noy rivers using lift nets (*kadoung* or *sadoung*). Women are the main participants in this fishery, which lasts between just a few days or as long as ten days to two weeks. Many people, such as villagers from Ban Som Sa-at, in Xaibouli district, use these fish to make *pa dek* (fermented fish paste). Most people living along the rivers say that more fish are caught at this time of year than at the beginning of the rainy season. Villagers from Xiang Khai sub-district, in Xaibouli district, reported that each family could catch a total of about 60 kg or more of fish during the period of the *pa soi* fishery. While much of the catch is used to make *pa dek*, some of the fish are also dried in the sun to make *pa katao .* One woman from Ban Keng Pe reported catching over 120 kg of *pa soi* over a four-day period in November 2000. Most fishers believe that the fish

are moving up the Xe Bang Fai and Xe Noy rivers at this time, and while people are apparently engaged in this fishery along both rivers, the fishery seems to be most prominent in areas with rapids that, according to villagers, are an important habitat for the fish.

At about the same time as the *pa soi* fishery is underway, fish are also moving out of rice fields, streams, oxbow lakes and natural depressions to return to the main rivers. At this time many villagers make barrier traps (*tone*) at the edges of rice fields and on streams to catch fish, and in some places large quantities of fish are caught. For example, villagers from Ban Pheet Si Khai, Nyommalat district, reported to the survey team that they caught an average of between 50 and 200 kg of fish per barrier trap at the end of the rainy season. Many villagers use much of these fish catches to make *pa dek* (fermented fish paste) at this time of year.

In October and November each year, most fish in small streams and other seasonal wetlands (containing water only during the rainy season) move downstream to find year-round water bodies to take refuge in during the dry season. However, the situation differs in the Houay In, near Ban Thong Kong, in Nyommalat district. The Houay In flows into the Nam Ngo, which itself joins the Xe Bang Fai River near Ban Sen Phan in Boulapha district. According to local fishers, fish of the Houay In migrate upstream and into caves at the end of the rainy season. The species reported to migrate upstream are all of small to medium size. They include *Rasbora* sp. (*pa sieu khao*, not more than 15 cm length), *Systomus* or *Osteochilus* sp. (*pa ka bok*, not more than 20 cm length), an unidentified cyprinid (*pa hang tem*, and according to villagers the largest of these migrating fish), another unidentified cyprinid (*pa khang bang*), and a *Schistura* or *Nemacheilus* sp. (*pa phan*, 5-10 cm length).

As upstream migrations occur at the end of the rainy season, rather than at the beginning, migrations of the same fish species downstream occur in June and July, during the early rainy season. Villagers in Ban Kouan Khwai, situated approximately 20 km from the Xe Bang Fai River in Mahaxay district, described a similar migration pattern, with fish migrating out of the cave (*khoun*) at the origin of Houay Kasok stream and moving downstream at the beginning of the rainy season. These fish then migrate upstream into the *khoun* at the end of the rainy season. Villagers also reported that at the same time as fish are migrating downstream from the cave, other fish migrate upstream from the Xe Bang Fai River, and when fish migrate upstream to the cave, others migrate downstream to the Xe Bang Fai. Villagers living near the Nam Pheet wetlands have also reported a similar pattern of migrations (See box: The Nam Pheet Wetlands). Baird (1998) also found these fish migration patterns in other parts of Khammouane province, especially in bodies of water near limestone karst.

About a month after the *pa soi* fishery, and after fish begin to leave the seasonally inundated wetlands, many fish migrate down the Xe Bang Fai River. Villagers often refer to these as 'large fish', and those caught by local fishers include the same species that were caught moving up the river at the beginning of the rainy season. According to local fishers, many of these fish are migrating back to the Mekong River. During this period of fishing activity on the Xe Bang Fai and other rivers, the gill net (*mong*) is the main fishing gear used.

Another fishery in the Xe Bang Fai River takes place each October at the Nam Pheet's confluence with the Xe Bang Fai in Mahaxay district. At that time villagers catch large numbers of *pa phan* (probably *Schistura* or *Nemacheilus* sp. or spp.) as the fish congregate in the area of the confluence of the two rivers. Some villagers say that *pa phan* are spawning at that time of year, and that these fish are only found in the area at this time of year; people from many villages in Mahaxay district come to fish the area using small seines (*nyeng*) and many make *pa dek*. The *pa phan* fishery usually lasts two to seven days.

According to local fishers, during the dry season, usually from December to May or June, the best fishing areas in the Xe Bang Fai and Xe Noy rivers are rapids, where the rivers' flow over a layer of rock is relatively rapid and shallow, that connect deep-water pools and stretches of seasonally-inundated forest along the river. Xe Bang Fai district officials told the study team that the rapids of Keng Sateu are one of the best fishing grounds in the district. Also in Xe Bang Fai district, Ban Keng Pe villagers stated that rapids are some of the best fishing grounds near their village, as did villagers living along the Xe Noy River in Xiang Khai sub-district in

Xaibouli district, and villagers in many other places in the river basin. Clearly, river rapids are extremely important for the fish and fisheries of the Xe Bang Fai basin.

At the height of the dry season, fish catches in the Xe Bang Fai River tend to decline, because increased algae growth in the river can make gill netting difficult, thus preventing some fishing activities.

Fishing Methods

There are a wide variety of fishing methods and fishing gears utilized by villagers in the Xe Bang Fai basin. Most, but not all, are illustrated in Claridge *et al*., (1997). Some of these gears and methods are commonly used throughout much of Laos, while others are more particular to the Xe Bang Fai basin. The most popular fishing gears in the study area are nylon monofilament gill nets (*mong*) with various mesh sizes (mostly 2.5 cm to 10 cm). Apart from setting gill nets vertically in the water, fishers also sometimes use gill nets to encircle inundated wetland bushes and then chase the fish out of bushes and into nets (*ome phoum*). Fish are also chased into gill nets by either banging the water with a long pole (*lai pa sai mong*), or by throwing a heavy object with a rope attached to it into the water, pulling the rope and retrieving the object, throwing it again and repeating this process a number of times (*keng mak kalong lai mong*).

One fishing method commonly used in the Xe Bang Fai River but not seen in most other rivers in Laos is known locally as *pok moung* ("cover with the mosquito net"). It does not use a mosquito net, but involves the setting of gill nets horizontally along the surface of the river, the net stretched open by bamboo buoys floating on the water. Villagers say that this method of gill netting is more effective than common gill netting. The *pok moung* method is designed to entangle fish when they move to the water surface, and it has undoubtedly been designed based on local ecological knowledge of the habits of fish in the Xe Bang Fai River. This method is also used by people living near the Xe Noy River, a large Xe Bang Fai tributary.

Cast nets (*he*) are another commonly used fishing gear in the Xe Bang Fai basin. Various mesh sizes are used. Large triangular scoop nets (*long sone*), side funnel filter traps (*sai*), front funnel filter traps (*lope*), drop-door basket and box traps (*chan*), woven wedge traps (*se* or *kasone*), and various kinds of barrier traps (*tone*) are also commonly used. Villagers also use wedge cone traps (*svang*) in the Nam Pheet to catch fish as they migrate in and out of the river.

Some types of fish traps are designed for use with varieties of bait. The *toum* trap can be baited with bran, rice husk or the rice grain by-product of making whisky (*khi lao*) to catch small cyprinids (*pa khao* and *pa oup deng*), with red ant eggs (*khai mot deng*) to catch *Clarius* spp. walking catfish (*pa douk*), or with termites to catch the catfish *Hemibagrus nemurus* (*pa kot*). The *lan* basket fish trap is also baited with rice bran to catch cyprinids.

Lift nets (*kadoung* or *sadoung*), scoop nets (*saving*), scoop baskets (*kheung*), and plunge baskets (*soum*) are also commonly used gears. These are the main types of fishing gear used by women.

Fish are caught by hand or scooped into nets when wetlands are emptied using either a hand-powered water scooper (*ka so*) or more modern pumps (*chak soup nam*).

There are also a wide variety of hook and line fishing methods used, including set pole and lines (*bet pak*) baited with earthworms, hook and lines (*bet khan*) baited with rotten *hoi sai* snails to catch *Hemibagrus nemurus* (*pa kot*), and long lines (*phiak*) baited with earthworms or shrimps. Children use poles and line (*bet teuk*) to catch small fish along the edge of rivers and streams.

A commonly used fishing method along the mainstream Xe Bang Fai River is *houm* – piles of wood debris placed in the river to attract fish looking for food and shelter in these piles.

Although the *houm* fishing method is not only used in the Xe Bang Fai basin, it is probably more common in the Xe Bang Fai than in any other river basin in Laos. Once a pile of debris has been in place for a few days, or long enough for fish to move into the area, either a gill net (*mong*) or a small seine (*nyeng*) is used to surround the debris. Fishers then move the debris around or take it out of the area, a process that scares the fish and causes them to swim into the surrounding nets.

Another fishing method that is common in the Xe Bang Fai River depends very much on wetland forests. Called *chim pa*, it involves using a modern scuba mask along with a hand-made spear gun for shooting fish underwater. Fish seeking the shelter of seasonally inundated vegetation near rapids and riverbanks are often the targets of the *chim pa* method. Boys and young men were the only people observed by the study team using this somewhat modern method. Single and triple pronged spears (*lem*) are also used to stab fish, and knives are sometimes wielded to opportunistically chop and kill fish resting in shady shallow waters (*fan pa hom*).

In the lower part of the Xe Bang Fai basin a few small seines made of very fine-mesh mosquito netting were observed by the survey team, although most seines are made of nylon fishing nets that have much-larger mesh sizes relative to the mesh of mosquito netting. Although most of the fishing gears used in the Xe Bang Fai basin are small-scale, one large *mong kouat* seine net was seen drying in front of Ban Tha Kham, Xaibouli district, not far from the mouth of the river.

Villagers from Ban Keng Pe in Xe Bang Fai district stated that killing and catching fish by using explosives (*mak tek*) took place near their village as recently as four or five years ago. However, Ban Keng Pe villagers say that explosives are no longer used for fishing in the area. Throughout the survey area, none of the people interviewed by the survey team reported any other recent incidents of 'explosive fishing'.

In some areas of the Xe Bang Fai basin, villagers fish primarily at night during the dry season. For example, people from Ban Keng Pe were observed fishing at night, using horizontal *pok moung* gill nets and hooks and lines (*bet khan*). They return to the village each morning to sell their fish catches, and then sleep for most of the day before going out to fish again in the evening. Fishing trips lasting for a number of days, and that involve sleeping on the banks of the river, are not uncommon along the Xe Bang Fai and Xe Noy rivers during the dry season.

Wetland Management and Fisheries

For the purposes of this report, wetlands are defined as areas around and including bodies of water in which, or around which, annual and perennial plants are growing. Seasonal wetlands refer to water bodies that are described by local people in the villages of the Xe Bang Fai River Basin as wetlands (as defined above) that have water for part of the dry season, but which dry out before the end of the dry season and the onset of the rainy season. As the rains arrive, subsequent flooding of the area by rainfall and/or flooding by waters from nearby rivers occurs. Year-round wetlands are those wetlands in which water remains throughout the dry season or, in other words, wetlands that do not dry out before the beginning of the rainy season. Large areas of water that remain in natural depressions in the landscape after the recession of seasonal floods (for example, *nam keng*) are referred to as ponds. Water bodies in former channels of the Xe Bang Fai are termed 'oxbow lakes' (although these lakes are certainly 'wetlands') for the sake of simplicity and to indicate the distinct ecological characteristics, and community management systems related to, these water bodies.

During both the rainy season and the dry season, people living in the Xe Bang Fai basin catch fish in streams, oxbow lakes and other wetlands, and flooded natural depressions. Wetland fisheries are particularly important for those communities situated away from the Xe Bang Fai and other major rivers in the basin. For example, people in Nong Bok district probably do more fishing in streams and wetlands than they do in the Xe Bang Fai River. Of course, many

of the fish caught in water bodies away from the main rivers do live a large part of their life cycles in the Xe Bang Fai and Mekong rivers.

Wetlands and wetland fisheries are often managed by communities to conserve these ecosystems, to maximize the productivity of the associated fisheries, and to ensure that all members of these communities share the benefits derived from these management systems. These systems of community wetland and fisheries management in the floodplains of the Xe Bang Fai basin are diverse. Although two of these broad systems are described in the following sections, it should be noted that even within these systems there are various wetland micro-habitats that are managed and used in different ways depending on environmental and social conditions. The full variety of management systems being utilized by communities in the Xe Bang Fai basin cannot possibly be described here.

As an example of a management system of a micro-habitat, villagers in Ban Tha Kho, Ban Tha Hat and Ban Keng Pe in Xe Bang Fai district described fishing activities in *pa nam kham* — spring-fed wetlands surrounded by dense forest, located kilometres from the mainstream Xe Bang Fai River. Women in these villages explained that they catch *Channa gachua* (*pa kang*) snakeheads in these wetlands with their hands — in other words, without using fishing gear. They also use the vine *kheua han deng* that, when placed in small bodies of water, poisons fish that can then be collected by hand. This method of fishing, based on local ecological knowledge, was reported only in this part of the survey area, although it is probably used in other areas of the basin, as its use has been documented in other parts of Khammouane province (Baird, 1998).

Pha Nong **Systems of Managing Wetlands and Fisheries**

The most common fisheries management system in the wetlands and other water bodies of Xe Bang Fai floodplains is the *pha nong* system developed by lowland ethnic *Lao* communities. *Pha nong* systems are practised in many other parts of rural Laos as well. Although there are many variations of *pha nong,* depending on local ecological and social conditions, most *pha nong* systems share some common characteristics. They are generally used to manage clearly defined wetlands and other water bodies, including year-round, but especially seasonal, oxbow lakes and other wetlands. *Pha nong* is also occasionally used along stretches of streams, and in *nam keng* — areas of the floodplain where natural depressions in the landscape allow for floodwaters of greater than average depth (during the rainy season) and where, after the floods recede at the end of the rainy season, floodwaters remain to form a seasonal pond. *Pha nong* systems almost always restrict fishing activities in the designated wetlands and water bodies during a certain period of the year. Sometimes fishing is prohibited in all parts of the wetland/water body, while in other *pha nong* systems fishing is permitted in certain areas of the wetlands/water body all year round. There is usually a male elder, or a group of elders, in a community that is responsible for ensuring that the regulations of the management systems are respected. *Pha nong* systems, particularly relating to areas and times when fishing is prohibited, are often founded on local Animist belief systems and respect for the places of abode of village spirits (*phi ban*).

Under the *pha nong* system, after fishing has either been partially or completely prohibited in a wetland or water body for most or all of the year, the villagers set a day and a time in which all people in the community are allowed to fish in the wetland area at the same time. Sometimes only people from the village that manages the wetland are allowed to participate in fishing activities, while in other places people from neighbouring villagers are welcomed. The day and time for fishing is usually near the end of the dry season, although it can be earlier if the area will dry out before the beginning of the rainy season. The total catch of fish is divided amongst those who have participated in the fishing. The area is then either closed to fishing again, or in the case of most seasonal wetlands and water bodies, is opened up for the rest of the dry season to anybody who wants to fish. Basically, *pha nong* systems are designed to provide fish time to grow before being harvested as late as possible in the dry season and then ensure the equitable distribution of the wetland fisheries amongst community members. These systems also maintain and increase solidarity within and between communities.

In Ban Som Sa-at, Xaibouli district, two wetlands are managed under a *pha nong* system by the community. These seasonal wetlands, totaling 0.5 hectare (ha) in area, are opened up for all villagers to fish in once a year near the end of the dry season. At this time, villagers from other communities are allowed to fish in these wetlands as guests of the host village.

Pha Nong **Management of the Nong Sok Wetlands at Ban Dong Kasin, Nong Bok District**

Nong Sok is a wetland about 200 metres long and 100 metres wide and is situated about two kilometres from the ethnic *Lao* village of Ban Dong Kasin in Nong Bok district. As with many natural wetlands in the Xe Bang Fai basin, it is managed according to a *pha nong* regime. Flooded by the Xe Bang Fai River in the rainy season and containing water all year round, fishing in Nong Sok is prohibited for most of the year. Hunting of wildlife and the collection of food plants near Nong Sok is also strictly banned. If anybody 'steals' fish from the *nong* during times when fishing is prohibited, local people believe that the thief will suffer various misfortunes — and the only way to escape these misfortunes is for the thief to organise a ceremony and ask to be forgiven by the spirit (and by extension, the community) protecting Nong Sok.

According to long-established tradition in Ban Dong Kasin, each year on the day of the full moon of the fifth Lao month (April) — which coincides with the Lao New Year (and associated celebrations) — people from the village (and only people born in the village, or married into the village and presently living there) are allowed to fish in the pond, but only for a few hours in the afternoon. In fact, while people from other villages can come to watch the fishing of Nong Sok, only people of Ban Dong Kasin are allowed to enter the water. Monks also come to observe the fishing activities each year and water from the village (not from the *nong*) is used to wash the Buddhist images in the temple — these images are brought to the *nong* on the same day as fishing takes place.

Before fishing can begin, villagers participate in a ceremony known as *liang seng* or *liang phi ban* ("sacrifice for the wetland or sacrifice for the village spirit"). A male elder (*pho cham*) of the village is responsible for the care of Nong Sok and conducts ceremonies related to the *nong.* The spirit of the *nong* is *phi nya khou* (commonly referred to by local people as *nya khou*), the spirit of a long-dead feudal lord (*chao muang*). The spirit's (and perhaps, the feudal lord's) full name is *nya khou sai-nya-vong rasa thelat*, and the spirit reputedly has the ability to appear as a tiger, crocodile or large snake. The village spirit house (*ta ho*) is located adjacent to Nong Sok, and after the *phou cham* recites a chant, he asks the spirit to provide fish for the village. According to villagers, about 15 minutes after the chant has been completed fish begin appearing at the surface of the pond. If the fish rise to the surface, *nya khou* is believed to be happy, and everybody yells out in joy, and begin fishing in the *nong.* If the fish do not rise to the surface, fishing still occurs, but catches are significantly reduced, as *nya khou* has apparently decided to not give as much fish to the villagers.

