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Situation Analysis

Lower Songkhram River Basin, Thailand

By David J. H. Blake and Rattaphon Pitakthepsombut

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Abbreviations and Acronyms

ALRO	Agricultural Land Reform Office
ARD	Accelerated Rural Development Office
BDP	Basin Development Plan
BOD	Biological Oxygen Demand
cm	centimetre
CPT	Communist Party of Thailand
DEDP	Department of Energy Development and Promotion
oC	Degrees Celcuis
DEQP	Department of Environmental Quality Promotion
DO	Dissolved Oxygen
DWR	Department of Water Resources
EIA	Environmental Impact Assessment
FPC	Flood Pulse Concept
ha	hectare
GEF	Global Environment Fund
IAS	Invasive Alien Species
IUCN	The World Conservation Union
km	kilometre/s
KKU	Khon Kaen University
LSRB	Lower Songkhram River Basin
m	metre/s
mm	millimetre/s
mg/l	milligrammes per litre
m3/s	cubic metres per second
m.a.s.l.	metres above sea level
MCM	million cubic metres
MoNRE	Ministry of Natural Resources and Environment
MOAC	Ministry of Agriculture and Cooperatives
MRC	Mekong River Commission
MWBP	Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme
NEB	National Environment Board
OEPP	Office of Environmental Policy and Planning
ONREPP	Office of National Resources and Environment Policy and Planning
RBC	River Basin Committee
RFD	Royal Forestry Department
RID	Royal Irrigation Department
RVC	Riverbank Vegetable Cultivation
SWOT	Strengths and Weaknesses, Opportunities and Threats
TAOs	Tambon (Sub-district) Administration Organisations
TCB	Total Coliform Bacteria
TNMC	Thai National Mekong Committee
µS/cm'	Unit of measurement for conductivity (mho = Siemens) of a solution
US$	United States Dollar

Glossary of Thai terms

chow naa	rice farmers
don pu taa	sacred or spirit forest
gor kor	Thai abbreviation for the Rice Department
hed peung thaam	popular variety of mushroom found in flooded forest
hom mali	jasmine rice
kasetagon	farmer/s
man saeng	type of edible, wild tuber
meun	traditional measure of rice weight (approx. 12 kg)
naa bee	main rainy season rice crop
naa dam	transplanted rice crop
naa prang	secondary dry season rice crop
naa thaam	rice fields found in former seasonally inundated forest
naa wan	direct seeded rice crop
paa boong paa thaam	seasonally inundated floodplain forest
paa chaa	cemetery forest
pai gasa	bamboo type commonly found in the flooded forest
paa satarana	public use forest
pla som	sour fermented fish
rai	land measurement equivalent to 1,600 m2
Sor Por Kor (สปก)	acronym used for Agricultural Land Reform Office
wang anurak pla	fish conservation pool in river

1. General Background

The Songkhram River has the second largest catchment of any basin in northeast Thailand after the Mun-Chi Basin and is the largest Mekong tributary of the upper northeast region, with a catchment area of 12,700 km^2 and a total length of 420 kms. It rises in the western Phu Phan mountain range at an altitude of around 400 m and flows through parts of Udon Thani, Nong Khai, Sakon Nakhon and Nakon Phanom provinces, collectively referred to as the Sakhon Nakhon Basin. Along most of its lower reaches the river meanders over an extensive floodplain at an altitude of between 145 – 160 m.a.s.l. and a gentle gradient of about 1:30,000. The Songkhram River enters the Mekong River in Tha Utaen District of Nakon Phanom province, some 40 kms north of Nakhon Phanom city. Several major tributaries join the Songkhram River from the north (e.g. Mao, Huay Khong and Huay Hi) and from the south (Oon and Yam) forming one extensive lowland floodplain system. The Songkhram River's lower reaches and floodplain are considered by the Thai government to be a wetland site of international importance (OEPP, 1999).

The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP), Lower Songkhram River Basin (LSRB) Thailand Demonstration Site is located in the lower floodplain sections of the Songkhram River catchment covering an area of approximately 3,000 km^2, and includes parts of twelve districts in three provinces, namely:

- Tha Utaen, Sri Songkhram, Naa Waa, Naa Thom and Phon Sawan Districts – Nakhon Phanom Province.
- Kham Tha Gla, Agaat Amnuay, Waanon Niwat, Ban Muang Districts – Sakhon Nakhon Province
- Segaa, Beung Khong Long and Phon Jaroen Districts – Nong Khai Province

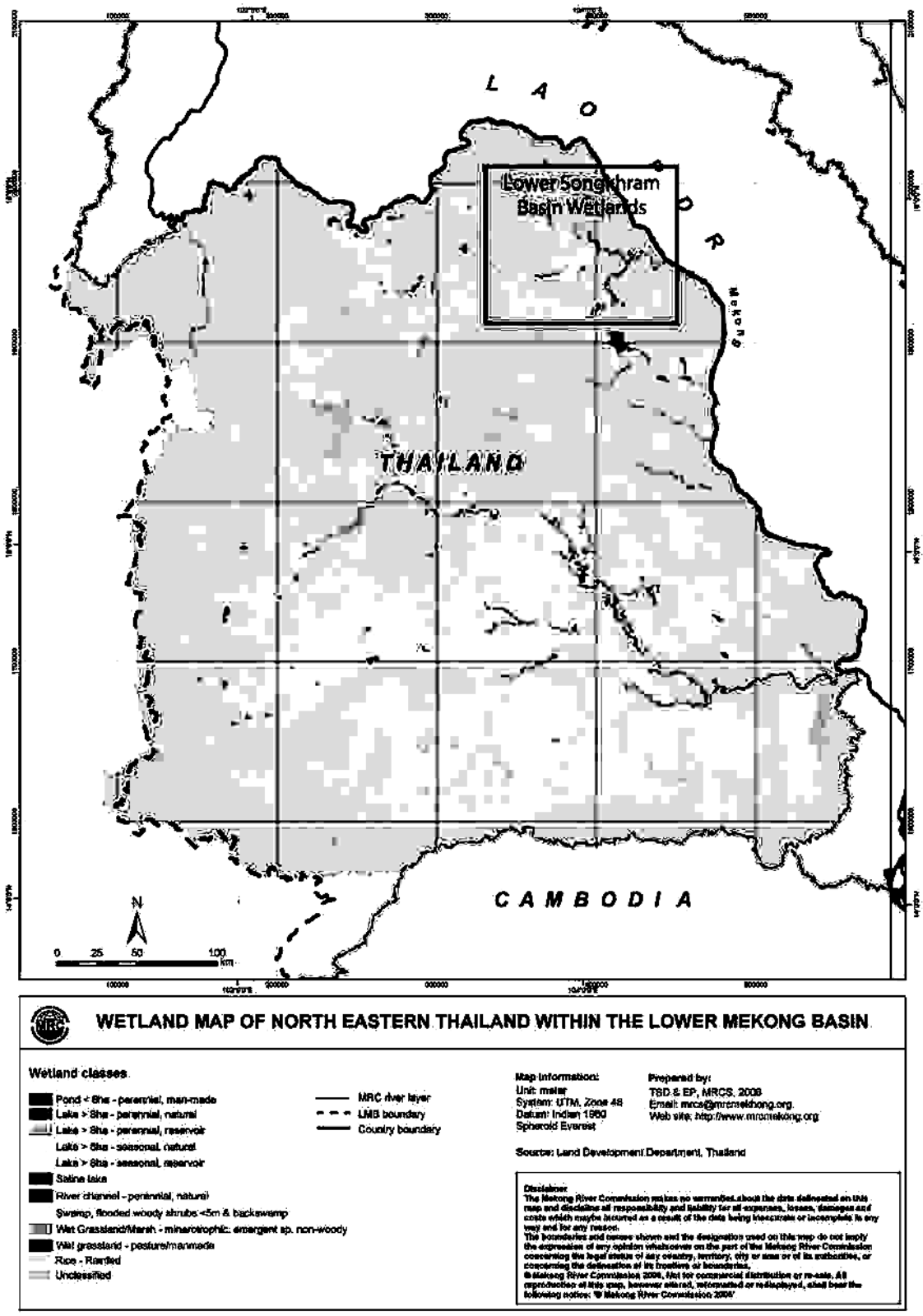
The Demonstration Site area is yet to be formally delineated, but it is estimated that within this area there are at least 130 villages (KKU, 1996) with an approximate population of 17,000 – 20,000 households or about 92,000 – 108,000 people. The majority of these people are of Tai-Lao ethnic descent, although several other minority ethnic groups are represented in the Lower Basin. The livelihoods of the local population are closely linked with the natural resources provided by the surrounding wetlands, while main subsistence needs and household income are frequently provided by wetlands-derived products. In the past, fishing was the most important component of the village-based economy, providing most families with their principle means of subsistence. Many other dietary, medicinal, fuel and household needs were provided by the surrounding forests and wetlands (and still are to a large extent today), while rice was usually obtained by bartering with other villages for preserved fish products, like fermented fish. Even today, many families rely heavily on capture fisheries and fish processing or trading for their livelihoods, although nowadays a large proportion of the fish processed in some villages come from outside the Songkhram Basin. It is only in relatively recent times (i.e. last 30 – 40 years) that floodplain villages have adopted dry season rice cultivation on a large scale, in partial response to declining fish yields and state policies to convert the seasonally inundated forest (officially classified as "vacant wasteland" or "public use land") into agricultural uses.

The floodplain of the Lower Songkhram River Basin (LSRB) is comprised of a number of different wetland habitat types, including the main river channel, pools, riverine sand bars, tributary streams, seasonally-inundated forest, swamps, ponds, depressions, channels, ox-bow lakes and seasonally inundated grasslands. As a result of stream blockage by weirs, embankments and small dams there has been an increase in permanent wetland areas in the form of shallow lakes and reservoirs across the basin. Nearly all of the original native lowland forest cover has been cleared and converted to rice paddies, which have become significant seasonal wetland habitats in themselves. Large areas of floodplain have also been cleared relatively recently by agribusiness companies for intensive agriculture or pulpwood tree plantations. On the northern fringes, the Demonstration Site area also encompasses a large, modified shallow lake system called Beung Khong Long that has been designated as one of only ten Ramsar Sites in Thailand (See Annex 1, for further details).

The diversity in habitat types and profound influence of the annual flooding regime derived from in-basin and the Mekong river hydrological flows has contributed to wide diversity in aquatic fauna across the Songkhram wetlands, reflected in a figure of 183 species of fish known from the entire Songkhram Basin. Many of these fish species are migratory and spend part of their life cycle in the mainstream Mekong, but enter the Songkhram wetlands during the early rainy season (May) to feed and breed. At least six fish species known to be present in the LSRB are listed in the IUCN *Red List of Threatened and Endangered Species*. In addition, bird and plant diversity are thought to be high but are relatively poorly studied, with the possible exception of Beung Khong Long.

The LSRB wetlands are unique in many ways, not least because of the dramatic Mekong-influenced floods which turn the wide lower floodplain into one massive shallow lake system each rainy season, but also because of the high value of livelihood services and ecological functions the wetlands offer local communities that harvest the biodiversity resources for income and subsistence needs. However, the continued prosperity of these wetland resource-dependent communities may well be seriously threatened by a number of threats arising both from within and outside the local resource users' sphere of influence, not least the spectre of various large-scale irrigation schemes either built already (but non-operational) or planned, including a scheme to divert water out of the Mekong into the Songkhram Basin under the proposed "Water Grid" project. These large irrigation schemes are invariably vehicles to promote more intensive agriculture, which if implemented, have the potential to profoundly modify the ecological health of the entire wetlands complex. Meanwhile, fisheries resources are perceived to be in decline as a result of both in-sector and external factors, although studies have been relatively few in the past to monitor the overall capture fishery health.


LAO PDR
VIET NAM
THAILAND
Wetland Map of Songkhram, Thailand
Version: January 2008
Wetland and non-wetland habitat map based on 2004 field survey data and classification of Landsat ETM image acquired on 30 November 2001, 18 February 2002, and 18 March 2003.
Dry grassland
Dry scrub/shrub
Bamboo/mixed forest
Dry forest - semi-deciduous/mixed
Plantation
Dry agricultural land - Fallow
Dry agricultural land - Rainfed
Rice field
Rice field - rainfed
Rice field - recession
Other wet crop - rainfed
River bank/beach/bar
Natural channel
Artificial channel/canal
Surface water (ponds, reservoirs, rivers)
Lake > 8ha - natural
Reservoir > 8ha
Artificial pond < 8ha
Salt Paddy
Burassot
Buildings
Country boundary
MRC river layer
N


L A O
Lower Songkhram Basin Wetlands
Mekong
THAILAND
CAMBODIA
N
0 25 50 100 km
WETLAND MAP OF NORTH EASTERN THAILAND WITHIN THE LOWER MEKONG BASIN
Wetland classes
Pond < 8ha - perennial, man-made
Lake > 8ha - perennial, natural
Lake > 8ha - perennial, reservoir
Lake > 8ha - seasonal, natural
Lake > 8ha - seasonal, reservoir
Saline lake
River channel - perennial, natural
Swamp, flooded woody shrubs <5m & backswamp
Wet Grassland/Marsh - mineralotrophic, emergent sp. non-woody
Wet grassland - pasture/manmade
Rice - Rainfed
Unclassified
MRC river layer
LMB boundary
Country boundary
Map information:
Unit: meter
System: UTM, Zone 48
Datum: Indian 1960
Spheroid Everest
Prepared by:
TSD & EP, MRCS, 2008
Email: mrcs@mrcmekong.org
Web site: http://www.mrcmekong.org
Source: Land Development Department, Thailand
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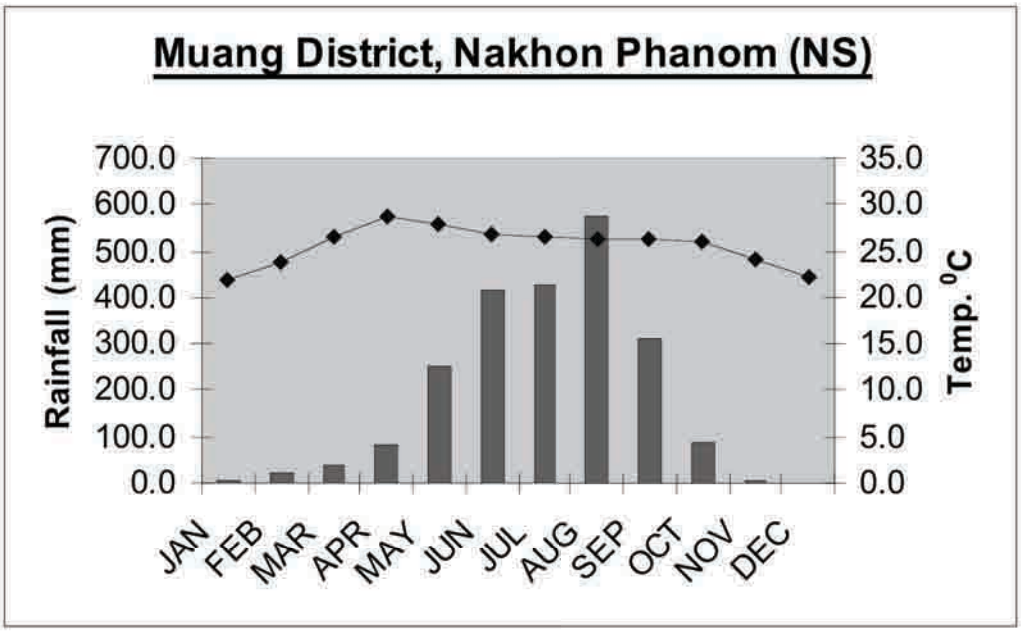
1.1 Climate

The Songkhram River Basin experiences a tropical, semi-arid climate, with three distinct seasons. There are six to seven rainy season months (May–October), when nearly 90 % of the annual rainfall is recorded. Average rainfall within the basin varies considerably, with southern parts of the basin receiving less than 1,200 mm per annum, rising to over 2,100 mm per annum in the far northern part of the basin (Sombutputorn, 1998). Annual precipitation at Nakhon Phanom city varies between 1,600 – 2,900 mm[1], which makes this one of the wettest part of northeast Thailand, receiving as much rainfall as many central and southern parts of Thailand, but in a shorter time period. The rainy season normally peaks in August to September, when floods reach their maximum extent. The cool season extends from November to February and is marked by generally dry and cool air from the northeast monsoon. Minimum temperatures rarely fall below 10 ^{0}C in the cool season. The hot season extends from March to mid or late May, if the rains arrive late. The early part tends to be very dry and warm, marked by occasional thunderstorms, and as maximum daytime temperatures climb to over 40 ^{o}C by mid to late April, so the intensity and frequency of thunder showers increases, marking the onset of the southwest monsoon. Annual evaporation rates are reported as being between 1,558 – 2,054 mm/year (KKU, 1997).

The year 2004 and early 2005 was notable in terms of climate, as the rainy season in northeast Thailand finished rather abruptly in mid-September, at least a month ahead of normal. This caused water levels to fall rapidly in the Songkhram river and floodplain, and according to resource users fish catches were noticeably lower than in previous years. Additionally, rice yields from the 2004 rainy season crop were reduced by approximately 50 % through late drought conditions in middle and upper terrace fields and in January 2005, impacted villagers in Nakhon Phanom Province were being offered partial compensation by the government for losses sustained. By March 2005, a water crisis had been declared by the government and extensive national cloud seeding operations were underway.

[1] Nakhon Phanom Metereological Station data, recorded between 1992-2004

TABLE 1. Average Annual Rainfall and Temperature Data for Nakhon Phanom Between 1952-1989

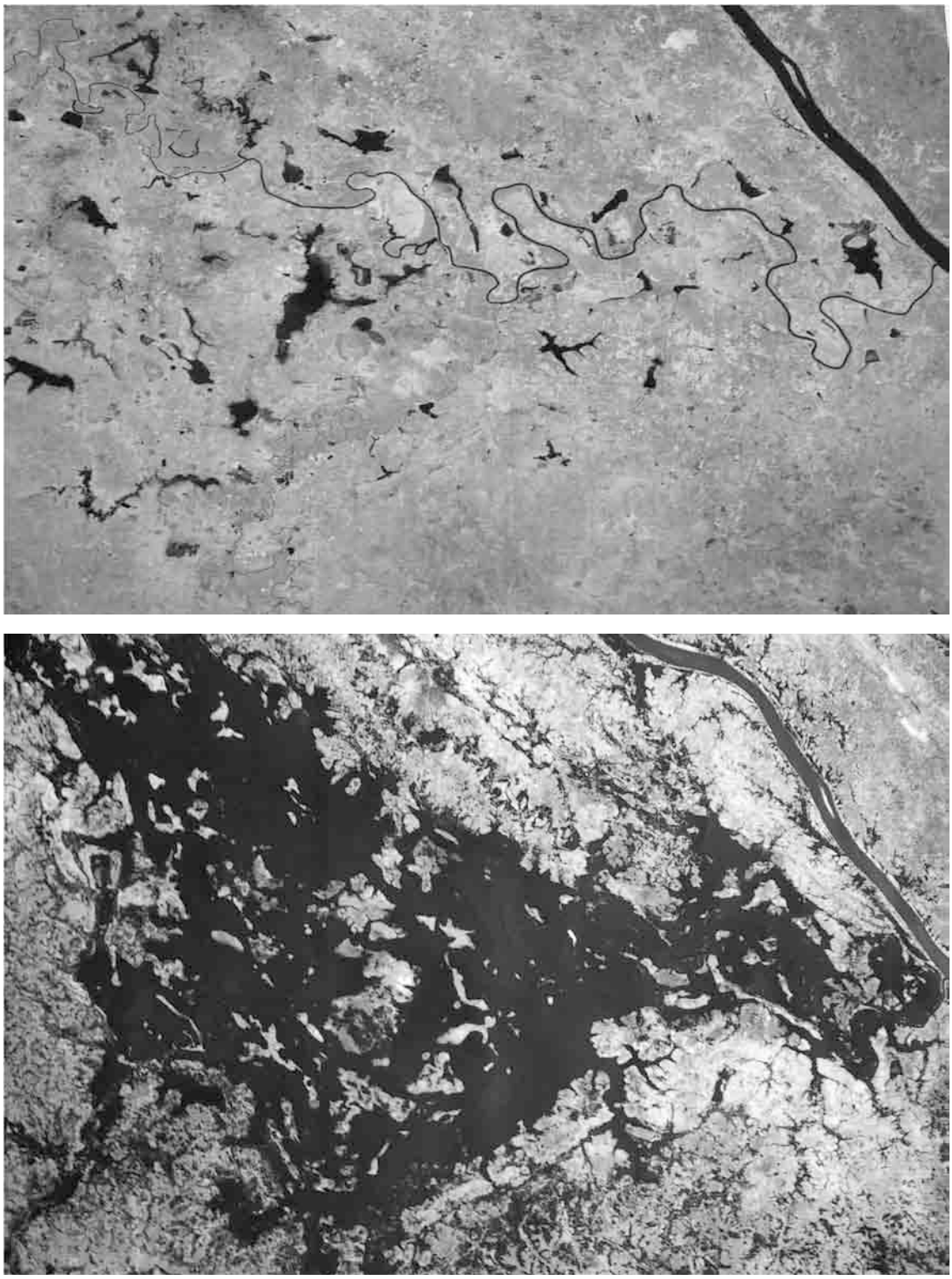


1.2 Topography and Geology

The floodplain of the Songkhram River is characterised by a gentle gradient of 1:30,000 (i.e. 3 - 4 cm/km slope) and average elevations of 145–160 m.a.s.l. The broad floodplain displays many typical topographical features such as levees, back-swamps, ox-bow lakes, hollows, channels and permanent lakes, to name but a few. Surrounding the floodplain are slightly elevated lower and middle terraces, dissected by mini-watershed valleys and seasonal streams. The meandering river channel cuts across the floodplain and is broad and deeply incised in its lower reaches, in the dry season being 10 – 12 m below the bank edge. The floodplain gets narrower with higher banks as it nears the Mekong confluence and in the last 10 kms or so cuts through terrace deposits of gravel, sand, silt, clay and lateritic soils, which may act as a constriction to the passage of floodwater during the peak rainy season.

The Lower Songkhram River Basin (LSRB) forms part of a larger geological plateau formation known as the Sakhon Nakhon Basin. It is bounded by the hard sandstone capped Phu Phan Range (up to 600 m high) to the south, off which the Songkhram and many of its tributaries flow, and a series of low sandstone, shale and conglomerate hills (lower and middle Khorat series) to the north marking the watershed between the Songkhram and shorter Mekong River tributaries. Most of the floodplain and surrounding terraces of the LSRB are geologically derived from the Maha Sarakham formation of the upper Khorat series, comprised of a mixture of salt, shale and weathered sandstone. Formerly known as "the Salt Formation", it contains considerable quantities of evaporites in the form of rock salt, halite, gypsum and potassium materials, including potash (Mongkolsawat et al., 1988). These salts rise close to the surface as salt domes at some locations in the Sakhon Nakhon Basin, allowing exploitation at various levels of commercial intensity, which has profound implications for the development of water resources and agriculture in the region

(Ghassami et al., 1995). A survey for the Songkhram Project found that only 23.56 % of soils in the area potentially impacted by the proposed irrigation scheme were non-saline, the rest being saline or with the potential to be saline (KKU, 1997).



A comparison of dry and wet season sattelite images of the Lower Songkhram River Basin, illustrates a marked seasonal difference. In the dry season (Upper plate), a large number of discrete surface water bodies are revealed, which in the majority of cases are shallow irrigation reservoirs. In exceptional wet seasons (Lower plate), the Nam Songkhram water spreads out over the floodplain and forms one vast lake, with many scattered islands on which villages are often located.

1.3 Hydrology and Water Resources

Because around 90 % of the annual rainfall in the Sakhon Nakhon Basin falls within the six month rainy season, the flow of the Songkhram River is highly seasonal and closely related to the monthly precipitation. Peak local discharges usually occur in August or September, while minimum flows occur between February and April, before the arrival of the rainy season (May-October). The total annual run-off of the Songkhram River is estimated at 10,066 MCM (Dept of Water Resources, 2004a) and there is a mean annual river flow of approximately 300 m^3/s (KKU, 1997). The computed mean annual run off per unit land area has been estimated at 33.55 litres / second / km^2 (DWR, 2005). The hydrological situation in the lowermost part of the Songkhram Basin is complicated by an occasional backflow from the Mekong River occurring during July – August, the influence of which can sometimes be felt up to 126 kms upstream from the mouth of the Songkhram River. Local in-basin precipitation and reverse flow from the Mekong cause extensive flooding for two to four months a year, forming one massive shallow lake covering an area of about 600,000 rai (96, 000 ha) (OEPP, 1999). This is equivalent to 31 % of the entire LSRB area being temporarily under water. One study suggested that the 50 year flood would inundate an area of 1,158,000 rai (185,280 ha) or 60 % of the lower Songkhram Basin (KKU, 1997). River levels typically vary 10–12 metres in height difference between the dry and wet seasons (Boonyaratpalin et al, 2002).