On the day when fishing is allowed in Nong Sok, each of the 80 families in the village can catch about 20 kg of fish. However, a few years ago catches were significantly less. Elders explained that at that time, people had lost some of their respect for the spirit. But after some people suffered injuries after they had stolen fish from Nong Sok, the spirit regained the respect of the people and since then the catches have returned to normal.

As described above, fishing activities regulated by *pha nong* systems can occur at different times of the year, depending on the amount of water in a particular wetland or water body.

The *pha nong* system of villagers in Ban Thong Kong in Nyommalat district, allows fishing in a small *nong* in December and January, since the pond dries out quickly. In Ban Pheet Si Khai, Nyommalat district, six small *nam keng* are fished each year around February or March, and in Ban Na Kieu, Mahaxay district, two wetlands are fished each year in March.

Through the *pha nong* system in Ban Thong Kong, Nyommalat district, local people have long maintained three protected areas for fish in the small stream, the Houay In, near their village. As the stream almost dries out in the dry season, the three deep-water pools protected by the villagers are important as fish refuges. People who violate the village's *pha nong* rules are reputed to have suffered illness as a result of the anger of spirits associated with these pools. Villagers are only allowed to fish in these areas for two hours on a single day in January each year, but then fishing is again strictly prohibited until the next year.

Some villages, like Ban Tha Phoxay, in Xaibouli district, and Ban Keng Pe and Ban Tha Kho in Xe Bang Fai district, used to practice *pha nong*. However, in recent years they have stopped doing so, and the wetlands that were communally managed have become the private property of individuals. This has reportedly occurred due to the government's requirement that farmers pay taxes for the land to which they have been granted ownership. The owners of rice fields around the wetlands must also pay taxes for demarcated areas of ownership that extend into the wetlands, and therefore these individuals claim that they should be the sole owners of the wetlands. This indicates that individual land title and payment of land taxes appears to transfer communal property resources into privately owned resources.

Until last year, the people of Ban Keng Savang in Mahaxay district managed the Nong Song pond with a *pha nong* management system. However, this year they have had to stop doing so, as the pond now contains water all year due to seepage into the pond from nearby irrigated *na seng* fields. In the past the pond was fished on a single day in the fifth Lao month (lunar month, April). However, as Nong Song is not large, fisheries production was relatively low and there have been no noticeable impacts on the food security of villagers. In Xaibouli district, villagers of Ban Keng Veng reported that they used to manage Nong Bo through a *pha nong* system, but that the wetland that they used had been filled in with dirt and converted to rice fields.

In some places, community *pha nong* systems are becoming commercialized. This year Ban Beung Boua Thong and Ban Nao Neua, Xaibouli district, plan to allow the edge of Nong Boua Thong to be fished for just two or three hours on one day, and to collect money from villagers who come to fish during the allocated fishing period. Charges will be based on the types of fishing gears used (i.e. higher rates for more efficient fishing gears). But the villagers have also decided that they will not permit fishing in the deepest part of the wetland, which they plan to maintain as a protected area. This will be the first year that this system is adopted in Ban Beung Boua Thong and Ban Nao Neua, and villagers hope to raise money for repairing the village school and health centre.

The village of Ban Som Sa-at also sells tickets for fishing gears used in one of the village's communal wetlands, Nong Boung, which is opened up for fishing once a year for a few hours. Nong Boung is flooded each year by waters from the overflowing Xe Bang Fai River, and fish enter the wetland from the main river at that time. This 200 metre-long by 100 metre-wide wetland has generated about one million kip (US$122) per season in recent years.

Nong Seng Wetlands at Ban Na Phoke Tha in Xe Bang Fai District

Nong Seng is one of the most productive wetlands in the Xe Bang Fai basin, and is located near Ban Na Phoke Tha in Xe Bang Fai district. Ban Na Phoke Tha is situated on high ground along the bank of the Xe Bang Fai River, but according to villagers, they mainly fish in Nong Seng, since fishing is generally better there compared to fishing in the river. About 90% of the canoes owned by villagers are used in Nong Seng rather than in the Xe Bang Fai River.

Nong Seng is a two kilometre-long year-round oxbow lake (a body of water and wetland in a former main channel of the Xe Bang Fai River) situated very near the river's present channel, and is an extremely important livelihood resource for local people. A large area of wetland forest surrounds Nong Seng, of which the main species of trees are *mai ben* and *mai seng*.

In the past, the waters of Nong Seng would rise and fall naturally and were managed by the community according to its *pha nong* system. But around 1961, the villagers of Ban Na Phoke Tha decided to build a weir of wood, rocks and mud to block the stream connecting the wetland with the Xe Bang Fai River. This was done to reduce the amount of water that flowed into the wetland from the Xe Bang Fai during the height of the rainy season (and thus flood nearby rice fields), but the structure did not provide villagers with the option of releasing water from Nong Seng when they desired. It was only after the water in the wetland could be maintained at higher-than-natural levels during the dry season that the village began to lease the fishing rights to Nong Seng.

In 1995, the Australian government provided assistance to the village to construct a *pit-peut* floodgate to regulate the amount of water entering and leaving Nong Seng. Now, the *pit-peut* system is closed shortly after the end of the rainy season to prevent fish from leaving the wetland and to store water in Nong Seng that irrigates (without the use of pumps) natural dry season rice cultivation, *na seng thammasat*, on 30 hectares of land. Villagers also set a very effective fish trap at the *pit-peut* floodgate every year at the end of the rainy season to catch fish trying to migrate back into the Xe Bang Fai River. Fish caught in this trap are divided equally amongst the 71 families of the village, each receiving an average of 40 to 60 kg of fish per year, most of which is used to make *pa dek*.

Now, while many wetlands in the Xe Bang Fai basin are managed according to the *pha nong* system, the Nong Seng wetland is managed differently. In some years village leaders lease the fisheries of the wetland for four months (during which time the people of Ban Na Phoke Tha must do most of their fishing in the Xe Bang Fai River). The purchaser of the lease, or the 'concessionaire', under this system, has exclusive rights to catch the fish in Nong Seng between October and January, is allowed to guard the area to prevent others from fishing in Nong Seng, and can fine people who try to catch fish there. This year the community sold such a lease and received seven million kip (approximately US$850) in return. Apart from leasing the fishing rights for Nong Seng, the fishing rights to six smaller natural ponds near Ban Na Phoke Tha are also leased by the village some years. Each of these six ponds – Nong None, Nong Phat, Nong Lao, Nong Nyang Ngoua, Nong Sa Po and Nong Vai – were leased this year, and the village received 60,000 kip per pond. This money is communally managed, and this year it is expected that it will be spent to fix the village school. In other years, when there is not as much need for money, the village does not lease the fishing rights for the wetlands. Then, the fish catch from Nong Seng and other wetlands is divided equally amongst the villagers.

Between October and January, the main species of fish harvested from Nong Seng are black fish, including the species listed in Table 3.

Table 3

Local taxonomy names	Western science taxonomy names
pa douk	*Clarius* sp. or spp.
pa ian	*Monopterus albus*
pa i-tou	*Morulius* spp. (juvenile)
pa kadeut	*Trichogaster trichopterus*
pa khai	*Channa lucius*
pa khao	*Systomus* sp.
pa kheng	*Anabas testudineus*
pa kho	*Channa striata*
pa lot	*Macrognathus siamensis*
pa nai	*Cyprinus carpio*
pa nin	*Oreochromis* sp.
pa phia	*Morulius* spp. (juvenile)
pa sieu	*Esomus* or *Rasbora* spp.
pa sout	*Hampala dispar*
pa tong na	*Notopterus notopterus*

Of the fish, the snakehead *Channa striata* is reportedly the most abundant by weight. Shrimps (*koung*) are also caught at this time.

Even during years when fishing rights are sold for part of the year, villagers are still allowed to fish in the wetland at various times of year. During the rainy season, before and after the concession period, fishing with hooks and gill nets provides most families with fish to eat, sell, and to make *pa dek*.

Many families are each able to harvest about 100 kg of snails (*hoi pang, hoi na, hoi khong* and *hoi choup*) from the wetland each year, and much of the harvest is sold at market. Unlike other wetlands visited in the Xe Bang Fai basin, shrimp (*koung*) are also harvested. Local people distinguish between two kinds of shrimp, small ones (*koung poi*) and large ones (*koung nyai*), and families can sell 20 to 30 kg of shrimp per year. The large shrimp are also sometimes used for baiting hooks to catch fish.

Villagers also collect other resources from Nong Seng. Many types of edible wild vegetables are harvested from around the wetland, including *ne, phak top, phak kadon nam, phak kieu feuang, phak khai kai,* and *phak khi som dang khom*, and young shoots of *mai ben* are also eaten. Villagers also collect *pheu* reeds to make floormats.

There are a number of species of water birds and rodents found around Nong Seng, some of which are occasionally snared by locals. There are at least nine species of snakes and two species of hard-shelled turtles harvested for food and for sale. Villagers harvest frogs (*kop, khiat* and *eung*) from the wetland using lights and hooks — and by

digging up their burrows during the dry season, and they collect wild honey (*nam pheung*) produced by two species of bee (*pheung kon* and *pheung hang*).

Although villagers from Ban Na Phoke Tha are the main users of Nong Seng, villagers from neighbouring communities including Ban Som Sa-at, Ban Nyang Kham, Ban Na Phoke Theung, Ban Hat Kham Di, and Ban Tang Tha also occasionally come to harvest fish and other resources from the wetland.

According to villagers, the wetland is a rich resource of vital importance to their livelihoods. But locals are confronted with a difficult dilemma. The implementation by local officials of government policy to expand the area of *na seng* – dry season rice cultivation – has meant that villagers have cleared areas of the wetland forest surrounding Nong Seng for rice growing. Most of this forest clearance has been done during the past three years. Although village leaders maintain that some of the wetland forest will not be cut down, there is the potential that this deforestation will have a negative impact on the wetland resources upon which the villagers are so very much dependent. It may be that destroying the wetland forest to cultivate irrigated rice during the dry season will result in a net loss of food security and income for villagers.

Nong Sa Systems for Managing Fisheries

In the lower part of the Xe Bang Fai basin, it is easy to get the impression that aquaculture is a thriving local enterprise, as there are an increasing number of human-made ponds (*nong sa*) in the area that appear to be used for fish-raising. But villagers report that raising fingerlings purchased from the government or hatcheries in Thailand is generally not very profitable. For example, villagers in Ban Som Sa-at, Xaibouli district, told the survey team that purchased fish did not grow very quickly, and that there was not sufficient food to feed the fish. In reality, the *nong sa* ponds are built in the flood plains not for raising aquaculture species but for the trapping of wild fish when the floodwaters recede at the end of the rainy season. *Nong sa* systems are mainly used in the lower part of the Xe Bang Fai basin, including Nong Bok district, the western part of Xaibouli district, and the western part of Xe Bang Fai district.

Villagers in Ban Na Phoke Tha, Xe Bang Fai district, reported having many small *nong sa* in their rice fields, and that the wild fish trapped from the average *nong sa* sold for about 100,000 kip. Villagers in Ban Som Sa-at, who also have *nong sa* in their fields in the flood plains, are able to make about one million kip (US$122) per pond each year. A family in Ban Hat Kham Hiang in Xe Bang Fai district received more than 3,000,000 kip (US$366) through selling wild fish from a single *nong sa* this year. The amount of fish that can be caught in each *nong sa* varies depending on its size and location in the floodplain.

The Abbot of the Buddhist temple in Ban Som Sa-at is planning to repair and expand the temple's *nong sa* for collecting wild fish so as to generate funds for the temple. The Abbot is not planning to raise aquaculture fish species in the pond. Last year the monks of the temple harvested 200 kg of fish, used to make *pa dek*, from the temple's as-yet uncompleted *nong sa.* Villagers from Ban Dong Kasin in Nong Bok district also reported that about 20 families have dug *nong sa* in their rice fields for collecting wild fish at the end of the rainy season.

However, *nong sa* can only be used in certain areas of the Xe Bang Fai basin. Villagers in Ban Tha Kho, eastern Xe Bang Fai district, reported that making *nong sa* was not possible near their villages because the soil is very porous and this prevents water from accumulating in the fields.

Fishing and Local Livelihoods

Wild capture fisheries are clearly one of the most important livelihood resources for people living in the Xe Bang Fai River Basin. And while fisheries have always been important to local people in the basin, the relative importance of the Xe Bang Fai fisheries to the national society and economy of Laos may actually be increasing. Until recently, most fishing was for subsistence purposes — there were few markets where fish could be sold, and many people caught fish for their own consumption and that of their family members. Now, however, fishing in the Xe Bang Fai basin not only supplies local families with their most important source of dietary protein, but is also an important means of gaining income, as fish are sold in local markets and often transported as far as Vientiane for sale. And as most populations of forest-dwelling wild animals have declined in recent years, and as the government has enforced restrictions on the hunting of these animals, including the collection of guns from villagers, fish will continue to increase in importance as a source of food and income — both for people in the Xe Bang Fai basin and those living elsewhere.

In many villages in the Xe Bang Fai basin, annual rice harvests are not sufficient to supply families with a yearlong supply of this staple food. In many villages, the vagaries of soil quality, rainfall and natural flooding, or official restrictions on land-use in upland areas, are often the major factors causing rice shortages, while in the middle and lower basin, natural floods of longer-than-usual duration or higher-than-usual levels can significantly reduce rice yields. Consequently, wild capture fisheries provide locals in rice-deficient villages with their main means for getting rice — either through direct barter trade with other villages or through selling fish at market and using the income to buy rice. In the ethnic *Brou* villages of Ban Tha Hat in Xe Bang Fai district and Ban Na Kieu in Mahaxay district, both of which experience chronic rice shortages, the barter and sale of fish secures sufficient supplies of rice. Villagers in Ban Keng Pe, Xe Bang Fai district, also reported that in the dry season it is often possible to catch 8 to10 kg of fish per day that could then be sold at market, the proceeds being used to purchase rice. As Ban Keng Pe frequently experiences rice shortages, the importance of fish for the people of this village is reflected in their saying that they *het na sai lang pa* ("grow rice on the back of a fish").

The fermented fish paste known as *pa dek* is the second staple food of the Lao diet, apart from rice, and is especially important for the ethnic *Lao* of the lowlands. Most villagers in the lower and middle parts of the Xe Bang Fai basin gain much of their dietary protein from *pa dek*. For example, the average family in Ban Na Phoke Tha, Xai Bang Fai district, makes between four and eight jars of *pa dek* each year, with two or three jars consumed per family and the rest being sold. Each jar contains approximately 22 kg of fish. Villagers in Ban Keng Pe reported that each family in the village consume two to three of these jars of *pa dek* a year, and villagers in Ban Tha Kho and Ban Som Sa-at, Xai Bang Fai district, both reported consuming about two jars per family per year. Villagers at Ban Kouan Khwai and Ban Na Kieu (both *Brou* villages) in Mahaxay district, reported making one jar a year for family consumption. Ban Thong Kong villagers in Nyommalat district, located well away from the Xe Bang Fai River mainstream, were the only people visited by the study team who said that they have to regularly buy *pa dek*, since they do not catch enough fish to make any themselves; they only catch small amounts of small fish that they almost always eat soon after being caught.

Fish are not the only aquatic animals that constitute a source of food for the people of the Xe Bang Fai basin. Snails (*hoi*), frogs (*kop*, *khiat and eung*), crabs (*kapou*), shrimps (*koung*), and aquatic insects (*meng mai nam*) are also important sources of food and income. For example, villagers in Ban Thong Kong told the study team that they generally consume more frogs and tadpoles than fish in the rainy season. Only a few fish are caught in the small streams near this village, while villagers in Ban Keng Pe and other villages reported that frogs are mainly caught and sold at market during the rainy season. The people of Ban Na Phoke Tha in Xe Bang Fai district sell substantial amounts of shrimp and snails caught in their wetland area, Nong Seng (See box Nong Seng Wetlands at Ban Na Phoke Tha in Xe Bang Fai District).

Some of the largest aquatic animals in the Xe Bang Fai system are the soft-shelled turtles. Local people identify two species in the river, the larger of the two being called *pa fa* (possibly *Pelochelys cantori*) and the smaller turtle known as *pa pou lou* (possibly *Amyda certilaginea*). Over the last two years, fishers caught two very large *pa fa* at the mouth of the Xe Bang Fai River. Each of the turtles weighed about 100 kg, which is probably close to the maximum weight for the species. Turtle meat is eaten by villagers or sold at market.

And then there is the diminutive earthworm (*khi ka deuan*). Living in the moist soils of the riverbank, earthworms are collected and used as fish bait. Some fishers require 100 or more earthworms to bait their hooks each day. While not eaten or sold at market by local people, the earthworm is of value — both as fish bait and as a symbol of the relationship between land and water.

2. Dry Season Riverbank Vegetable Gardens

The cultivation of vegetables and other crops in gardens on the banks of the Xe Bang Fai River and many of its tributaries is, according to villagers, one of the most important sources of food and income for local families. It is particularly important for women, as they do most of the gardening work and then often determine how the produce — and income from its sale — is to be used.

There are two overlapping periods of riverbank gardening, both of which relate directly to the natural rise and fall of rivers. The first is from August or September to December. Crops are planted in the moist, fertile soil of the riverbank as soon as the floodwaters start to recede and water levels in rivers begin to decrease. Gardens include corn, yams, watermelon, cotton, cassava and other tubers, peanuts, long beans, mung beans, a local variety of cucumber, chilies, eggplant, pumpkin, and many other varieties of vegetables.

In December, the second cultivation period begins. Additional crops are planted further down the riverbank as water levels continue to decline in the dry season. At this time, a larger area of land can be cultivated and the river provides a near-by water source. Crops planted tend to be ones with a short growing seasons, and most are harvested by March, including lettuce, long beans, garlic, Chinese parsley, cabbage, dill, watermelons, tobacco, and cucumbers.

Some riverbank gardens are located directly in front of the houses of the owners, while in other cases villagers must walk many kilometres to reach their gardens. For example, a few families from Ban Thong Khong in Nyommalat district cultivate dry season vegetable gardens on the banks of the Houay Khama stream, which is many kilometres away from their village. Other villages, like those from Ban Sang and Ban Na Khom, in Xe Bang Fai district, that are located far from the Xe Bang Fai River, have dry season vegetable gardens on the river's banks. Many of these crops are consumed within the family and are a source of nutritious food. Some crops, such as tobacco, are grown mainly for sale.

In some villages, especially those in the lower part of the basin, the tobacco crop is the largest single source of cash income. Villagers living along the Mekong River in Nong Bok and Xaibouli districts sell dried tobacco leaves for 30-35 Thai baht/kg (US$0.65-0.75/kg). However, villages situated along the Xe Bang Fai and Xe Noy rivers, such as Ban Dong Mak Fai and Ban Tha Phoxay in Xaibouli district, grow tobacco of higher quality that they are able to sell in Savannakhet town and Xeno town for 40-80 baht/kg. Villagers from Ban Dong Mak Fai, in Xaibouli district, reported an average annual income per family of about two million kip (US$244) from the sale of tobacco. Most of the tobacco is grown along the banks of the lower Xe Noy River, and on the banks of one of its small tributaries, the Houay Tabong Hap.

At Ban Pheet Si Khai, in Nyommalat district, large amounts of cucumbers are grown along the banks of the Nam Pheet in the dry season, and are sold along the main road to Nyommalat district town. Villagers use water diverted from the Nam Pheet for their crops. The stream originates at a nearby cave at the base of a limestone mountain, and is probably spring-fed. A

small concrete weir has been constructed near the headwaters of the stream to make a reservoir from which water flows to the gardens.

Some villages situated near the mouth of the Xe Bang Fai River grow vegetables on islands in the Mekong River. In Xaibouli district, these villages include Ban Boua Khai, Ban Pong and Ban Tha Kho, and farmers from those communities are able to grow large quantities of vegetables. Some of the best vegetable growers can apparently make up to 20 or 30 million kip per year from selling their produce.

Although most of vegetables grown in the Xe Bang Fai basin are watered by hand, some small irrigation pumps have also been introduced for growing vegetables. These are particularly prevalent in the lowest part of the basin. However, in 1998 two families from Ban Keng Pe, in Xe Bang Fai district, also received two 7 horsepower Indian pumps from the government on credit. One is presently being used for growing chilies, while the other is providing water to grow chilies and watermelons. The owners have not made as much profit as expected, due to problems with marketing their produce, and are concerned that they will not be able to pay back the government for the cost of the pumps.

Fisheries, Riverbank Vegetable Gardens and Food Security in Ethnic Brou Communities

The ethnic *Brou* communities of Ban Dang, Ban Na Phong, and Ban Vat That, in Mahaxay district, are experiencing a severe rice shortage this year as much of their rice crop was destroyed by flooding last rainy season. They also have many problems related to the pumped dry season irrigation system constructed near their villages, including difficulties in constructing the canal, erosion, and high expenses. Consequently, fishing and the cultivation of vegetable gardens on the banks of the Xe Bang Fai and the Houay Naphong stream are essential if families are to have an adequate diet and to purchase a supply of rice sufficient for their needs. Some of the fish caught and some of the vegetables grown are sold, but local families consume much of the fish and vegetables harvested. However, most of the tobacco, corn, tubers, and small red onions are sold — most families grow these onions in about 30 small beds per family each dry season. The onions are sold at Mahaxay town for 5000 kip/kg. Each family's annual income from selling vegetables is approximately the same as that from selling fish. The sale of fish and vegetables by families in these three villages is clearly of critical importance to food security in these communities.

3 . Forests and Livelihoods

The livelihood security of people living in many of the villages in the Xe Bang Fai River Basin is closely linked to the natural forests near these villages. These forests include: the seasonally flooded riverine forests along the Xe Bang Fai River, and many of its tributary rivers and streams; the seasonally flooded wetland forests of the basin's floodplains; and, dry-land evergreen and semi-evergreen forests in the lowlands. Forests and vegetation in the immediate vicinity of wetlands, ponds and oxbow lakes are usually flooded during the rainy season and during the early period of the dry season, and are defined in this report as 'seasonally-flooded wetland forests'. Dry-land evergreen and semi-evergreen forests in the lowlands may be flooded for short periods or during unusually large flood events, but for the most part are located outside the usual zone of flooding, or are upland forests that are never subject to floods.

Seasonally Flooded Riverine Forests

Large areas of seasonally flooded riverine forests grow along the Xe Bang Fai River, especially the middle and upper parts of the river, as well as along the middle and lower stretches of many of the Xe Bang Fai's tributary rivers and streams. During the rainy season, from around June until November, these forests are flooded as river water levels increase and the waters flood into these adjacent forests. These forests are extremely important for maintaining a vibrant aquatic ecosystem. Apart from being a source of organic nutrients, seasonally-flooded forests are the habitat of a wide variety of animals — including many species of birds, mammals, amphibians, reptiles, insects, shrimps and shellfish, and, of course, fish. Fish rely on the forests for food directly, in the form of fruit, seeds, other fish, and aquatic plants and animals, and indirectly, since much of the food eaten by fish and other aquatic animals depends on the food web initiated due to the nutrients contributed to the ecosystem by the forests. Fish use the trees as refuges from predators, and some species use the flooded forest as nursery and breeding grounds. Flooded forests in the river also play an important role in reducing riverbank erosion and providing shade that keeps the water relatively cool and therefore a comfortable environment for the fish.

Compared to other types of forest, seasonally flooded riverine forests are unique in that they have adapted to survive long periods of inundation by rivers that have widely fluctuating water levels over the course of a year. In the tropical monsoon climate of Laos, most plants exhibit their most important periods of growth during the rainy monsoon season. However, the trees and bushes of the seasonally flooded riverine forest are different – they grow in the dry season, when they are not inundated. During the rainy season, when they become flooded, annuals die and perennial plants lose their leaves to reduce friction with the strong current of the river. Basically, the perennial plants become dormant until the flood recedes, at which time the new leaves of these plants quickly emerge. Essentially, seasonally flooded riverine forests are highly adapted to the seasonal hydrological cycles of the river — the main plant species in these forests exist as a result of the seasonal rise and fall of the river's waters each year.

The main plant species found in the seasonally flooded forests of the Xe Bang Fai River are the trees *mai khai* and *mai ben*. They are often found in lower parts of the riverbed, either around rapids and other rocky areas, or on the banks of the river or sand bars. The *mai mak nao nam* tree is found higher up the riverbank.

Along the Xe Bang Fai River, local people collect many perennial and annual plants — used as food and/or medicine — that grow in the seasonally flooded riverine forests. These plants include *phak khom nam*, *phak koum*, *phak i-som*, *phak dang khom*, *phak kat hong*, *phak hom keua*, *phak kheng khiat*, *phak ham pou*, *phak kadon nam*, *phak kieu feuang* (also known as *phak mai*), *phak bouang*, *phak kai*, *phak liam*, *phak nam*, *phak kout nam*, *phak kout khi pa*, and *phak khai kai*.

Edible insects, including mole crickets (*meng chi nai* and *meng cha lo*) and *meng khanoun* beetles, that have lifecycles that depend on the seasonally flooded forest habitat are also collected from these forests, as are other aquatic animals such as shrimps (*koung*), frogs (*kop*, *khiat* and *eung*), snails (*hoi sai*, *hoi choup* [*hoi kon lem*], and *pak kouang*) and shellfish (*hoi kheng* [*hoi keng noi*], *ki*, and *kouang*).

Seasonally Flooded Wetland Forests

Seasonally flooded wetland forests grow in areas adjacent to seasonal and year-round wetlands and oxbow lakes throughout much of the Xe Bang Fai River Basin. While much of the seasonally flooded wetland forest areas in the lower part of the basin have been cut down to make way for rice fields and other forms of agriculture (Claridge, 1996), there are many other areas where these forests remain. For example, the protected *nong* wetland of Nong Boua, adjacent to Ban Beung Boua Thong and Ban Nao Neua in Xaibouli district, is still surrounded by pristine wetland forests. The long wetland adjacent to Ban Na Phoke Tha in Xe Bang Fai district is also still surrounded by significant tracts of wetland forest—although on-going conversion of parts of this forest to dry season rice paddy is occurring (see box: Nong Seng Wetlands at Ban Na Phoke Tha in Xe Bang Fai District). There are also significant amounts of wetland forest adjacent to the Nam Pheet in Nyommalat and Mahaxay districts. While many of the tree species found near these wetlands are similar, there are significant differences in the species of plants and their relative abundance in each area, depending on the ecological and natural hydrological cycles in the area.

As with seasonally flooded riverine forests, villagers collect edible plants that grow in seasonally flooded wetland forests, including *ne*, *phak kieu feuang* (*phak mai*)*, phak pote*, *phak pong*, *phak mak chap*, *phak kaset*, *phak kadon nam*. The young shoots of *mai ben* are also eaten.

Although most year-round wetlands contain floodwaters that remain after the recession of the flood at the end of rainy season, villagers identified *pa nam kham* as a particular type of forest that grows adjacent to year-round wetlands fed by springs that are the source of small streams. Villagers in Ban Keng Pe, Ban Tha Kho and Ban Tha Hat in Xe Bang Fai district were familiar with this type of forest ecosystem, and local women in Ban Keng Pe identified twelve separate *pa nam kham* areas by name. However, people in these villages were concerned about the potential damage caused by the logging of the forests as the springs and associated wetlands have dried out in other areas where *pa nam kham* has been logged.

The Nam Pheet Wetlands

In Nyommalat district, the Nam Pheet is a small, seasonal river of approximately nine km in length that enters the Xe Bang Fai River between the villages of Ban Na Kieu and Ban Keng Savang in Mahaxay district. At the confluence of the Houay Khama stream (also known as Houay Khieou) and the Nam Pheet (about four km downstream from the source of the Nam Pheet), there is a seasonally flooded forest that covers an area of more than 70 ha and is referred to by local people as *tham bone nam thouam* (the flood area wetland) (hereafter referred to as the 'Nam Pheet flooded forest').

The trees found in the Nam Pheet flooded forest are known locally as *mai houman*, *mai ke*, *mai kasa*, *mai khama*, *mai seng*, *mai kham nam*, and *mai ben*. The largest trees in the forest are less than 30 cm in diametre, but there are many trees and the forest is very dense.

As with all seasonally flooded forests, the trees and other vegetation of the Nam Pheet flooded forest grows during the dry season — but it is during the floods of the rainy season, as the trees are dormant, that this forest literally 'comes to life'. At this time, as the main tributaries of the Nam Pheet — the Houay Pheet, Houay Lom, and Houay Khao Khouang — begin to flow with the run-off of the early monsoon rains, connecting the sources of these streams (pools fed by springs in the Nam Pheet basin's upper catchment in the Say Phou Ak mountains) with the Nam Pheet, the water level in the Xe Bang Fai River is also increasing. It flows into the Nam Pheet's channel, causing the Nam Pheet to backup and flood the forest at its confluence with the Houay Khama. During the height of the rainy season, the forest is often three to four metres

underwater. Villagers from Ban Pheet Si Khai have about 20 canoes that they use during the wet season, as the depth of the water makes paddling a canoe far more convenient than walking or swimming through the flood.

In May and June, a large number of fish migrate up the Nam Pheet from the Xe Bang Fai River to enter the flooded forest. According to local fishers, many of the fish species use the forest as a spawning ground. At around the same time many fish that have spent the dry season in spring-fed pools in the caves at the origins of the tributary streams of the Nam Phe*et also* migrate out of these pools and move downstream into the flooded forest. According to villagers, the fish species that migrate to the flooded forest — both from the Xe Bang Fai and from the spring-fed pools in the mountains — include those listed in Table 4.

Local taxonomy names	Western science taxonomy names
pa chat.	*Poropuntius* sp.
pa douk.	*Clarius* sp.
pa hang deng	*Dischero dontus ashmeadi*
pa ka	*Pristolepis fasciata*
pa kang	*Channa gachua*
pa keng	*Cirrhinus molitorella*
pa khai	*Channa lucius*
pa khao	*Systomus* sp.
pa khao	*Wallago attu*
pa kheng	*Anabas testudineus*
pa kheo kai	*Botia* sp.
pa kheung	*Hemibagrus wyckioides*
pa khi khom	Undetermined cyprinid
pa khi lam	*Labiobarbus* sp.
pa kho	*Channa striata*
pa khoun	*Wallago leeri*
pa kot	*Hemibagrus nemurus*
pa kot thon	*Hemibagrus wyckii*
pa kva	*Tor* sp.
pa lat	*Mastacemblus* sp. or spp.
pa nyone	*Laides* or *Pangasius* sp.
pa oup deng	*Cyclocheilichthys* sp.
pa pak	*Hypsibarbus* sp.
pa phan	*Schistura or Nemacheilus* sp.
pa phia	*Morulius* sp. or spp.
pa pok	*Systomus* or *Osteochilus* sp.
pa sa nyeng	*Mystus* sp. or spp.
pa sakang	*Puntioplites* sp.
pa sanak	*Raiamas guttatus*
pa sathong	*Xenentodon* sp.
pa seuam	*Ompok bimaculatus*
pa sieu	*Esomus* or *Rasbora* sp. or spp.
pa sout	*Hampala dispar*
pa vian fai	*Barbodes* sp.
pa yeun	*Pterocryptis cochinchinensis*

One species of fish, identified by local people as *pa ket lep* could not be identified by its western science taxonomy name, but is probably a small cyprinid. *Wallago leeri* is probably the largest fish to enter the Nam Pheet flooded forest, with some individuals of this species reaching 100 kg in weight. These same fish return to the Xe Bang Fai River in late September or October, when the rains begin to stop and water levels decline. Villagers estimate that about 60% of the fish in the flooded forest come from the spring-fed pools in the caves, while the remaining 40% migrate up from the Xe Bang Fai River.

During the rainy season, villagers take advantage of the large influx of fish into the flooded forest, and use gill nets (*mong*), hooks baited with earthworms (*bet khan*) and long lines (*bet phiak*) to catch fish. The level of water in the wetland area rises and falls every few days throughout the rainy season and villagers take advantage of this situation by using gill nets to catch fish when water levels drop. At that time they position their nets in the channels where they know the fish will need to pass to escape from areas that will soon be drying out, and villagers are able to catch particularly large quantities of fish in these channels at that time. Villagers sell much of the fish that they catch either as fresh fish or as barbecued fish (*pa ping*). Villagers also produce a small amount of smoked fish (*pa yang*). However, fish are so abundant in the rainy season that prices are very low and it is often difficult to sell the fish because supply exceeds market demand.

The flooded forest is a resource used by many villages in the area including Ban Pheet Si Khai, Ban Khok, Ban Na Kieu, Ban Phon Sang, Ban Kouan Phan, Ban Phoi, Ban That and Ban Mouang Khai. Villagers from communities located many kilometres from the flooded forest, including Ban Keng Lek, Ban Fang Deng, the Mahaxay district Centre, Ban Nong Ping, Ban Nyommalat, the Nyommalat district Centre, Ban Phon Kham, Ban Phon Sa-at, Ban Pha Choum Khong, Ban Tham Phouang, Ban Don Peuay, Ban Phathoung, and Ban Phon Khene also come to fish and catch other aquatic animals in the Nam Pheet flooded forest. (The villages of Ban Phatoung and Ban Phone Khene are ethnic *Sek* communities.) According to villagers, the Nam Pheet flooded forest is the most important fishing grounds in the district, and they recognize that the large tracts of seasonally flooded forests along the Nam Pheet are the reason that these fishing grounds are so highly productive. Indeed, according to local fishers, the only other Xe Bang Fai tributary with comparable but, nevertheless, less productive fisheries compared to the Nam Pheet, is the Nam Oula.

While the cutting of large trees in the flooded forest is restricted, villagers gather smaller branches for firewood and to make fence poles. A number of medicinal herbs are collected including the epiphyte *fak mai ke*, which are boiled in water and the mixture drunk to cure diarrhea and ulcers, and *mai houman* wood, which is also boiled in water and drunk as tea so as to increase resistance to diseases.

The flooded forest is the habitat of various species of birds, reptiles and amphibians, especially in areas where there is dense vegetation. Villagers also collect species of frog (*kop*, *khiat* and *eung*), shrimps (*koung*), crabs (*kapou*), snails (*hoi pang*, *hoi choup*, *hoi khong*, *hoi pak kouang*, *hoi na*, and *hoi ke*), and other animals from the forest. Much of this harvest of aquatic animals occurs at the end of the rainy season as water levels are decreasing. Some of the frogs and snails are sold, but local families mainly consume the shrimps and crabs.

Dry-land Forests

Many of the forests in the Xe Bang Fai basin are tropical evergreen, semi-evergreen mixed deciduous, and dry dipterocarp forests. Generally, these forests are managed as common property resources and as such are considered by villagers as being communally owned by

village communities. All villagers can gather non-timber forest products from these forests, but most communities have agreed to some restrictions related to the way the forests are used, especially in relation to cutting down large trees. Many of these village also respect 'spirit forests' (*pa khet*) where violent activities such as logging and hunting are prohibited (but NTFP collection is generally permitted) due to community beliefs that these forests are the home of benevolent (and, if offended, potentially malevolent) spirits.

Forests provide local people with many livelihood resources, and villagers collect a large number of non-timber forest products (NTFPs) for use and sale. Some make substantial incomes from the gathering and selling of NTFPs, but all local people rely on NTFPs for subsistence. For example, people in the ethnic *Brou* village of Ban Na Kieu, Mahaxay district, told the study team that they sell bamboo shoots (*no mai*) collected from a nearby forest and that this is one of their most important sources of income — although bamboo shoots are also consumed as food by local families. The collection and sale of bamboo shoots mostly occurs at the beginning of the rainy season, and the shoots of species collected include *mai houak, mai ka san* (*Bambusa* spp.), and *mai lai* (possibly *Oxythenanthera albociliata*).