This annual Mekong influenced flooding has often been likened to the well-known rainy season phenomenon occurring at the Tonle Sap and Great Lake in Cambodia, but on a considerably smaller scale. However, in the dry season the situation is somewhat different from the Great Lake, in that relatively little permanent water naturally remains in the LSRB after November / December. The Department of Water Resources (2004b) estimates that the area of permanent water bodies is 116 km^2 or just 3.8 % of the entire surface area. Hence, a large portion of the land is in a state of flux between flood accession and flood recession, which leads to a significant area of temporary wetland habitats at various times of the year. Apart from the mainstream river channel itself and several large tributaries, there are estimated to be 282 permanent water bodies (Actionaid, 2003) including many large and small ponds, lakes and swamps scattered over the floodplain, plus a fair number of artificial reservoirs, created in the last 30 years by damming streams.

Nam Songkhram river during July – October flood season, overtops its banks each year and spreads into surrounding flooded forest habitat (*paa boong paa thaam*)

Although there are numerous weirs and dam structures of all sizes built on tributaries and headwaters throughout the basin, up until the recent past the Songkhram River was recognised as, "The last tributary of the Mekong River in Thailand unaffected by large-scale water resource development" (http://www.mekongwetlands.org/Demonstration/Thailand/biodiversity.htm). Since 2003, this description should no

longer be considered correct, as a result of the construction of two mainstream "Ogee weir" structures with liftable water gates being constructed in the middle Songkhram reaches of Ban Dung District, Udon Thani Province. These structures were built occupying the same ecosystem type as the Lower Songkhram River Basin (i.e. seasonally inundated riparian forest), but where the floodplain narrows up slightly. Some of the technical details of these two projects are shown in Annex 2.

Nong Gaa "Weir", middle Songkhram River, proposed and built by Accelerated Rural Development Office; but completed by Department of Water Resources in November, 2004, with added flood protection embankments. No irrigation system was included (surrounding land is almost entirely above water level) and no fish passage facility in design.

These "irrigation weirs" were built by the now-defunct Accelerated Rural Development (ARD) Office, under the Ministry of Interior, as part of a project called, "The Songkhram Basin Development Project, Udon Thani Province" (ARD, 1998). The two weirs were transferred to the responsibility of the Department of Water Resources, Area 3 Office in Udon Thani, under the Ministry of Natural Resources and Environment. Following construction in 2002-04, the weirs and upstream flood embankments were given to "the people for use and maintenance," according to signs erected at the sites. It is unclear to what extent the "weirs" are presently regulating the flow of the Songkhram, but they are reportedly built near some of the most salinity-prone areas of the Basin (personal communication, Nakhon Phanom Provincial Land Development Department, December, 2004). In mid February 2005, there was only a trickle of water passing below the lower of the two "weirs" at Ban Nong Gaa, Ban Dung District, effectively blocking the entire flow of the Songkhram River at that point.

1.4 Geomorphology

The mainly sandstone derived soils of the upper and middle Songkhram Basin are generally sandy, with low organic matter and clay content, and prone to erosion, especially when exposed by inappropriate agricultural practices. As most of the basin land has been converted from forest cover to various agricultural uses in the past four decades, (with much of the uplands zone devoted to annual cash cropping of cassava and sugar cane), there are typically high erosion rates from soil exposure, compaction and regular ploughing. No empirical data is available on suspended sediment load or bed load of the Songkhram River, although it was estimated that 145,473 million tonnes of soil are lost each year from erosion in the entire Songkhram Basin, and that over 945,000 tonnes of suspended solids were assumed to pass the site of the planned Songkhram Dam, with peak sediment levels in August (DEDP, 1997). It is known that waters from the Mekong sometimes enter the Lower Songkhram River during certain periods of high water in the Mekong. Therefore, it can be reasonably assumed that sediment deposition on parts of the lower floodplain maybe derived from two sources – within basin soil erosion and sediment derived from the Mekong

Basin upstream of the Songkhram confluence. A farmer in Ban Pak Yam village, Sri Songkhram District estimated that at least 2–3 cms of alluvial sediments were deposited on his *naa thaam* floodplain fields each rainy season following river inundation (Blake, 2001). Many local villagers have given anecdotal accounts of gradual shallowing of pools and the main river channel over the years and a sand bar has recently formed across the mouth of the Songkhram River at Ban Chaiburi, Tha Utaen District, Nakhon Phanom. A likely function of the Songkhram annual flooding event is the storage and slow-release of floodwaters over an extended period, thus avoiding more serious flooding in the lower Mekong Basin.

1.5 Land Use and Wetlands

A small Nam Songkhram tributary (Huay Khone) near Sri Songkhram town in the dry season with fringing seasonally inundated forest dominated by bamboo stands on one bank and dry season (*naa prang*) rice fields on the other.

Although definitions of the term 'wetlands' may vary considerably from the very broad definition of the Ramsar Convention, to more specific and narrower definitions in some countries, there can be no doubt that large portions of the entire Songkhram river basin should be regarded as wetlands. This view was highlighted by an MSc study, which used a modified classification system proposed by Dugan (1990) and found that 54.2 %, or 709,110 hectares, of the entire basin could be classified as 'wetlands' in their broadest sense, of which the vast majority was made up of 'Seasonal Flood Plantation' (i.e. rice fields) covering 38.68 % of the basin (Sombutputorn, 1998). In wet rice paddies, the period of inundation varies depending on many factors, but generally is not less than two months at the height of the rainy season, when monthly rainfall can reach 500–800 mm. In addition, 55,597 ha or 4.25 % of basin was reportedly devoted to 'artificial seasonal wetland rice', which relates to irrigated dry season rice areas. However, on the basis of available data of dry season irrigation extent, it would seem that this figure is an overestimate of the current actual area, which was reported as just 16,600 rai in the entire province of Nakhon Phanom (Nakhon Phanom Agricultural Statistics, 2005), and irrigated areas in the other provinces could not account for such a high figure.

Other significant natural wetland types classified were seasonal back swamp marshes (34,541 ha), natural seasonal flooded swamps (27,563 ha), seasonally flooded forest and shrubs (26,593 ha) and seasonal floodplain lakes (12,000 ha). It is interesting to note that there is a relatively large area of salt lake/s (858 ha) and salt works (2,161.5 ha) identified in the survey, both located in Ban Dung District, Udon Thani province, which could pose an environmental threat to the local ecology and salinity of the River Songkhram and tributaries. Other extensive industrial salt operations not listed in Sombutporn (1998) are located in Waanon Niwat and Ban Muang Districts of Sakhon Nakhon Province (Pathumpon, 2004).

TABLE 2. Total Area (in hectares) of Wetland in Songkhram Basin by Category[2]

Freshwater (F) Type		
Riverine system (FRR)		
Pool in perennial river (FRR1a)	*	*
Artificial perennial canal (FRR1bm)	*	*
Pool seasonal river (FRR2a)	*	*
Floodplain wet rice (FRF1am)	12,077.25	0.92
Seasonally flooded forest / shrubs (FRF2a)	26,593.05	2.03
Seasonally flooded plantation / orchardsFRF2am	3,633.00	0.28
River Floodplain (FRF)		
Seasonal Floodplain Lake (FRF3)	12,009.00	0.92
Seasonal Floodplain pond (FRF4)	600.00	0.05
Seasonal Backswamp marsh (FRF5a)	34,541.00	2.64
Artificial seasonal wet rice (FRF5am)	55.597.25	4.25
Artificial seasonal wet plantation (FRF5bm)	199.00	0.02
Lacustrine system (FL)		
Lake (FLL)		
Natural permanent freshwater lake (FLL1a)	8,289.50	0.63
Artificial permanent freshwater lake (FLL1am)	13,007.50	0.99
Natural seasonal freshwater lake (FLL2a)	1,510.25	0.12
Artificial seasonal freshwater lake (FLL2am)	293.00	0.02
Pond (FLP)		
Natural permanent freshwater pond (FLP1a)	2,390.50	0.18
Artificial freshwater aquaculture pond (FLP1am)	406.75	0.03
Natural seasonal freshwater pond (FLP2a)	567.00	0.04
Palustrine system (FP)		
Artificial seasonal flooded plantation (FPSam)	505.940.99	38.68
Natural seasonal flooded swamp (FPSc)	27,563.00	2.11
Artificial seasonal flooded plantation (FPScm)	677.25	0.05
Salt Water (S) Type		
Inland system		
Salt lake (SISL)	858.25	0.07
Salt work (SISW)	2,161.50	0.17
Total Wetland	709,110.24	54.20
Non-Wetland	599,037.25	45.80
TOTAL Land Area (Ha)	1,308,147.49	100.00

Source: Sombutputorn, 1998

[2] The wetland categories given are modified from the classification system of Dugan, 1990, and based on data obtained from maps, satellite images, ground truth surveys and other statistics.

Habitat alteration – a drainage ditch leading water out of a small, natural wetland to make way for an irrigation project, is a common sight in Sri Songkhram District, Nakhon Phanom.

While there are no doubts that the Lower Songkhram River Basin is a significant wetland area, the nature of and change in the wetlands composition in recent years is not well appreciated. There is strong evidence to show that there has been a very rapid conversion of forested lands and natural wetlands, across the LSRB in recent decades, principally being replaced by agricultural land and permanent lacustrine wetlands, i.e reservoirs. This is illustrated by the data shown in Table 3, which was taken from analysis of a 739 km^2 block of land lying to the west of Sri Songkhram town, roughly coinciding with one of the largest areas of flooded land each rainy season. "Marsh and swamps," which no doubt contained some of the richest aquatic biodiversity during the dry season have declined almost 39 % in the space of just nine years, while the category "water resources," equating to rivers, permanent lakes and artificial reservoirs (of which there are several large examples of over two km^2 in this land block), increased by a staggering 110 % in the same period.

Interestingly, while the sharp increase in water resources appears to be closely correlated with the decline in forest and natural wetland resources, there has not been a corresponding increase in paddy land as a result of more irrigation sources available. Yet, the most common justification for construction of water storage reservoirs given by state agencies responsible (like the Royal Irrigation Department and the Accelerated Rural Development Office) has been provision of water for "agricultural use" in the dry season. The increase in "field crops" of 14 % is likely to be attributable chiefly to non-irrigated cash crops such as sugar cane and cassava grown on upper alluvial terraces and to a lesser extent, some irrigated high value crops (such as tomatoes and sweet corn). Yet at the same time, the more significant rise in the amount of "idle land" locally is noteworthy, which may well be attributable to the abandonment of intensive tomato plantations by several large agribusiness companies in the past 15 years.

TABLE 3. Land Use Changes Across 739 km^2 of Floodplain Land in Lower Songkhram River Basin Between 1989 and 1998

Land Use Types	1989		1998		Land use changes (%)
	Area (km^2)	%	Area (Km^2)	%	
Urban land	10.27	1.39	16.11	2.18	+ 57.38
Paddy	348.12	47.12	353.81	47.89	+ 2.26
Field crop	59.03	7.99	67.38	9.12	+ 14.02
Forest	113.70	15.39	73.58	9.96	- 35.33
Disturbed forest	33.62	4.55	9.60	1.30	- 71.30
Bamboo forest	22.98	3.11	12.12	1.64	- 47.13
Disturbed forest	-	-	4.51	0.61	-
Idle land	105.94	14.34	138.89	18.80	+ 21.16
Marsh & swamp	21.65	2.93	13.30	1.80	- 38.69
Water Resources	23.49	3.18	49.50	6.70	+110.73
TOTAL	**738.80**	**100.0**	**738.80**	**100.0**	

Source: Chutiratanaphan and Patanakanok, 2001

1.6 Forestry and Natural Vegetation

Natural forest cover throughout the northeast region has been much reduced during the latter 20th century and what remains today is just a fraction of the former extensive forests of five decades ago, with overall forest cover in the northeast reportedly declining from 42 % in 1961 to 14 % in 1985 (Vitayakon, 1993). The Lower Songkhram River Basin is no exception to this rapid decline and according to one report, there was only 50 km^2 or 1.6 % of forest remaining a decade ago (KKU, 1996). However, there remains doubt as to what exactly qualified as "forest" in this survey, which has long been an issue of contention in Thailand. Although no accurate figures appear to be available for forest coverage in the whole area covered by the LSRB, the table below is indicative of general forest coverage in the provinces of Nakhon Phanom and Sakhon Nakhon and its continual decline in recent years. In the floodplain of the Songkhram River it is likely that the seasonally-inundated forest or *paa boong paa thaam* has not been included in the total forest area figures below, as it has long been officially classified not as forest land, but "public use land" or "vacant wasteland" (ALRO, 2004). The view that non-agricultural use wetlands are "*wastelands*" has commonly been expounded by governments and other external institutions in many countries across the world in the past (Barbier et al., 1997).

Table 4. Overall Forest Coverage in Sakhon Nakhon and Nakhon Phanom from 1993-1998

PROVINCE	Total land area (km^2)	Area of forestry land					
		1993		1995		1998	
		Km^2	%	Km^2	%	km^2	%
Sakhon Nakhon	9,605.76	1,416.5	14.75	1,392.75	14.5	1,361.5	14.17
Nakhon Phanom	5,512.67	571.0	10.36	566.0	10.27	563.0	10.21
TOTAL	15,118.43	1,987.5	13.15	1,958.75	12.96	1,924.5	12.73

A more startling view of deforestation rates in the immediate vicinity of the demonstration project site is offered in Table 3 above, which shows that landuse categories of "forest", "disturbed forest" and "bamboo forest" (this category directly relates to seasonally inundated forest area) have declined by a total of 35 %, 71 % and 47 % respectively over a mere nine year period. This rate of deforestation must surely rate as one of the highest in the country for the same period and came after a national ban on logging was introduced in 1989. From the data presented it would appear that the forest land in the area in question, has not been lost to paddy land or field crops, as these categories have only slightly increased, but the majority has been converted to "idle land" and "water resources". Yet, the most commonly attributed reason for reduction in forest area has traditionally been farmer-led encroachment for conversion to agricultural land, which is a frequently cited ongoing problem nationwide[3]. However, many observers point out that this was preceded by state policies promoting logging and charcoal making concessions, and state-led encouragement to maximise export-driven cash crops, which were more important underlying factors in the forest loss in most provinces (Bello et al. 1998; DEQP, 2004). This perception of the low value of the Songkhram floodplain land, once denuded of valuable timber, is significant as empirical studies have shown the *paa boong paa thaam* to make up at least 37 % of the floodplain land that would be inundated by the Songkhram Project[4] (KKU, 1996). The degraded *paa boong paa thaam* is presently dominated by bamboo stands (*Bambusa* spp.) and multi-species low shrub forest which can tolerate annual flooding of three to five months duration. The next most common types of forest in the potential reservoir zone were reported as dry dipterocarp forest (1.92 %), eucalyptus plantations (1.85 %) and mixed deciduous and dry evergreen forest (1.18 %) (KKU, 1996).

Secondary and regrowth forest is cleared and burned for monocrop rubber plantations – a common sight above the floodplain in Sri Songkhram, Na Waa and Tha Utaen Districts, of Nakhon Phanom province.

[3] An article in the 'Sunday Perspective' of the *Bangkok Post* of February 6, 2005 (titled: 'Vanishing Forest'), reported that according to the National Park, Wildlife and Plant Conservation Department, Thailand has lost more than 1.5 million rai of forest land in the last four years alone, resulting in a decrease in national forest cover from 33 % to 32.6 %.
[4] Refer to Box 4, page 63, for further details of the Songkhram Project.

While continuous and dense forest is now largely absent in the Basin (with the exception of areas of the Phu Phan mountain range), there are significant areas of degraded secondary forest and the mixed native-domesticated trees in paddy and cash crop fields agroforestry systems (Vitayakon, 1993), dominating the upper lowland landscape today. However, a growing trend in the upper northeast which has been promoted by national agricultural policy, is the conversion of agricultural land to mono-crop rubber tree plantations. According to the National Statistics Office (2004), the area planted to '*para*' rubber across the northeast region increased by 102.5 % in just five years from 1998 to 2003, much of which is thought to be located in Nakhon Phanom and Sakhon Nakhon Provinces. It is uncertain whether rubber plantations are included in the provincial or regional forest cover estimates, but if so this may be masking a trend of continuing deforestation in the upper northeast, as native mixed species agroforestry systems and regenerating forest are sacrificed for a single exotic tree species. It was observed that wide areas of secondary and recovering natural forest in Sri Songkhram and Tha Utaen Districts were clear-cut for rubber plantation during the 2004-05 dry season.

1.7 Local Level Natural Resource Management

Nam Songkhram village life and culture: a traditional *bai sii soo khwan* ceremony, held in the spiritual forest of Ban Tha Bor, near the Nam Songkhram River

One hundred years ago, all land in Siam[5] nominally belonged to the state, but every subject had the right to request a piece of land to work, on the condition that an annual tax was paid (Tips, 2000). Population pressure was low, available land for agriculture was plentiful and landlordism was rare. At that time, most forest and water resources in northeast Thailand could be considered communally owned and managed, under a system of traditional usufruct rights. Before Thailand started to industrialise and promote expansion of export-led cash cropping to subsidise the urban-industrial sector during the 1960s, there was little reason for state interest in the village resources of the northeast, as there was relatively little agricultural surplus to tax (Bello et al., 1998). Agricultural land could be privately owned and traded but there were no land titles as such, with the headman collecting just a nominal sum from each family to pass on to the state. Rice culture depended primarily on rainfall, so was restricted to the wet season crop in most villages[6], while households generally farmed just enough land to meet their own rice subsistence needs, with the remaining land around the village mostly being left as forest. The extensive forests and seasonal wetlands of the northeast were able to provide most

[5] Thailand was officially known as Siam up to 1939.

[6] In seasonally flooded wetland areas such as the lower Songkhram Basin, villagers were able to practice a form of dry season rice cultivation, called *naa saeng*, which relied on natural moisture remaining around lakes and swamps to sustain the rice crop, through creation of small bunded paddies. However, it is thought that it was never as widely adopted agroecosystem, as the more extensive areas of *naa saeng* once found on the Mun and Chee river floodplains in central and southern Isaan (Blake, 2001).

villagers' subsistence needs beyond rice, including diverse plant and animal food items, herbal medicine, fuel, household or fishing implements and house-building materials. As the economy was not primarily market driven or commoditised, there was little incentive to extract more than individual household needs and northeast villages were perceived as relatively egalitarian and autonomous compared to northern or Central Plain villages (Bello et al., 1998).

In pre-modern Thai society, the Thai term for forest (i.e. "*paa*") referred to more than that embodied in the literal English meaning, but had deeper socio-cultural connotations of being "a sacred, enchanted place, made distant from human beings by the aura of fear, mysticism, and reverence" (Laungaramsri, 2001). "*Paa*" was the realm of hermit monks and spirits, both benign and destructive, as well as wild animals and numerous potential hazards. Thus, it was a place both to respect and one suspects for most villagers, avoid unless absolutely necessary and only then enter in the security of a group. Certain days each year were set aside for going into the forest and making offerings to the resident spirits (*pii*) in return for favours to the village, whether in the form of good health, harvests or luck during the following year (Actionaid, 2003). The spiritual dimensions of northeastern forests may have acted as both a 'pull' and 'push' factor in the dynamics of deforestation and conservation, with limited special areas being preserved while most areas were sacrificed to demand for timber and agricultural expansion, one suspects with little lament at the time.

While the teak forests of Northern Thailand attracted the attentions of colonial forestry interests and the subsequent "scientific forestry" management model adopted by the RFD during the late 19th and early 20th centuries, the mixed deciduous forests of *Isaan*, largely escaped the attentions of commercial logging until the post-WWII era. Hence, local communities were able to traditionally manage the forests, land and water resources and practice traditional cultural beliefs without serious state intervention for longer than many other parts of Thailand. Today, only vestiges and remnants of these old cultural practices and traditions remain evident in Isaan villages, even though the natural resource base is much altered and degraded. An example is the twice yearly ceremony practiced by many villages in the Songkhram Basin to honour the protective spirits of the local forest (*leang puu taa*) with offerings such as turtles, chickens, whiskey, tobacco, betel, etc. As well as sacred spirit forest (*don puu taa*) located near the village, other forest areas managed by the villagers for different purposes were cemetery forest used for firewood cremations of the dead (*paa chaa*) and public use forest (*paa satarana*), or the remaining forest area which can be used for customary food gathering, hunting, fuel wood, construction materials and livestock grazing. Villages generally have rules and regulations governing the use of certain natural

Making offerings to forest spirits (*leang puu taa*) is still an integral part of village life and local culture for the people of the Nam Songkhram Basin

resources within community forests and fisheries (independent of state laws), decided by a village committee and villagers have to pay a fine if they break the rules (Ngamjaroen and Jong-gawng-giat, 1998; DEQP, 2004).

Some observers have pointed out that communal property rights will vary between different ethnic groups and are usually complex and multi-dimensional in their holding structures (Trakarnsuphakon, 2003). Individual and communal holdings may be superimposed on one another and even individual property can be considered a communal resource at the same time. For example, generally rice fields are "owned" and farmed by a single family, but were traditionally an open resource to all in the community for collecting living aquatic resources, plus grazing and wild vegetable gathering rights at other times of year. With fishing, there were traditionally few set rules and regulations regarding methods, seasons and times, until commercial fishing and large gears started to become common about 30 years ago and competition for

Signboard for community fish conservation zone, agricultural conversion area and protected forest area in Ban Dong San, Agaad Amnuay District, Sakhon Nakhon Province

the resource increased. It was only in relatively recent times that selling or auctioning concessions for exclusive rights to block a particular location during flood recession became the norm for fishing right allocation by village committees (Tai Baan Research, 2004). Another recent management innovation was the introduction of conservation pools (*wang anurak pla*) in some villages to restrict or prohibit fishing in certain areas, sometimes associated with the village temple. Some villages in the LSRB that have established conservation pools in the last decade include Ban Yang Ngoi and Ban Pak Yam, Sri Songkhram District; Ban Dong San and Ban Tha Rae, Agaad Amnuay District (DEQP, 2004).

1.8 Socio-Economic Situation

In the last two to three decades, Thailand's economic growth and development has been rapid and impressive, with the exception of a few years of recession following the Asian economic crisis in 1997. Through successive five year National Economic Development Plans stressing industrial development over agriculture, the industrial sector grew rapidly through the 1970s, 80s and 90s as foreign and domestic investors established factories nationwide, though mainly around Bangkok and the Eastern Seaboard. However, this growth came at great cost to the natural resource base and

biodiversity underpinning rural livelihoods and sustainable forms of agriculture (Bello et al, 1998). To date, northeast Thailand has seen less industrial development than other regions of Thailand, with agriculture forming the mainstay of the local economy. While the general social and economic status of most households has improved considerably in the last 30 years, gaps in incomes between rural people and urban dwellers has widened dramatically, with agricultural workers receiving an average of one-sixth of other sector wages in the early 1960s, changing to just one-fifteenth by 1999 (Leonard and Na Ayutthaya, 2003). Nationally agriculture still employs around 40 % of the workforce and this figure rises much higher in the northeast region.

As far as local average incomes are concerned, it is estimated that in Sakhon Nakhon the average is 14,482[7] baht/person/year, while in Nakhon Phanom it is slightly lower at 13,883 baht/person/year (DWR, 2005). This compares against a national average income level of approximately 50,000-60,000 baht per annum. As most rural households still practice subsistence crop farming with little agricultural surplus each year, household income is mostly derived from non-agricultural sectors particularly labour remittances from domestic and overseas sources. Commonly, many households derive considerable seasonal income from the sale of local wetland resources, especially fish, fish products, fungi and bamboo shoots. One detailed economic study of a rural village located near the Songkhram found that 60.8 % of households sourced their main income from outside the agricultural sector, while the average income derived from agriculture was just 1,033 Baht per month compared with 2,254 Baht per month and 3,930 Baht per month from general labouring locally and working in Bangkok respectively (Prompakping, 2002). Raising livestock, especially cattle and buffalo, can be a vital source of income for many families, the animals often being sold at times of urgent economic need, such as for educational or medical fees.

The marked wealth disparity between city and countryside has long been one of the major motivating factors driving rural-urban migration, a phenomenon common to all northeastern provinces for several decades now. The Lower Songkhram River Basin is no exception with mass out-migration of the young and economically active members of society to major cities and other regions of Thailand (Prompakping, 2002), but also commonly to destinations abroad, especially the Middle East, Singapore and Taiwan. In some villages, up to 90 % of households received remittances from abroad (Actionaid, 2003), testifying to the importance of this source of income to the local economy. In the same report, it raised the notion that contrary to popular opinion that it is mainly poverty that drives out-migration, in the villages studied it was not the poorest men in the village that had migrated abroad for employment, but some of the better off households that were most likely to seek work overseas. Table 5 shows how villagers themselves may view their economic situation in a typical lower Songkhram basin village.

According to a recent document, 95.95 % of households and 51.6 % of villages have mains electricity and piped water respectively in the LSRB (DWR, 2005). Other development indicators listed in the same report, were that 10.57 % of villages have a public telephone, 91.89 % have a primary school and 85.01 % have a health centre. The national population growth rate was recently reported to be just 0.7 % p.a. (Anon. 2004). Road communications are good at inter-district and provincial levels and there are airports serving Nakhon Phanom and Sakhon Nakhon Provincial cities. No villages

[7] The US$ - Thai baht exchange rate in January 2005 was approx. 38 baht = 1 US $

are more than about 10 kms from a paved highway and public transportation reaches nearly all villages.

Table 5. Intra-village Structural Economic Differentiation Example – Ban Kaew Pad Pong, Sri Songkhram District, Nakhon Phanom

Economic Status	Description	% of households
Insufficient	Landless families, in debt, with little social capital and limited income generation	60
Balanced	Own farmland, debts equal assets, has income and a moderate earning capacity	30
Sufficiency	Owns farmland, debts smaller than assets and income, earning capacity and income is relatively high	5
Enough-to-share	Very high income with property and assets, with enough to lend to others	5

Source: From participatory economic assessment exercise by villagers reported by Actionaid (2003)

2. History

2.1 A Brief History of Northeast Thailand

The upper northeast Thailand is recognised as one of the earliest known centres of ancient civilization, witnessed by the Bronze Age archaeological findings from Ban Chiang, Udon Thani province in the upper Songkhram Basin. Discovered during the late 1960s, subsequent excavations revealed the site to have been settled continuously from as far back as 3,600 BC up to around 200 AD. This has provided important new knowledge about early prehistoric humankind in Southeast Asia, including the unearthing of iron and bronze jewellery items and distinctive ceramics (http://www.archaeology.about.com/cs/asia/a/banchiang.htm). The lack of weaponry found in graves suggests that the people lived a relatively peaceful existence as agriculturalists, hunters and fishers in the surrounding forests and wetlands.

Prior to being settled by Tai-speaking peoples from further north in the Mekong Basin, the Khorat Plateau was dominated by Khmer people of the Angkor Empire for several centuries. They built impressive temples and other buildings at strategic sites across the landscape, including Sakhon Nakhon province. Villages in the Songkhram Basin, like Ban Yang Ngoi, Sri Songkhram District, claim Khmer roots in their past with evidence of an ancient burial site and temple remaining. In the 13th century Lao-speaking peoples from the Lan Xang Kingdom and Thai-speaking peoples from the Sukhothai Kingdom started to have more influence in the region, until the Lao king, Chao Fa Ngum was able to capture most of the northeast as part of a Lao vassal state around 1350. In temporarily uniting the Lan Xang kingdom, Fa Ngum was able to protect the northeast against Siamese expansion into the region for several centuries following his reign. By the 17th century, the Lan Xang Kingdom had started to weaken and during the reign of King Suriya Wongsa (1633–1690), it broke into three smaller kingdoms, namely Luang Prabang, Vientiane and Champasak. Thus split and weakened, the Siamese Ayuthaya Kingdom was able to dominate militarily and expand its influence in the region. However, with the fall of Ayutthaya to the Burmese in 1767 and an alliance of the Lao with the Burmese, the Siamese forces under General Phraya Taksin had to fight to regain control on the northeast.

In 1782, the Chakri dynasty was founded in Thonburi, on the west bank of the Chao Phraya river, and controlled the kingdoms of Luang Prabang, Vientiane and Champasak as Thai vassal states, paying tribute to the Siamese King. In 1827, after the accession of King Rama III, King Chao Anou of Vientiane attempted to retake control of Isaan and march on the Siamese capital in Bangkok. His army was intercepted around Saraburi and the Lao troops were subsequently defeated. In retribution, King Rama III ordered the sacking of Vientiane and forcibly relocated many Lao people across the Mekong to settle in Isaan and parts of central Thailand. The difference in the population density found on the plains of the western and eastern banks of the Mekong is still evident today, probably as a result of both enforced and voluntary resettlement during the 19th and early 20th centuries. With the rise of European colonialism in the region, the latter half of the 19th century was marked by territorial disputes and treaties between Siam and France, which had occupied Indochina intent on exploiting the natural wealth of the region and opening up the Mekong corridor to international trade. The present borders of Isaan were fixed in a Treaty between Siam and France in 1904, which ceded west bank areas of Sayaboury and Champasak Province to France and allocated islands in the Mekong to Laotian control.

According to local people, in the Songkhram valley, there has been a long history of water-borne trade with other areas in the Mekong basin. Early settlers in the lower reaches reportedly included Khmer (locally referred to as "*Khom*") who came up the Mekong in boats bringing silverware, gold, knives and swords for exchange or bartering (Tai Baan Research, 2005). People within the Sakhon Nakhon Basin have traded salt, fermented fish and rice produced locally for perhaps many centuries, both along the Songkhram itself and with Lao villages along the Mekong and up tributaries in Khammouan and Savannakhet provinces. Settlements often sprang up at the mouths of rivers, which were key focal trading points e.g. Ban Pak Oon and Ban Pak Yam.

2.2 20th Century and Post-World War II Era

The first half of the 20th century was marked by colonial domination by Britain and France of states surrounding Siam, (or Thailand as it became in June 1939) and increasing trade with other nations. In June 1932, Siam changed from an absolute monarchy to a constitutional monarchy through a bloodless revolution. This marked the start of a period of political instability between the forces of democracy and those of more autocratic, military-led rule, which generally were to dominate government for the next four decades. As French colonial influence in Indochina waned rapidly after World War II, the whole of the Southeast Asian region became embroiled in a game of political and ideological warfare between the world's new superpowers of the US and Soviet Union (and to a lesser extent, China), with rapidly changing political boundaries and allegiances between 1950 and the late 1970s. Through successive dictatorial governments up to 1973, Thailand allied itself to the Western powers, courting US support, both military and economic. However, most economic aid was focused in and around Bangkok and remote provinces received very little of the fruits of economic growth evident in the capital and Central Plains provinces. Long isolated from mainstream socio-political Thai life both geographically and culturally, a minority of northeast villagers and some Vietnamese dissidents[8] became natural allies of reactionary communist forces operating within Laos, who were able to recruit members in remote parts of the upper northeast during the late 1950s and 60s. They operated largely as propagandists to villagers, although some were armed and occasionally attacked government and military targets (http://www.rci.rutgers.edu/karnchan/isan_his.txt).

With greater military involvement in the Viet Nam War during the mid1960s, northeast Thailand was increasingly used as a strategic base for land and air attacks into Indochina against the rapidly spreading communist forces of Viet , Laos and Cambodia. Hence, the US established large military bases at several locations around the northeast including Ubon Ratchatani, Udorn Thani and Nakhon Phanom. While these were used ostensibly as bases for military operations across the Mekong in Indochina, they also served to help further American economic development goals in the region. But as a result of the stationing of large numbers of foreign troops on Thai soil, this also helped fuel a degree of anti-American and anti-capitalist sentiment amongst local people, especially young idealist intellectuals and students. While Prime Minister ML Kukrit Pramoj secured the withdrawal of American troops from Thailand in 1975, the

[8] In 1945-46, when the French reoccupied Indochina, and some 45,000 Viet Namese sought political asylum in the northeast Thai towns along the Mekong, many of whom decided to settle and make Thailand their home (www.rci.rutgers.edu/karnchan/isan_his.txt)

internal insurgency problem continued to grow in the northeast, and US aid remained important to the Thai government. Supported by arms and money from China, the Communist Party of Thailand (CPT) received a recruitment boost when a new authoritarian regime cracked down on democratic elements following 6 October 1976, and led to large numbers of students temporarily joining the armed resistance movement operating from jungle bases in the upper northeast.

The numbers of active members of the CPT in the northeast were never very large during the 1960s and early 1970s (measured in the hundreds),but reached a peak of perhaps 5,000 persons in the early 1980s, which was enough to give the state authorities a constant battle of containment in certain localities (http://www.rci.rutgers.edu/karnchan/isan_his.txt). Particular hotbeds of CPT activity were the mountainous areas of Loei, Kalasin, Udon Thani, Sakhon Nakhon and Nakhon Phanom provinces (especially Phu Phan mountain range forming the headwaters of the Songkhram), where dense forest cover gave the operatives a fair degree of security from detection. Hence, there was a strong strategic reason for reducing forest cover and providing state-led development initiatives to remote communities to counter the attraction of communist ideology to villagers. Using American funding, the Thai government established the Accelerated Rural Development (ARD) Department as a vehicle to bring the periphery into the market-led economy and improve basic living conditions, as a means of winning rural support. A massive road building, irrigation and well drilling programme was initiated all over the northeast, but especially concentrated in the more sensitive provinces bordering the Mekong. This was both strategic and helped fuel the commercialisation of agriculture, especially the planting of cash crops such as cassava, maize and kenaf for export (Prompakping, 2002). In a four year period in the mid 1970s, the area of land planted to cassava alone quadrupled in the northeast, through farmers pushing the agricultural frontier into surrounding forests, even where soils were of marginal quality (Bello et al., 1998). By the mid-1980s, with cessation of funding for the CPT from China, an amnesty offered to those members who surrendered their weapons, roads cut into even the most remote of villages and vast tracts of land laid bare by logging concessions, encroachment and extensive cash cropping, the insurgency movement in northeast Thailand rapidly faded into history.

The recent past of northeast Thailand has been marked by continuing struggles and tensions between city and countryside, state and peasant movements, periods of political instability, as well as rapid economic growth and social change. With the end of war in Indochina, the region was slated to be transformed from a "*battlefield to a market place*", through a process of promotion of foreign-led investment in business opportunities, industrialisation at certain favoured locations and ubiquitous state-led development projects in all sectors, but especially energy, communications and transport. With the possible exception of irrigation infrastructure, agriculture was a consistently under-invested sector of the economy, especially the small-farm sector which has contributed to the massive rural-urban migrations witnessed from Isaan (Bello et al., 1998). At the same time, natural resources continued to be depleted and land degraded through unsustainable land management practices. Some of these issues related specifically to the Lower Songkhram River Basin were discussed by a range of stakeholders and compiled into a book, from which the following section on the recent history of natural resource usage is taken.

2.3 A Recent History of Natural Resource Use Issues (late 1950s onwards)

(Translated and adapted from: Anon., 2004. *Proceedings of a Seminar to Propose a Natural Resources Management and Environmental Plan, by the Lower Nam Songkhram Basin Communities*. Held at Sakhon Nakhon Rajabhat Instutute, 24 April, 2004)

During the last five decades, important changes in natural resources usage and overall health of the environment have been noticed by many, which roughly coincides with the time that Thailand released its first of nine five-year National Economic and Social Development Plans in 1961. This period has seen widespread introductions of new agricultural and fishing gear technology; vast improvements in communications networks; and the opening of foreign export markets, both regional and worldwide. With regards to the lower Songkhram Basin, three distinct periods concerning natural resources usage in the Basin can be identified as follows:

2.3.1 Era of Trade in Freshwater Fish; Logging Concessions and Commercial Charcoal Burning (1957–1977)

The year 1957 marked the introduction of nylon fishing nets to northeast Thailand, replacing natural fibres, and large fishing gears plus outboard engines on boats started to become more common. As trade with distant markets grew and fishing effort became more commercialised, so the fishery resources started to decline both in terms of species diversity and overall quantity. Meanwhile, the *paa thaam* forest, which serves as an important habitat and food source for fish, started to become degraded from being opened up to agriculture for the first time, while logging concessions and charcoal production cleared large areas of surrounding forests. Logging concessionaires were active between 1967–1972, although the majority of large trees were removed in just one or two years. Commercial charcoal production started around 1965, supplying traders from Nakhon Phanom, Sakhon Nakhon and Udon Thani, and the trade reached a peak in 1974–1976, but was largely over by 1979, as the raw material supply was exhausted. This extensive charcoal production across the LSRB was the primary reason for the clearance of large trees from the *paa boong paa thaam*, leaving mostly bamboo stands and small trees or shrubs.

2.3.2 Era of Agricultural Development and Expansion of Agro-Industry (1977–1997)

After 1977, the LSRB communities started to adopt agricultural innovations more widely, such as hand-held tractors and improved irrigation, such as weirs and water storage reservoirs, through budgets provided by the financial reforms of the Kukrit Pramot government of the time. This led to a rapid expansion of dry season rice farming onto the floodplain areas that were formerly grassy plains or *paa thaam* forest. Agro-industry started to have a presence in the Songkhram Basin around the same time. The first company to establish an integrated tomato production and export business was Tawan Farm Company Ltd. in 1978, at Ban Sang, Segaa District of Nong Khai Province. Sun Tech Group Ltd. arrived later in 1984, with a tomato and pineapple canning factory and business in Sri Songkhram District of Nakhon Phanom Province. Other companies set up dairy farms and milk processing businesses over the next decade. Tung Songkhram Industry Ltd., which later became Asia Tech Group Ltd., formed a subsidiary called Asia Tech Pulp and Paper Ltd., in 1996, with a plan to build a 150,000 tonne/year capacity pulp mill. To obtain raw material, the company planned to extend the growing of *Acacia mangium* (*gratin tepa* in Thai) trees to 100,000 households farming an area of 160,000 rai, under a contract farming scheme.

However, the 1997 Asian economic crisis intervened first and Asia Tech was not able to follow through with its plans due to financial troubles.

From around 1977 onwards, large amounts of land in the LSRB were obtained by the agri-business companies at cheap prices, initially just around the company's premises and factories. But later, large amounts of public land were encroached to grow eucalyptus plantations or intensive tomato crops by one or two companies, until conflicts with the local communities ensued. Some of the disputes led to protracted court cases, and in a few cases have resulted in victories for the local communities, whom have had the public land ordered to be returned to them (e.g. Ban Dong San and the *Tung Pan Kan paa thaam* forest, and Ban Tha Rae and the *Thaam Thaolee* forest).

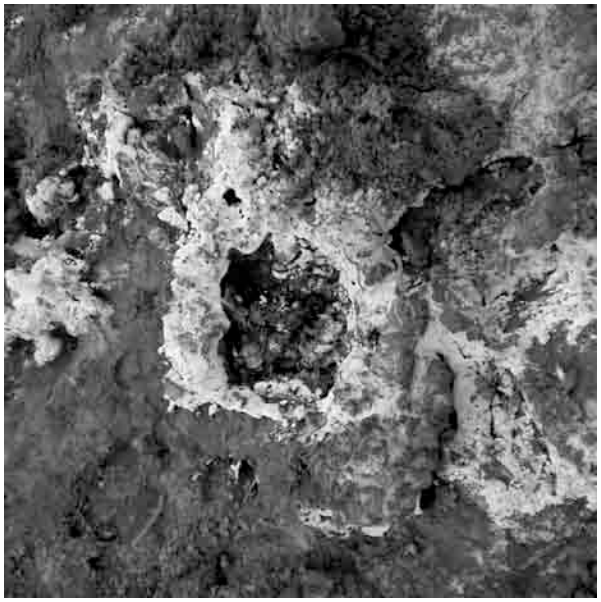
2.3.3 Era of Rubber Plantation Expansion (1997 Onwards)

After expansion of rubber plantations in the South of Thailand reached a point of saturation, there was a policy of spreading rubber cultivation to other regions of the country, especially the eastern region and upper northeast, because of their plentiful annual precipitation. At present, the northeast has an area of productive rubber plantation of 320,000 rai (51,200 ha) and it is expanding all the time. Much of the expansion area has been replacing former cash crop areas, but there has also been encroachment into natural forests. These natural forest areas had gone through transition from the original primary forest, through logging, clearance and cash cropping phases, then a period of natural recovery to secondary forest, before once again being clear-cut for rubber plantations. It is land that was used as a source of food, firewood and other domestic purposes by village communities, but as rubber growing is promoted by government, so this policy will encourage the encroachment of some of the last remaining areas of natural forests benefiting local communities remaining in Isaan. This will impact plant biodiversity and the basis of the local self-reliant, community-based economy.

The Songkhram River is still under threat from a proposal to build a dam near its confluence with the Mekong, associated with the Nam Songkhram Project (see Box 3, page 56, for background details). The origins of this project can be traced back to a perception by state officials that the main natural problems of the area are "floods" in the rainy season and "drought" each dry season. These "natural disasters" can be solved by building a dam that would in theory protect against backflow from the Mekong causing floods and store water in the dry season for use in agriculture. This external perception varies from that of local villagers who view floods as a natural occurrence that brings benefits and not a disaster, while low water levels in the dry season are not considered "drought", but just a part of the natural hydrological cycle. On 26 March 2002, the Cabinet passed a resolution not to proceed with the Nam Songkhram Project, in agreement with the findings of the National Environmental Committee, because of high impacts and not being a worthwhile investment. Despite this, the Nam Songkhram Project has already used a total of 99 million baht, spent on studies (66.7 million baht) and on buying land (32 million baht), even though the Project had not passed the scrutiny of the Office of Environmental Policy and Planning. This project and the local campaign against its construction helped play a role in raising awareness of villagers' rights and the need for community-backed plans for managing natural resources.

In the period while the local community movement to conserve the Lower Songkhram River Basin was progressing, another large irrigation project was being implemented in the Upper Songkhram Basin in Udon Thani, without lower basin stakeholders' knowledge. This project was implemented by the Accelerated Rural Development Office (ARD) from 1998 onwards, and the Upper Basin plan proposed building six weirs, four storage reservoir projects and another six canal dredging projects which would improve 70 kms of river. This plan was over and above the existing water resources development projects of the Public Works Dept; RID and other agencies, which amounted to 58 projects under varying degrees of planning or completion. Hence, in the Upper Songkhram River Basin in Udorn Thani alone which includes 176 kms of the mainstream river, it would be equivalent to having a weir, dam or other structure every three kms along the river. All the projects express the same justification of providing water for dry season agricultural consumption and solving the problem of flooding in the area. From the feasibility study of the Upper Songkhram River Basin in Udon Thani Project for the Ban Nong Gaa and Ban Muang Weirs[9], (later transferred to the Dept of Water Resources for implementation), the following potential impacts are of concern:

1. **Expansion of saline areas**. The location of the project is situated above a particular geological structure known as the Mahasarakham or Salt Formation, where salt or potash deposits are found under 90 % of the area, and salt extraction is practiced nearby. Hence, there are risks of soil salinisation in adjacent areas and negative impacts occurring on the *paa boong paa thaam* and riverbank agriculture downstream. Indeed, soil coated with saline crust could be seen adjacent to the Ban Muang Weir in February 2005.



Salt encrusted soil adjacent to the newly-constructed Ban Muang Dam in Udon Thani, attest to the unsuitability of local soils for irrigation development. Despite the risks being well known, two large dams have been built on the mainstream nearby, but it is doubtful if they will ever provide a fraction of their proposed irrigation capacity.

2. **The diversity of fishery resources and local fishery-based livelihoods are threatened**. In the Upper Songkhram Project study it lists that there are just 29 species of fish found locally and concluded that building the weirs would have a positive impact on local people as it would increase income from fisheries. At the same time, the Songkhram Basin is widely recognised by other fishery experts as having special significance in terms of a rich fish biodiversity and important role in supporting local livelihoods. The Songkhram River could be impacted by the weir construction though blocking fish migrations and reducing local fishery resources,

[9] **N.B.** These two dams were completed in 2004 and already environmental impacts can be observed nearby. See Annex 2 for technical details provided by ARD pre-construction

habitat simplification, lowering flows downstream in the dry season and reducing depths of pools. This phenomenon can lead to over-harvesting of pools, for example as occurred on the Yam in the past following construction of a dam causing lowered water levels, where villagers brought a pump in to pump pools dry downstream of a weir and remove the fish.

Raised embankments either side of the Nam Songkhram river, effectively isolating the river from its floodplain. Location: looking upstream of the new Ban Muang Dam in Ban Dung District, Udon Thani.

3. **Constructing riverside embankments to protect against erosion and flooding**. Apart from destroying natural vegetation and riparian forest which acts as a natural buffer against erosion, the embankments can actually cause worse flooding of villagers' fields, as they can interfere with natural water drainage patterns off the land into the river. Erosion rates may sometimes increase upstream and downstream of the embankments due to altered flow patterns.

3.People and Livelihoods

3.1 People and Ethnic Diversity

The LSRB is populated by a number of different ethnic groups, the majority of whom are of ethnic lowland Tai-Lao origin. Other minority ethnic groups represented in the area include Galeung, Phu Tai, Tai-So, Nyaw, Saek and Yoi, some of which had their origins in the Annamite mountains of present day Lao PDR, before migrating or being relocated to the west bank of the Mekong in the 19th century. The groups originally had distinct linguistic and cultural differences, but in recent times there has been much assimilation of the ethnic differences into the dominant Lao and Thai-speaking groups. Many ethnic Lao villagers claim roots from the neighbouring Lao provinces of Khammouan and Savannakhet, although some reportedly migrated to the area from as far away as Luang Prabang (Actionaid, 2003). In the towns and district centres, other ethnic groups such as central Thai, Vietnamese and Chinese migrants are found, commonly working in commerce and government positions. There are also some ethnic origin Vietnamese and Chinese families found in some of the larger villages along the Songkhram River such as Ban Saiburi and Ban Tha Bor, who settled there several generations ago to trade when the river was the major transport artery for the basin and commercial trade in salt, fermented fish and rice brought people into the heart of the Basin from far afield. Many found the local natural resources bountiful and decided to settle at key nodal villages.

3.2 Livelihoods

In common with much of northeast Thailand, the rural population of the Songkhram Basin are largely dependent on natural resources for their livelihoods. Outside agencies and researchers have often tended to categorise most northeast villagers as "farmers" (*kasetagon* or *chow-naa*), even if they only spend a small fraction of their working lives on agricultural-based activities, and proportionately more time in hunting, fishing, foraging or gathering surrounding natural resources. This common perception of most northeastern villagers being primarily agriculturalists is perhaps more a reflection of traditional dominant views, cultural stereotypes and sampling bias due to inflexible approaches of inquiry, rather than based on direct empirical research. A typical example is provided in the table below, showing main and secondary occupations of questionnaire informants living in LSRB villages located near the *paa boong paa thaam* (KKU, 1996)

TABLE 6. Main Occupations Stated During Survey of Villagers

MAIN OCCUPATION	No. of persons	%	SECONDARY OCCUPATION	No. of persons	%
1. Rice farmers	499	92.07	1. Rice farmers	12	2.21
2. Fishers	20	3.69	2. Fishers	152	28.04
3. Labourers	9	1.66	3. Labourers	68	12.55
4. Other	14	2.58	4. No secondary occupation	180	33.21
			5. Other	130	23.99
TOTAL	542	100.00	TOTAL	542	100.00

*Main or primary occupation refers to the main income earning or livelihood occupation of the respondent. Secondary or tertiary occupation is ranked in order of importance in terms of income or livelihood.

Yet this same survey team had previously stated that only 36.53 % of households actually practiced rice cultivation in the *paa thaam*, while 90.22 % collected bamboo shoots and 87.82 % went fishing in the wetlands. Furthermore, the majority of household respondents (63.47%) with rice fields, said they planted less than one rai of rice and were doing it purely for subsistence purposes. In nearly every village interviewed, more people were involved in harvesting wetlands products than they were in agricultural-based activities like rice cultivation, livestock raising or growing vegetables. Rice cultivation is a very seasonal activity, governed closely by prevailing meteorological and hydrological conditions and increasingly socio-economic factors outside the farming sector. By contrast, collecting wetlands derived products is a daily subsistence activity year round for many households, and takes up a greater proportion of their time. Indeed, according to the KKU (1996) report, 46.13 % of people interviewed said that they go to the *paa bung paa thaam* on a daily basis, while only 0.74 % of respondents said that they never go. Hence, the livelihood responses suggest that a new occupational term needs to be coined to more accurately take account of the level of dependence of local people on the Songkhram wetlands. For simplicity's sake, they might be termed "wetland product harvesters" and would almost certainly describe the occupation of a large proportion of the riparian citizens of the Songkhram floodplain communities. Interestingly, many people would not immediately identify themselves with such a livelihood description, probably due to a mix of tradition and degree of social programming in which Isaan village people will often automatically state: "*kasetagon*" or "*chow naa*" when interviewed by state authorities and outsiders about their occupation. But closer livelihood analysis could support the need to devise a revised

Commercial and subsistence artisinal fishing is still a very important part of local livelihoods for many people living next to the Nam Songkhram or utilizing extensive floodplain wetlands

set of occupational descriptions more appropriate for the locality, as outlined in following sections.

3.2.1 Fisheries

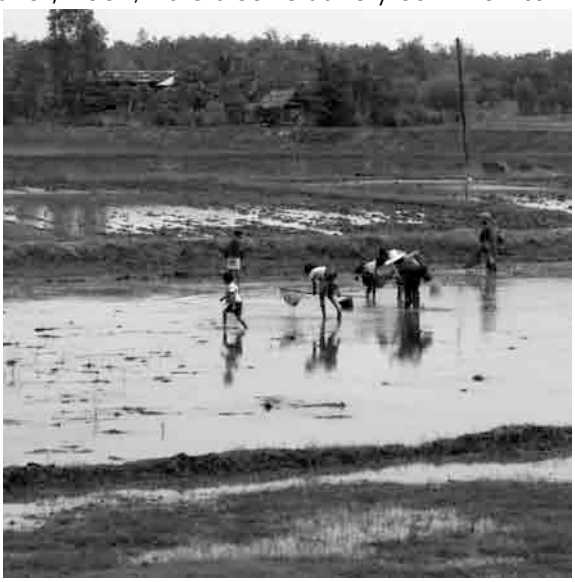
Large numbers of people throughout the Lower Songkhram Basin are dependent on fisheries for both subsistence and income. According to the MWBP's *Tai Baan* research in four villages located next to the Songkhram River, about 90 % of households have members who fish or are involved in fishing activities to some degree (Baker, 2004). Most are part-time fishers catching fish for food and supplementary income, but a significant minority in some riverside villages derive the major part of their annual household income from fishing-based activities. However, fishing tends to be a highly seasonal activity, peaking during periods of fish migrations, both up and downstream. The most productive fishery comes at the end of the rainy season (September-October), when water levels are receding and vast amounts of fish are intercepted by various large fishing gears as they migrate out of the floodplain, back to the mainstream Songkhram River and downstream to the Mekong. Depending on season and hydrological conditions, fishing activities may be focused on the main Songkhram river channel, tributaries, back swamps, oxbow lakes, artificial reservoirs, rice fields, trap ponds or flooded forest itself. Men, women and children are involved with fishing activities, but men spend proportionately more time and energy fishing than women and children and the fishing gear used is broadly divided according to gender. *Tai Baan* researchers classified a total of 85 different fishing gears used or formerly used in the Lower Songkhram River Basin (Tai Baan Research, 2005).