Villagers living near dense forest, such as the people of Ban Thong Kong, Nyommalat district, collect the shoots of *san* (*Raphis exelsa*, described as both a 'spiny palm' and a 'non-climbing rattan') as a food. Some is also sold locally. *Phak van* (*Melienthes suavis*) is also collected for food in some villages, and is occasionally sold. The tender growth at the tip of the stems of many species of rattan (*nyote vai*) (possibly *Calamus* sp.) are collected for eating, and rattan is also used to make baskets and other household items. Red ant eggs (*khai mot daeng*) and honey (*nam pheung*) are both harvested for food and sale during the dry season. Some villagers, such as the *Brou* people of Ban Tha Hat in Xe Bang Fai district, make and sell resin-fuelled torches (*kabong*), the resin being tapped and collected from large *mai nyang* (*Dipterocarpus alatus* or spp.) dipterocarp trees.

People from many villages harvest and sell *"khisi"* tree *(Shorea* or *Parashorea* spp.) resin. The resin is secreted from the tree and accumulates in a mass stuck to the tree's bark, and is then collected by villagers. The resin is used for patching boats when mixed with *mai nyang* resin, and for other purposes. People in many villages told the survey team that there is now very little resin available to be collected. This may be the result of excessive collection that prevents the accumulation of large amounts of resin, or the result of reductions in the number of trees due to logging. Furthermore, the collection of resin takes much time and effort, while the market price of 700-800 kip/kg may be too low to make collecting it worthwhile for villagers. In Xe Bang Fai district, Ban Tha Hat villagers estimated that they harvested and sold just 200 kg last year — an amount less than in previous years. In contrast, traders at Ban Manilat in Xaibouli district reported that *khisi* is one of the most important NTFPs traded in the area, and that people from many villages came to the market at Ban Manilat to sell resin.

Many varieties of wild mushrooms (*het*) are collected in forested areas. These include *het pho* (*Astraeus hygrometricus*), *het bot* (*Lentinus kurzianus*), *het phouak* (*Termitocytes* sp.), *het khai*, *het din*, *het khone*, *het khao*, *het nam mak*, *het na sao khao khai*, *het pheung*, and *het la ngok*. *Het pho* is the most economically important of these varieties; they are very abundant and can be preserved better than most other types of mushrooms. Mushrooms are an especially important NTFP in the lower part of the Xe Bang Fai basin. For example, villagers from Ban Tha Phosy, Ban Tha Kham, Ban Keng Veng, Ban Dong Mak Fai and Ban Palay in Xaibouli district, and Ban Tha Kho in Xe Bang Fai district all sell large amounts of wild mushrooms collected in semi-evergreen dipterocarp forests located near their villages. Villages near Thailand sell the mushrooms directly to Thai traders for 30-40 baht per kg. Villages farther from the border sell the mushrooms to intermediate traders who then sell them in Thailand. On average, a family from Ban Tha Kho makes about 50,000 kip per year from selling mushrooms. But in Xiang Khai sub-district in Xaibouli district, villagers reported to the study team that some families in the village were selling 500,000-600,000 kip of mushrooms per family per year. In all villages, it is women who collect most of the mushrooms from the forests and sell them either at market or to people who then sell the mushrooms at market.

Villagers from Ban Keng Veng and Ban Palay, in Xiang Khai sub-district, Xaibouli district, reported collecting live orchids (Orchidae) from the forest beginning in 2000, and selling them to Vietnamese traders at Khoua Xe and Ban Manilat for 500-1000 kip per plant.

Fuel wood is gathered in most village forests and is primarily used for cooking fires. Some firewood also is processed into charcoal and sold along the Route 13 highway or to Thailand. However, this is the exception rather the rule, and there is only a moderate amount of firewood and charcoal sold in the basin. Firewood is mainly used for local consumption and in most places it is still relatively easy to find.

In some villages in the lower part of the Xe Bang Fai basin, such as Ban Som Sa-at, in Xaibouli district, families can make a considerable amount of income by making and selling rice-bundling bands (*toke lao*, very thin strips of bamboo used to tie bunches of rice stalks during the harvest) to rice farmers in neighbouring provinces of Thailand. Villagers harvest the bamboo from small plantations at the edge of the Xe Bang Fai River. They have been selling these rice-bundling bands to Thailand for about six years, and sell millions of them each year. Sale of the bundling bands occurs only at the end of the rainy season. One thousand bands sell for 40 or 50 Thai baht, and each family sells between 10,000 and 100,000 bands per year. In the past, many villagers hunted birds and small animals in the forests, but throughout the survey area the survey team was informed by villagers that there is much less hunting than in the past — due both to recent legal restrictions and a decline in wildlife populations. The government's program to collect all guns from civilians over the last few years appears to have been a major factor in reducing hunting. However, a number of villagers reported still using snares (*hang heo*) to catch small mammals, including squirrels (*kahoke* and *kate*) and rodents (*nou*), and birds like pittas (*nok kho*, possibly *Francolinus pintadeanus*) and jungle fowl (*kai pa*, *Gallas gallas*). Although most of the animals caught are eaten locally, villagers in Ban Dang, Ban Vat That, Ban Na Phong and Ban Na Kieu in Mahaxay district, and Ban Tha Hat and Ban Tha Kho in Xe Bang Fai district said that they occasionally sell small animals, or trade them, for rice.

Although villagers say that wildlife populations have declined throughout the Xe Bang Fai basin, villagers also continue to see large mammals in some parts of the basin. These animals include sambar deer (*kvang*), giant and regular muntjac (*fan*), wild pig (*mou pa*), southern serow (*nyeuang*), white-cheeked gibbon (*thani*), douc langur (*kha deng*), Francois's langur (*khong*), and various species of macaque. In Xiang Khai sub-district of Xaibouli district, tigers (*seua khong*) are occasionally seen in the *Say Phou Xoy* mountain range, and villagers from Ban Thong Kong in Nyommalat district reported seeing elephants (x*ang*) near their village on a regular basis. These elephants apparently spend most of their time in the *Say Phou Ak* mountain range. The upper Xe Bang Fai River upstream of the *Tham Khoun Xe* cave is the border of the Hin Nam No National Biodiversity Conservation Area; the NBCA is home to many large animal species, probably including the recently discovered mammal *saola* (Vu Quang Ox, *Pseudoryx nghetinhesis*) (WWF, 1999).

In many places the area of natural forest has declined and the forests that remain are under threat. This is due to several factors. In some areas there has been an on-going expansion of rice fields and grazing areas. Forests have also been extensively logged, mostly by outsiders. Some villages along the Xe Bang Fai River, including Ban Keng Pe in Xe Bang Fai district, were participating in the now-suspended FOMACOP (Forestry Management and Conservation Program) forestry program supported by the World Bank and Finland's International Development Cooperation Agency (FIDA, formerly FINNIDA).

In Ban Keng Pe, the survey team talked with the village's headman and villagers who had been working for the project. According to the headman, he consented to the project after foreigners working with the project explained to him and villagers that the logging of the forest near the village would be *tat pa mai bep nyeun nyong* (sustainable logging). During the consultation, village women expressed concerns that logging of the *pa nam kham*, a spring-fed wetland surrounded by dense forest, would cause the wetland to dry out. Ban Keng Pe villagers were expecting part of their forest to be logged (500 m^3) last year, and the villagers were supposed to receive a substantial portion of the income for building a new school and

health care centre. However, the logging was delayed, and as of February, 2001 had still not been approved.

Many villages in eastern Xaibouli district reported intense logging pressure by outside companies granted concessions by the provincial or national governments. Conflicts caused by these concessions are ever-present. Villagers are seldom consulted and efforts to gain their voluntary consent to the logging of their forests are essentially unheard of. When their forests are logged, the compensation they receive for their losses is very low and often comprises nothing but unfulfilled promises. For example, Ban Palay in Xaibouli district received just 600,000 kip (US$73) in exchange for the 31 cubic metres of high quality timber that was taken from the community's semi-evergreen forest last year. Other village leaders also reported gaining little or nothing from logging activities in the forests of their communities.

Villagers also reported that since large *mai nyang* (*Dipterocarpus alatus* or spp.) trees had been chopped down, villagers can no longer make money from tapping these trees for resin, which was previously an important source of income. *Phou Thai* villagers in Xiang Khai sub-district of Xaibouli district told the survey team that the logging of their *mai nyang* trees and subsequent loss of the tapping and sale of resin has had a serious and negative impact on their means of livelihood security. Even community forests formally established by communities working in cooperation with nongovernmental organisations and provincial forestry departments have been destroyed or severely degraded by logging concessions granted to outside investors by provincial authorities — without the informed consent of affected communities.

4. Rainy Season Rice-Based Agriculture

There are two main kinds of rainy season rice-based agriculture – lowland paddy cultivation and upland swidden cultivation.

Lowland Rice-Based Agriculture

All of the villages situated along the lower and middle sections of the Xe Bang Fai River do at least some lowland rice farming (*het na*), and people in many villages identify lowland rice cultivation as their most important livelihood activity. The size of rice fields varies widely from village to village, but is generally between one and three hectares per family (see Table 5). However, some villages, especially some ethnic *Brou* villages situated along the river, have smaller rice fields per family and are therefore particularly dependent on fishing in the river and collection of NTFPs as sources of income and food. It should be noted that government statistics of the area of agricultural land being cultivated by some communities are less than the actual areas of agricultural land. Table 5 (below) summarises agricultural land areas that villagers reported to the survey team.

The success or failure of rainy season rice farming is closely related to the natural floods of the Xe Bang Fai River. The lowland rice fields of many villages in Nong Bok, Xaibouli, Xe Bang Fai, Mahaxay, and Nyommalat districts are located in the Xe Bang Fai flood plain. A certain amount of flooding is very beneficial, as the floodwaters deposit nutrients in the fields that act as natural fertilizers. But if rice seedlings are totally submerged for more than about one week they will not survive. Therefore, many villages lose a high per centage of their rice crop to flooding every year. In years when floods are of greater than usual depth, such as occurred in the 2000 rainy season, a very large per centage of the rice crop can be damaged (see Table 5, below). According to the Deputy district Chief of Nong Bok district, the district suffered severe flood damage to 6,000 ha of paddy out of a total area of 10,500 ha planted in 2000.

Negative flood impacts are somewhat balanced out by the richness of the soil in the flood plains. When farmers are able to raise a crop not damaged by flooding, they get high yields, often providing enough rice to last a family for more than one year. For example, villagers from Ban Dong Kasin in Nong Bok district often lose part of their rice crop to flooding, but in

some years, when floods are not damaging, they are able to reap large harvests. In those years, some families are able to harvest over 8000 kg of non-husked rice, which is more than enough to feed themselves for two years. Chemical fertilizers and other foreign-produced inputs are not widely used for rainy season rice cultivation in most parts of the basin, as the silt deposited by the yearly floodwaters fertilizes the land.

This cycle of poor and good harvests from year to year is long established in communities along the Xe Bang Fai and has been documented in previous research. In 1995, research indicated that Ban Tha Bo of Xaibouli district was able to harvest two years worth of rice in a year when there was little or no damage to the crop by flooding. But in years of heavy flooding, most of the crop was lost and villagers could only harvest a supply of rice equivalent to approximately four months supply (Somphone *et al.,* 1995).

Planting rice is a yearly gamble in which farmers invest in seeds, labour and other inputs in the hope that the floods will not be severe. According to villagers there are very tight flooding margins involved in growing rice in the rainy season, and relatively small increases in the depth and/or duration above the optimal flood can make the difference between having a large harvest of rice or no harvest at all.

Table 5. Selected Villages: Rice Fields per Family and Flood Damage

Name of village* and district	No. of families	Ha of paddy	Avg. Ha of paddy per family	Ha of paddy damaged by flood in 2000
Dong Kasin, Nong Bok	80	122	1.52	119
Na Phoke Tha, Xe Bang Fai	82	120	1.46	108
Keng Pe, Xe Bang Fai	80	120	1.50	105
Tha Hat, Xe Bang Fai (Brou)	54	38	.70	18
Tha Kho Xe Bang Fai	56	119	.47	90
Dang, Na Phong, & Vat That, Mahaxay (Brou)	155 (total 3)	294	.53	"all" **
Na Kieu, Mahaxay (Brou)	86	68	.79	"Most"
Tha Phoxay, Xaibouli	102	108	1.05	"Most of 65"
Tha Kham, Xaibouli	93	96	1.03	"Most of 30+"
Keng Veng, Xaibouli (Phou Thai) (on Xe Noy River)	110	61	.55	"Half"
Kouan Khwai, Nyommalat (Brou) (19 km from Xe Bang Fai River)	36	95	2.64	0
Palay, Xaibouli (mostly Brou)	43	32	.74	"Most"
Som Sa-at, Xaibouli	128	233	1.82	85 Approx.

* Unless otherwise noted, these villages are ethnic *Lao* communities.
** Quotations indicate estimates provided by villagers to the survey team.

In addition to excessive flooding, rice farmers face other problems. In some areas a variety of algae grows in rice fields during the rainy season. Known as *ne khao* by villagers, this algae is apparently toxic to rice. *Ne khao* is reportedly the biggest obstacle to rice agriculture in Ban Pheet Si Khai and a number of other nearby villages in Nyommalat district. It appears to occur only in areas near limestone karsts. Villagers have no way of protecting their rice crop from this algae and it causes large numbers of rice plants to die each year.

Another problem that farmers frequently cite in relation to wet season rice cultivation is the presence of the rice eating pest known in the Lao language as *boua* or *louang ko*. There is a simple method to prevent this pest from infesting rice crops using traditional plant-based remedies but farmers in the study area knew little about these techniques and were eager to hear about them from the survey team.*

All along the Xe Bang Fai River, people describe problems related to flooding but they also accept that the seasonal floods are a normal aspect of life in the river basin to which they adapted and that bring as many benefits as difficulties. However, it is clear that the rainy season rice crop, and therefore local people's supply of this dietary staple, hinges on the nature of the floods. Given the importance of wet season rice farming to people all along the Xe Bang Fai, a much more detailed study of the basin's complex hydrology and agro-ecology is required before any attempts are made to prevent flooding with the narrow objective of (only) increasing annual harvests of the rainy season rice crop.

Upland Swidden Cultivation

Apart from lowland rice-based agriculture, the cultivation of upland swiddens (*het hai*, often referred to in English as 'shifting cultivation' or, disparagingly, as 'slash-and-burn agriculture') is also practised by some communities living in the Xe Bang Fai River Basin. Ethnic minority villagers as well as some lowland ethnic *Lao* farmers cultivate swiddens, in which rice and a large variety of other crops are grown (largely for subsistence purposes). However, the practices and management systems of swidden cultivation often vary according to site-specific ecological, economic, social and cultural characteristics. Generally, in those communities in which swidden cultivation is a long-established practice, rice and other crops are grown (or were grown, see below) on a plot of land for (usually) one to three years, and then the plot is left fallow for (usually) longer than five years to allow the recovery of soil fertility before the swidden is again cleared and used to grow crops.

Due to the diversity of swidden cultivation systems in the basin and elsewhere is Laos, generalizations regarding upland swidden cultivation — and the people who practise this method of cultivation — should be avoided. For example, while the *Brou* people are generally referred to as cultivators of the uplands, there are many *Brou* villages situated along the Xe Bang Fai River where lowland rice paddy farming has been adopted for decades. However, there are also *Brou* villages such as Ban Tha Hat, where some lowland rice is grown as well as small areas of upland cultivated. These upland areas are generally referred to as *souan* (gardens) rather than as *hai* (swiddens), although the differences between *souan* and *hai* are not always clear.

Nor should ethnicity be considered as a factor by which practioners of upland swidden cultivation can be differentiated from lowland cultivators. While the ethnic *Lao* are often referred to as lowland rice farmers, there are some villages in the Xe Bang Fai basin, such as

* Rice seeds need to be soaked in water for two to three days before planting. The technique involves soaking rice seeds in water mixed with cut up and pounded pieces of the *kheua kha ho* vine or neam (*kadao*) leaves (*Acadirachta indica*). These very bitter substances stick to the seeds as they begin to germinate in the water and repels the *louang ko* insect. Since rice plants are vulnerable to the *louan ko* only during the germination period (although the insects eat the inside of rice kernals later when the plants are fully grown), the technique eliminates this pest problem for farmers. In many cases, use of this technique leads to significant increases in crop yields. Moreover, the method is not labour intensive, and since all the products used are locally available in the forests and fields, it is inexpensive and widely available.

Ban Thong Kong in Nyommalat district, where the ethnic *Lao* inhabitants have long been cultivating plots of land in the uplands. In these villages, the areas available for lowland rice cultivation have very porous soils that prevent the accumulation of surface water needed to grow rice. The government has been encouraging Ban Thong Kong farmers to rotate the cultivation of their swiddens over a three-year period — in other words, of leaving swiddens to fallow for only two years before again cultivating these plots. However, villagers prefer to follow a longer cycle — due to concerns about soil fertility and as after only two years of fallow, the trees in the plot have not re-grown to a size sufficient to prevent the growth of grasses on the plot, thereby increasing the amount of labour required to clear the plot of these grasses. Consequently, many of these farmers are presently allowing their swiddens a fallow period of five years or longer, during which time the soil fertility of the swidden has more of a chance to regenerate. Ethnic *Lao* villagers in Ban Keng Pe, in Xe Bang Fai district, also reported that they traditionally mixed lowland rice cultivation with upland swidden cultivation as a way of reducing risk in terms of food security, since their lowland crops were often damaged or destroyed by floods.

Farmers of upland swiddens are under increasing pressure to reduce the area of swidden cultivation or to stop cultivating their upland swiddens altogether. The Government of Laos aims to eradicate upland swidden cultivation by the year 2005, and contends that "slash-and-burn agriculture" is the major cause of deforestation in the country.

5. Domestic Livestock

The raising and sale of small and large livestock is a significant source of income in many villages, especially in the lower Xe Bang Fai basin. In some of these villages, income from the sale of livestock is greater than the income generated by selling fish. However, in other villages the income from livestock is less important or equally important compared to the sale of fish. For example, ethnic *Brou* villagers in Ban Tha Hat, Xe Bang Fai district, sell a considerable amount of fish, making it one of their most important sources of income, as well as an important source of food. However, buffalo in Ban Tha Hat are valued at over one million kip (US$122) each. On average, each family in the village owns more than two buffalo, as well as two cows per family. Most families sell a buffalo or cow once every year or two, making the total value of a single sale greater than the annual income derived from selling fish catches throughout a year.