Of the more commercially-oriented fishing gears, the most important in terms of fish weight caught are barrage fisheries (*gad dawn*); raft mounted lift nets (*yaw kan chaw*); beach seine nets (*uan tap taling*); bamboo traps (*lawp yeun*); stationary trawl nets (*dtong*) (Insert Photo 26); and V-shaped scoop nets (*chawn sanan*), according to a study by the Thai Department of Fisheries (Boonyaratpalin et al., 2002). The annual catch of these six fishing gears alone in this study, conducted over a 170 km stretch of the lower Songkhram was estimated to be 1,400 tonnes per year. There is a concession system in operation for exclusive rights to use large fishing gears at many favoured fishing sites, often allotted by village committees through an auction system. Some concessionaires are reported to pay up to 100,000 baht to village committees for the exclusive rights to set barrage nets at certain productive locations. The money raised from these concessions is used by the village committee for locally beneficial projects such as repairing the temple, school, village meeting hall or other communal infrastructure.

In a separate baseline study of fisheries at 19 stations in the Lower Songkhram Basin by MRC scientists during 1999-2000, extrapolation of the results estimated that there was a total annual catch from the river of between 22,000 to 26,000 tonnes per year (Suntornratana et al., 2002). This highly important natural river floodplain fishery supports many families from direct fresh fish sales and an ancillary fish processing industry, plus an extensive network of fish traders who sell on the fish products to local and distant markets in other regions of Thailand. Restaurants in other provinces which advertise "Mekong River fish" as a customer draw-card, may frequently have wittingly or unwittingly sourced their fish from the Songkhram river and wetlands. It should be noted, that due to the seasonal migrations between the Mekong and Songkhram rivers, these can to all intents and purposes be considered a common stock.

Local fishers also catch live fish for the aquarium trade. There is an active network of local agents who buy certain popular fish species from local fishers who may hold them in cages or concrete fish tanks, until being sold to wholesalers located in other regions of Thailand. This trade is little studied, but is thought to be quite significant and lucrative for the traders involved. Individual fish specimens of popular or rare species, like tiger-perch (*Datnioides* spp) and *Raiamas guttatus* can fetch up to several thousand baht per fish, making them far more valuable alive than dead in the market. Most of the fish that supply this trade are caught in intensive fishing gears during the flood recession, making it a highly seasonal activity.

Besides fish, many other types of living aquatic organisms are also captured or harvested from the Lower Songkhram wetlands. These include 15 species of bivalve molluscs and gastropods; three species of shrimp; two species of crab and indeterminate number of turtle species (Baker, 2004). It is also relatively common to see other aquatic animals such as insects, tadpoles, frogs, snakes, monitor lizards and wetland birds being harvested for food and sale. One survey found that over 50 % of the local population were involved in collecting frogs, shellfish and turtles from the *paa boong paa thaam* (KKU, 1996). In addition, various types of aquatic plant species are commonly harvested and may be used for human consumption, animal feed, or medicinal uses such as eliminating parasites, reducing fevers and lowering inflammation (MRC, 2003). Together, these aquatic resources provide crucial food security and income for some of the poorest sectors of society and their abundance is dependent on the natural hydrological flood-ebb cycle and healthy, functioning ecosystems of the Songkhram River Basin.



People of all ages are involved in the Nam Songkhram fishery throughout the year and a wide variety of aquatic organisms and habitats are utilized. Here, small amphibians, fish and insects are caught for household consumption

3.2.2 Fish Processing

Local fish processing methods include drying, salting and various techniques of fermenting. Large fish are often fermented quickly using small quantities of salt, garlic and boiled rice to make a sour product called *pla som.* However, the bulk of the fish catch during the late rainy season downstream migration is heavily salted in large clay jars (*ong*) and mixed with rice bran using a slow fermentation process over 6-12 months, to create a locally famous condiment called *pla daek* (Lao language) or *pla rah* (Thai language). The strong smelling *pla daek* is a staple ingredient in most Lao-Isaan cooking and comes in many forms. In liquid form it may be added to dishes as a flavouring, while larger chunks of preserved fish may be boiled or fried and eaten as a meal in itself. It is consumed daily by most ethnic Lao households and the Songkhram *pla daek* is known throughout northeast Thailand as a superior product, and so families with the means to do so make large quantities each year as the waters recede out of

the flooded forest. It is not uncommon for some families in communities located at favoured sites like Ban Pak Yam or Ban Tha Bor with access to large fishing gears (e.g. *dtong* or *gad dawn*) to make 30–40 jars of *pla daek* each year, which is later sold on to mobile traders. *Pla daek* is both an important local "currency" having been traded along the river for possibly several centuries and an integral part of the local and regional culture.

Fermented fish is made both at the village level and on a larger scale at the district level, with the latter using a higher level of processing to make a sweeter, less pungent product (Baker, 2004). Smaller quantities of local fish are made into *pla som* by villagers, although large quantities of cultured fish (e.g. *Barbonymus gonionotus, Pangasius hypophthalmus* and *Channa micropeltes*) are bought from the Central Plains (e.g. Ang Thong and Suphan Buri provinces) for processing into *pla som*, which is then sold in markets across the region. One village located near Sri Songkhram – Ban Tha Bor – is famous for *pla som* production, and several families are involved full time in the cottage industry, with part time labour hired according to varying demand. Ban Chaiburi near the Songkhram mouth is well known for *som pla doe* (sour fermented snakehead fish), and it is promoted as a local One Tambon One Product (OTOP) item.

Pla daek – (slowly fermented salted fish) is a traditional Nam Songkhram "currency", made and traded by numerous households and an ubiquitous culinary additive, found in homes across Northeast Thailand

BOX 1. Some Economic Values of Fish Processing in LSRB

Pla daek – unit sold by is called a "*meun*" or "*bip*" (approx. weight = 12 kg), or sometimes by the "*ong*" (a large clay jar). Price varies by fish type. Cost of *pla daek pla naang* (scale-less catfish) = 400 Baht/*meun*; cost of *pla daek pla ruam* (mixed species, scaled fish) = 100 – 150 baht/*meun*. Top quality *pla daek* from Ban Pak Yam fetches 120 baht/kg jar. Some households make up to 50 *ong* a year.

Pla som – sold by the kilogramme. Small local fish = 40 Baht/kg; large non-local fish e.g. *pla tapien* (B. gonionotus) = 60 baht/kg or *pla sawai* (P. hypophthalmus) = 50 baht/kg; mini fish and shrimp mixed bi-catch = 25 baht/kg. Snakehead fish (C.micropeltes) fetches a better price, and is generally wrapped with bamboo leaves into small packages, selling at 4 or 5 baht/piece.

Pla haeng – sun dried fish, either sold by the kilogramme or by one standard size General mixed species fish = 100 – 150 baht/kg. *Pla sob tawng haeng* (X. cancilla) = 350 baht/kg. *Pla dawg bua* (small cyprinids cut into thin flower shaped strips and dried) = 5 baht / piece.

3.2.3 Harvesting Wetland Products

The range of wetland products (some of which could be classified as NTFPs) is extremely diverse and attests to the high value of the ecosystem for biodiversity, supporting local livelihoods and the regional economy. Both plant and animal species are commonly harvested from the wetlands for a variety of uses. A survey by Khon Kaen University researchers found the following natural wetland products were most commonly harvested from the *paa boong paa thaam*, during a survey of 542 households in villages near the Songkhram River (KKU, 1996). They found that 46.1 % of the sampled households go to the *paa boong paa thaam* on a daily basis and that collection of wild products (both terrestrial and aquatic), was a more important component of the livelihoods of many households than agricultural production.

Table 7. Some Important Terrestrial Wetland Products Harvested in the Seasonally Inundated Forest and Their Respective Reported Average Household Income (data taken from Table 5.19 and Table 6.8 in KKU, 1996)

Wetland Product	No. of H/H* that collect product	Percentage	Average income value per year (THB)
1. bamboo shoots	489	90.2	231
2. wild vegetables	408	75.3	10
3. red ants eggs	350	64.6	15
4. collect firewood	342	63.1	-
5. mushrooms	236	43.5	49
6. hunted rats	157	29.0	1
7. hunted birds	138	25.5	1
8. wood for household tools	75	13.8	-
9. make charcoal	60	11.1	-
10. hunt snakes	54	9.96	-
11. house repair timber	27	5.0	-
12. collect medicinal herbs	27	5.0	-

* H/H refers to households.

The figures in the table above showing monetary income from various items fail to give a sense of the true value of the wetland products, as they only give the average declared income through sale of the product by survey respondents, rather than the implied household economic benefits for each product i.e. the cost the respondent would have had to pay to obtain the same quantity of the product through conventional market sources. For instance, bamboo shoots collected by 90 % of respondents are eaten by villagers almost daily in a variety of forms – what would be the market costs of purchasing one kilogramme of fresh or preserved bamboo shoots and multiplying these figures by the estimated overall annual consumption to obtain the opportunity cost or equivalent product value? It is questions like these which are essential to learn, if an accurate figure for present wetland value to local livelihoods is to be obtained.

More recent data collected by the Tai Baan Research Network gives another perspective on use of vegetation from the *paa boong paa thaam*. Village researchers have catalogued a total of 191 species of plants and 17 species of fungi used or consumed by local communities and found in various ecosystem types surrounding

the village (Table 7). When broken down by usage categories, it was found that native plants were used for subsistence, economic and cultural purposes, as shown in Table 8.

Table 8 Vegetation Species Used by Local Communities Classified by Habitat Type

Habitat Type[10]	No. of species
Jan	16
Bank seepage areas (*sam*)	24
Channels (*hong*)	51
Non	59
In and around lakes (*nong*)	62
Swamps (*gud*)	66
Dong	68
Streams (*huay*)	77
Dawn	77
Kok	81
Open plains / meadows (*tung*)	87
boong	110
thaam	134

TABLE 9. Beneficial Uses of Plants by Category Collected by Floodplain Communities From Surrounding Ecosystems

Purpose / Use of Plant	No. of species
Edible food or flavouring	139
Food source for fish, wildlife or domestic animals	119
Source of fuel wood	60
Raw material for household tools / implements	64
Raw material for making fishing gear or fish bait	55
Herbal or medicinal plants	89
Plants that are sold for household income	61
Raw material for building houses and other structures	45
Protection of watercourse banks from erosion	33
Raw material for toys and musical instruments	14
Used in ceremonies and local ethnic belief systems	-

Plants obtained from the surrounding natural environment of LSRB communities are literally providing a grocery, larder, pharmacy, emergency fund source, construction material supplier and tool shed for villagers to utilise for everyday needs. Some plant types are available year round, while others, especially in the lower *paa boong paa thaam*, are highly seasonal in their availability. Good examples are bamboo shoots (April-May), mushrooms (May–August), certain tubers like *man saeng* (January–April) and various fresh leaves used as food or flavouring, which are only found at certain times of year, often during a short window of availability according to environmental

[10] See Annex 6 for explanation of ecosystem type

cues like rainfall, soil moisture content, sunlight or temperature. The edible plant products found in the *paa boong paa thaam* generally command good demand by people living outside the immediate area and there is a healthy trade in many products, both fresh and processed. For example, *man saeng* tubers fetch a price of 25–30 baht/kg fresh, or 50–60 baht/kg boiled or steamed and sold in bags in the market. One person can collect 4–5 kg per day. Bamboo shoots are collected in large quantities in season (up to 100 kg/person/day according to one Tai Baan researcher) and may be sold fresh (price: 4 baht/kg) to traders who come to the village to buy them by the sack or processed by villagers into sour (price: 8 baht/kg) or salted products to be consumed at home or sold later. *Hed peung thaam*, a popular type of mushroom found only in *paa boong paa thaam* during the early part of the rainy season is collected around dawn by villagers and normally sold at a price of 40 – 50 baht/kg (Insert Photo 14). During the first part of the season when they are still scarce the price can reach up to 90 baht/kg, providing good income to local villagers and outsiders who come from other provinces (reportedly as far away as Khon Kaen) in groups to harvest mushrooms, bamboo shoots and other natural produce from the *paa boong paa thaam*. Hence, the benefits of the wetland products and NTFPs are shared by people over a large geographical area, not just the immediate surrounding communities.

3.2.4 Agriculture

The main agricultural crop grown in the LSRB is wet paddy rice (principally glutinous varieties); with smaller areas of cash crops (e.g. sugar cane, cassava, tomato, melon and maize) and vegetables grown for local markets and subsistence purposes. Most farming in the region is characterised by rainfed agriculture, with a relatively small area being used for irrigated agriculture in the dry season. According to a recent report by the Department of Water Resources (2005) quoting 1995 data, the total land area of the LSRB devoted to rice cultivation is 1,056,738 *rai* (1,690.78 km^2), with 244,295 *rai* (390.87 km^2) used for field crops and 77, 261 *rai* is irrigated land. Agriculture is generally considered by most external observers to be the mainstay of the local economy. While this may be true of the majority of northeastern villages, for many communities located on or around the Songkhram river floodplain, a larger part of the local economy is likely to be derived from wetland products, especially fish and other living aquatic organisms, although no large scale economic studies appear to have been conducted to prove or disprove this hypothesis[11]. However, according to the GEF Project Brief for the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (2000), "The average income for communities in the demonstration site is US$ 2,500 – 2,950/family/year, two thirds of which comes from direct harvest of wetlands, and only one third from rice cultivation. This average income is higher than that of seven districts' average of US$ 1,474/family/year."

One study showed that mean land holding in villages located on the floodplain is 2-6 ha/family, depending on location and history of land allocation (Blake, 2001). Ironically, the villages with the largest land holdings tend to be those with the richest fisheries (e.g. Ban Pak Yam), yet villagers often only actually cultivate a small proportion of their total land holding, the rest abandoned as regenerating *paa boong paa thaam*. Much of the land nominally owned by villagers is designated Agricultural Land Reform Office

[11] A village level study in 1996 by the NGO Project for Ecological Recovery (PER) in Ban Dong San, Sakon Nakhon Province, found that the average household catch of aquatic animals including fish, shrimp and crabs weighed 788 kg/family/year and provided an equivalent value of US$ 1,432 /family/year.

(ALRO or *Sor Por Gor* in Thai) land, and is officially classified as "vacant" or "public use land", according to ALRO documents (Naakwibun-wong, 2004). Because of the annual rainy season inundation, it is only possible to guarantee a crop in the dry season, with most land devoted to glutinous rice and a lesser amount in some villages given to intensively grown cash crops like tomatoes, sweet corn and melons. Some farmers attempt wet season rice (*naa bee*) on the lower floodplain each year, but even if the crop is not wiped out altogether by floods, the yields obtained are generally low (< 400 kg/rai). See Annex 5 for further details of crop yields obtained from districts lying in the LSRB.

Dry season rice field *(naa prang*), at harvest in early April. These fields are carved out of the *paa bung paa thaam* flooded forest and so cannot be cultivated in the wet season due to prolonged flooding.

In the past, dry season rice cultivation was more extensive than at present, due to various government agencies providing incentives such as water pumps and other external input subsidies like fuel, fertiliser and pesticide, but many of these projects have proven unsustainable without continuous external assistance. The farmers that practice dry season rice farming nowadays often use small tractor-mounted water pumps to irrigate usually no more than 7-8 *rai* and grow just enough rice to cover their own subsistence needs, plus a small surplus for emergencies or sale the following year. The desire of most Isaan families to be self-sufficient in rice is deeply ingrained in local society and traditional culture, even though it could be regarded as a marginal economic activity under present circumstances. The net income per rai from rice cultivation, if calculated on a monetary basis would generally amount to no more than about 1,000 baht/*rai* (i.e. US$25/*rai*), even without including the cost of farmer's own labour (Piansak Pakdee, personal communication, March 2005)

There have also been efforts in the last 15 years to get large numbers of farmers involved in contract farming of tomatoes during the dry season for supply to local canning factories, but these have not proven altogether successful due to high input costs, price fluctuations, brokers deceiving farmers and other financial problems faced by the villagers. The cultivation methods extended are highly intensive, with heavy applications of fertiliser and pesticide required. These methods are still employed for tomato and sweetcorn cultivation on the extensive land holdings of the SunTech Group (8,000 + *rai*), found within a 10 km radius of the factory located at Ban Dawn Daeng, Sri Songkhram District, Nakhon Phanom. In 2005, Suntech was reportedly cultivating 1,000 *rai* of tomatoes, while contract farmers were growing 3,000–4,000 *rai* (personal communication, Suntech factory manager, March 2005)

Currently, 15 varieties of rice are reportedly still grown in the Lower Songkhram Basin, but most of these are grown only on middle or upper terraces above the floodplain (Baker, 2004). They include varieties of plain and glutinous rice, although the majority of farmers now plant just one or two cultivars of improved rice varieties, like *gor kor 6* (glutinous rice) or *khao hom mali* 105 and *gor kor* 15 (variety of plain rice known abroad as jasmine rice). Although the main rice crop is planted in the rainy season (*khao naa bee or khao naa pai*) in areas not usually impacted by annual floods, a minority of farmers also practice dry season rice cultivation (*naa prang thaam*), in the flooded forest. Typical yields are 250 – 300 kg/rai (or 1,560 – 1,875 kg/ha) for *naa prang thaam* (Blake, 2001) and exceptional yields of up to 1,000 kg/rai (or 6,250 kg/ha) have been reported for *naa pai* (KKU, 1996).

A terraced riverbank vegetable garden near the Nam Songkhram – Mekong confluence at Ban Chaiburi. This type of traditional flood dependent agroecosystem is rapidly declining in the LSRB, due to a complex set of factors

For many villagers, dry season rice is the only crop of rice they are able to grow and allows them a measure of rice self-sufficiency. However, it is a relatively new agricultural practice which has expanded since introduction of new technology and intensive government promotion. In earlier times, villages located near the floodplain could mainly rely on bartering abundant surplus preserved fish products (*pla haeng, pla som* and *pla daek*) for rice from non-floodplain villages with surplus rice. Dry season rice cultivation in the *naa thaam* as a widespread practice was introduced and encouraged by government agencies like the Department of Agricultural Extension (DOAE), Royal Irrigation Department (RID), ARD and ALRO only in the past two to three decades as a core tenet of rural development policy for the region. There is ample evidence to suggest that the practice has declined in recent years, with abandonment of much land at numerous irrigation schemes even where water is provided free and unlimited (see Table 3.1 and personal observations, Nam Oon Irrigation Project, Sakhon Nakhon, March 2005).

Aside from wet and dry season rice cultivation and intensive farming of vegetables or cash crops for contract companies, villagers also practice a number of other agricultural systems for both subsistence and income purposes. Amongst these are riverbank vegetable cropping (RVC), *naa thaam* vegetable cropping (NTVC) and home gardens (Blake, 2001). All three of these agroecosystems are typical low external input systems, which provide the households with subsistence food and sometimes a surplus for sale. They also help to reduce household expenditure and in many cases provide the family the reassurance that what they consume is home grown and safe from agro-chemicals. Riverbank vegetable cultivation (RVC) and NTVC are flood-dependent agroecosystems, with cultivation able to take place only after the flood recession in October–November, up until the hot season and start of the rains in late April or May. While RVC takes place on cleared, terraced slopes down the riverbank

and generally relies on hand watering from the river; NTVC is usually practiced on paddy bunds or in small clearings of less than one rai (1,600 m^2) in the *paa boong paa thaam* and may rely on hand irrigation or small pumps from streams or lakes.

There is a wide variety of vegetable types grown, with one study in five villages located adjacent to the Songkhram river identifying 32 types of crops being cultivated, with yard long bean (*V. sesquipedalis*), chilli (*C. annum*), shallots (*A. ascalonicum*), cucumbers (*C. sativus*), mustard cabbage (*B. juncea*) and dill (*A. graveolens*) predominating (Blake, 2001). Data from two villages showed that mean household incomes from these systems varied between 375 baht/season to 1,630 baht/season, with large amounts of produce being given away to friends and relatives, in addition to home consumption. When village respondents practicing RVC were questioned about what they perceived as the most serious problems affecting their farming system, the most common problem cited was "pests and diseases", closely followed by "fear of the Nam Songkhram Project" (Blake, 2001). As young people have migrated out of the village, it has mostly left old people to tend vegetable plots, many of whom cannot physically cope with lifting water up steep river banks or fencing off plots from grazing livestock. By 2005, the number of households practicing this form of low-input, high-output agriculture had declined still further at three villages in the lower reaches of the Songkhram River previously studied in 2001 (personal observation, April, 2005).

Cattle are led home in the late afternoon along the edge of the flooded forest. Cattle and buffalo raising are still important livelihood activities in the Nam Songkhram Basin and fulfills many economic and ecological functions.

3.2.5 Livestock Raising

Villagers raise a range of livestock, both small-scale penned livestock (e.g. pigs) and poultry near their homes, plus extensive grazing of large livestock (i.e. buffalo and cattle) in areas surrounding the village, including rice fields in the dry season and forested areas. For villages situated near the floodplain *paa boong paa thaam*, raising buffalo and cattle is an especially important livelihood activity, with large numbers of animals being raised, supporting many households. According to a survey of 542 households using the *paa boong paa thaam* in 23 villages in the LSRB by researchers from Khon Kaen University, the proportion of families raising buffaloes and cattle was 33 % and 18 % respectively (KKU, 1996). Just 3.5 % of households raised ducks and 1.9 % raised fish by comparison. The Tai Baan Research Network in four villages found that between 40 % and 65 % of households owned buffalo or cattle, depending on the village, and seven breeds of cattle and two breeds of buffalo were represented (Baker, 2004). Numbers raised have declined from past years, reportedly because a rise in mechanisation replacing buffaloes for draft power and a decrease in available public land for grazing, as progressively more land has been turned over to rice and other field crops, or usurped by private companies. Now the average number of cattle

or buffalo raised per household is just three to five head, with a maximum of 20 head (Baker, 2004).

Thirty years ago, cattle and buffalo were raised communally in large herds that roamed freely in the *paa boong paa thaam*, with the owners only occasionally checking up on their animals to make sure they were alright, or bringing one or two back to the village for sale, slaughter or for ploughing, for example. But nowadays, each individual owner is responsible for his or her animals and must follow them out and back to the grazing areas daily, to make sure they do not eat or trample others crops and to protect them from theft. At night, the animals are kept under the villagers' houses or in a nearby pen, allowing the manure to be collected for soil improvement. In some villages, like Ban Pak Yam, villagers have started raising hybrid breeds of cattle in pens near their homes, using a cut and carry feeding system, where fodder grasses are grown specifically for the purpose and supplementary feeds or vitamins may be given (Baker, 2004).

Buffaloes and their keepers are no longer held in such high regard in the community as they once were, as the status of the buffalo in rural society has slipped with the introduction of mechanised methods of ploughing and field preparation. It is now estimated that only 5 % of families still use buffalo for preparing rice fields (Baker, 2004), and with the introduction of hybrids and government livestock programmes, there is less knowledge of traditional forms of veterinary care, including herbal medicine remedies for buffalo and cattle ailments. However, there are exceptions to this general trend, one of note being the village of Ban Nong Ba-tao, Sri Songkhram District, where villagers still value their buffalo and numbers have increased in recent years. This is thanks in part to the efforts of one teacher at the village primary school who has campaigned over many years to raise the status of the humble buffalo and utilise buffalo manure lying on roads, by composting it with leaves and selling it on as organic soil conditioner. With recent rises in the price of buffalo meat and beef, raising large livestock is recognised as an important form of income and savings devices for a great many local people, to recycle the manure on fields and be sold at times of economic need (e.g. medical expenses or weddings).

3.2.6 Aquaculture

A small proportion of total households in the LSRB practice various forms of aquaculture, including raising fish in ponds, concrete tanks near homes and floating cages in the river. For most households, it is practiced on an extensive or semi-intensive level, by stocking purchased fish seed in ponds and giving limited supplementary feed (e.g. rice bran or termites) and organic fertiliser or just relying on the natural fertility of the water for fish productivity. Inputs and management are relatively low, and fish yields reflect this, with most harvests being consumed at a subsistence level. Other factors acting as a disincentive to large investments in pond aquaculture is the annual flooding of the river and natural abundance of wild fish, with aquaculture species being less popular for home consumption and for finding a local market. Some farmers have reported making a loss on their investment on pond construction and raising fish (Actionaid, 2003). Concrete tanks near houses are mostly used for culturing catfish and frogs, using complete pelleted feeds, but the economics of this venture are uncertain and the fish are susceptible to disease.

A new form of aquaculture for the area, which has become popular in certain riverside villages during the last five to six years is the intensive cage culture of fish, in

particular, tilapia (*Oreochromis niloticus*). This activity has been heavily promoted by a couple of agro-industrial companies, who have encouraged farmers to diversify into this business as a growth industry to supply distant markets. A survey by the Dept of Fisheries between 2001–2002 found that there were 420 cages along the Lower Songkhram River, mostly concentrated in the stretch of river between Sri Songkhram District town and the Mekong confluence at Ban Chaiburi, Tha Utaen District. In January 2005, the river above and below the main Nakhon Phanom-Nong Khai highway bridge was densely packed with groups of fish cages containing tilapia and the water was dark green from a phytoplankton bloom. Local people have complained of deterioration in water clarity and quality since cage culture became popular about ten years ago.

The owners have to invest heavily in the initial cost of cages and seed, plus high running costs are necessary to purchase pelleted complete diet feed. The fish must be fed two or three times daily and feed is often mixed with antibiotics to treat opportunistic disease or prophylactically. Market size fish are usually sold at a fixed price to a middle-man, or may be bought directly to the company that supplied the fish seed and feed, in a contract farming arrangement. The culture system is characterised by high inputs and high outputs, with a significant degree of risk attached in the event of mass mortality or escape, which occasionally happens in the rainy season if cages are punctured by floating debris or mooring ropes break during strong flows. Many farmers have started and subsequently abandoned this activity after incurring losses and falling into crippling debt.

Fish culture cages compete for space beneath the bridge at Ban Hat Paeng, Sri Songkhram District. Invariably, the only fish raised in cages is the exotic species Nile tilapia, Oreochromis niloticus, using highly intensive husbandry practices

An alternative form of cage culture to tilapia farming practiced in some villages like Ban Pak Yam, is culture of native fish species, especially some higher value carnivorous species, including *pla boo* (*Oxyeleotris marmoratus*), *pla chado* (*Channa micropeltes*), *pla neua awn* (*Ompok* sp.), *pla god leuang* (*Hemibagrus nemurus*) and some Panagasiid catfish species. These tend to be slower growing than tilapia and cannot be raised at such high densities, but on the plus side, they can be captured locally and grown on using complete high protein diets or locally collected worms, and fetch a high price in local markets, up to two or three times that of tilapia. Intensive culture of tilapia in cages has been implicated in altering riverine water quality, leading to algal blooms near cages in the dry season and foul-smelling water. In addition, there are risks to native biodiversity from escapes of exotic species in an open system like the Songkhram river and wetlands, although there have apparently been no specific studies to look at the ecological impacts of tilapia cage culture to date.

3.2.7 Salt Production

Salt production has long been a traditional livelihood activity in the Songkhram Basin, especially in the middle reaches where underground salt layers are easily accessible (Prompakping, 2002). The KKU (1996) survey of 542 households in 39 villages located near *paa boong paa thaam* in the LSRB found that only one household was involved in salt production. This survey was looking only at the potential reservoir inundation area of the Songkhram Dam (i.e. land below 147.5 m.a.s.l) and not the surrounding floodplain lowlands, whereas in fact there are numerous salt extraction operations of various sizes found in certain localities of Udon Thani, Sakhon Nakhon and Nong Khai Provinces (See Annex 3 for details). These generally use primitive technology to purify saline water pumped up from underground, and may include unlined evaporation ponds, boiling or a combination of the two. Some operations cover up to 200 rai of land, most of which has been converted to salt drying pans. The numbers of people employed in the industry is not insignificant with 1,839 people reportedly being employed in Udon Thani Province and 481 people in Sakhon Nakhon Province (Pathumpong, 2004). Commercial extraction of rock salt is practiced at various levels of commercial intensity from small, traditional family production to large, industrial production involving outside investors.

View of salt evaporation ponds in Waanon Niwat District, Sakhon Nakhon Province in the dry season. Environmental protection measures are weak and saline water finds its way into the local streams and Nam Songkhram river during the early rainy season.

In other parts of northeast Thailand where salt mining has been a major activity in the past (especially parts of Mahasarakham and Nakhon Ratchasima Provinces), there have been major environmental impacts on surrounding agricultural land and salinisation of streams and rivers, causing conflicts between villagers, business investors and state authorities. In one renowned case in Mahasarakham Province, prolonged pleas by affected villagers for the government to control the commercial salt mines and occasionally violent protests, finally culminated in the Provincial Governor ordering the closure of all the salt extraction operations around 1990. According to one report, many of the affected salt production businesses relocated to the Songkhram Basin around that time, where they have been granted operating licenses by the Department of Basic Industries and provincial authorities (Pathumpong, 2004). The Environmental Office, Region 9 in Udon Thani has noted some of the environmental problems caused by the commercial salt operations as:

1. Improper storage and containment of burnt ash, a side product from boiling saline water, with poor drainage and run-off into local watercourses;
2. Acrid smoke from burning ash blowing into local communities;
3. Inadequate containment and drainage of salt in evaporation ponds, causing run off and pollution of local water courses and also highly saline water finding its way into the mainstream Songkhram River;

4. During rainy season, salt drying ponds and yards are flooded and dissolved salts are washed into streams and Songkhram river causing elevated salinity. A study of salinity levels in tributary streams draining salt mining areas in July 2004 found that 12.5 % of water samples registered over 2,250 S/cm conductivity, which translates to extremely saline water unfit for agricultural uses;
5. Due to prolonged pumping of underground salt layers over many years, parts of the land surface are subsiding, causing severe erosion and damage to nearby buildings. One hole in Ban Non Sabaeng, Ban Muang, Sakhon Nakhon increased from 13 m width to 32 m width in just one year.

3.2.8 Local Hired Labour

Many villagers are hired on a daily or monthly basis as labourers either in the agricultural sector or for construction work. The latter may either be for private construction companies or individuals (e.g. to build houses), or for government related projects (e.g. new buildings, roads or bridges). The period 2003–2004 has seen a construction boom locally and regionally of a sort not seen since the mid 1990's. Daily wages vary between 120–150 baht / day, depending on skill level or location. Agricultural work is highly seasonal and usually temporary (e.g. rice transplanting, harvesting or tending fruit orchards or rubber plantations). Wages are commensurate with the lower rate for construction labour, but the hirer will normally provide lunch and alcohol to all the workers. However, there has been a noticeable trend in the last few years away from the labour intensive activities associated with rice cultivation such as transplanting seedlings (*naa dam*), being replaced with direct sowing (*naa waan*), while hand harvesting and threshing being replaced with externally hired combine harvesters. This trend both decreases the need for local labour but also causes a net flow of funds out of the village that would normally circulate internally, thus accelerating the rural-urban labour drift.

3.2.9 Labour Out-migration

Villages in the LSRB exhibit a high rate of out-migration for labour, both domestically and abroad. Young men tend to find work in unskilled or semi-skilled occupations overseas (especially Singapore, Brunei and the Persian Gulf states), while women tend to migrate for work opportunities within Thailand, particularly Bangkok and surrounding provinces. In some villages, up to 90 % of households receive remittances from abroad (Actionaid, 2003). Contrary to the common perception that it is the poorest economic groups that will migrate first to find labour outside the village, the situation in the LSRB tends to suggest otherwise with regards to economic standing and migration. Here, it tends to be the wealthier villages and the wealthiest households in those villages that were the first and remain the most common group for seeking overseas employment. This is likely due to richer households being more willing to take the risks involved in using family assets or borrowing money to pay the considerable broker and agency fees involved (100,000–150,000 baht) in sending someone abroad. It could also be hypothesised that the abundant natural resources of the LSRB (particularly fisheries) and monetary wealth that some families have been able to acquire from their harvest has allowed a higher percentage of households to be in a position to migrate overseas for work, as opposed to other poorer and more agricultural-based economy districts of northeast Thailand. Once a few members of any given community are successful overseas and send back regular remittances, there is a natural tendency for many other hopefuls to follow in the pioneer's footsteps, which seems to be a recurring pattern in Songkhram villages. The fruits of overseas labour remittances are obvious in the form of new houses, vehicles and

other overt signs of wealth in certain villages, and it could easily account for the foremost revenue source for some villages. For example, in Ban Na Piang, Sri Songkhram District, it was estimated that three million baht per annum was received by the 36 % of households with members working abroad (Actionaid, 2003). Overseas migration is primarily a male domain, but there are some isolated examples of women migrating abroad for labour, especially to Taiwan, and being successful.

4. Biodiversity and Environmental Issues

The Lower Songkhram River Basin wetlands is partly comprised of one of the last remaining extensive areas of freshwater seasonally inundated forest (*paa boong paa thaam*) in Thailand and is one of 12 national wetland systems of internationally recognised importance identified by the Office of Environmental Policy and Planning (OEPP, 1999). Similarly, a study by the Bird Conservation Society of Thailand and BirdLife International (1999) identified eight important wetland bird areas nationwide, one of which was the Songkhram River. The LSRB however, is noted principally for its fish biodiversity, with 183 species having been recorded, including 20 endemic species, 11 of which are thought to be endangered in Thailand (OEPP, 1999). The Tai Baan Research network, looking at just four villages has already identified 124 native species found in the area. In addition to fish species, there are known to be a wide diversity of other aquatic animals and plants, many of which have high usage value for local communities, although no systematic studies have been conducted before. The Tai Baan Research has identified 10 species of molluscs, three species of shrimp and four species of crab commonly consumed by villagers. According to the MRC (2003), researchers have documented 30 kinds of aquatic invertebrates that are consumed in northeast Thailand, most of which are thought to also occur in the Songkhram wetlands and surrounding area.

BOX 2."*Paa boong paa thaam*" – the seasonally flooded freshwater swamp forest of Isaan

Paa boong paa thaam (PB-PT) is a lowland floodplain forest ecosystem rich in biodiversity and unique to parts of Isaan (northeast Thailand), Lao PDR and Cambodia lying in the Lower Mekong Basin. For several reasons PB-PT is a relatively poorly studied ecosystem type and little has been published about it until the last decade (Chusagun, 2001). Yet there is a rich store of local knowledge about the ecosystem that has long gone unnoticed by academic researchers. Many outside observers and government agencies have dismissed *paa boong paa thaam* in the past as "wasteland" or mere degraded forest with little value and no real beneficial uses. This has been a serious oversight. Formerly common and extensive along the floodplains of the Mun, Chee, Songkhram and certain other smaller tributary rivers of the Mekong, it forms a species-rich forest fringing lowland rivers and wetlands. Due to extreme seasonal variations in river levels, PB-PT experiences inundation for two to five months of the year. For the rest of the year it is a complex of various habitat types, including many kinds of seasonal and permanent wetlands, scrubby mixed forest and bamboo stands, open grassland areas and land converted for agricultural purposes. Despite its poor reputation, it is actually an incredibly rich and diverse ecosystem providing many functions and benefits to resource users and the wider environment. It is also an ecosystem subject to multiple environmental threats leading to degradation and destruction, as has extensively occurred along the Mun and Chee valleys in the recent past. This leaves the remaining Songkhram seasonally inundated forest as the last relatively intact area of *paa boong paa thaam* ecosystem left in Isaan, thus raising its conservation importance. In a few isolated places, some small stands of near-original state *paa boong paa thaam* may remain, for example at the 10-15 rai wetland site at Tha Songkhram Wittayakom School, Ban Tha Gon, Agaad Amnuay District, Sakhon Nakhon Province

Throughout the northeast, seasonally inundated forests have been severely degraded and altered through multiple hydrological and geomorphological changes to the river and sediment flows; past logging and charcoal making concessions; conversion of

forest to agricultural land and industrial tree plantations; sand and gravel extraction operations; and loss or degradation of flooded forest (PB-PT) to external impacts such as permanent flooding by reservoirs formed behind dam or weir structures (Department of Environmental Quality Promotion, 2002). Along the Mun and Chee Rivers where 30 – 40 years ago there were still extensive seasonally inundated forests, now only small remnant patches of *paa boong paa thaam* remain visible and much of this has been invaded by alien plant species (e.g. *Mimosa pigra* and *Eucalyptus camaludensis*) and remaining wetland resources are heavily utilised by the local human population. In the Lower Songkhram Basin though, the situation is less critical with regular natural annual flooding across the floodplain; more intact forest habitat (albeit degraded) and relatively good connectivity between the floodplain wetlands, tributaries, the Songkhram River and the Mekong mainstream. However, numerous threats to the remaining flooded forest habitats exist in the Songkhram Basin, not least further encroachment and conversion to agricultural land, encouraged by state policy, like the "Assets to Capital" scheme.

4.1 Biodiversity

The wetlands of the LSRB, support a wide range of biodiversity, some of which is recognised to be rare, endangered or threatened. However, little systematic or comprehensive data on biodiversity has been collected in the past and many flora and fauna groups are not well documented in available literature. Where some collection of specimens has taken place, it has generally been conducted during rapid surveys for EIA studies and not been comprehensive. The best studied taxa are birds and fish, but even these are lacking temporal in-depth knowledge of the distribution, ecology and status of individual species or even families. Little information exists for whole groups such as amphibians, reptiles, invertebrates and even small mammals. The best studied area in terms of biodiversity is the Ramsar Site at Beung Khong Long in Nong Khai Province (see Annex 1 for more details), which is the only state protected part of the LSRB.

Below is a summary of the status of the main taxa.

4.1.1 Amphibians

Data deficient. Frogs and toads are widely harvested in the wetlands by villagers in dry and wet seasons. One survey identified seven species from three families. (DEDP, 1997).

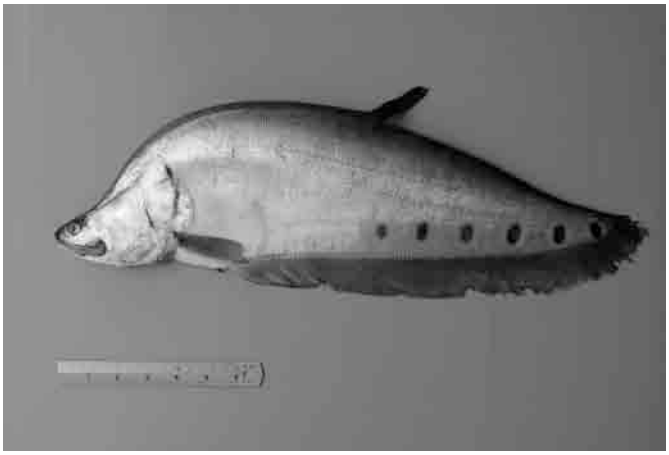
4.1.2 Birds

Sombutputorn (1998) lists 87 bird species found in the entire Songkhram River basin at various wetland sites. Other surveys done at Beung Khong Long Lake between 1998 and 2000 identified a total of 67 species of bird from 28 families (see Annex 1 for further details). An earlier EIA survey for the Songkhram Dam Project reported 61 species from 29 families in various habitats including scrub forest and agricultural land (DEDP, 1997). More survey work is needed to better understand the distribution and status of avian fauna in the LSRB.

4.1.3 Fish

Department of Fishery surveys across the Songkhram Basin have identified 183 species of fish (OEPP, 1999), while a more recent study focused over 170 kms of the Songkhram River between June 2001 to August 2002, revealed the presence of 149

species representing 33 families and studied aspects of fisheries ecology (Boonyaratpalin et al. 2002) (see Annex 4 for full list of species). Using many interviews with fisher groups to collect local names and direct observation of fish catches in just four villages, the Tai Baan Research Network identified 124 species found in the locality. Of these, 57 species are considered by fishers to be migratory species from the Mekong, nine species are non-native, 15 species are considered as being rare in catches, while another 12 species are now no longer caught or near local extirpation (Tai Baan Research, 2005). Cyprinids are the dominant family found in the LSRB and in the lower Mekong Basin in general.



Left: Typical catches from many fishing gears often contain 15 – 25 fish species reflecting the wide aquatic biodiversity still present in the LSRB wetlands. 29. Right: *Pla tong grai* – Chitala ornata or featherback fish - still a relatively common fish species in the Nam Songkhram wetlands which may weigh up to 8 kg.

A species formerly caught regularly in the Songkhram River, but now extremely rare is the MWBP "flagship" and IUCN *Red List* 'critically endangered'[12] species, the Giant Mekong Catfish (*Pangasianodon gigas*) known locally as *pla beug*. Captures have steadily declined in numbers over the past five decades and individual fish caught in recent years are much smaller than in the past, when they have reportedly been caught up to 270 kgs weight at Ban Tha Bor, Sri Songkhram District, Nakhon Phanom. For example, in 2003, only two giant Mekong catfish were caught near Ban Tha Bor, the largest of which weighed 60 kgs, while reportedly there were 20 individual fish caught near Ban Pak Yam in 2002, all in the 40–80 kg range (Baker, 2004). Local villagers suspect that the giant catfish caught nowadays are not wild spawned stock, but may be introduced fish from a Dept of Fisheries stocking programme, and there is no evidence elsewhere that artificially reared giant catfish have successfully spawned in the wild (Anon. 2004). This issue could possibly be verified by a focused study looking at genetic traits to determine origin. There are several known former spawning grounds identified near the participating research villages, but it is unlikely if fish are able to spawn at these same sites nowadays, due to obstruction of flow by weirs, habitat loss, fishing pressure and other gross environmental changes that have occurred.

Other globally threatened IUCN *Red List* species of the Lower Mekong Basin, which have been identified in catches in the Songkhram River include *Tenualosa thibaudeaui* (Endangered); *Probarbus jullieni* (Endangered); *Probarbus labeaminor* (Data Deficient);

[12] IUCN. 2003. Giant catfish on brink of extinction. News release on 18 November, 2003. http://www.iucn.org/info_and_news/press/catfish.pdf

and *Panagasius sanitwongsei* (Data deficient). There are certain to be additional species in the Songkhram River not included on the *Red List*, but which are rare and threatened with local extirpation. The mass propagation of non-native aquaculture species, particularly sex-reversed Nile Tilapia (*Oreochromis niloticus*) in cages in the mainstream Songkhram River is of concern to native fish biodiversity, as these fish regularly escape and are aggressive competitors for habitat and food sources, as well as posing potential threats through the transmission of disease (Matthews, 2004).

4.1.4 Invertebrates

Data deficient. Villagers report ten species of aquatic mollusc, three species of shrimp and four species of crab being caught in the wetlands area (Tai Baan Research, 2005). An EIA survey for the Nam Songkhram Project identified 12 species of molluscs representing four families (KKU, 1997).

4.1.5 Mammals

Data deficient. Fifty or more years ago, the forests of the LSRB would have been dense, largely contiguous and contained a broad assemblage of mammal species, once common throughout the lower Mekong lowlands. However, habitat loss, forest defragmentation and degradation, and hunting pressure have taken their toll on mammals. Twenty years ago, there were still reported to be populations of mongoose, monkeys, civets and rabbits in the *paa boong paa thaam* (KKU, 1996). A live trapping survey a decade ago found eight species of mammals in five families, including the common tree shrew (*Tupaia glis*) and variable squirrel (*Callorciurius finlaysonii*) (DEDP, 1997). Presently, most species of mammals, with the exception of some bats, rats and other rodents, would appear to be very rare or absent in the lowland forest. However, villagers in Ban Tha Bor, Sri Songkhram District report that Asiatic jackals (*Canis aureus*) locally known as '*maa jing-jawg'* are occasionally encountered in the *paa boong paa thaam* during the dry season.

4.1.6 Reptiles

Data deficient. One survey reported the presence of 11 species from five families, including the king cobra (*Ophiophagus hannah*) and spitting cobra (*Naja naja*) (DEDP, 1997). Reticulated pythons are still reported by villagers at some isolated locations (e.g. Ban Tha Gon, Agaad Amnuay District, Sakhon Nakhon), while yellow tree monitors are still reportedly widespread. There are several species of turtles reported to be present in the *paa boong paa thaam* wetlands and periodically caught, with Tai Baan researchers recognising five species (Tai Baan

Pla fa ong – soft shelled turtle – rarely seen, but still present in the lower Nam Songkhram basin wetlands.

Research, 2005). With more detailed research, it is likely that many species of snake, lizard and turtles could be identified from less disturbed remnant patches of seasonally flooded forest.

4.1.7 Plants

No systematic and comprehensive biodiversity studies on plants appear to have been undertaken in the LSRB, with the exception of Beung Khong Long (see Annex 1). However, Sombutputorn (1998) reported the occurrence of 138 plant species associated with wetlands, including agricultural crop species and non-native introduced species. More specifically, the Tai Baan Research network has catalogued 191 native plant species with beneficial uses to villagers found in surrounding ecosystems of just four floodplain communities. These have been listed and further sub-divided into favoured habitat type, but they have yet to be identified by scientific name. The habitat type with the highest biodiversity was found to be "*thaam*" or the slightly elevated portions of the seasonally inundated forest, often dominated by dense bamboo stands (*Bambusa* spp.) and scrub-like forest. An EIA study carried out by researchers from Khon Kaen University, found that some of the most common species of trees and shrubs in the *paa boong paa thaam* were: *Bambusa* sp. (*pai gasa*); *Mitragyna javanica* (*gratum*); *Eugenia thorelii* (*Hwaa*); *Lagerstroemia cuspidata* (*dton dtabaek*); *Terminlia nigrovenulosa* (*dton ben*); Xanthophyllum glaucum (*dton saeng*); *Albizia chinensis* (*dton kang hung*); *Mallotus thorelii.* (*fai*); *Phyllanthus rabolan* (*makham pawm*); *Combretum guadrangulare* (*dton sagae*); *Randia dasycarpa* (*naam taeng*); *Artabotrys spinosus* (*nao*); *Phyllanthus taxodiifolius (krai hang naak); Barringtonia acutangula* (*gradon*); and *Ixora cibdela* (*kem paa*) (KKU, 1997). A study carried out in February 1995, identified only eight species of aquatic plant at six stations surveyed (DEDP, 1997).

In addition to fish biodiversity, there is a high diversity of plants found in the LSRB, both aquatic and terrestrial, many of which are utilised by local people

4.1.8 Fungi

In-depth interviews with villagers in four LSRB villages over a year, revealed that 17 species of fungi are harvested from the *paa boong paa thaam* for consumption or sale (Tai Baan Research, 2005). They have not yet been identified scientifically, but local names are recorded e.g. *hed khi khwai*, *hed yaw*, *hed sin khon*, *hed la ngawk* and *hed peung thaam*.

4.2 Ecosystems of the Lower Songkhram River Basin

The wetlands of the Lower Songkhram Basin are a complex matrix of habitat types, exhibiting a variety of physical, hydrological, geomorphological and ecological characteristics, which tend to make definitive categorisation difficult. The various habitats found are in a state of dynamic flux dependent on in-basin derived flows and the seasonal hydrological pattern of the Mekong mainstream, which partly determine the structure and function of the wetlands, as well as anthropomorphic influences.

Although a number of different classification systems have been used (Sombutputorn, 1998; Daconto, 2001) or are being developed in the lower Mekong basin, for the purposes of this report, the following main wetland habitat types can be identified:

4.2.1 Lowland River Channels

- Main river channels – comprised of both the Songkhram mainstream and some of its larger tributaries, like the Nam Oon, Yam, Huay Khong, Huay He and Mao which have large catchments of their own. With gentle gradients and slow flows, the rivers meander across wide floodplains. The river level varies markedly between the dry and wet seasons and the unobstructed channels are vitally important as longitudinal migratory corridors for "white fish" species, which migrate long distances to spawn and feed in the seasonally inundated forest.
- Pools – while the Songkhram River is a slow-flowing, mature river there are some pools along the river where the currents have scoured out deeper holes in the river bed. Villagers report that these pools are generally much shallower than they were in the past, suggesting that sedimentation has become a more serious problem in recent years. These pools are considered important dry season refuges for many species of fish, both resident and migratory, but are also heavily targeted for fishing.
- Riverine sand-bars and shallows – landscape feature which only becomes apparent during the dry season, when sand bars emerge and people are able to use shallow areas to cross the stream. These shallows attract certain species of small fish for feeding and may be important fish spawning grounds also.

4.2.2 Permanent and Seasonally-inundated Floodplain Wetlands

A number of seasonal and permanent lotic and lentic wetland habitats are found across the floodplain of the LSRB. These wetland features are flooded during the rainy season by a combination of in-basin precipitation and run-off, plus occasional back-flows from the Mekong River itself, when there is a height differential between the Mekong River and the floodplain of the Songkhram. The annual floods help maintain a number of ecologically important and productive habitats for local livelihoods, as outlined below.

- **Seasonally inundated riparian forest** (*paa boong paa thaam* – refer to Box 2, page 48, for more details). Biologically diverse lowland forest that is flooded for 2–4 months annually. Due to much human disturbance, the forest vegetation is now dominated by bamboo stands (*Bambusa* sp.) and smaller shrubby trees than was formerly the case. Bamboo appears to act as a useful pioneer grass species, out-competing other tree species for light and available nutrients. Vitally important to the continued aquatic resource biodiversity and productivity of the LSRB, yet is threatened by many external factors. With floods, likely to be one of the key "drivers" in fuelling the productivity of the wetlands ecosystems and in returning nutrients to the riverine floodplain system.
- **Marshes, pools, ox-bow lakes and other seasonal wetland habitats across the floodplain** – there are a whole range of seasonal and permanent shallow water bodies which merge into the one large lake created at the peak of the rainy season floods. They contain a mosaic of wetland habitats including reed, sedge and lotus beds, plus open water. Some are man-made, created by damming streams or digging reservoirs, while others are natural features and often connected to the mainstream or tributary rivers by channels. They are important habitats for fish and

other aquatic animals and plants and are extensively utilised by local communities throughout the year.