Large animals, particularly water buffalo, cows and pigs, contribute to the livelihood security of village families in other ways as well. These animals are *de facto* banks for many families — animals can be sold for cash during times of particular need, such as during rice shortages and illnesses amongst family members, or to pay for important ceremonies such as weddings and funerals.

The Xe Bang Fai River, as well as other rivers and wetlands in the basin, acts as an important resource in terms of livestock raising. During the survey team's travels along the Xe Bang Fai, pigs were seen foraging for worms along the riverbanks, water buffalo wallowed in the river and entered it to drink water and eat large amounts of algae and small aquatic plants, ducks swam and foraged amongst aquatic plants in the river's shallows, and chickens, goats and cows drank water from the river. Chickens and pigs are also fed rice bran, and cattle and buffalo are fed rice straw, by villagers raising these animals. The river is an easily accessible source of food and water for livestock, and this reduces the amount of resources — in terms of work and time — that owners of livestock need to devote to the care of their animals. This in turn makes the raising of livestock a more efficient and more economical activity.

However, flooding of unusual depth and/or long duration can have serious impacts on livestock. Animals sometimes drown or are lost as their owners herd them to higher ground. Finding sufficient amounts of feed for animals during flood periods is another problem. And when large numbers of animals are confined in small areas during flood periods, diseases can rapidly infect many of the animals. This is especially true for tick-borne diseases such as

Theileria, *Babesia* and *Anaplasma*, all of which can increase the rate of mortality amongst large livestock. This has also shown to be the case in many other parts of the region, including parts of northeast Cambodia (Pers. Comm., Ashish John, CARERE, 2000).

Another constraint is a lack of food to feed small livestock. Many villagers, such as those in Ban Dong Kasin, reported reducing the number of pigs they raise in recent years due to the low market price for pig meat and the high cost of rice bran as supplemental feed. This is also a constraint in terms of expanding production.

Despite the obvious importance of water buffalo, the numbers of these animals is declining in many villages as farmers increasingly switch to using small-motorized tractors for working the fields. Farmers generally have to sell five or six water buffaloes in order to obtain one small tractor. In many places these tractors are not so much in demand for use in tilling the soil, although they are certainly used for that purpose, as for transportation of people and goods to markets from villages. For example, in Xiang Khai sub-district of Xaibouli district, villagers rely heavily on tractors converted for road travel to transport goods to the market at Khoua Xe.

In the lower part of the Xe Bang Fai basin, there is an additional reason that steadily fewer villagers are raising buffalo — increasing numbers of their buffalo are being stolen, apparently because of the proximity of the area with the Thai border. Water buffaloes are an increasingly rare commodity in Thailand, where their replacement by tractors has almost made buffalo-raising a thing of the past. Villagers in Ban Tha Phoxay and Ban Tha Kham, Xaibouli district, said that if they did not carefully look after their buffalo, they would be quickly stolen and sold in Thailand. There are fewer problems with buffalo theft in areas of the basin that are farther from Thailand, where buffalo are often left to roam freely during the dry season. Villagers in Ban Dang in Mahaxay district and Ban Keng Pe in Xe Bang Fai district release their buffalo throughout the dry season.

Probably the most serious constraint on livestock raising is that disease regularly causes large numbers of animals to die. Community leaders from Ban Keng Pe, in Xe Bang Fai district, reported that there used to be over 200 buffalo in their village, but that over the last two years many have died due to diseases and now only 80 remain.

Villagers from Ban Keng Veng in Xaibouli district said that they had vaccinated their buffalo and cows, but that many had died from diseases anyway. Villagers from Ban Dang, in Mahaxay district, reported that all their buffalo had contracted foot and mouth disease over the last two years. (The presence of foot and mouth disease in southern Laos has been confirmed by the Deputy Director of the Department of Agriculture and Forestry, Chamapassak province.) The name that local people use to describe this disease, *pak peuay long lep*, translates literally as 'mouth disintegrating [and] toe-nails falling off'.

According to villagers in Ban Som Sa-at, Xaibouli district, there were three periods last year when many small livestock died. Villagers in Ban Keng Veng, in Xaibouli district, reported that large numbers of both chickens and free-roaming indigenous pigs died of diseases, and that although vaccinated, many of their buffalo and cows died from diseases also. In Ban Tha Kho, in Xe Bang Fai district, large numbers of free-roaming indigenous pigs died of disease recently.

6. Local Economies in the Xe Bang Fai River

Villages located along the Xe Bang Fai River and villages located a substantial distance from the river or its main tributaries have long-established trading links and interdependent local economies. For example, many villages located away from rivers, particularly in the middle and lower basin, have rice fields outside of the flood zone while many of the rice fields of villages located near the major rivers are within the floodplain. Of the villages with fields outside of the flood zone, some are able to produce a substantial rice surplus on a regular basis. For example, Ban Kouan Khvai, in Mahaxay district, has almost three ha of paddy per

family outside of the flood zone, and harvests frequently yield large surpluses of rice. However, villagers catch relatively small amounts of fish from a small tributary stream, the Nam Houng. Therefore these families trade their surplus rice with villages situated closer to the river in exchange for barbecued fish (*pa ping*), smoked dry fish (*pa heng*), fermented fish paste (*pa dek*), betel nut (*mak khieou*), sweet tamarind (*mak kham van*) and various other goods.

In Xe Bang Fai district, villagers told a similar story. In Ban Keng Pe, villagers explained that they normally trade fish, vegetables grown along the riverbank, and other consumer goods with villagers at Ban Khamphe Nyai (situated eight km from the river) in return for rice and rice whisky. Villagers in Ban Na Phoke Tha also reported trading corn and tubers grown along the edge of the Xe Bang Fai River with other villages for rice, since annual flooding results in chronic rice shortages in their village. District officials in Xe Bang Fai and Nong Bok districts also reported that people from many villages also trade fish and vegetables for rice grown by other communities. These long-established trade patterns, which are evident throughout the Xe Bang Fai basin, illustrate the interdependence of communities, and clearly indicate that those living in flood-prone areas depend on those communities outside of the floodplains, and vice versa.

Table 6. Relative Importance of Various Livelihood Resources for Six Villages on the Xe Bang Fai River

#	Na Kieu Mahaxay	Keng Pe Xe Bang Fai	Pheet Si Khai Nyommalat	Som Sa-at Xaibouli	Kouan Khwai Nyommalat	Nao Neua Xaibouli
1	Fish	Fish	Vegetable gardens	Labour in Thailand	Rice	Labour in Thailand
2	Forest products	Vegetable gardens	Chickens and pigs	Rice	Forest products	Livestock
3	Vegetable gardens	Forest Products	Fish	Bamboo rice-tying bands sold to Thailand	Fish	Fish
4	Local labour		Buffaloes	Chickens/ pigs		Vegetable gardens
5			Rice	Vegetable gardens and fish		Trading
6						Foreign remittance

Note: Village name is followed by district name. Information in this table is based on subjective villager recollection rather than a detailed quantitative survey. Rice is only included if sold for income.

There is obviously a large amount of fish traded and marketed in the Xe Bang Fai basin. For example, villagers in Ban Keng Pe sell 50-120 kg of fresh fish per day to traders who come to the village from Tha Khek district town during the dry season. A daily average about 80 kg is sold. Most carps and catfish sell for about 9000 kip/kg (US$1.10) at Ban Keng Pe and the catfish *pa kheung* (*Hemibagrus wyckioides*), the most expensive fish, each of a weight usually more than 3 kg, sells for 20,000 kip/kg (US$2.44). Two fish traders from Khoua Xe also travel to Ban Tha Hat to buy about 20 kg of fish per day, and Ban Tha Kho villagers reported selling a similar amount. In the rainy season, traders travel to these villages by boat. In other areas, like at Ban Na Kieu in Mahaxay district, villagers sell their own fish at the district town market. Marketing patterns and the economic relations between villages, fish buyers/sellers, and markets differ from place to place.

For those villagers who mostly rely on the Xe Bang Fai River for fishing, the best time to catch fish tends to be in the dry season, while villagers who catch fish in the wetland and water

bodies of the floodplain tend to catch more fish during the rainy season. Traders in Ban Manilat in Xaibouli district reported that it is during the latter part of the rainy season between August and November that most fish is sold by nearby villages as fresh fish. The traders also said that these villagers sell a few large jars of *pa dek* as well.

Fish caught in the Xe Bang Fai River are also sold in Thailand, although it is illegal to sell wild caught fish to Thailand, as the Government of Laos wants to keep fish in the country so as to provide the population with adequate quantities of reasonably priced animal protein. However, the Deputy District Chief of Nong Bok district told the survey team that some fish are illegally smuggled to Thailand by traders. It is difficult to know the extent or the economic value of this cross-border trade in fish.

Other patterns of trade in the local economy of the Xe Bang Fai basin are more easily discernable. River transportation during the dry season is reportedly less than in the past, and there are only a few regular passenger boat services (with many passengers carrying items to be traded or sold in markets) operating in the lower section of the river. Rapids (*keng*) at many places upstream from Khoua Xe make travel by larger boats difficult during the dry season when there are low water levels in the river.

Although many roads along the Xe Bang Fai River and elsewhere in the basin have been recently improved, many villages located along the river are not connected to useable roads. For the people of these villages the river remains essential for dry season transportation, and especially for bringing fish, vegetables and NTFPs to market. Fishers from Ban Pong, Ban Phanang, and Ban Khampeuang in Mahaxay district told the survey team that they bring fish by boat to Ban Keng Pe in Xe Bang Fai district every day, where they are sold to other traders who take the fish to markets in Tha Khek, the capital of Khammouane province. Villagers in the lower Xe Bang Fai basin use boats to bring vegetables to the weekly market at the confluence of the Xe Bang Fai with the Mekong River.

Public Services and Access

The survey team also examined some aspects of public services that relate to the livelihoods of villagers living in Xe Bang Fai River Basin. Health-related issues include access to drinking water and access to health care services. Issues relating to education include availability of facilities and accessibility of education services.

1. Health

Many villages depend on the Xe Bang Fai River directly for their drinking water, especially during the dry season. Mainly women and girls carry water from the river to their houses, often making many trips throughout a day. While villagers have been advised by government and NGO health services that water should be boiled before being consumed, most water consumed by villagers has not been boiled.

During the rainy season river water becomes much more turbid, and so is much less useful as a drinking water source. At that time villagers turn to alternative sources of drinking water, including rainwater and small seasonal streams and springs. However, some people use the river as their main source of water throughout the year.

Some villages in limestone karst areas, including Ban Dang, Ban Vat That and Ban Na Phong in Mahaxay district, obtain their drinking water from small streams that emerge from limestone caves, or *khoun*, that are the sources of these streams. This is a source of drinking water of very good quality, but is only available in some areas at some times of the year. At other times water from the Xe Bang Fai River is consumed in these villages.

Some villages in the lower part of the Xe Bang Fai basin have hand-powered water pumps for obtaining groundwater for drinking and other domestic uses. In Ban Som Sa-at, Xaibouli district, there are three of these pumps used by the community and another 23 privately-owned pumps — water from the Xe Bang Fai is not used much anymore, but among the villages in the basin, the situation in Ban Som Sa-at is uncommon. In Ban Tha Phoxay there are four wells, of which two are not operational and the water from the other two pumps is too salty to drink or use for domestic purposes. Therefore, the village relies on water from two shallow, open wells that villagers have dug, as well as water from the Xe Bang Fai River.

Entrepreneurs in Ban Manilat and in the two-village community of Ban Beung Boua Thong/Ban Nao Neua have set up private systems for supplying water to villagers without easy access to a source of good-quality drinking water. As many of the houses in these communities are quite far from water sources, they prefer to have water piped to their homes. But the cost of this service is very high. In Ban Manilat, water is pumped from the Xe Bang Fai River and treated before being piped to users in the village. One 20 litre container of the piped water costs 1500 kip, and a cubic metre costs 2500 kip. Each month, most families spend 60,000 to 70,000 kip (about US$8) for the piped water, which is a significant expense when considered in relation to the income of families. Some villagers have stopped buying the water due to the high cost, but most have become accustomed to the convenience of water piped directly to their houses. About 10 families have decided that the piped water is too expensive and they continue to carry their own water up from the Xe Bang Fai River to their houses, a distance of approximately one-half of a kilometre. In Ban Nao Neua and Ban Beung Boua Thong, water is pumped from a village well and piped to some families, who are spending between 50,000 to 60,000 kip (about US$7) per month for the water.

Many communities in the Xe Bang Fai River Basin do not have effective access to health services, but this situation is slowly improving. The Japan International Cooperation Agency (JICA) and United Nations International Children's Emergency Fund (UNICEF) have been supporting a vaccination program for women and children in Xaibouli district. And in the same district, an NGO supported the construction of a health centre in Ban Som Sa-at. In some

villages, such as Ban Dang in Mahaxay district, JICA has also supported the establishment of revolving funds that provide local families with the opportunity to purchase medicines as needed, and to contribute to the purchase of basic medicines by the local clinic.

Nevertheless, Mahaxay district officials reported that there are only three sub-district health clinics in the district, and that many sub-district health officials still did not have easy access to basic medicines. In Xaibouli district, the healthcare officer in Xiang Khai sub-district complained about the fact that there is still not a health care centre in the sub-district.

The absence of health care services in sub-district centres and villages results in much suffering that is preventable. In the villages of Ban Dang, Ban Vat That, and Ban Na Phong in Mahaxay district, and like many other villages, malaria and diarrhaea affect the health of members of every family every year, especially at the beginning of the rainy season. Villagers from Ban Na Kieu, also in Mahaxay, said that cholera outbreaks occurred every few years, with some people in the village dying of this illness.

It is clear that, while NGOs and other donors have provided important health care assistance in the Xe Bang Fai basin, many needs remain and there are opportunities for further assistance.

2. Education

The quality and quantity of basic education and schools varies widely in the Xe Bang Fai region. For example, in Ban Som Sa-at, in Xaibouli district, the Japanese government recently provided funding to build a new school. In stark contrast, the school of the *Brou* village of Ban Tha Hat in Xe Bang Fai district has a dirt floor, no walls, and zinc roofing of poor quality. Approximately 88% of school-age children in Xe Bang Fai district are registered to attend school, but in some remote parts of the district less than 50% of children are registered. As an example from this district, in Ban Tha Hat 60% of the children are attending school. But many girls do not go to school, and those who do attend do so for only a few years. There are two teachers assigned by the government to teach grades one to three in Ban Tha Hat. If children are to continue their schooling, they must walk to Ban Keng Pe, about five km away, to study grades four and five. Most of the children do not continue on to grades four or five.

Elsewhere, 95% of the *Brou* children at Ban Dang, Ban Vat That and Ban Na Phong in Mahaxay district, are attending school, even though there are not enough desks and blackboards for all the students. At the school at Ban Na Kieu, also in Mahaxay, only grade one is taught, and children who want to attend grade two to five must cross the river to attend the school at Ban Som Sanouk.

One factor that prevents children from attending school is that some families have rice paddy fields far away from the village and the village school. During the rainy season these families often live in huts next to their fields, and this can result in their younger children not going to school, as it is too far for them to walk on their own.

The education office of Xe Bang Fai district hopes to expand the education system so that all villages have schools that go up to grade five, but it will take a considerable amount of effort to achieve this goal. Generally speaking, the quality and quantity of education is low in remote areas, and is certainly poorer in the upper part of the basin than in the lower part. A number of NGOs have assisted with teacher training and school construction, but the need for further external assistance remains high.

Rural Infrastructure

The survey team also examined some aspects of rural infrastructure that relate to the livelihoods of villagers living in Xe Bang Fai River Basin.

1. Transportation: Roads and the River

Route 13 is the only paved road in the Xe Bang Fai basin, and the Route 13 bridge, Khoua Xe, is the only permanent bridge crossing the Xe Bang Fai River.

Many roads have been built during the past ten years, and some dirt roads have recently been graded and leveled. The construction of new roads is continuing — in Xaibouli district a new road runs from Ban Manilat on Route 13 east to the sub-district centre of Xieng Khai along the Xe Noy River and connects nine villages. Besides connecting these villages, this road has also been used for the transport of logs. Dirt roads extend along both sides of the river from Khoua Xe down to the Mekong. Travel is by small truck, tractor, horse cart (especially in Nong Bok district, where a local variety of small horse is used), bicycle, walking or motorcycle.

Many of the access roads to villages situated along the Xe Bang Fai River are in poor condition and cannot be used during the rainy season. This causes problems for some villages. In Xaibouli district, for example, villagers from Ban Som Sa-at claimed that it was difficult for them to sell their rice at the end of the rainy season, since trucks could not access the village when the road was still wet. People in Ban Keng Phosy reported that they were not able to sell rice last year because of damage done to the access road by flooding.

At Ban Pheet Si Khai, which is situated next to the Nam Pheet, villagers have constructed a long wood trestle bridge for use in walking out of the village and to access the village's forest during the wet season. When water levels are low, temporary bridges are built across many of the Xe Bang Fai River's smaller tributaries. For example, at Mahaxay district town a temporary bridge is built across the Xe Bang Fai.

River transportation during the dry season is reportedly less than in the past, and there are only a few regular passenger boat services operating in the lower sections of the river. Rapids (*keng*) at many places upstream from Khoua Xe make travel by larger boats difficult during the dry season when water levels are low.

While the construction of roads may be a major factor in the reduction of use of the Xe Bang Fai River for the transport of goods and people during the dry season, some roads are in such poor condition that they are not usable even during the dry season. For example, for people in the villages of Ban Veune Xe/Veunesenam, Ban Keng Kasi, and Ban Keng Khene in Xe Bang Fai district, and several villages in Mahaxay districts, the river remains essential for dry season transportation, especially for bringing fish, vegetables and NTFPs to market. Fishers from Ban Pong, Ban Phanang, and Ban Khampeuang in Mahaxay bring fish by boat daily to Ban Keng Pe in Xe Bang Fai district, where the fish are sold to traders who take the fish to markets in Tha Khek, the capital of Khammouane province. Villagers in the lower Xe Bang Fai use boats to bring vegetables to a weekly market along the Mekong.
During the rainy season, the use of boats for transportation increases greatly, as water levels increase and submerge the rapids, and as many roads become impassable due to flooding.