- **Inundated grasslands** – near some villages there are extensive seasonally-inundated grasslands, where there are no trees or shrubs evident and the soil appears to be rather infertile. To what extent they are natural landscape features or a result of deforestation and/or overgrazing is unclear, but they are important grazing areas for cattle and buffalos in the dry and early rainy season and fishing during the inundation period.
- **Paddy fields** – large areas of the *paa bung paa thaam* have been converted into paddy fields in the last three decades, principally for dry season rice cultivation. Although artificial, they have become important wetland features in the dry season, either taking water from nearby lakes or pumping it out of the Songkhram River itself along concrete or earthen canals. Depending on the amount of agro-chemicals used, the fields may often harbour a broad assemblage of edible aquatic organisms, both vertebrate and invertebrate, which are harvested by villagers for subsistence purposes. Outside the rice cultivation period, pioneer vegetation including exotic, invasive weed species quickly colonise the fields until flooding occurs during July to October/November. Higher surrounding terraces that have been converted to paddy fields become wetland features in the rainy season and dominate the overall landscape, forming temporary refuges for fish and other aquatic organisms.

An alternative local habitat classification system developed by the Tai Baan research network, proposed that ecosystems of LSRB can be broadly split into four sub-groupings:

A. upland ecosystem habitats include: *dong, khok, dawn, pon, kui, non, ba*)
B. lowland ecosystem habitats include: *sawm, kham, sam, sang, tong or tung naa* (meadows or rice fields)
C. wetland floodplain ecosystem habitats: *nong, huay, hawng, sawng, pbaag, sai, boong, thaam, gud, doom or doon or pong, jan*
D. riverine ecosystems: *wang* (pools), *haad* (beach), *gaeng* (rapids), *lang or hawd*

(See Annex 6, for description of each habitat type)

5. Development Trends

The main issues and trends related to development in the Songkhram River Basin, which may directly or indirectly impact wetland resources and biodiversity include:

- Continual external pressure to build large-scale civil engineering projects "to solve" perceived water resource shortage or drought problems for domestic, agricultural and industrial uses, and/or "solving" the annual natural flooding phenomenon.
- Central government, agricultural policy to expand area of industrial tree plantations in Upper northeast region, leading to rapid growth of monocrop plantations (i.e. rubber, eucalyptus and oil palm) with attendant ecological problems e.g. lowered water tables, increased erosion, reduced soil fertility and reduced local biodiversity.
- Expansion and intensification of salt extraction activities in middle and upper Songkhram basin. This issue is linked to sustained building of dams/weirs for irrigation raising water table and leading to increased salinisation downstream.
- More industrial facilities being sited in LSRB, assuming Indochinese trade and communications expands, increasing risks of water pollution, both from agri-business activities and direct waste water release from factories.
- Promotion of policies that would encourage the conversion of recovering forest land into agricultural use, or the encroachment of public land to obtain land documentation.
- Increased or continuing use of destructive/unsustainable fishing practices and gears along river, tributaries and in adjacent wetlands.
- More encroachment on to sensitive floodplain wetland habitats by infrastructure projects, especially roads, embankments and large buildings, like schools.
- Further introduction and spread of exotic plant and animal species through the wetland ecosystem, especially of escaped tilapia from cage culture operations and the invasive weed, *Mimosa pigra*.
- Expansion or growth of agribusiness companies promoting intensive agriculture on sensitive floodplain lands.
- Change in natural hydrology and flood levels of Mekong River precipitated by upstream hydropower dam developments in Yunnan and elsewhere.

(Refer to Annex 7 for a diagram representing the linkages).

5.1 Building of Large-scale Civil-engineering Projects

For the past three or four decades, there have been concerted efforts by various state agencies to implement a range of massive water resources development projects across the northeast region, especially irrigation projects. The latest, large-scale irrigation project slated for the northeast, involves a complex "water grid" system, where water is moved across international borders and about the region by a network of canals and pipes to areas where it is supposedly required for agriculture (Anon., 2005). Despite massive past investments in irrigation infrastructure, the current area of land throughout northeast Thailand devoted to irrigated dry season rice cropping is reported to be only 1,070 km^2 (i.e. 0.6 %), out of a total area of 184,000 km^2 (ADB, 2004). In the Lower Songkhram Basin, the area of irrigated dry season rice is thought to not exceed 2,374 rai (i.e. 3.80 km^2) (DWR, 2004a) or just 0.12 % of the entire land surface area. In the past ten years, the main mega-irrigation project pushed by the state has been the Nam Songkhram Project (see Box 3). Developed by the now-defunct Department of Energy, Development and Promotion (DEDP) in parallel to the

Khong-Chi-Mun Project, which saw several large dams built on or near salt domes in the Mun-Chi Basins and abandoned within just a few years of completion with zero irrigation benefit provided, these projects left a legacy of massive ecological damage (Khamkongsak and Law, 2001). The Songkhram Project has the potential to cause similar or worse problems, due to the greater remaining extent of the *paa boong paa thaam* and other unique wetland features; close proximity to saline-effected land; the crucial importance of the local capture fisheries dependent on annual flood regimes and hitherto unblocked access for migratory fish to and from the Mekong River; plus several other serious negative social, economic and environmental impacts that might result from altered hydrology and permanent inundation of the wetland ecosystems.

BOX 3. Nam Songkhram Project (Krong-gan Nam Songkhram)

This project was originally proposed in 1983, by the former Mekong Committee, with the stated objectives of providing a source of water for irrigation, regulating water levels in the lower Songkhram Basin covering parts of Nakhon Phanom, Sakhon Nakhon and Nong Khai provinces. A secondary purpose was preventing rainy season flooding of the area caused by backflows from the Mekong River. The Project was assigned to the Department of Energy Development and Promotion (DEDP) under the Ministry of Science, Technology and Environment, who hired various consultant companies to undertake feasibility studies for implementation. Under the plans a 15 m high, 130 m wide, five gate dam structure would be built just 8 kms upstream of the Mekong confluence, creating a 255 km^2 reservoir, which would be used to irrigate a total of 565,000 rai (90,400 ha) of farmland above the reservoir in two phases, using electric powered pumping stations. In 1995, the entire project was estimated by DEDP to cost around 10 billion baht (i.e. approx. US$ 400 million).

In January 1994, the Project's Environmental Impact Assessment (EIA) was rejected by the National Environment Board (NEB), which recommended lowering the height of the dam by three metres, to create a smaller reservoir and supposedly reduce the negative impacts. The new EIA contract was awarded to Khon Kaen University, who sent a 12 person team to restudy the revised project design and concluded that the dam and reservoir would be highly favourable for fisheries and aquatic ecology, but there would be some negative impacts on surface water, ground water, soil and erosion / sedimentation. However, this EIA was also rejected by the NEB and the project met strong opposition from local communities who would be displaced or otherwise lose natural resources or livelihood benefits to the project. In March 2002, the Cabinet passed a resolution agreeing with the findings of the NEB that the project would have unacceptably high impacts and the benefits did not justify the costs. (Sources: DEDP, 1995; KKU, 1997; Breukers, 1999; DEQP, 2004)

Despite increasing evidence as to the unsustainable and environmentally destructive nature of this type of traditional paradigm, top-down, mega-infrastructure development in Thailand and elsewhere, the model still holds sway amongst some state agencies, evidenced by the inclusion of the Nam Songkhram Project as a potential development option in recent reports produced by hired consultant companies (DWR, 2004a and 2004b) and strong moves to promote the national "Water Grid" project (Anon., 2005). These reports still perceive the main water resource issues that require solving through engineering interventions to be a seasonal water shortage for agriculture and household consumption, plus normal annual rainy season flooding within the Songkhram Basin. A recent example of this approach in practice has been a proposal to build a six gate dam structure across the Oon river nearby Sri Songkhram township,

creating a supposed 50 MCM reservoir on the floodplain to irrigate a theoretical 28,000 rai of dry season crops at a construction cost of 250 million baht (RID, 2004). No feasibility, cost-benefit study or EIA would be deemed necessary for this scheme to go ahead apparently.

There are several regional water management processes under various stages of planning and implementation at present, which seem to be largely dedicated towards the goal of increasing irrigated area coverage in the Songkhram River Basin area (Anon, 2005). This is despite little evidence to show that past irrigation projects have succeeded in meeting their stated objectives and plenty of local evidence to show many, if not most, have failed. Whether large or medium irrigation storage dams, weirs or pumped irrigation projects, the picture region wide would seem to be one of only marginal agricultural benefits having been realised, but at great economic cost, largely subsidised by state budgets or externalised onto society and the environment and therefore ostensibly "invisible" to planners (Khamkongsak and Law, 2001).

A new "weir" built on the Nam Mao at a cost of 23 million baht – a tributary of the Nam Songkhram – which has yet to deliver any irrigation benefits, but entirely blocks the river's flow in the dry season and is an obstruction to fish migrations.

There is also concern about the planning of smaller projects. A Khon Kaen University study of 15,000 small reservoirs and 10,000 weirs constructed by 1984, which found only 50 % operable or in use (Tantuvanit et al., 1988, quoted in Blake, 2001). A rapid visual assessment of many weirs and small dams in the LSRB would suggest that the situation is no better locally. Due to normally sufficient rainfall during the rainy season when rice is the main crop grown, irrigation is often not critical, but during the dry season when irrigation is most required, official data in the LSRB shows that all types of irrigation systems are only able to deliver from zero to 10 % of rainy season irrigation coverage (DWR, 2004a). The particularly early finish to the 2004 rainy season and dry start to 2005 has generated renewed interest in water infrastructure development. It is notable that the RID is slated to receive 48.9 % of the entire budget devoted to water resources projects in 2006 for the provinces of Sakhon Nakhon, Nakhon Phanom, Mukdahan and Amnat Charoen (DWR, 2005).

There are some positive signs that the past emphasis on only technical solutions to water resources development could be slowly changing in some areas, as hinted at by the Nam Yam and Nam Oon cases in Table 10 below, which shows a summary of water management strategies for three rivers in the Songkhram Basin (DWR, 2005). However, one continuing concern is that plans and developments in the Lower Songkhram River Basin are not linked at present to those in the Upper Basin where two mainstream dams were built in 2003-2004 alone, and so there still appears to be

no overall total catchment approach to managing the Songkhram River Basin water resources, integrating the needs of all resource user sectors.

Table 10. Water Management strategies devised for the Lower Songkhram Basin and two major tributaries, during stakeholder meetings in 2004.

River Basin	Strategy		
	Management	Sources and development	Efficiency increases
Lower Songkhram	Water management is able to use the resource to its fullest extent	Dig natural water channels to solve the problem of watercourse shallowing	Manage irrigation so that plentiful water in the rainy season is available in the dry season
Yam	1. Increase the efficiency of the basin committee 2. Form water users groups		1. Improve the environment so it returns to its former state 2. People are able to depend on the river to deliver maximum benefit
Oon	Open opportunities for all groups to participate	Aim to develop water sources for agricultural consumption, in order to gain benefits	Use budget economically and for the maximum value

Source: Department of Water Resources, 2005

5.2 Central Government Agricultural Policy

One of the core goals of current government policy is to expand the area of rubber plantations in the upper northeast, due to its assumed advantages of plentiful rainfall and providing high quality rubber yield. There are presently ubiquitous signs of a rapid expansion in rubber plantation area around Sri Songkhram and Tha Utaen Districts, evidenced by many rubber seedling nurseries being established along the main roads, and new plantations appearing at many locations above the floodplain level. These plantations, apart from being exotic monocrops and the attendant risks from new disease and pests arriving, are often planted on areas of recovering natural forest. The natural forest is usually clear-felled, then bulldozed to remove all remaining vegetation before planting the rubber seedlings, hence causing a nett loss of biodiversity locally. The plantations also require regular ploughing or herbicide application between rows to minimise weed competition, thus opening up the soil surface to potential erosion, loss of soil fertility and risks of downstream high turbidity and sedimentation, where streams are located nearby. Research is needed on the ecological impacts and risks that come with such a rapid spread of rubber plantations. In the past, eucalyptus plantations were planted on a large scale (up to 3,000 rai) in the Songkhram floodplain area, mainly by large agri-business companies (Guayjaroen, 2001). However, this practice led to conflicts between local villagers and the companies after public lands were lost and communities were excluded from using the areas for livestock grazing and gathering of NTFPs (Anon., 2004). Eucalypts are still a commonplace landscape feature throughout the Basin and are still being planted in large quantities by individual households, who were observed nursing seedlings around houses in several LSRB villages in early 2005.

5.3 Expansion or Intensification of Salt Extraction Activities

At present, there are industrial salt extraction operations found in Ban Dung District of Udon Thani, Ban Muang and Waanon Niwat Districts of Sakhon Nakhon and So Phisai District of Nong Khai. According to Region 9 Environmental Office based in Udon Thani, these operations extend to at least 4,150 rai (664 ha) in Ban Dung alone and employ upwards of 2,400 people (Pathumpong, 2004). They employ primitive technology to extract salt from saline water pumped up from underground, and would appear to be major local sources of both air, soil and water pollution. A Mineral Resources Department map shows a large swathe of land in these same districts is subject to saline groundwater with chloride levels above 1,000 mg/l (KKU, 1997). It has been reported that electrical conductivity and salinity of the Songkhram is higher in the rainy season than the dry season, due to dissolution of the rock salt deposits lying on or near the soil surface in the salt drying pans.

A typical scene around the salt production factories in Waanon Niwat District, Sakhon Nakhon Province, where both evaporation ponds and primitive boiling technologies are used to produce rocksalt, in the process polluting the local air, soil and water quality

The salt extraction operations come under the regulations of the provincial Industrial Offices, who issue licences and make guidelines on the mining practices (Pathumpong, 2005). However, the guidelines may be flouted, like extending production past the officially allowed operating period of October to March, and still mining into the early rainy season. Where saline water has seeped on to adjacent paddy fields or land plots and caused loss of productivity, the owner may ask the operator for compensation for damages, but there does not seem to be a standard procedure in place and it is provided on an ad hoc basis. It is unclear if the salt operations are currently undergoing expansion or retraction in area or numbers, but any future expansion would have potentially severe consequences on water quality in downstream stretches of streams into which they drain and the Songkhram River itself. Large areas of land in the affected area are already almost treeless and present a sterile-looking landscape. It is not known what the biological status of receiving watercourses is, but they can be expected to be bio-pauperate and the issue deserves further research to establish actual impacts of existing operations. Because part of the upper and middle Songkhram Basin is underlain with potash as well as salt deposits, there is always a distinct possibility of commercial interest being shown in this mineral too in the future, which would create a new threat to the river basin.

5.4 Industrialisation

Industrialisation has several potential impacts on aquatic resources: (Sverdrup-Jensen, 2002):

- Increased water abstraction by specific types of industry;

- Increased production of wastes and effluents discharged into waterways;
- Increasing urbanisation.

Although no data on industrialisation levels exists for the Songkhram Basin itself, there is data for the number of factories located in the surrounding provinces, as shown in the table below. At present there appears to be few industrial facilities located directly in the Songkhram River Basin and most of these are thought to be situated near the main towns of Udon Thani, Nong Khai, Sakhon Nakhon and Nakhon Phanom.

Table 11. Showing the number of factories in Provinces surrounding the Lower Songkhram Basin that are potential sources of dangerous waste

Province	No. of factories	No. of factories that are sources of dangerous waste	%
Udon Thani	1,325	322	24.3
Nong Khai	375	50	13.3
Sakhon Nakhon	340	94	27.7
Nakhon Phanom	359	92	25.6
TOTAL	2,399	558	24.2

Source: Pathumpong, 2004

A sugar processing mill in Chaiwan District, Udon Thani of the upper Songkhram Basin, uses large quantities of cooling water for its operations

Main point sources of pollution along the Songkhram river may be attributable to:

- Runoff from intensive agriculture, including pesticides and chemical fertiliser, especially from the large tomato plantations of up to a thousand rai managed by agri-business companies and local farmers on Songkhram floodplain, which use large quantities of agri-chemicals on a regular basis near to water bodies draining directly into the Songkhram or tributaries.
- Untreated domestic sewage releases and waste dump seepage from adjacent communities.
- Occasional accidental spills of organic and inorganic pollutants from various sources, including run-off from roads, construction yards and garages.
- Runoff from salt works in Waanon Niwat and Ban Muang Districts, Sakhon Nakhon finding its way into tributary streams and thence the Songkhram River, thus altering water pH and salinity.
- One or two agri-business canning factories in Sri Songkhram District, Nakhon Phanom and Segaa District, Nong Khai (latter reportedly closed now), which have been implicated by local villagers in water pollution incidents in the past.
- Organic pollutants released from intensive cage fish culture operations in lower Songkhram River communities. A chronic problem each dry season for the last five to six years. These pollutants include uneaten fish feed and excreta below the cages, plus also various treatments (especially antibiotics), applied by the operators in fighting fish disease and parasites.

Little data or prolonged research on water quality and pollution appears to be available. The Pollution Control Department have taken samples from seven stations along the length of the river, twice a year in the past, which indicated that the water was generally "good of standard Class 2–3 rating" (Srimechai, 2003). BOD varied between 0.7 – 1.7 mg/l; Dissolved Oxygen (DO) varied between 4.4 – 7.2 mg/l and Total Coliform Bacteria varied between 20 - 5,400 MPN/100 ml. The author indicated that water quality was better from Sri Songkhram District downstream, than the upstream length, due to a greater density of communities upstream.

Discarded pesticide bottles found beside a melon field next to a Nam Songkhram tributary stream. Melon, tomato and other crops grown for contract companies require intensive applications of agrichemicals, according to farmers.

Informal discussions with local communities at several locations have revealed that pollution incidents have occurred occasionally in the past, especially nearby to agri-business tomato plantations. These would appear to be connected to intensive spraying of pesticides (including by helicopter in the past) in fields adjacent to the Songkhram and Oon rivers, leading to acute localised pollution unlikely to be detected by a twice yearly water sampling regime. As tomato cultivation mostly takes place during the dry season, there is obviously less opportunity for dilution of pollutants at this time. Another critical time when villagers have reported

seeing large numbers of dead fish is after the first rains of the year. This is likely to be from mixed pollutants from agriculture and ash from extensive forest and plantation fires finding their way from tributary streams into rivers and causing death from deoxygenation and direct toxicity. In areas below intensively reared fish cages, there is likely to be large concentrations of fish excreta and waste which will be lifted up into the water column causing a rapid rise in BOD and bacterial levels, following increased flows after early rains which may also lead to anoxic conditions for fish and aquatic life.

It is likely that as trade routes open up from northeast Thailand into Indochina, especially to the ports of Viet Nam, there will be increasing pressure to build more industrial facilities where a. land and other factors of production are cheap and b. communications are conveniently situated to border crossings. When the Nam Theun 2 Hydropower Project currently under construction in central Lao PDR is complete around 2009, this will further intensify the chances of industrial facilities in Nakhon Phanom Province, keen to utilise a potentially abundant electricity supply. The risks of declining water quality and pollution incidents in the future would thus appear to be increased, unless strict industrial zoning and pollution control measures are implemented.

5.5 Land Conversion and the Encroachment of Wetland Areas

One much publicised idea of the present government to reduce poverty has been the pursuance of a policy to increase basic wealth creation opportunities, namely the 'Assets to Capital' scheme. It is designed to allow the poorer sectors of society previously not eligible to formal sources of credit, to use their main assets (whether property or a capital item like a vehicle) to be converted into capital for productive use, such as starting a small business. Often the reason that poorer villagers have been denied credit facilities in the past has been the non-acceptance by the formal banking sector of various categories of land documents as collateral, unless they were a *chanote* or *nor sor 3*[13], which in many villages only a minority of villagers have obtained. Small landowners without official land title are frequently forced by circumstances into using informal credit sources, which often charge inflated interest at daily or monthly rates, thus exploiting and compounding the weak financial situation of the one of the most vulnerable groups in society. However, under the new policy, various mechanisms are available to villagers to present other categories of land documents to existing and new banking facilities set up by the government to address the financial situation of the poor. This would include the acceptance and parallel upgrading of land documents like *sor kor 1* and *sor por gor* 4-01 (Agricultural Land Reform Office, ALRO) that were previously non-eligible for loans to full land ownership documentation status. The fears of critics of this scheme are that villagers would be forced to prove occupation or usage of the land in order to be eligible for benefits, which could lead to wholesale clearance of regenerating forest land, like the *paa boong paa thaam.*

[13] *chanote* and *nor sor 3* are land title documents allowing the fullest rights to the land owner, including the right to buy and sell the land in question

BOX 4. Recent Land Use Changes and the Agricultural Land Reform Office (Alro) on Lower Songkhram River Basin

An ALRO office has been established in Nakhon Phanom Province since 1976, and administers 26 projects in ten districts (plus one sub-branch district) covering a total area of 405,838 rai (64,934 ha) (ALRO, 2004). A significant proportion of this land is located in the area around Sri Songkhram and Naa Thom Districts and lies on the floodplain of the Songkhram river. Much of this ALRO land on the floodplain was formerly officially classified as "public use land" (*tee satarana prayot*) or "vacant waste land" (*tee rog rang wang plao*). This wetland has been progressively converted from public common property to private property under ALRO over the last 30 years. Several of the project villages participating in the Tai Baan Research network, including Ban Pak Yam, Ban Tha Bor and Ban Uan have land that is under the administration of ALRO and the villagers hold *Sor Por Gor* land documents. This documentation gives the holder rights to practice agriculture on the land and can be passed on to offspring as inheritance, but cannot be bought or sold officially. The ALRO land on the floodplain includes large tracts of seasonally inundated forest which has been converted for agricultural use at various times in the past by being levelled with heavy earth moving machinery. Later, villagers have further modified the area by building up bunds round fields and water channels for dry season rice cultivation. However, due to the poor economic returns on rice and other complex external factors, much of the land has never been cultivated or was only temporarily cultivated for one or two seasons. Once abandoned, the *paa boong paa thaam* forest rapidly regenerated, especially hardy pioneer Bambusa sp. (*pai gasa*) and a range of low canopy shrubs. Hence, the *Sor Por Gor* land is currently a mosaic of agricultural land and degraded natural forest in different stages of regrowth. In the rainy season, most of it disappears under flood waters for two to four months and becomes an extensive lentic-lotic ecosystem, while in the long dry season it reverts to a mix of terrestrial and aquatic habitats. Villagers still regard the wetland natural resources on the land as common property for the benefit of all.

5.6 Destructive/Unsustainable Fishing Practices and Gears

As populations have grown, communications have improved and the local economy has changed from a largely subsistence economy to a more commercialised one, resulting in increased pressure on the remaining fishery resources. Fishing gears have become larger and more efficient, to the extent that during the downstream fish migration, whole tributaries may be blocked off by nets (*gad dawn*) using mesh down to several millimetres thick. Villagers comment that these nets can catch everything down to the size of mosquitoes. More traditional and less efficient gears which allowed small fish to escape are less frequently

New canals and roads cutting into the *Tung Pan Kan* flooded forest for planned irrigation of newly created rice fields near Ban Dong San, Agaad Amnuay District, Sakhon Nakhon province.

used, and some have been abandoned altogether (Tai Baan Research, 2005). Hence, with the increase in commercial oriented fisheries and efficiency of gears, the average size of catch has decreased and small, artisanal fishers report it is more difficult to catch enough fish even for subsistence purposes outside of the main fish migration periods (Baker, 2004). Anecdotal reports are also rife of widespread use of illegal and ecologically destructive methods of fishing such as use of electricity and poisons, as well as the intensive and efficient large-scale net and barrier fisheries common along the lower reaches of the Songkhram (Boonyaratpalin, 2002). Some large scale fisheries rights are auctioned off to private individuals through TAOs, even though the gears used are semi-legal or illegal, but may offer opportunities for more closely monitoring catches and fishery trends in the future.

If the fishery continues to be harvested in the future beyond its limits of sustainable yield by increasing pressure on remaining stocks, then it can be expected that fish catches will decline from those at present and the number of people dependent on the fishery will decrease. There will also likely be a decline in biodiversity as larger fish species are progressively "fished down". Although not well documented, this is widely reported to have happened on rivers elsewhere in northeast Thailand and the Mekong basin. However, it is debatable whether the factors behind the decline have been a result of primarily within-sector over-fishing or external environmental causes. Most observers suspect the latter (Sverdrup-Jensen, 2002). The main hope for reversing the trend and promoting sustainable use of aquatic resources lies in promoting multi-sectoral planning approaches to water management, facilitating fishery co-management arrangements, and increasing appreciation by all stakeholders in the importance of healthy wetland resources for local fishery livelihoods.

5.7 Encroachment of Infrastructure on Wetlands

As communications and development infrastructure have been upgraded across the Songkhram Basin, so it has come at a cost to the environment, not always appreciated or predicted. A key factor is the construction of raised roads across the floodplain which can serve to alter the hydrology of the rainy season flows and hence impact migrations of fish. Unless sufficient drainage culverts and bridges are built at permanent and seasonal streams, the raised embankment roads act themselves as flow impediments, and can cause prolonged flooding on the upstream side, while causing fish movement to be restricted to narrower points than was formerly the case. This can allow greater harvests of fish by villagers, but may have a long term impact on the fishery, for example if mature fish are being removed at bridges on their upstream migration before spawning can take place. It is becoming increasingly common for reinforced embankment projects to be built, especially near communities. While these may help to protect against the effects of erosion locally, they may often lead to increased erosion up and downstream of the embankments and lead to the loss of riparian vegetation and sometimes, riverbank gardens that were formerly tended by some of the poorest and least empowered sectors of the community. Some raised embankments are now being promoted as flood protection schemes by lifting the banks above the former natural level, which serves to alter local hydrological characteristics and can actually increase local flooding behind the banks in some cases.

Another trend has been the construction of state infrastructure projects, such as schools or local administration buildings on floodplain and former *paa boong paa thaam*

areas. This has often involved the razing of natural riparian vegetation and then piling up large volumes of earth to bring the construction site above the normal flood level. The soil used is often taken from an adjacent area, causing further destruction of riparian vegetation and ecological disturbance. In one notable case, at Ban Tha Gon, Agaat Amnuay District, Sakhon Nakhon, a large area of once healthy *paa boong paa thaam* adjacent to the Songkhram River was sacrificed to make way for Tha Songkhram Wittaya Secondary School, teachers' houses and a sports field. According to one report, this school was built on the healthiest stand of community-owned *paa boong paa thaam* remaining in the Songkhram River Basin (KKU, 1996) even though there would appear to be other less sensitive sites nearby above the floodplain where the school might have been constructed.

A remnant patch of moist evergreen seasonally flooded forest remains near Ban Tha Gon, Agaad Amnuay District, Sakhon Nakhon, and is notable for a sizable well which acts as a source of clean drinking water for villagers and the many species of epiphytes and orchids the trees harbour

5.8 Introduction and Spread of Exotic Plant and Animal Species

There are a number of potentially harmful invasive, alien plant and animal species, both terrestrial and aquatic, which are spreading in the LSRB area, either as a result of deliberate or accidental introductions from other localities. The spread of invasive alien species (IAS) is now recognised as one of the greatest threats to the ecological and economic well-being of the planet (Matthews, 2004). As globalisation continues and the movement of people, goods and biological resources increases at all geographical scales, so the spread of IAS increases and the potential for greater ecological and economic costs associated with the damage they cause and efforts in controlling or eradicating them. At present there would appear to be little awareness of the potential threats from IAS spread amongst government authorities at the local level in the Demonstration Site area, although the problem is well recognised at the national level (OEPP, 2002). Invasive alien fauna and flora known to be present in the LSRB wetlands and believed to be having negative (but so far, unquantified) ecological and economic impacts, include:

Animal species

- Nile tilapia (*Oreochromis niloticus*) is widely cultured in cages along the lower 100 kms of the Songkhram river and in aquaculture ponds on the floodplain. Native to East Africa, these fast-growing and prolific breeding species have been heavily promoted for culture in cages by one or two large agri-business companies and have become so synonymous with one in particular, that they are now often referred to as '*pla CP*'[14]. These fish regularly accidentally escape from fish cages

[14] CP – Charoen Phokpand – is a Thai based multi-national company with interests in many sectors of the economy, but was originally based on agri-business ventures ranging from feed mills to agrichemical supply to intensive fish, prawn and pig farms.

or from ponds during flooding episodes and become established in slow-flowing rivers, lakes and ponds. Tilapia has been implicated in negatively impacting local biodiversity through domination of the fish biomass in certain waters, and competition with native fish for food, habitat and breeding sites (Matthews, 2004). They have rapidly become one of the two dominant fish species (both exotics) in the modified environment headpond of the Theun-Hinboun hydropower project in Lao PDR, even with no deliberate stocking (Blake et al., 2005) They may also play a role in spread of disease and parasites to native fish populations.

- Common carp (*Cyprinus carpio*) is a native fish species of central Asia, but has become widely established in a variety of aquatic habitats throughout the Lower Mekong basin. It has long been deliberately stocked in aquaculture ponds, natural and artificial lakes, and reservoirs for food and to augment natural fish stocks. Common carp displays wide physiological tolerance, omnivorous diets, fast growth rate and a high fecundity, and so can tend to dominate the biomass of waters in colonises. Being a bottom feeder, it often turns clear waters cloudy through its feeding activities and has frequently been observed eating the eggs of other fish species. Hence, it has been implicated in negatively impacting the native fish fauna in waterways that it becomes established in. It is regularly caught in the mainstream Songkhram and associated wetlands, and is considered to be good eating by local people.
- The golden apple snail (*Pomacea canaliculata*) is indigenous to South America, but in recent years has become an invasive pest throughout South East Asia (Matthews, 2004). The snails feed on young rice seedlings with an adult snail being able to consume up to 25 per day. They also eat a wide variety of other aquatic plants and are likely to impact indigenous fauna though habitat modification and competition. It is known to be widespread in the rice paddies of the LSRB and is considered a serious pest by farmers. Some villagers collect the snails by hand and consume them, but it is not as popular as native species of snail. In other parts of Thailand, raising duck and fish in the rice fields have been used to control the population of snails.

Plant species

- The giant mimosa (*Mimosa pigra*) is indigenous to Central and South America, but was introduced to Thailand via Indonesia and was originally introduced by the Irrigation Department to stabilise bank erosion along irrigation canals (OEPP, 2002). It has rapidly spread to all parts of northeast Thailand and is widely evident in the LSRB wherever there is newly disturbed soil in lowland areas, especially along road and canal embankments. Due to its characteristics of rapid growth, prolific production of seeds and adaptation to both aquatic and terrestrial environments, the giant mimosa has aggressively colonised large areas of land, replacing biodiversity-rich natural ecosystems with monospecific stands of giant mimosa (Matthews, 2004). The dense thorny stands hamper movements of livestock and people, colonise former livestock grazing and wetland product harvesting areas and restrict access to water. They are resistant to many chemical and physical control measures, but there are insect bio-control agents which have been used with some measure of success in Thailand (Matthews, 2004). An integrated approach to control is most successful, using a variety of techniques together.
- Water hyacinth (*Eichornia crassipes*) is considered the one of the world's worst invasive aquatic weed and large financial resources are spent in Thailand and elsewhere in the tropics in trying to control its spread. Native to the Amazon basin

of South America, it was originally introduced into Thailand as an ornamental plant. Water hyacinth infestations have many negative socio-economic and environmental impacts, including blocking navigation; clogging irrigation canals and pumps; adversely affecting drinking water quality; creating conditions suitable for mosquitoes and other disease vectors; reducing light penetration into water and thus lowering natural food productivity and disrupting the ecosystem. Although present in the LSRB, it is not clear how much of a local pest water hyacinth is or how much damage it causes. However, in the nearby regulated Nong Han lake in Sakhon Nakhon Province, large budgets are allocated annually by the Fishery Department in its physical removal by raft-mounted machines.

5.9 Agribusiness

Within the LSRB area there has been a history of involvement of a handful of large agribusinesses investing in intensive agriculture, pulp tree plantations and food processing plants over the last 30 years or so. Some of these business' activities are outlined in Section 2.1 of the History of Natural Resource Issues in Chapter 2 and summarised in the table below.

Table 12. Agribusiness companies established in LSRB

NAME OF COMPANY	YEAR OF ESTABLISHMENT	MAIN ACTIVITIES
Tawan Farm	1978	Contract farming – intensive crops
Ut-sahagaam Kaset Isaan	1984	Contract farming – intensive crops
Suntech Group Ltd.	1988	Tomatoes and eucalyptus
Tung Songkhram Industry Ltd.	1990	Eucalyptus
Asia Tech Group Ltd., & Asia Tech Pulp and Paper Ltd.	1996	Tomatoes for canning, eucalyptus plantations for pulp and paper

Source: Guayjaroen, 2001a

These companies were established with state inducements and subsidies to open up the area to modern agri-business stemming from a perception that the climate and soils of the Lower Songkhram Basin had advantageous agricultural characteristics over other parts of the northeast. At the time, agro-industrial expansion fitted into wider regional development policy promoted by central government under successive National Economic and Social Development Plans. Another likely attractive inducement for the companies was the common perception that floodplain land was a. under-utilised (i.e. "wasteland") and b. cheaply (or even freely) available. Land was quite gradually usurped or bought from villagers at prices as low as 150 baht/rai (even though the villagers had no official land title over the land and so were not legally permitted to sell), but in some cases the same land was later found to have been upgraded to full legal title. Other tactics for land acquisition included restricting access to land of somebody reluctant to sell by surrounding it with fence or agents offering inducements to headmen to persuade villagers to sell up at preferential rates. Hence, in a relatively short period of time, the companies were able to accumulate many thousands of *rai* of public land or state forest reserve, and in some cases obtain full ownership rights over the land. The villagers, unaware of their land rights and what was at stake became easy prey for unscrupulous land agents and lost vast amounts of land for what was later recognised to be a pittance. In only one case – Ban Dong San, Agaat Amnuay District, Sakhon Nakhon – has a prolonged court battle to regain lost

public land from a large private company resulted in a successful outcome in favour of the village community.

Former natural wetlands and communal land bought at low prices from villagers over 20 years ago and levelled for intensive vegetable cultivation by SunTech Group Ltd., Sri Songkhram District, now lies largely idle.

Ironically, many of the intensive agriculture initiatives of the agribusiness companies do not appear to have thrived or been successful. Indeed, there is now a smaller area of tomato and sweet corn cultivation being practiced than in the ten years ago, according to the manager of Suntech Company (Mr Khamton Chulajarupan, personal communication, 30 March 2005). The companies over time have diversified from conducting their own on-farm intensive agriculture to promoting off-farm contract farming through agents or brokers who make deals with villagers. This no doubt reduces the production risks and overheads of the company and transfers them to the farmers, who are then expected to suffer the consequences of regular intensive application of agri-chemicals[15] on crops and price fluctuations at harvest. Anecdotal evidence suggests that many farmers suffered financial losses through taking out loans to cover the costs of seed, fertiliser, pesticides and other external inputs, but ended up owing the company money at harvest as the price of produce was lower than expected or tomatoes were rejected for being "below grade". This either precipitated a cycle of debt or impoverishment, or led to the farmers becoming very sceptical about ever believing extension advice or practicing intensive cash cropping again. It may partially explain why there are relatively low levels of dry season agriculture observed nowadays, even where water source are apparently available and what planting does take place is mostly the relatively low-input, low-risk form of dry season rice culture, as opposed to potentially higher return cash crops.

5.10 Changes natural hydrology and flood levels of the Mekong River

At present there are two large hydropower dams regulating the flow of the Lancang-Mekong river in Yunnan province of China, while two more are under construction (Jinghong and Xiaowan) and there are plans for a further four dams to be constructed before 2015. It is anticipated that as the upper Mekong reaches are progressively controlled by further hydropower dam developments, so the degree of control of downstream flows will progressively heighten, altering the present hydrology significantly. Studies predict that these dams storage capacity (an estimated 23,200 MCM by 2025) and operating regimes will serve to significantly increase dry season flows and lower rainy season flood peaks as far downstream as Cambodia (Plinston and Daming, 2000; ADB, 2004). This scenario will have potentially serious negative

[15] In a small sample of pesticide bottles discarded by farmers in fields, the following brand names were noted: "Kanozeb" – alkylenbis (dithiocarbamate); "Omite-20" (for controlling red mites); "Bulldock Star" – betacyfluthrin & chlorpyrifos; "Eralaxyl"; "Kaluza"; "Folidol" (methyl-parathion).

impacts on the fisheries and other natural resources of the Songkhram Basin by affecting water quality and environmental cues for longitudinal fish migrations in the mainstream Mekong and possibly reducing habitat available for spawning, nursing and feeding, as well as knock-on effects to soil fertility and agriculture through altered sedimentation rates. In the last few years alone, precipitous declines in fish catches have been observed in Cambodia, while the MRC reports that there has been a measurable decline in sediment levels as far downstream as Pakse in southern Lao PDR. Fifty per cent of the entire sediment load reaching the Mekong Delta previously originated from China (Plinston and Daming, 2000). Villagers in the Lower Songkhram Basin have been reporting instances of unusual water level fluctuations in the Songkhram River, especially in the dry season over the past few years (Tai Baan Research, 2005).

6. Politics and Institutions

Since the early 1990s, Thailand has taken a more coordinated approach to wetlands management. The Office of Environmental Policy and Planning (OEPP) was appointed to act as a national focal point and established a National Sub-committee on Wetlands Management on 1 July 1993 (Chansiri, 2003). This Sub-committee was chaired by the Deputy Permanent Secretary of the Ministry of Science Technology and Environment (now MoNRE) with representative members from relevant government agencies (i.e. ONREPP; Royal Forest Department; Department of Fisheries; Royal Irrigation Department; Department of Land Development; Department of Local Administration; Department of Environmental Quality Promotion; Budget Bureau; Department of Technical and Economic Cooperation; Department of International Organisation and the Royal Thai Navy), plus non-government organisations (NGOs) such as Wildlife Fund of Thailand, Bird Conservation Society of Thailand and various distinguished experts. To assist its work, in 1999 the National Sub-committee on Wetlands Management appointed the Technical Working Group on Wetlands consisting of wetlands experts and university scientists, relevant government agencies and NGOs to provide technical consultation to the Committee.

Wetland management involves many government agencies nationally, some primarily concerned with coastal marine wetlands and some with freshwater wetlands, with each agency having its own objectives, approaches, policies and operational regulations on wetland management. Table 12 below summarises the roles, authority and responsibilities of the various government agencies involved in wetlands management.

Table 13. Main wetland related government agencies in Thailand

Wetland related agency	Roles, authority, responsiblities
The Cabinet	• Oversee the national natural resources and environmental policy and plans • Decide and approve key principles, measures and strategies
National Environment Board (NEB)	• Approve national wetland policy and key measures • Provide comments and advise on national environmental strategies to the Cabinet
National Sub-Committee on Wetlands Management	• Provide common guidelines and coordinate actions on wetland management through formulation of national policy, measures and action plan on wetland management and protection • Provide support and monitor implementation of the national policy; support, supervise and monitor implementation of the Ramsar Convention; promote consideration of wetland fundamentals in formulation and implementation of natural resources development and conservation plans, assist strengthening awareness, provide education and wetland related studies and research
Technical Working Group on Wetlands Management	• Act as preliminary reviewing panel for wetland management plans of each wetland site before being presented to the National Sub-committee, provide technical views and information on issues discussed by the Scientific and Technical Panel of the Convention on Wetlands
Ministry of Natural Resources and Environment	
Office of Natural Resources	• Formulate policies, measures, operational frameworks, management/action

and Environmental Policy and Planning (ONREPP)	plans on conservation and use of wetlands at national level in accordance with the national environment plan and the National Economic and Social Development Plan and in conformance with obligations and strategic plans of the Convention on Wetlands and other related conventions. These actions are taken under the Enhancement and Promotion of Environmental Quality Act (1992) • Coordinate with relevant agencies to enable implementation of the policies, measures and plans; monitor and evaluate their implementation • Act as the national focal point for the Ramsar Convention • Act as the secretariat body of the National Sub-committee on Wetlands Management
Department of Water Resources (DWR)	• Manage water resources nationally • Act as national coordinating body of the Mekong River Commission
Department of National Parks, Wildlife and Plants	• Manage and conserve wetlands within protected areas, i.e. Wildlife Sanctuaries, National Parks, and Wildlife Non-hunting areas in accordance with the National Park Act (1961) and the Wildlife Preservation and Protection Act (1992) • Regulate the use of parks and their resources; provide appropriate recreational facilities; introduce and conduct interpretative programmes to build visitor's understanding and appreciation of park values • Protect wildlife and increase populations; protect wildlife habitats and educate the public regarding wildlife protection
Department of Environmental Quality Promotion (DEQP)	• Enhance and promote national environmental quality via public relations, education and awareness programmes • Coordinate and support activities of NGOs • Maintain environmental database and information systems
Pollution Control Department	• Control and prevent pollution of all forms from all sources
Provincial Natural Resources and Environment Office	• Oversee and coordinate provincial natural resources and environmental management strategies
Ministry of Agriculture and Cooperatives	
Department of Fisheries (DoF)	• Manage and conserve fishery areas and wetlands which are habitats of aquatic animals, under the Fishery Act (1957); the Fishing Right in Thai Fishing Area Act (1959); the Thai Fishing Vessels Act (1938); the Fishing Port Act (1963); and the Wildlife Preservation and Protection Act (1993) • Enhance fishery productivity, conserve and develop aquatic species, replenish natural stocks and long-term use of fishery resources • Conduct studies, research and experiments in every field of fisheries; explore and analyse fishing grounds beyond Thai waters and promote fisheries cooperation with other nations; develop occupations relating to fisheries
Royal Forest Department[16] (RFD)	• Manage and conserve all types of forests including those associated with natural wetlands, e.g. mangrove forests, peat swamp forests, as well as streams, marshes, canals, ponds, waterfalls, under the Forest Act (1941) and Forest Protection Act (1964) • Protect and rehabilitate denuded watersheds, introduce alternative land use and agricultural practices to discourage shifting cultivation • Mangrove, Swamps and Wetlands Management Division, Forest Research

[16] The RFD has now been transferred to the responsibility of the Ministry of Natural Resources and Environment, and is awaiting official designation of new roles.

	Office: established on 20 October 2000, for research on mangroves, swamps and wetlands; technology transfer and information service; develop action plans; protection and rehabilitation measures; established RFD's Wetlands Committee on 8 June2001 to set up a wetlands management policy and action plan and to implement the Ramsar Convention. RFD developed Action Plan for Sustainable Wetland Management Phase 1; 2003-2007, GOALS: targeting establishment of 22 Wetland Information Centres; survey and research at least 2 million rai of wetland area; set up community networks for at least 10 wetland sites; 15% of targeted population participate in wetland management; 20% of targeted communities get access to wetland information service, and participatory sustainable wetland management
Royal Irrigation Department (RID)	• Develop water resources and manage water supply for various purposes, e.g. for storage, cultivation, drainage, flood prevention and transportation under the Public and Civil Irrigation Acts (1939)
National Resources and Biodiversity Institute (NAREBI)	• Facilitate a new concept of ecosystem management to reduce the institutional overlap and duplication of efforts among various agencies
Ministry of Transportation	
Harbour Department	• Maintain and protect wetlands for use as transportation routes e.g. rivers and canals in accordance with the Maritime in Thai Waters Act (1992, 14th revision)
Ministry of Interior	
Department of Lands	• Determine rights, guidelines, criteria, conditions and methods of land use as well as private and public real estate by issuing land holding documents under the state's protection, all in accordance with the law on land and group four of the civil and commerce laws entitled property in management of natural wetlands
Department of Local Administration	• Supervise local administration in administering local areas in accordance with government policies and in providing adequate service to local communities
Department of Town and Country Planning	• Conduct studies and formulate landscape design plans in areas around and adjacent to wetlands to ensure the existence of the entire wetlands ecosystem
Provincial Office	• Oversee and coordinate management activities in wetlands within provincial boundary
Local Administration Organisation	• Local administration plays a part in ensuring wetland management and conservation is implemented in accordance with both national policies and needs of local people. The administrations have close links with village institutions, and thus their actions may have direct impacts on wetlands and the population of surrounding areas. • Administration of wetland management is under the Sub-district Council and Sub-district Administration Organization Act (1994), especially the maintenance of natural resources an environment under the jurisdiction of sub-district council and sub-district administration organization in Article 23(4) and Article 67(7)
Ministry of Education	
Department of Education	• Oversee and develop educational curriculum and enhance wetland education
Ministry of Tourism and Sports	
Tourism Authority of Thailand (TAT)	• Promote appropriate tourism activities in wetlands in order to generate and enhance local occupation and income
Ministry of University Affairs	
Universities and academic institutions	• Provide technical and academic service; serve as members on Committee, Sub-committee, Working Group and as individual consultants

	• Contribute to wetland management projects/programmes and activities of GOs, NGOs and IOs • Wetland education and public awareness raising

The Lower Songkhram River Basin, Thailand Demonstration Site office of the MWBP is located in Sri Songkhram District administration office, Sri Songkhram District, Nakhon Phanom Province. The MWBP had been working in the area for approximately 18 months, in a pre-project preparatory phase, prior to the official start of the MWBP on 19 July 2004[17]. Initially the MWBP will be working primarily in two provinces – Nakhon Phanom and Sakhon Nakhon. There are plans to create two provincial Songkhram Wetlands Demonstration Project Steering Committees – one for Nakhon Phanom Province and one for Sakhon Nakhon Province to help guide the field office in the planning and implementation of the project in each province. According to the MWBP Programme Document (2004): "These will be chaired by the respective Provincial Governors with members from related provincial departments and local NGOs. The provincial offices of the Ministry of Natural Resources and Environment would provide the secretariat to their Steering Committees assisted by the IUCN Wetlands Project Co-manager". Further, "In order to coordinate between these two Provincial Steering Committees within the basin as a whole, to exchange information with and provide links with other organisations, a Lower Songkhram Basin Technical Advisory Committee will be established, with representatives from the two Steering Committees, other relevant organisations, including the other two provinces in the Songkhram Basin (Nong Khai and Udon Thani) and NGOs. This will be coordinated by the regional Director of ONREPP, with support from the IUCN Wetlands Project Co-manager." (Programme Document, Final Version. 2004)

These provincial-level committees are still in the discussion phase of formation, as various linkages, roles and responsibilities of key institutions are being established and contacts made by the project. To date, the principle project partners and key stakeholders in wetland-related issues are perceived as including the following government and non-government institution stakeholders.

6.1 Key Provincial Government Institutions:

- Nakhon Phanom **Provincial Office of Natural Resources and Environment,** Ministry of Natural Resources and Environment. The Director of the Office is the acting Provincial Project Co-manager and is kept closely informed of all project activities and plans on a regular basis. The Director was transferred to another province in January, 2005 which has created a knowledge and project familiarity gap.
- Sakhon Nakhon Provincial **Office of Natural Resources and Environment**. At the moment, this office has yet to be actively involved in project activities, but this is expected to change as the project focus areas expands in 2005 and beyond.
- Nakhon Phanom and Sakhon Nakhon **Department of Water Resources**, MoNRE
- Nakhon Phanom and Sakhon Nakhon **Provincial Fisheries Department Offices**, Ministry of Agriculture and Cooperatives (MOAC).
- Nakhon Phanom and Sakhon Nakhon **Provincial Freshwater Fisheries Centres**, MOAC – in particular Sakhon Nakhon Centre where the Director has been actively

[17] Press Release: "$30 million Mekong wetlands biodiversity programme gets green light" 19 July, Vientiane, Lao PDR. UNDP/IUCN/MRC.

involved in monitoring fishery regulation issues and breaches on the Songkhram River for many years.

- Nakhon Phanom and Sakhon Nakhon **Provincial Forest Departments**, MoNRE.
- Nakhon Phanom and Sakhon Nakhon **Provincial Agriculture Departments**, MOAC.
- Nakhon Phanom and Sakhon Nakhon **Provincial Agricultural Land Reform Offices**, MOAC. Large areas of the LSRB wetlands, especially in Sri Songkhram and Naa Thom districts are ALRO designated land holdings, including most of the best remaining stands of seasonally flooded forest.
- Nakhon Phanom and Sakhon Nakhon **Provincial Land Development Departments,** MOAC.
- Nakhon Phanom and Sakhon Nakhon Provincial **Royal Irrigation Department** Offices, MOAC. RID is the largest recipient of state funds for water resources development projects (including irrigation and flood prevention) in the LSRB by a wide margin.
- Nakhon Phanom and Sakhon Nakhon **Community Development Departments**, Ministry of Interior. The CDD has a mandate to promote the decentralisation process through empowering local organisations, networks and people through community forums at the village and sub-district level.
- Nakhon Phanom and Sakhon Nakhon **Provincial Local Administration Extension Departments**, Ministry of Interior.
- **Bung Khong Long Non-hunting Area and Ramsar Site Office**, Nong Khai Province. Under Department of National Parks, Wildlife and Plants, MoNRE.

6.2 Educational Institutions:

- **Rajabhat University**, Sakhon Nakhon.
- **Faculty of Social and Humanities Studies**, Khon Kaen University.
- **Walai Rukhavej Botanical Research Institute**, Mahasarakham University.
- **Faculty of Environment and Natural Resources Sciences**, Mahidol University.

6.3 Non-government Organisations and Civil Society Groups:

- The Bangkok-based organisation **Project for Ecological Recovery (PER)** has worked in the Songkhram River Basin since 1996, when it began monitoring the Songkhram Project (large dam and irrigation project). Project for Ecological Recovery (PER) has been actively involved in raising awareness of natural resource issues locally and nationally, through local studies, information dissemination, arranging seminars and workshops for all stakeholders. It has also helped in capacity strengthening of local communities and resource user networks.
- **Nakhon Phanom Environmental Conservation Club (NECC)** is a local civil society group of environmentally concerned individuals, drawn from both government and the private sector, based in the provincial capital of Nakhon Phanom. It has been instrumental in assisting some aspects of the Tai Baan Research programme and is keen to promote eco-tourism locally.
- **Southeast Asia Rivers Network (SEARIN)** is a Chiang Mai-based NGO focusing on sustainable and just use of aquatic resources and large infrastructural project impacts on rivers in the Mekong and Salween basins. It was contracted to guide and supervise the first phase of the Tai Baan Research component of the MWBP Demonstration Site activities in four local villages, after conducting similar local knowledge research at several other sites around Northern and northeastern Thailand.