2. Electricity

There are many villages in the Xe Bang Fai basin without electricity, but a large number of villages do have access to electricity and this number has rapidly increased in recent years. Now most villages adjacent to the middle and lower stretches of the Xe Bang Fai River have

electricity. Many villages have been connected to the electricity grid only in the past few years, as many of these are villages where there is potential for the implementation of pumped irrigation projects.

Other Sources of Income

Many villagers also have other sources of income that are not so closely linked to the Xe Bang Fai River. Some of these are long-practised by villagers, such as weaving and other artisanal crafts, while other means of attaining income have become available only recently.

1. Weaving

Cotton is grown in some parts of the Xe Bang Fai basin, and village women then process it and weave it into various items. *Brou* and *Lao* villagers from Ban Tha Kho and Ban Tha Hat in Xe Bang Fai district also sell small amounts of cotton, or trade it for rice or salt. Looms are visible under the houses in many villages, but in some villages many women have stopped weaving. Nevertheless, weaving is an activity that is a relatively widespread and important livelihood activity in the Xe Bang Fai basin, especially when compared to many areas of southern Laos where weaving is rapidly disappearing.

Many of the woven products are for household use within the family, but in some areas products are sold and provide cash income for women. The main items woven are bathing clothes (*phe ta lo*), blanket covers (*pha hom*), and shirts (*seua*). Villagers from Ban Na Phoke Tha in Xe Bang Fai district and Ban Palay in Xaibouli district reported selling bathing clothes to traders at Khoua Xe and Tha Khek for 5000 kip apiece.

At Ban Beung Boua Thong and Ban Nao Neua in Xaibouli district, an NGO-supported project is promoting weaving for village women as part of a non-formal education and literacy promotion initiative. Although there were apparently some problems with the adoption of the project initially, many women appear to have become involved and participation levels are high. According to village women, most of the products made so far have been for household use rather than for sale, but some women said that they are making considerable amounts of income by selling the woven products.

Some villagers sell small quantities of bamboo and rattan baskets. For example, local people in Ban Palay, in Xaibouli district, reported selling hand-made baskets for 6,000-7,000 kip apiece. Villagers from Ban Tha Kho, in Xe Bang Fai district, collect *bai tao* from semi-evergreen forests to make brooms, a few of which are sold. Villagers in Ban Na Phoke Tha, also in Xe Bang Fai district, weave floor mats from the wetland reed locally known as *pheu.* These mats are usually not sold, but sometimes they are marketed at Khoua Xe for 2,000 kip each.

A noteworthy artisanal craft of Nong Bok district is pottery, which is made in large quantities in some villages, and is an important source of cash income for villagers. The survey team did not investigate the details of this pottery-making or its sale.

2. Sale of Labour

Increasingly, local people are working in locations outside of their villages to generate cash income. Some of this labour is domestic — such as working at local sawmills or factories. Local wages are very low – less than US$1 per day — and working conditions are often extremely difficult and dangerous. In Mahaxay district there is a large wood processing factory owned by the Chinese company, Luan Fat Hong Co. Ltd., at km 7 on the road to the district town. The company employs people from many villages in the area. People from several villages, who have worked in the factory, reported long and unusual working hours and a lack of basic measures to protect workers. Workers complained about having to work night shifts from 7 p.m. to 7 a.m., as they believe that they are at much more risk of injury when they work overnight shifts, since they are often sleepy, and are therefore more vulnerable to having

work-related accidents. Last year, after workers complained about the night shifts, the company agreed that it would no longer require its employees to work during the night. But after one week, villagers reported, the company reneged on the agreement, and the factory has been operating for 24 hours a day ever since.

The company pays wages irregularly, and workers must often work for three months before receiving their salary for the first month. According to villagers in Ban Na Kieu, Mahaxay district, about ten people from the village work in the factory for short periods of time, and their monthly wages — depending on amount worked – is from 70,000 to 300,000 kip (approximately US$9 to $40, the higher salary requires working considerable amounts of overtime). In Ban Lao, also in Mahaxay district, villagers reported that people from their village who work at the Luan Fat Hong factory receive wages of between 70,000 and 100,000 kip per month, along with one meal a day at the factory.

Inadequate compensation has been provided when people have been injured on the job. Some workers who have been injured in the factory have reportedly had to leave their jobs without compensation. Other injured workers reported that the company pays only 50% of the medical costs of work-related injuries.

Villagers report that the Luan Fat Hong factory at km 7 is releasing toxic wastes that have poisoned the nearby Houay Siang Sit stream. Villagers described the stream as being full of "black water" and as "dead" — fish no longer live in the stream. While these toxic releases do not reach the Xe Bang Fai River in the dry season, during the wet season the stream — and the pollution — flows directly into the Xe Bang Fai.

Apart from working in local factories, some villagers work in factories in larger cities in Laos, including Vientiane, Tha Khek and Savannakhet. However, the number of people working in these places is relatively small compared to the number working in Thailand.

Many people are now going to work in Thailand, where wages are generally higher than in Laos. This is a sensitive issue as much of this out-of-country work is illegal and villagers and local officials are sometimes reluctant to talk about it. However, it is apparent that working in Thailand is an increasingly common occurrence, particularly in villages in the lower Xe Bang Fai basin, close to the Thai border. Most such work is seasonal in nature, such as working in fruit orchards or in other agricultural work. Some people also work on shrimp farms in eastern and southern Thailand, and some women work as maids and nannies. Agriculture work is more common than working in factories. Many of the people working in Thailand work in Bangkok and in the south or southeast of the country, rather than in the nearby provinces of northeastern Thailand. However, large numbers of Lao people also cross over to adjacent provinces in Thailand for short periods (generally about ten days at a time) to work as rice planters at the beginning of the rainy season. The wage for rice planting is 100 baht per day, and villagers explained that this type of short-term work is legal.

In many of the villages in the lower Xe Bang Fai basin large numbers of people now travel regularly to Thailand for work. A number of villages in Xaibouli district illustrate this trend. At Ban Nao Neua, Ban Beung Boua Thong and Ban Som Sa-at, villagers told the survey team that wage labour in Thailand is now the main source of village income. In Ban Som Sa-at, "more than 40 people" (out of a total population of 677) were working in Thailand during the 2001 dry season. At the same time, in Ban Beung Boua Thong and Ban Nao Neua more than 100 of the 1,400 people living in the villages were reported to be working in Thailand. Villagers from Ban Tha Phoxay and Ban Tha Kham reported that, "Two or three people from each family are working in Thailand."

For people in the lower Xe Bang Fai basin, Thailand's economy provides many opportunities for employment and, as Thailand and Laos have developed more open relations, wage labour in Thailand is an attractive option for many Lao people. There are a number of factors that may explain this trend, including rapid population growth in Laos, declines in the availability of local resources, and increasing materialism and consumerism that is (to some extent) an effect of Thai television and the 'culture' propagated through that medium. In addition to

ensuring the basic food security of their families, many villagers labouring in Thailand have been able to assist relatives, improve their homes, and buy some consumer goods with the income they have received.

While work in Thailand provides opportunities for increased cash income, these opportunities are coming at a price and villagers have many stories of exploitation and bad experiences from working there. As illegal workers, Lao people in Thailand lack legal rights and so are in particularly vulnerable to dangerous working conditions, discrimination and other abuses. Some villagers have returned from Thailand with serious ailments due to exposure to chemicals used in agriculture and industry. Villagers at Ban Nao Neua, in Xaibouli district, reported that two people had returned from working as pesticide sprayers in eastern Thailand and then died soon afterwards, apparently as a result of being exposed to chemicals contained in the pesticides.

While it is a sensitive topic for discussion, it is apparent that there has been a certain amount of trafficking in young girls and women for the sex trade in Thailand. Many villages now say that they no longer allow any younger women to go work in Thailand for fear they will be exploited and forced into the sex trade. However, villagers in Xiang Khai sub-district reported that more women than men are working in Thailand. Village leaders worry that HIV/AIDS is now present in the area and that HIV/AIDS infection is increasing in their communities. Villagers from Ban Som Sa-at, in Xaibouli district, reported that some people in the area had already died of AIDS after returning from Thailand.

One of the most serious social problems in villages located near the border with Thailand relates to village youth, especially young people that have returned from working in Thailand. While the trafficking of women and children, prostitution and HIV/AIDS infection are certainly some of the most acute problems, there are many other issues that also require urgent attention. Amphetamine-use and glue-sniffing are increasing, even in rural villages, and general lawlessness, petty crime, gambling, and violence amongst young people has increased markedly. This is major problem for village leaders and government officials, many of whom do not understand these 'modern' young people, and have few innovative ideas for dealing with their problems. Generally, there is a considerable need for expanding youth-specific programs in the lower part of the Xe Bang Fai Basin.

3. Foreign Remittances

People in some villages, particularly along the lower Xe Bang Fai basin, have relatives in countries such as the USA, Canada, France, and Australia, who left the country during the 1970s and early 1980s. Some of these relatives send money to their families in Laos. While some send remittances on a regular basis, most apparently send money just once or a few times a year. While foreign remittances were not reported to be a significant source of income in most villages, people are often somewhat reluctant to discuss this issue, particularly as the benefits are just to some families and are not available to the whole community. Some families report receiving US$100 to $200 per year, and some have built new houses and/or have purchased tractors, motorcycles, etc., with this money.

External Development Interventions

There are a number of small-scale and large-scale development projects that have been implemented or are being implemented or planned with the objective of providing people living in the Xe Bang Fai River Basin with opportunities to increase their incomes, and to diversify their sources of livelihood. While doubtless being planned or implemented with the best intentions, many if not most of these projects have caused, or have the potential to cause, unforeseen hardships for the people (who have been designated as the potential benificiaries by the proponents of these projects) of the Xe Bang Fai basin.

1. Aquaculture

Aquaculture — the raising of fish in human-made or natural ponds — is not particularly popular in most parts of the Xe Bang Fai basin. However, there are some places where it is practised. There are a few small ponds near the wetlands of Ban Na Phoke Tha where aquaculture with non-native fish species such as tilapia (*Oreochromis* sp.) (*pa nin*), common carp (*Cyprinus carpio*) *(pa nai),* and others are raised in small quantities. The profitability of many of these operations is questionable as the ponds are often vulnerable to flooding each rainy season. One farmer explained that when the floods came last year, he did his best to catch the fish in his aquaculture pond before it was flooded and the fish could escape into the wild. He then kept the fish he caught in a large clay jar (*hai*) until the floodwaters receded more than a month later. However, many fish died during capture and during captivity in the jar. Only a few could be reintroduced into the pond after it was no longer flooded.

In contrast, villagers from Ban Pheet Si Khai, in Nyommalat district, reported that three families have begun raising aquaculture fish species in human-made ponds, and that last year raising fish was reasonably profitable. An NGO has assisted with this project.

In Nong Bok district, one person has made a large investment to raise tilapia in cages in the Mekong River. He reportedly has about 100 cages in which the fish are raised, and he has also begun raising fish in a few cages along the lower part of the Xe Bang Fai River. As this large-scale aquaculture project has begun only recently, it is too early to determine whether it will be profitable or not.

In Nong Bok, there are reportedly some *Clarius* walking catfishes (*pa douk*) raised in ponds situated under the pens of large-scale pig-raising operations. The survey team was unable to access information regarding the profitability of these operations.

2. Industrial Tree Plantations

In some villages, industrial plantation forestry is being promoted. This is mainly through the Asian Development Bank (ADB)-supported Plantation Project . In the most recent form of this project, a private company with majority New Zealand ownership, BGA Lao Plantations, has been granted concessions to develop eucalyptus plantations on 50,000 ha of land in central Lao PDR (of which only a small amount has so far been planted) (Lang, 2001). At Ban Nao Neua, in Xaibouli district, villagers reported that 100 ha of their dry dipterocarp forest area (*pa khok*) was destroyed before being planted with eucalyptus (*mai vik*) in the mid-1990s. The ADB Plantation Project supported the eucalyptus planting. At first, the village agreed to the project, but they later heard rumours that eucalyptus plantations caused soil infertility and made soils planted with eucalyptus unusable for other agricultural purposes.

Villagers also observed that the forest resources that they used to depend when the area was covered with natural forest could no longer be found in the plantation. ADB consultants tried to reassure the villagers that their plantation would not cause soil fertility problems, but locals

remained skeptical. The foreigners with the project could not speak the Lao language, and the villagers reported that they were not able to clearly express their concerns to them. Finally, when the ADB suggested that villagers convert more of there land into eucalyptus plantations, the villagers refused and they have not planted any additional eucalyptus on common lands since then. Some say the project is of little value to the village, and some villagers would prefer to withdraw from the project totally and try to restore their natural forest area lost to the plantation. Villagers are also skeptical as to whether their will be a market for the trees, since some are already large enough to harvest, but so far nobody has offered to buy them.

The sub-district leader from Xiang Khai sub-district in Xaibouli district also reported that eucalyptus plantations were causing forest, soil, and water resource degradation. He has ordered that no more eucalyptus plantations be established in his sub-district, although it is unclear whether he will be able to enforce this order.

Eight families from Ban Manilat, a trading village situated adjacent to Route 13 in Xaibouli district, recently received loans from the Agriculture Promotion Bank (APB) to establish eucalyptus plantations in dry dipterocarp and degraded forests near the village. Each farmer received six million kip (US$732) worth of credit to support the planting of each hectare of land, with each farmer planting two or three ha of land. The money from the APB was allocated for fencing off the areas planted, purchasing eucalyptus seedlings, and buying chemical fertilizers for applying to the newly planted seedlings. The APB has told farmers to use four bags of fertilizer per hectare of land during the first year, and to apply the fertilizer twice a year. After the first year, according to the APB, chemical fertilizers are no longer required. Despite receiving the loans, villagers remain skeptical about this programme, which the APB has been aggressively promoting. One of their major concerns is that they will not be able to sell the wood, or that prices will be so low that it will be difficult for the farmers to make a profit.

Another concern is that forests managed as commons by communities will be replaced with privately-owned industrial tree farms, thus marginalizing the poor and disadvantaged groups in society who previously relied on these commons resources for their livelihoods. For example, some of the eucalyptus plantations established by Ban Manilat villagers are situated near Ban Palay, a largely ethnic *Brou* village in Xiang Khai sub-district. Wild mushrooms are one of the most important sources of cash income for villagers in Ban Palay, and the best areas for collecting mushrooms are in the dry dipterocarp forests that are beginning to be converted into eucalyptus plantations. While dry dipterocarp forests have less economically important trees than semi-evergreen forests, their value to local people is high, since mushroom production is much higher there than in semi-evergreen forests. Dry dipterocarp forests are also important grazing areas for village livestock.

3. Dykes and 'Flood Prevention'

In parts of Xaibouli district along the lower Xe Bang Fai River, a dyke system has been partially constructed between Ban Som Sa-at and Ban Keng Phosy, and the district hopes to expand the system from there upriver to Ban Hat Sai Soung. While the first part of the dyke has reportedly not been very successful in stopping flooding since it was built in 1993, last year it was apparently able to reduce flooding in some areas. If completed, the dyke system would reportedly provide flood protection to over 6,700 people and 4,000 ha of rice paddy land. It is unclear, however, what impacts these dykes are having or will have on water levels and wetlands, or whether they will exacerbate flooding in other areas. It would appear possible that during a year of severe flooding when waters break through the dykes, they might actually end up worsening or prolonging flooding by preventing water from draining back into the main river.

Some village leaders, including those from Ban Dong Kasin in Nong Bok district, claim that the dykes on the Xaibouli side of the river have already worsened flooding across the river in their village. In 2000, it was reported that 71 of the district's 72 villages were subjected to severe

inundation in Nong Bok district. Floods were generally between 30 cm and 1.5 m high. Nong Bok is now planning on constructing its own dyke system for its side of the river, and villagers reported that a crew from Vietnam surveyed the Khammouane side of the river in early 2001 in preparation for building the dyke. At the same time, Xaibouli district is also planning to increase the height of its dyke system from the original height of 2 m to 2.8 m, reportedly with the support of the government of Japan. Last year bags of sand were used to raise the dyke by about 20 cm.

Once dykes are built on both sides of the river, it is unclear where the water that previously entered the flood plains during the rainy season will go or what the impacts will be on the aquatic ecosystem in the area. Local officials and villagers were unclear whether any in-depth study of the issues involved had been conducted or if the mainstream Xe Bang Fai River really has the capacity to channel all the rainy season waters down to the Mekong if the dyke systems are completed. This deserves further consideration as dykes can actually result in increased and more severe flooding when high water levels are reached, as has been demonstrated elsewhere.

Apart from the dykes, floodgates have also been constructed at the mouths of many of the streams that flow into the Xe Bang Fai River in Nong Bok and Xaibouli districts. These *"pit-peut"* gates have been built to help keep streams from backing up and flooding over at times when Xe Bang Fai water levels are high. They also help to retain water in wetland areas at the end of rainy season, as is the case for Ban Na Phoke Tha in the western part of Xe Bang Fai district. However, the *pit peut* on the Houay Pa Pak in Xaibouli district is not high enough up to prevent floodwaters from going over it during most years, and the effectiveness of many other floodgates is not clear. Other developments may also be impacting flooding but they have not been studied in sufficient detail. The Deputy District Chief of Nong Bok district stated that he believed flooding was getting worse due to changes in natural hydrological patterns caused by the construction of roads in the district, which was done without considering the impacts in terms of disrupting natural water drainage.

All along the Xe Bang Fai River people mention problems related to flooding but they also acknowledge that it is a normal aspect of life in this region, to which they are more or less accustomed. But while people have adapted to the flood cycles of the Xe Bang Fai, many are living in a precarious and vulnerable balance and they are susceptible to changes in the hydrological system. Given the importance of wet season rice farming to people all along the Xe Bang Fai, much more detailed study is needed of the basin's complex hydrology. This should be done well in advance of constructing more dykes or initiation of other projects potentially affecting the river flow in this region.

4. Dry Season Rice-Based Agriculture

While the main rice crop is grown in the lowlands of the Xe Bang Fai River Basin during the rainy season, a much smaller second crop is sometimes grown during the dry season. The dry season crop, known as *na seng*, requires irrigation, either through diverting naturally flowing streams into the rice fields or by using water pumps that extract water from rivers or other water bodies. Due to local geographical and hydrological conditions (sufficient water available at the needed elevation) there is very little natural dry season rice farming (*na seng thammasat*) done in the Xe Bang Fai basin.

Ideally, *na seng* could provide an important supplemental source of rice for villagers, for both household-use and even for sale, as the main rice crop is often insufficient to meet local requirements due to flooding, insufficient areas of paddy fields, or damage to crops caused by pests. However, the promise of *na seng* has generally not become a reality due to local ecological conditions and national economic circumstances.

Problems with the Pumps

The Government of Laos, assisted by some international development institutions, is promoting the expansion of *na seng* and dry season rice production throughout the country. In 1997, the government invested US$30 million of its own limited foreign exchange resources to purchase over 7,000 irrigation pumps of various sizes, both diesel- and electricity-powered, from the Indian company, Kirloskar Brothers Ltd. In addition to the purchase of these pumps, investments have been made in the construction of networks of canals and related water control structures to deliver irrigation to the fields during the dry season. In some areas — including Nong Bok, Xaibouli, and Xe Bang Fai districts, and parts of Mahaxay district — the infrastructure associated with these investments has included electricity transmission systems to supply rural communities. However, it is evident that these transmission systems have been built to supply electricity-powered irrigation pumps as the first priority. For example, in Xiang Khai sub-district of Xaibouli district, available electricity supply is already being used for irrigation but connections for household-use have not yet been provided.

Most villagers view *na seng* as a supplement to — not as a substitute for — the main rice crop grown during the rainy season. According to villagers interviewed by the survey team, they do not see irrigated dry season rice cultivation as either a panacea or replacement for their rainy season rice crop, no matter if that crop is occasionally damaged or completely destroyed by floods. In fact, while *na seng* continues to be promoted heavily by the government and some international development institutions, in reality its expansion and whole economic basis are increasingly problematic. This is due in part to the loss of value of the Lao currency, making imports of fuel and chemical fertilizer more expensive. Electricity prices in kip are also increasing rapidly, as part of a belated attempt to adjust prices to compensate for recent periods of hyperinflation. The price of rice, however, remains low in relation to these increasing production costs.

Having been installed only three or four years ago, during the dry season of 2001 all of the diesel-powered pumps along the Xe Bang Fai had been taken out of operation — most were used for just a single season. Not one of these pumps was reported by villagers interviewed by the survey team to be operational, and the survey team did not see a single diesel-powered pump in operation during the dry season of 2001. Farmers interviewed in Mahaxay district provided a typical scenario that illustrates why people have stopped using these pumps. Last season, a farmer spent 800,000 kip (approximately US$100) for basic inputs of diesel fuel and fertilizer for a 0.5 ha plot of *na seng*. However, the market value of the harvested rice was only 490,000 kip. This resulted in a significant loss to the farmer even without the value of labour, rice seed — and of the pumped irrigation systems — being considered. In Ban Tha Kho, villagers used a diesel-powered pump for two years during the dry seasons of 1998-99 and 1999-2000, but their financial losses were so severe that they did not use the pump during the 2000-2001 dry season. Having taken out loans from the Agriculture Promotion Bank (APB) for fuel and fertilizers, the villagers were forced to sell buffaloes and cows to pay back the loans.

The economics for the electric-powered pumps are better than the diesel-powered pumps, but still marginal at best. In Mahaxay district, farmers reported spending 500,000 kip for electricity and fertilizer to cultivate a 0.6 ha plot of *na seng*. The value of the rice harvested, at the quite good yield of 3.3 tonnes/ha, was 560,000 kip. Once the value of labour, and the capital costs of rice seed, and the costs of the pumps and irrigation systems are included, this slim profit also becomes a net loss. A farmer in Tha Khek district in Khammouane province effectively summed up the situation in the following way: "The price of electricity is high, the price of fertilizer is high, the price of rice is low."

The economic realities of pumped irrigation appear to be contributing to a general decrease in the area of *na seng* being cultivated. While many of the electricity-powered pumps were operating during the dry season of 2001, use of the pumps is declining — continued use of these pumps seems to be occurring only because local government officials are encouraging farmers to do so. Nevertheless, at Ban Dong Kasin in Nong Bok district, nearly all villagers told the survey team that they had been involved in *na seng* cultivation during the previous year

(1999-2000 dry season), but that only half of their number were doing so during the 2001 dry season. At Ban Som Sa-at in Xaibouli district,villagers had been gradually increasing their *na seng* over the last four years — from 30 ha in 1997-98 to over 200 ha in 1999-2000, but in 2001 the area of irrigated *na seng* totaled just 80 ha. Farmers in villages all along the Xe Bang Fai River recounted similar experiences with dry season pumped irrigation.

At Ban Keng Savang, just outside Mahaxay district town, an additional problem related to pump irrigation is becoming dramatically apparent. The poorly engineered installation of a pump system there has resulted in leakage from the pipe connecting the pump to the top of the riverbank, and is causing massive erosion of the riverbank. The pipe is in imminent danger of collapsing. If this pipe collapsed during the dry season, the entire irrigated rice crop covering eight ha and vegetable gardens on another eight ha, both dependent on a regular supply of water, would be destroyed.

Farmers that rely on pumped irrigation of dry season rice crops are also vulnerable to financial loss because of mechanical break-downs of pumps — a break-down that stops the supply of irrigation water for only a few days at certain periods of the growth of rice plants can cause irreparable damage to the whole crop. Villagers in Ban Som Sa-at were forced to take out a loan of two million kip (US$244) from the APB to repair the electricity-powered pump they were using last year.

The potential benefits of these pumped irrigation projects have often been over-estimated. For example, the pumped irrigation system installed in late 1997 to supply the villages of Ban Dang, Ban Na Phong and Ban Vat That in Mahaxay district was promoted as being able to provide dry season irrigation to all of the rice fields in these three villages, totalling 294 ha. But as of 2001, only between 37 and 57 ha had ever actually been irrigated. Parts of the canal system were poorly constructed and are already deteriorating due to erosion and lack of maintenance, further reducing the potential of the system to irrigate a larger area of land in the future.

Finally, villagers informed the survey team that government officials were telling villagers that the cost of the pumped irrigation systems must be paid by the villagers themselves. According to villagers, government officials did not tell the villagers that the pumps would have to be paid for, nor did the officials tell villagers how much the pumps cost. In Ban Som Sa-at villagers said that government officials had said that one pump cost 460 million kip and that villagers are expected to pay this amount back to the government over a twenty-year period — each farmer must contribute 150 kg of rice per ha per year for the loan repayment. The economics of dry season pumped irrigation is already marginal (at best) and this added expense is further contributing to disillusionment and frustration on the part of many farmers.

Contributing Factors Associated with Problems Related to Dry Season Irrigation

While negative net economic returns from dry season pumped irrigation rice crops are the major factor in the increasing abandonment of pumped irrigation by farmers in the Xe Bang Fai basin, several additional problems have also arisen that are further hindering the potential for dry season irrigation. Fields that are used for both rainy and dry season rice crops are experiencing greatly increased populations of stinkbugs (*meng kheng*) and grasshoppers (*tak ten*), both of which are causing serious damage to both dry season and wet season rice crops. Stinkbugs, which have a five-month life cycle, previously died out in the dry season, but they now flourish as rice fields are wet and full of rice plants (apparently the preferred food of stinkbugs) most of the year. Pesticides have not been effective in preventing wide-scale damage to the crop.

In several villages, farmers told the survey team that problems had been caused in *na seng* cultivation due to the porous local soils and resulting rapid seepage of irrigation waters out of rice fields. This makes pump irrigation especially uneconomical. This problem was reported at

Ban Tha Hat and Ban Keng Pe in Mahaxay district, and at Ban Thong Kong in Nyommalat district. Villagers at Ban Thong Kong believe this problem affects many parts of Nyommalat district, and that these natural conditions are one of the most important factors that limit the potential expansion of irrigated dry season rice crops. They pointed out that water only remains in rice fields adjacent to the Houay Khama (also known as Houay Khieou) when the stream is full of water and the soil near the stream is completely saturated with water.

Problems are being experienced in some villages related to grazing buffalo, which were formally allowed to roam freely during the dry season, as has long been the common practice in many villages in the middle and upper parts of the Xe Bang Fai basin. Now villagers must keep their buffalo tied up during the dry season, build fences to protect their dry season rice fields from grazing buffalo, or release the buffalo in the daytime and then try to catch them and tie them up at night. Regarding the latter practice, several villages reported that this has nevertheless led to problems with buffalo getting into rice fields and damaging crops — leading to conflicts between villagers.

While many villagers told the survey team that they would like to do more *na seng*, they also said that they are increasingly worried about the trade-offs involved and, as a result, are not enthusiastic about dry season pumped irrigation at present. Many are concerned that they will not be able to pay back the loans they have borrowed from the APB. Meanwhile, local officials — who appear to be under pressure to show results that achieve targets set by government policy — continue to promote *na seng* while over-estimating the area of *na seng* currently in production as well as the potential for its future development. For example, officials from one of the districts visited reported that they had expanded dry season irrigation beyond the target levels set by the government. However, during visits to a number of villages in that district, most farmers reported that they had in fact reduced the amount of land under dry season irrigation in comparison to the previous year. Some villagers expressed interest in the idea of growing other crops requiring less water during the dry season, although they also expressed concerns about the potential market demand for such crops. Their concerns are justfied; this year in some areas of the basin there appears to be an over-supply of watermelons, which have become a popular dry-season crop over the past few years.

5. Large-Scale Irrigation Systems

Apart from the relatively small-scale pump irrigation systems described above, there are also a number of larger irrigation systems in the Xe Bang Fai basin. They are either completed, under construction, or in the planning stages. The survey team did not investigate any of these systems in detail.

Xe Bang Fai district officials did report that one large pump and canal irrigation system that had been built in the western part of the district. Constructed at a cost of US$8 million, the water pumped from the river was expected to irrigate 3,000 ha of dry season rice paddy in an area situated many kilometres from the river. However, during discussions with the survey team, these officials said that only 500 ha of that area were actually being serviced by the system in 2001. Another large irrigation project now under construction is the Vieng Phi scheme, which is planned to use large-scale pump irrigation from the Xe Bang Fai River to irrigate part of Xe Bang Fai district. The project will not be completed for at least three years. The Phouheuasaova irrigation project is located on the Xe Bang Fai River in Xaibouli district. This project, which began in 1998 and is presently under construction, involves creating a large reservoir, and building anti-erosion structures and feeder canals for the irrigation system. The project is being implemented in cooperation with the Japanese company Ebara and is expected to be completed by the end of 2001. The project involves three pump stations for taking water from the Xe Bang Fai River to irrigate 2,000 ha of wet rice fields in the dry season. One of the pumps has already been installed. The total cost of the project is about US$ 8.7 million.

One of the largest irrigation schemes envisioned for the lower Xe Bang Fai basin is still in the planning stages. It would involve building a water diversion dam across the Xe Bang Fai River at the Keng Keo rapids, just down river from the confluence of the Xe Noy River with the Xe Bang Fai River. According to villagers, for a number of days three or four years ago, a large group of people came to survey the area to investigate the scheme's feasibility. Although villagers had little information about the proposed scheme to provide to the survey team, as far as they know the project would result in the diversion of water from the Xe Bang Fai River. This would be done through blocking the river and creating a reservoir that would back-up into the Xe Noy River. The water would then be channeled through a canal system in Xiang Khai sub-district and into Atsaphone district, Savannakhet province, for irrigation during the dry season. Villagers reported that all the communities in Xiang Khai sub-district would have to be relocated if the project were to be implemented, but they did not know about the details of the project or when the project would be implemented. Villagers did report that Keng Keo is one of the most important fishing grounds in their part of the Xe Bang Fai River.

There is also a proposal to expand irrigation in Nyommalat district as part of the diversion of large amounts of water from the Nam Theun River Basin into the Xe Bang Fai River by the Nam Theun 2 hydropower project (Scudder *et al.,* 2001; SMEC, 1996; Kottelat, 1996). However, funding for the construction of the Nam Theun 2 project has not yet been secured (Scudder *et al.,* 2001).

The objective of all of the projects described above is a massive increase in the area served by irrigation during the dry season. But recent experience in the Xe Bang Fai basin and elsewhere in Laos provides cause for caution. The potential benefits of *na seng* irrigation have often been greatly over-estimated.

Expansion of irrigation is often a slow long-term process involving a great amount of village labour and investment. Seldom is it an easy solution leading to a rapid increase in villager food security and income. As described by villagers, the current problems with dry season pump irrigation in terms of economics and pests, as well as soil quality in some areas, represent formidable obstacles to its rapid development.

Women, Their River, and Livelihoods

Gender plays an important role in determining how local people harvest and use many river-based resources. Women have distinct roles in managing, using and conserving natural resources. Many if not all of the communities living in the lowlands, including the *Lao, Phou Thai* and *Kaleung* ethnic groups are matrilineal societies, and women have the primary responsibility for managing household financial resources. They also do most of the selling of the marketable goods harvested and collected by family members, are responsible for the purchase of goods that satisfy the needs of their families, and are the managers of the cash reserves and financial expenditures in most families. In other ethnic communities, such as the *Brou*, men have a more prominent role in the management of money and its use.

While men plow the rice fields, the women plant the rice seedlings and do most of the rice harvesting. They do much of the watering and tending of riverbank vegetable gardens. Women also take care of and feed domestic animals such as pigs, chickens, and ducks. Women, including young girls, carry water up from the Xe Bang Fai River in places where it is the primary drinking water source, and they use its water for washing dishes, clothes and other items.

Women weave cloth for the use of their families and sometimes for selling to generate extra cash income. Ethnic *Kaleung* women from Ban Pheet Si Khai, in Nyommalat district, also appear to make more baskets than women from other Tai language-speaking groups. They were seen weaving bamboo fish scoop-baskets (*kheung*), rice baskets (*ka tip* and *ka boung*), rice steaming baskets (*houat*) and back-baskets (*ka yang*) for carrying wild vegetables, bamboo shoots, mushrooms and other forest products.

Women play a significant role in fishing, often at the beginning and the end of the rainy season, and in the dry season when river flows are not too strong. It is mostly men who fish in perennial water bodies, including oxbow lakes, natural depressions and rivers. They use a wide variety of fishing gears — although gill nets (*mong*), cast nets (*he*), hooks (*bet*) and seasonal barrier traps (*tone*) are generally the most important. Women target smaller fish and primarily fish in small water bodies, including seasonal wetlands and small streams. Scoop-nets (*saving*), scoop-baskets (*kheung*), and lift-nets (*kadoung* or *sadoung*) are the main fishing gears used by women.

The fish that women catch are often mixed with various other kinds of aquatic animals. Fish, shrimp, crabs, snails and aquatic insects are often scooped up in rapids or from along the roots of flooded forest trees. The fish and other aquatic animals caught are small, but they provide families with important sources of protein. Men tend to not be interested in catching such small fish. For this reason women from Ban Thong Kong in Nyommalat district catch more fish by weight over a year than men – the water bodies near this village, which is far from the Xe Bang Fai or any other major streams or rivers. Therefore, for most of the year the men are largely uninterested in fishing in the area, since the gears that they use are not suitable for catching the small fish in the small water bodies that can be found all year round. However, for the women, their gears are perfect for catching these small fish, and they regularly do so.

Women also collect many varieties of wild vegetables from riverine and wetland forests. Women generally play a major role in the gathering of aquatic and forest plant resources.

Despite some small differences, most of the livelihood activities conducted by ethnic *Kaleung, Phou Thai* and *Lao* women are similar. While there are more differences between the livelihood strategies of *Brou* women and of Tai language-speaking women, these differences are probably less notable in the lower and middle parts of the basin compared to those *Brou* living in the uppermost parts of the basin. *Brou* living in lower areas have been living in close contact with *Phou Thai* and *Lao* people for a long time, and have adopted many of the practices of these dominant groups. Unlike most of the *Brou* in the upper part of the basin — who have a history and livelihoods based on upland swidden cultivation — the *Brou* in the

lower areas of the basin are for the most part engaged in lowland rice paddy agriculture. It seems certain that the adoption of lowland agriculture will have required *Brou* women to make significant changes in their livelihood and cultural activities. But there are still a number of differences between women from the various ethnic groups found in the basin, and most *Brou* women continue to speak their own language.

Natural Resources Conservation and Management

The sophisticated local ecological knowledge systems of the people of the Xe Bang Fai River Basin is the basis for these people's use, management and the conservation of the natural resources of the basin. The survey team documented community management of rivers, wetlands and water bodies in the floodplains, along with forests and other important natural resources. This is not to say that villagers are not also sometimes responsible for the overexploitation of resources. However, there is certainly much to be learned from the local communities of the Xe Bang Fai basin regarding the management of the natural resources upon which they rely for their food security.

Community natural resource management systems are most clearly illustrated by regulations and restrictions agreed to by communities regarding the use of their natural resources. For example, in Ban Som Sa-at, Xe Bang Fai district, villagers have agreed to prohibit the use of large seine fishing nets of more than 10 metres in length (*kvat nyeng nyai*), while the use of smaller seines is permitted. Villagers also prohibit the poisoning of fish and the use of electricity and explosives to catch fish; due of these regulations, these methods have apparently not been used in the area of Ban Som Sa-at for many years.

A number of villages in the Xe Bang Fai basin prohibit fishing in the pools of water located in caves (*khoun*) at the base of limestone karst formations. For example, villagers from Ban Pheet Si Khai, Nyommalat district, told the survey team that the origin of the Nam Pheet River, *Khoun Nam Pheet*, is protected by spirits, and that nobody is allowed to catch fish there or even to go inside the cave. Other villagers reported that these cave pools are dry season refuges for fish and therefore fishing is prohibited. A previous study (Baird,1998) found that many villages in Khammouane province have similar practices of protecting these important water sources and dry season fish refuges. Another study (WWF and WCS,1999) found that in Boulapha district, the communities of Ban Nyavay, Ban Nong Ping, Ban Vang Nyao and Ban Pha Nop, in the upper Xe Bang Fai basin, have instituted rules that prohibit people from fishing in specific areas such as caves, ponds and certain stretches of the river.

The sophistication of the natural resource conservation systems of the communities of the Xe Bang Fai River Basin is illustrated by the method employed by many of these communities regarding the harvesting and protection of edible snails in areas of the floodplain, such as wetlands and rice fields. During the rainy season, groupings of large numbers of two species of snail (*hoi choup* and *hoi khong*) are often seen on the moist soil along the edge of flooded rice fields. Villagers refrain from harvesting these snails during the rainy season and instead harvest them during the dry season, when the individuals of these snail species have grown to a larger size. As they harvest these snails, villagers leave about five per cent of the snails where they found them, to ensure that the populations are not depleted. The survey team found that this practice is commonly known and adhered to by villagers in many parts of the Xe Bang Fai basin.

As with the fishes living in the pools in the caves of limestone karst formations described above, there are other species of wildlife protected by the belief systems of communities. Crocodiles and other wildlife in Ban Beung Boua Thong and Ban Nao Neua (see box: The Protected Crocodiles, Wetlands and Forests of Ban Beung Boua Thong and Ban Nao Neua) are protected by local communities according to their belief systems. The survey team was also told by villagers that crocodiles living in a natural, year-round wetland near Ban Na Khon, in Outhoumphone district, Savannakhet province, are similarly protected from human predation (the survey team was not able to confirm these reports or visit Ban Na Khon). Of course, crocodiles are not the only animals protected according to community belief systems. The survey team was told by villagers that in Ban Na Kham, Nong Bok district (the team did not meet with people from Ban Na Kham), the community protects the hard-shelled turtle, *tao sam san*. The species is said to be abundant in the village's protected forest located some three km from the Xe Bang Fai River.

A combination of common sense, local ecological knowledge and local belief systems also oblige many villages to protect and conserve all types of forest. For example, villagers in Ban Keng Veng in Xaibouli district reported that their long-established traditions prohibited the cutting of large trees near the house of the village spirit (*ta ho*). Villagers in Ban Thong Kong, in Nyommalat district, told the survey team that they have long protected a forest (*pa khet*) where village spirits prohibit the cutting down of trees. In Ban Pheet Si Khai, also in Nyommalat district, villagers have not permitted any cutting of trees living in the vicinity of the summits of the large steep mountains surrounding their village, as such cutting could result in erosion that could damage the streams and rice fields of the community. The village also has a protected lowland forest that was delineated a few years ago with the help of an NGO, and the villagers continue to protect this forest from logging and other exploitative practices.

Natural resources are also conserved by local communities for a variety of other reasons. Villagers in Ban Som Sa-at, in Xaibouli district, informed the survey team that they have established part of the Xe Bang Fai River near their village as a "tourist area" (*leng thong thieo*). The area, known as Keng Hat So, includes a series of shallow-water rapids exposed during the dry season. The area is a place of considerable cultural and livelihood importance to local people. It is the best fishing grounds near the village. However, only "normal" fishing is allowed in the area, and local people prohibit the use of *houm* (piles of wood debris used to catch fish) along the one km stretch of river that is considered to be within the tourist area. This fishing method is seen to be incompatible with the cultural values of the area. During the Lao New Year (mid-April), many people from villages near Keng Hat So come together at the rapids to feast, sing, play and celebrate the new year with their family, friends and neighbours.

The Protected Crocodiles, Wetlands and Forests of Ban Beung Boua Thong and Ban Nao Neua

The ethnic *Lao* communities of Ban Beung Boua Thong and Ban Nao Neua are situated a few kilometres south of the Xe Bang Fai River in Xaibouli district. Although previously a single village, in 1972 the community was separated into two villages, which presently have a total population of 250 families, or approximately 1,400 people. These villages are quite unique in terms of their traditional forest and wildlife conservation practices. The villages are located adjacent to two large, year-round oxbow lakes: Nong Boua (500 m long and 200 m wide) and Beung Boua Thong (800 m long and 800 m wide), both of which are flooded during the rainy season and the waters of which fed by an underground spring during the dry season. There is also a third oxbow lake, the largest of the three, called Beung Saiyan (4,000 m long and 1,000 m wide), situated within walking distance from the villages. The two villages are exclusively responsible for the first two lakes, while a total of six villages utilize Beung Saiyan for fishing. Fish migrate into Beung Saiyan and other wetlands in the area from the Xe Bang Fai River.

Villagers in Ban Beung Boua Thong and Ban Nao Neua told the survey team that they have long believed that Nong Boua and Beung Boua Thong are protected by powerful spirits. The village spirit house (*ta ho*) is situated on the edge of Beung Boua Thong but houses the spirit protecting both wetlands. According to villagers, fishing in the wetlands has been prohibited for as long as anyone can remember. However, villagers did recount an experience that re-affirmed the community's belief in the necessity of prohibiting fishing — in 1966, a very large fish was caught in Nong Boua and eaten by villagers, in violation of the community's customs. Shortly afterwards, people became seriously ill, and within a relatively short period of time between 86 and 160 people (two separate reports from villagers) had died. The water in Nong Boua and Beung Boua Thong is said to have turned red on the same day, but not because any human blood entered the water. Convinced that these deaths were due to the fish being caught in Nong Boua, villagers became increasingly vigilant in protecting the wetland from being

fished or damaged in any way by humans. Fishing in Nong Boua is now completely prohibited, and is only allowed around the edge of Beung Boua Thong.

Approximately 100 metres from the villages, the wetland forest surrounding Nong Boua is in pristine condition, with no gardens or rice fields having been established adjacent to the swamp. The main wetland tree species surrounding Nong Boua are *mai ben*, *mai va* and *mai seng*. There are some *choke* water plants at the edge of Nong Boua, and (unfortunately) some *phak top* (water hyacinth) was introduced into Nong Boua a number of years ago. Now villagers are trying to reduce the amount of *phak top* by pulling it out of the water and leaving it to dry out and die around the edge of the lake. Only the collection of water from Nong Boua for domestic use is allowed, along with a small amount of harvesting of small-sized frogs (*khiat*), crabs (*kapou*), and *nam mak chap* plants, which have edible leaves and stems. Boats are never allowed on the waters of Nong Boua.

The fish in Nong Boua are abundant, but are never harvested. This is because the spirits of the area are believed to be within the crocodiles (*khe*, *Crocodylus siamensis*) that inhabit all three lakes (moving between them according to the season). The fish cannot be caught because they are the food for the crocodiles. Although the survey team had heard about the crocodiles of Nong Boua and its associated wetlands — these crocodiles are well-known throughout the district — the survey team did not expect to actually see a crocodile as they are extremely rare and endangered wild animals, known to exist in only a few places in Laos. To the surprise of the survey team, however, one was seen and photographed, as it bathed in the mid-day sun.

Villagers are not certain how many crocodiles remain in the area, but they believe that there may only be two individuals, as they see crocodiles of only two sizes. There were apparently a number of crocodiles living in Nong Boua before, but they were killed and sold to Thailand in the early 1960s, before the illness and deaths in 1966 (see above). Since then, however, the capture or killing of the crocodiles has been prohibited. While the villagers know where the crocodiles lay their eggs in May or June of each year, they say that the eggs have not hatched for many years. Villagers have concluded that the remaining crocodiles may be all females.

Local people are not afraid of the crocodiles, which have never attacked people (although they do occasionally snatch small dogs and pigs that forage near the edge of Nong Boua). Many people believe that their welfare as a community is closely linked to the welfare of the crocodiles. Some villagers even keep pieces of crocodile dung in their houses for good luck, and whenever an animal is killed in the village during a ceremony, some of the meat is brought to the edge of Nong Boua to feed the crocodiles. According to the villagers, they are able to call one of the wild crocodiles up to the edge of the wetland; they feed it meat, and then it returns to the water. Even if there are hundreds of people watching, the crocodiles still emerge from Nong Boua to eat the meat.

Villagers would like to increase the crocodile population in the area through introducing a male crocodile to the lakes, so it could breed with the remaining females. While a full assessment of the crocodile population in the area is required before any new crocodiles are introduced to the area, the uniqueness of the situation certainly warrants further investigation. There may be the potential for increasing the crocodile population in the wetlands.

Apart from protecting the crocodiles, wetland forests and fish in Nong Boua, the villages also prohibit hunting around Nong Boua and Beung Boua Thong. A village headman of Ban Nao Neua explained, "We do not allow the sound of a gun to be heard in this area." Even sling-shots cannot be used within 100 metres of the lakes. As a result, bird life in the area is relatively plentiful, and there is a large flock of maybe more than a thousand lesser whistling ducks (*pet deng*) that move between the lakes. There are also other species of wild ducks (*i.e.*, *pet bong*) in the area, as well as various other species of

water birds. Soft-shelled turtles (*pa fa*) and hard-shelled turtles (*tao sam san*, *tao khwai* and *tao na*) are also reportedly found in and around these lakes.

Ban Nao Neua/Ban Boua Thong also has a large community dry-land forest adjacent to Nong Boua, that is approximately three km long and two km wide. Logging in this forest is not allowed, and villagers are determined to protect the forest for the benefit of future generations. Traditional medicine doctors are allowed to collect small amounts of plants not available in other forests from the community forest. A limited amount of firewood collection from the forest is also allowed.

Summary and Conclusions

River-based livelihoods involve a combination of many different linkages and relationships between people and their rivers. While rice fields, fisheries, livestock, and vegetable gardens are the most visible components of local livelihoods and economies, many other resources are perhaps less visible but no less important. Many of these less visible components of local livelihoods can only be appreciated and understood in the light of the knowledge and experiences of local people living along, and with, their rivers. Together, aquatic and forest resources form the foundation of livelihood security for many of the people living in the Xe Bang Fai River Basin.

The Xe Bang Fai River and its tributaries form a complex hydrological system that has not been well-studied and is little understood by outsiders. But it is clear that the people living in the Xe Bang Fai River basin have adapted to the specific environment of the area and have a sophisticated knowledge of the complex inter-relationships of diverse ecosystems in the basin. Consequently, local communities have long-established mechanisms that allow them to sustain and benefit from their natural resources while living within their natural environment. It should be noted however that this fragile balance is threatened by certain activities occurring in the basin — activities that are often not undertaken in support of, or in accordance with, the livelihood activities and natural resource management systems of local communities.

The complexity and variety of these natural resource management and development issues, and the potential vulnerabilities of the more than 120,000 people whose livelihoods are linked to the Xe Bang Fai River and its tributaries, deserves more recognition and requires much more in-depth research. This research would inform decision-makers, NGOs and donor agencies considering involvement in the Xe Bang Fai River Basin and would contribute to a better understanding of river-based livelihood issues in river basins throughout Laos. An understanding and appreciation of these livelihood links is essential for informed decision-making about proposed development initiatives — from projects targeting a single local community to projects that can affect entire river basin.

It is impossible to overestimate the importance of the rivers, wetlands, fields and forests, of the fisheries and NTFPs, to the means of livelihood security of the people living in the Xe Bang Fai River Basin. In the words of a female elder of a village in Mahaxay district:

> ***"I was able to raise five grandchildren because I could catch fish, shells, and crabs in the stream during the dry season and find bamboo shoots, rattan shoots, and wild vegetables in the area near the stream. I fished in the rice fields during the rainy season. I have not had much money but my grandchildren and I have been able to survive."***

This quote illustrates the findings of this survey. The fact is, people in the Xe Bang Fai River Basin are not only surviving. They are able to achieve levels of food security and economic self-sufficiency due to the natural wealth of the river basin and people's knowledge — a sophisticated and dynamic knowledge that is the legacy of the observations, inventions and experimentation of many generations of people living in the basin. The Xe Bang Fai River, and

the watersheds, tributaries, forests, wetlands and floodplains of the Xe Bang Fai basin, are the foundation of the means of livelihood security of the people living in this river basin. The Xe Bang Fai River is the cornerstone of this foundation.

River-based livelihoods in the Xe Bang Fai region involve many aspects, which vary over a large geographical area and affect a significant population. There are complex inter-relationships existing between many of these livelihood links. The intensity of the rainy season flooding may have an impact on the main rice crop but can leave the soil better off for dry season crops. Fish are abundant during the natural flood periods, and — along with riverbank vegetable gardens — are essential to people's diet, health and income. They are especially important in years when floods destroy large amounts of the main rice crop.

The Xe Bang Fai and its tributaries form a complex hydrological system. Both rainy and dry season river levels have major influences on wetlands and seasonally flooded forest areas of great livelihood importance for local communities. The impact of the river level in the Mekong on the Xe Bang Fai, as well as of the level of the Xe Bang Fai on its tributaries, is unclear. Many of the river's characteristics have both positive and negative features. Dry season rapids impede transportation but are an important habitat for fish. Rice field flooding deposits valuable nutrients for the soil — but too much flooding destroys the rice seedlings leading to losses.

It is clear that the people living along the Xe Bang Fai have adapted to the specific environment of the area. Long-established coping mechanisms are in place that allow them to live with the natural environment. However, in many ways this is a fragile system that is very vulnerable to change.

Some changes — population pressure, forest loss, modernization, and a decline in other natural resources — are already under way. People have had to respond by developing new sources of income, some of which have led to new problems and challenges. Some solutions, such as dry season irrigation and the selling of labour in Thailand, have involved many trade-offs and have been problematic. All along the Xe Bang Fai people express an appreciation of these challenges and an interest in looking at how better to conserve their remaining natural resources and livelihood links to the river for their communities' long-term benefit.

The complexity and breadth of these issues, and the potential vulnerabilities of the more than 120,000 people whose livelihoods are linked to the Xe Bang Fai, deserves more recognition and requires much more in-depth research. This would be of benefit both for decision-makers and NGOs and donor agencies considering involvement in this area and for furthering understanding river-based livelihood issues throughout Laos. Without understanding and appreciation of these livelihood links, there is the danger that poorly conceived development initiatives, even if well intentioned, could have many unforeseen results and the potential for doing more harm than good.

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Appendix 1

Glossary of Lao Terms Used

Ban	village
khoua	bridge
pa	fish
pa	forest
pa dek	fermented fish paste
phak	edible vegetable
nam	river
xe	river
houay	stream or small river
keng	rapids
tat	waterfall
pak	mouth (of river or stream)
beung	large perennial pond, swamp or lake
nong	perennial or seasonal pond or small lake
nong sa	human-made pond
mai	tree or wood
seng	wetland forest area
tham	wetland forest area
khoun	mouth of stream at the base of a mountain
say phou	mountain chain or ridge
tham	cave

Appendix 2

Explanation of Population Data and Estimates

The survey team obtained records of village names and populations directly from the district administrations of Nong Bok, Xe Bang Fai, and Mahaxay. Population figures for Xaibouli, Nyommalat and Boulapha, based on data from 2000, were obtained from the National Statistics Office in Vientiane. Population data were collected in all villages visited and compared to district statistics.

District and national statistics tended to be out-of-date and to underestimate the actual population. Statistics directly gathered from village headmen generally showed higher village populations. This disparity was often in the range of 5 to 10% but in some places reached 20% or more. However, other than for the 24 villages visited, district/National Statistics Office figures are used. It should also be noted that village populations along the Xe Bang Fai are increasing rapidly, possibly 2-3% per year in some villages. Five years from now the total population figure for the area may have increased by 10-20% or more.

Determining an accurate figure for the total number of people with direct or indirect livelihood links to the Xe Bang Fai and its main tributaries is difficult and would require extensive further research. We have tried to crosscheck information and to be as accurate as possible given the resources available and to err on the side of caution since our data suggests that the size of the population dependent on the Xe Bang Fai is significantly larger than previous estimates would indicate. Some errors in village names, locations and populations are probably inevitable. There were a few minor discrepancies between these village reports and district data, which could not be resolved within the available time. Only partial information about the ethnic composition of individual villages was available.

In trying to determine the overall number of villages and people dependent on the Xe Bang Fai River for their livelihoods, some assumptions and estimates have to be made given the available data. For villages in Vilabouli and Atsaphone districts in Savannakhet along the Xe Bang Fai tributary, the Xe Noy River, village names were provided but not populations. The researchers decided to estimate village populations based on average village size in the districts where such information was available and then to reduce this amount on the assumption that villages on tributaries may be smaller than average. Thus, an estimated population for these villages was set at 250 people per village, even though the average village population was 372 people in villages for which data was available.

Using this framework, a total of 49,876 people are living in 115 villages along the banks or within a short walking distance of the Xe Bang Fai mainstream. (An additional nine villages were reported but not confirmed with district data). An additional 17,254 people were estimated to be living in 55 villages along three major tributaries (Xe Noy, Nam Oula, and Nam Pheet). The numbers living along several other main tributaries (Houay Vay, Houay Sayphay, Nam Kathang/Nyom, Nam Ngo, and Nam Piat) were not calculated or estimated and are not included in this total. All together, this totals 170 villages and 67,130 people. The actual number is likely to be significantly higher due to the conservative assumptions made by the research team and the lack of inclusion of any population data from several major tributaries of the Xe Bang Fai.

In addition, the mainstream and its main tributaries all have smaller tributaries upon which many additional people depend for fishing and other livelihood resources. For example, on the Xe Noy, minor tributaries include the Xe Bay in Vilabouli district of Savannakhet on which there are 12 villages, the Nam Meng, also in Vilabouli, on which there are 3 villages, and the Nam Kapaw and Nam Mo, each with several more villages.

There are also many additional people living in villages further away from the mainstream and its tributaries but who depend on the Xe Bang Fai for parts of their livelihoods. Their connections include fishing, vegetable growing and gathering, and the collection of other aquatic or forest resources. Some are in trading relationships with villagers living right along the Xe Bang Fai mainstream.

As is described in the main text, based on anecdotal evidence it appears that for every village located right along the Xe Bang Fai and its major tributaries, there is at least one more village located further away in which many people have such links. Therefore, it appears that in addition to the minimum of 67,130 people noted above, at least another 60,000 to 70,000 (living along smaller tributaries or elsewhere in the basin) are to some extent dependent on the Xe Bang Fai for their livelihoods. Thus, according to this survey's findings, at least 120,000 to 130,000 people derive significant livelihood benefits from the Xe Bang Fai River. However, the actual number of people whose livelihood security is linked to the Xe Bang Fai River is undoubtedly much higher.