- The **Nam Songkhram Basin Conservation and Recovery Club** was established in 1996 as a community-based organisation with members in 10 villages who were concerned about potential impacts arising from the Songkhram Project and associated developments, including potential dam construction and the promotion of agri-business in the Basin, which was directly impacting local livelihoods. It works as a people's network, some of whom have been subsequently involved in the Tai Baan Research Network.

6.4 Village Level Institutions

There are both informal and formal groups found at the village level. A participatory study conducted by Actionaid (2003) identified 20 different groups or institutions present in one village alone. Some of the groups are villager-initiated, while others are initiated and partially managed by outside institutions, typically government agencies. Some relate to the provisions of services like credit, infant day care, public health or water supply, while others relate to production or livelihood activities, like livestock raising, sewing or agriculture. There are also groups related to law and order (e.g. Village Police) and product marketing (e.g. One Tambon, One Product). The villagers had different perceptions of the relevance and importance of these numerous groups, finding the "Elderly" and "Self-defence Volunteers" groups least important, while the "Agriculture", Cremation Revolving Fund and "Overseas Labour Migrant Loan Fund" groups were most important. As the report points out, village society is still governed by strong kinship and patronage systems, where family bonds are considered central and may act as both informal credit sources and controlling social behaviour (Actionaid, 2003). Village elders have strong influence on relationships and decisions within and between groups, and are often called to settle inter and intra family disputes. The village headman and deputies (which are state paid positions), are also crucial local actors in settling disputes within the village and with other villages. They are often entrusted with taking villager grievances to a higher level of authority at the district level, although some of their previous authority may have been undermined by the establishment of the Sub-District Administration Organisations (TAOs), with village-level representatives chosen though a four year election system. The Headman may be elected or appointed to the position until retirement at 60 years of age, depending on local circumstances.

6.5 River Basin Organisations

Water provision has traditionally been the domain of a wide range of government agencies, whether for agriculture, domestic use or industrial consumption. Village water supplies were, until a few years ago, being planned and built by up to 16 different government departments. The lack of coordination and overlapping roles and duties between the departments was evident in the abandoned water infrastructure commonly seen in villages across northeast Thailand. Since the formation of the Ministry of Natural Resources and Environment in 2002, water resources planning, management and conservation nationwide has been transferred to the responsibility of the Department of Water Resources (DWR), which has been charged with making a National Water Policy (passed by Cabinet on 31 October 2000) using an Integrated Water Resources Management approach in line with the 1997 Constitution (see Box 4). Under this plan, Thailand has been divided into 25 sub-areas, which either follow clear basin catchments (like the River Chee or River Mun basins) or follow more vague provincial groupings encompassing many smaller river basins. In the case of the Songkhram basin, it falls under the Mekong Basin Area 02 that includes many other smaller basins between Loei in the west and Amnat Charoen in the south east of

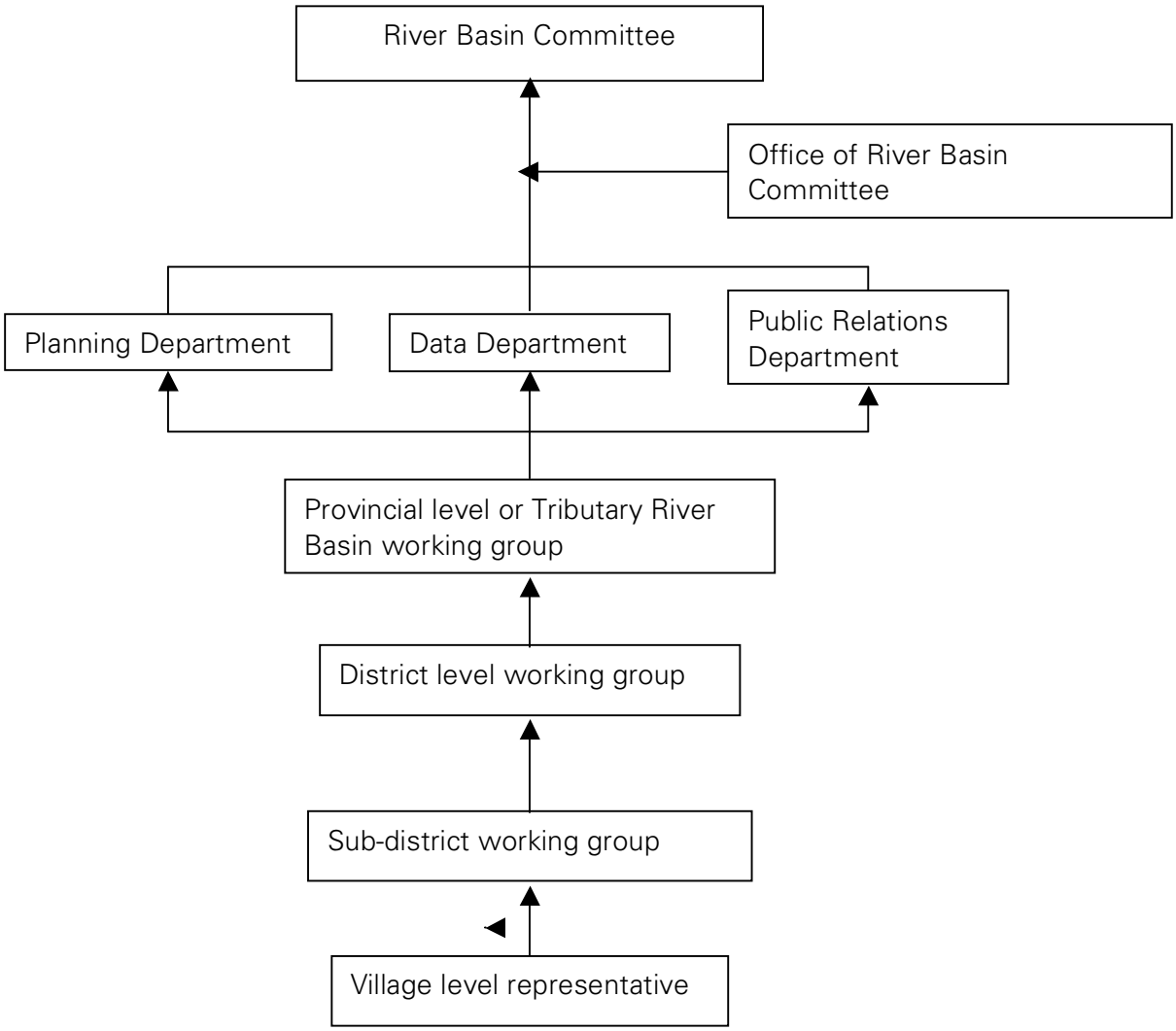
Isaan, which all fall under the responsibility of the Water Resources Office, Region 3, based in Udon Thani.

A key provision of the National Water Policy is:

Point 7 : *"Support and promote participation, together with planning the model of participation rights and clear duties of citizens, private organisations and government agencies in managing water resources; together with water use, responsibilities, conserving water sources and monitoring water quality in order to encourage efficient use of water resources."*

In line with this decentralisation and greater participation policy, River Basin Committees (RBCs) have been established with the following organisational structures:

Structure of River Basin Committees



Authority and Duties of River Basin Committees

1. Propose opinions to the National Water Resources Committee (*Gor Tor Chor*) about policy planning, projects and approaches to solving problems and obstacles in developing, using, conserving and implementing whatever is necessary for managing water resources, including implementation of works by various other relevant agencies in the basin.

2. Make a water resources management plan for the river basin.

3. Coordinate the implementation plans of various government agencies in the basin area, according to the water resources management plan in (2) above.

4. Consider prioritising according to importance together with fixing the amount of water used and practical measures to allocate water that are appropriate, just and efficient.

5. Follow-up and evaluate the implementation of work by various agencies that are related to water resources in the river basin area.

6. Request documents and actual observations about water resources to collate statistics, data, points of view, and various proposals about water resources management; development and conservation of water sources; prevention and solutions to water shortage, problems of flooding and taking care of the water quality problems in the basin.

7. Compromise, mediate disputes and solve problems that are related to implementing water resources management that arise in the river basin.

8. Coordinate practical work about water resources with other river basin committees that are related.

9. Publicise, do public relations, receive suggestions and build understanding with people so they know and understand the results or different methods of implementation of the river basin committee.

10. Establish a working group to implement the plans according to the river basin committee.

11. Implement other work according to *Gor Tor Chor*'s wishes.

While the goals and aspirations of the various River Basin Committees (RBC's) would appear to be well conceived and on paper at least, encourage the wide participation of various stakeholders, the reality on the ground still apparently has some way to go to meet the rhetoric. Reports suggest that the RBC's are still composed primarily of government officials and representatives from provincial and sub-district organisations that often stand to benefit from the continued unchecked expansion of water infrastructure projects, rather than a more rational approach that thoroughly considers the balance of needs between rapid economic development and that of society and the environment on the other. In other words, the needs and interests of diverse sectors and societal sub-groups are not adequately addressed or represented in the current RBC composition. One sub-district level committee member from Ban Pak Yam, Sri Songkhram District commented: "*It's a waste of time going to the meetings as they just want to build more big projects. They don't want to listen to my opinion or think about natural resources conservation*". Indeed, the budget plan for Water Resources Development for 2004 in Nakhon Phanom and Sakhon Nakhon is puts grater emphasis on water infrastructure for consumption and agriculture (DWR, 2005), rather than for "software" like wise management, capacity building, appropriate training or awareness raising.

Currently irrigation provision for agricultural purposes falls under the responsibility of two main government departments, namely the Royal Irrigation Department (RID), part of the Ministry of Agriculture and Cooperatives, and the Department of Water Resources (DWR). The Royal Irrigation Department (RID) and DWR are currently in the process of formulating plans to further expand and develop the irrigation infrastructure in the Songkhram Basin through development of mega-projects, like the National Water Grid which would involve trans-basin and trans-national water transfer schemes. However, increasingly Provincial and Sub-district Administration Organisations (PAO and TAO, respectively) are having to take over responsibility for existing irrigation systems, even when they do not have adequate budget or human resources skills to

manage and maintain such infrastructure (personal communication, Deputy Chairman of Nakhon Phanom PAO, 8 April 2005).

The Mekong River Commission (MRC) in cooperation with the Thai National Mekong Committee (TNMC) (which works under the DWR) has in the last few years been working on creating a Basin Development Plan (BDP) for the various sub-basins of the Mekong River within northeast Thailand. The overall objectives of the BDP are to create a sustainable water resources development plan for each sub-basin area, considering various development objectives in a balanced way, utilising input from a wide variety of stakeholders in a participatory, "joint-decision making process" (TNMC, 2004). The Songkhram River Basin comes under the BDP area designated as SA-3T, which covers eight provinces of upper northeast Thailand, in which according to the TNMC (2004), 290 irrigation projects have been identified covering a potential area of 1.67 million rai (267,000 ha). The Mekong River Commission (MRC) regards Flood Mitigation and Management as a key programme and emphases "flood forecasting". It has also been promoting integrated measures to control floods involving engineering and non-engineering approaches. The Nam Songkhram Project (formerly under DEDP) is considered as a large-scale project in the Mekong Basin, "which may involve trans-boundary issues and requires a comprehensive study prior to implementation" (TNMC, 2004).

In the Lower Songkhram River Basin, DWR has been responsible for putting together a master plan for water development, by contracting five consultant companies[18] to plan and manage the process, under a project called: "Project for Participatory Planning in Water Resources Management in the Mekong Basin area of Isaan". The LSRB demarcated area in the plan does not include all of the main Songkhram tributaries (such as the lower Yam and Oon river basins which are still an integral part of the overall Songkhram Basin's lowland seasonally-flooded wetlands as far as MWBP is concerned), but these are considered in separate sub-basin plans. To date, two stakeholder consultation meetings have been held to propose and consider various water development projects, and enact SWOT[19] analysis exercises with the participants concerning perceived local water problems and favoured solutions (See Annex 8 for further details).

6.6 Decentralisation and Local Decision-making

The present Thai Constitution was promulgated in 1997 and has been frequently referred to as "the People's Constitution", because of the broad participation by persons from all walks of life in the drafting process. For the first time, the 1997 constitution placed emphasis on such aspects as human rights, rights of freedom, gender equality, and personal rights to form groups, associations, unions, cooperatives and private organisations (http://www.apo-tokyo.org/icd/papers/E-publications/01.EffDecforICD/3-12.pdf). Furthermore local communities were granted rights to preserve or revive old customs, local wisdom, arts and were empowered to participate in natural resource and environmental management. Following the new Constitution was the passage of the Decentralization Plan and Process Act (1999), which provided for the establishment of local organisations such as Provincial Administrative Organisations (PAO's), Municipalities and Tambon Administrative

[18] The Companies contracted for the project are: Sanyu Consultants (Thailand) Ltd., Macro Consultants Ltd., Tesco Ltd., Thai D.C. I. Ltd., Southeast Asia Technology (Seatec) Ltd.
[19] "SWOT Analysis" is an acronym of Strengths, Weaknesses, Opportunity, Threats.

Organisations (TAO's), with the mandate to organise public services for local people, which can be classified into two main categories: social infrastructure development and quality of life.

Box 5. Relevant sections from the new Constitution of the Kingdom of Thailand on local participation in natural resources management

Clause 46

Persons so assembling as to be considered an established community shall have the right to conserve their customs, local knowledge, arts, culture of their community and the nation and participate in the management, maintenance, conservation and exploitation of the natural resources and environment in a balanced and sustainable manner according to the law.

Clause 56

The rights of people to participate with the state and communities in looking after and deriving benefits from natural resources and biodiversity, and in exercising control over the protection of environmental quality, in order to attain a normal and sustainable livelihood in an environment that is safe and healthy, or for the quality of life itself, as provided by the law.

Clause 79

The state shall promote and encourage public participation in the conservation, management and balanced exploitation of natural resources and biodiversity; and in the promotion, maintenance and protection of the quality of the environment in accordance with sustainable development principles; as well as the control and elimination of pollution affecting public health, sanitary conditions, welfare and quality of life.

Policies based on these two key pieces of legislation are evolving to enable a significantly restructured government to carry out its mandate. These policies are defining the specific mechanisms under which authority for planning and budgeting will be gradually devolved to the Tambons (sub-districts). Article 46 of the Constitution requires that local people must be involved directly in, and assume substantial responsibility for managing and conserving their natural resources. Along with several other related constitutional guarantees, these changes should play a decisive role in determining how Thailand's rural resource systems and biodiversity is managed in the future. Governance reform can be viewed as a direct response to the increasing influence of the non-government and civil society sector, which have played progressively more active roles in determining the nation's development directions since the 1980s.

Despite the positive rhetoric adopted and rights guaranteed under the Constitution, plus policy changes and government reforms that have occurred since 1997, there are still concerns amongst some quarters that the pace of decentralisation in practice is not progressing fast enough. For example, in the case of protected areas it has been recognised that expansion of the national protected area inventory and drafting management plans has not always been accompanied by adequate community participation and consultation, leading to alienation of the local people who would

otherwise have been key allies in their protection. Top-down approaches applied to area demarcation, monitoring, regulation, and enforcement still tend to predominate in the protected area management of many parks (http://www.mekong-protected-areas.org/thailand /nr_summary.htm). Although elected by the mass populace through democratic means, frequently Tambon Administrative Organisation (TAO) members have learned to adopt the methods of national politicians in ensuring election to office. Allegations of vote-buying and money politics are rife at election time and it is not unusual to find TAO members are allied to or owners of businesses that directly benefit from construction projects commissioned by the TAO. Decentralisation of budgetary planning and decision-making to sub-district level has not automatically made it more transparent and accountable to the interests of local people. Environmental considerations still would seem to have a very low priority when screening or implementing infrastructure projects in the local area. At the village-level, participation in decision-making and true local representation varies considerably from village to village. It is very dependent on the character and leadership style of the village headperson, who may be an elected representative (four year term of office) or appointed for life on the basis of past service. Headpersons (may be male or female in theory, but in practice nearly all are men) are, first and foremost, state officials acting as spokespeople for government policy at the local level and secondly, representatives of the people. At sub-district and village level, factionalism is quite common and there are frequently disputes between vested interests over land or business-related issues.

6.7 Land Access and Local Ownership Rights

Attempts by central government to decentralise decision-making to local bodies and encourage rural reform is not actually a new phenomenon in Thailand. The Kukrit Pramoj government tried to engineer reform during the mid-1970s when it introduced the following measures: requiring commercial banks to transfer 5 % of their deposits as loans to farmers; the creation of a special fund for development projects in the countryside; the so-called "Tambon Fund"; the implementation of land rent controls; and land reform and redistribution (Bello et al., 1998). Several pieces of legislation were enacted in an effort to more evenly distribute land and lower the incidents of landlord abuse of tenants. According to Bello et al. (1998):

- The Land Rent Control Act of 1974 and the Land Control Act guaranteed tenancy contracts for six years and fixed the landlord's share at a maximum of half the crop, after deducting one third for whoever shouldered production costs other than labour.
- The Land Reform Act of 1975 stipulated a maximum individual land holding of 50 rai, with surplus land subject to expropriation and distribution to peasants, following compensation at market value. However, land up to 1,000 rai could be kept if the landowners convinced the land reform committee that their land was being 'productively' farmed.

However, following the crushing of the student and reformist movement in October 1976 (after three years of democratic rule and the reinstatement of consecutive right-wing military governments) and subsequent entrenchment of urban-industrial elite rule in Thailand, land tenure reform was never again given serious attention by government. The Agricultural Land Reform Office (ALRO) which was set up in 1975 to enact the Land Reform Act, by the late 1990s, had never expropriated any private land for distribution to the rural poor, but has frequently been involved in land scandals implicating corrupt officials in aiding wealthy individuals to obtain land title over ALRO

land (*Sor Por Kor* programme) and vast swathes of common land nominally in national forest reserves has been expropriated from communities into the scheme (Bello et al. 1998). Furthermore, the same authors stated that: "*In over 17 years, only 43 families have received full landownership rights as a result of the reform, and the area covered amounts to just 795 rai*". Other reports have pointed out the inconsistencies and inherent conflicts in national land management regulations, stemming from the many laws and seven government ministries involved in land issues, which has led to increasing numbers of village land ownership protests arising in the country (Kaiyoorawong, 2003).

A recent newspaper article reported that ALRO was planning to buy land from private owners for distribution to landless farmers, while also grant rights over public land under its supervision to current occupants, as part of a major overhaul of the 30 year old Land Reform Act (*Bangkok Post*, 7 March 2005). According to the news report, 42 million rai of land nationwide has been taken over by ALRO since its formation, the majority of which it took over from the Forestry Department in 1993 "for distribution to landless farmers. About 26 million *rai* was eventually distributed to around 1.6 million farmers, while over 10 million *rai* was already occupied by non-farmers" (*Bangkok Post,* 7 March 2005). What the profession of these "non-farmers" was or what they were doing on the land is not immediately apparent, but an earlier news report on the land reform revision had shed some light on this: "More than 100,000 landholders in various occupations – teachers, traders and state officials – would be eligible to occupy reform land covering 10 million *rai*. About 6,000 possessed more than 50 *rai*. The total area covers 1.5 million rai. Under the proposed revision those holding over 50 *rai* of land would be allowed to rent the extra land for 15 years, with another 15 year extension, if they use the land for agriculture." (*Bangkok Post*, 28 February 2005).

This news potentially has some relevance to the LSRB where large amounts of land in the most sensitive wetland habitat – the *paa boong paa thaam* or seasonally-inundated forest officially falls under the ALRO land scheme (Refer to Box 4). In one contiguous floodplain area of Sri Songkhram, Na Thom and Ban Paeng Districts alone, 45,000 rai (7,200 ha) is ALRO allocated land (ALRO, 2004), and includes some of the last remaining large blocks of *paa boong paa thaam*.

While northeast Thailand has relatively fewer landless farming households compared to other regions – apparently just 4.77 % of the total number of farming households (Leonard and Na Ayutthaya, 2003) – it has not escaped certain problems common to all regions such as growing landlessness, land speculation, accumulation of land in the hands of wealthy elites and increasing amounts of land lying idle as the farming sector population ages and agricultural investment decreases. In the LSRB there has been the added problem of acquisition of significant areas of floodplain wetland (formerly public common property), by agri-business ventures that were encouraged to invest in the area by state inducements (Guayjaroen, 2001). Several individual companies are reported to now own up to 10,000 rai of low-lying land, which has been variously converted to intensive cash crop plantations (e.g. tomato or sweetcorn) or fast-growing industrial pulpwood plantations (e.g. *Eucalyptus camaludensis* or *Acacia mangium*). Much of this land was bought from local individuals and communities by the companies at very low prices using various means over a period of several years and led to many local land disputes, some of which led to prolonged court cases (Guayjaroen, 2001). Once secured, the land was subsequently bulldozed flat and used by the companies to not only grow intensive cash crops, but also as collateral to obtain

large loans from private banks to finance other speculative ventures. Many of these loans were frozen following the 1997 Asian financial crash and the companies have had problems obtaining funds since. Ironically, only a fraction of the land owned by the companies is now actually cultivated, the rest lying abandoned with slowly regenerating natural forest or stunted re-growth eucalypt trees interspersed with natural vegetation. However, some parts are fenced off and villagers are denied access for gathering NTFPs, fishing or grazing livestock, as they had been able to in the past.

It is not only agribusiness companies that have been able to buy or obtain ownership rights over former public lands on the Songkhram floodplain, but wealthy individuals also have been actively accumulating land in the area, at least around Sri Songkhram District township. For example, on the road out of Sri Songkhram District to Agaad Amnuay District, large areas of *paa boong paa thaam* have been "enclosed" on both sides, by digging a deep trench and bank around the perimeter, partially draining it and altering natural hydrological patterns across the floodplain.The underlying purpose of this expensive intervention is uncertain, but locals report that the land has been enclosed by the ditch to forestall possible attempts by the state to redistribute land left idle to poor families. Hence, the ditch is reportedly an attempt to show that the landowner is using the land for "fish raising". In March 2005, the ditch was nearly dry and the interior *paa boong paa thaam* subject to burning and dessication.

Flooded forest tracts are steadily being encroached and enclosed by influential outsiders. Here, a 2 m deep trench and high embankment has surrounded a significant area of floodplain habitat to the west of Sri Songkhram town altering flood patterns, exposing soil to erosion and draining the wetland.

Some land has apparently fallen into the hands of wealthy persons, by being put forward as collateral to secure loans for various purposes, even when the documentation for the land states that it is a non-transferable asset. Many villagers in the area have borrowed large sums of money (100,000–150,000 baht) from informal credit sources to send a family member to work abroad. Defaulting on informal high-interest loans has long been a common cause of villager land loss and out-migration to cities in the northeast. This was recognised in the pre-project Participatory Poverty Assessment conducted in two Sri Songkhram District villages, "Generally, villager leaders and wealthy individuals, as well as private sector outside the village are the ones who have legal ownership over the land. They are ready to buy and sell land to get high profits on land sales." (Actionaid, 2003).

7. Analysis

The Songkhram Basin taken as a whole is the second largest river catchment in northeast Thailand, including parts of Udon Thani, Nong Khai, Sakhon Nakhon and Nakhon Phanom Provinces and supports an estimated population of 1.7 million people. The LSRB includes about a quarter of the total basin area across 12 districts in three provinces, with a broad floodplain area that is reported to experience maximum 50 year floods of up to 185,000 ha. One study has estimated that at the height of the rainy season, up to 54 % of the entire Songkhram River Basin could be classified as wetlands, of which 38 % was comprised of wet rice fields (Sombutputorn, 1998). The exact geographical limits of the LSRB Demonstration Site have yet to be delineated, so it is not yet possible to comment on exact total areas or population figures lying within the project area. The floodplain features a wide diversity of wetland-type habitats, some permanent and some seasonal, but all reliant to a certain extent on annual flooding for recharge and interchange of physical, chemical and biological parameters, explained by the "flood pulse" concept (Junk, 1989). The duration and extent of flooding varies from year to year, and is not only dependent on in-basin runoff but is also influenced by water levels in the Mekong River, which on occasions may flow back up the Songkhram River for over 100 kms and spread out over the floodplain bringing additional sediments and nutrients which help fuel the Basin's renowned productive fisheries (Suntornratana et al., 2002). Despite past environmental studies to investigate the potential impacts of a proposed large dam near the mouth of the Songkhram River and associated irrigation scheme, it is apparent that the hydrology, geomorphology and ecology of the LSRB are complex and still poorly understood in a holistic sense by most stakeholders. Hence, these aspects and others require more detailed study to establish the exact relationships between the various in-basin and external components determining such factors as flood duration, extent, soil fertility, bioproductivity and biodiversity, in order to get a better understanding of the overall wetlands system.

Through participatory local research methodologies, like that of the Tai Baan Research Network, the significant level of aquatic and terrestrial productivity and high reliance of local communities on the wetlands-based resources becomes clear. The basis of most local livelihoods strategies has been founded on a complex mix of fishing, hunting, harvesting or gathering of wetlands biodiversity for subsistence and economic purposes (see Tables 6 and 8). Throughout the Lower Mekong Basin it has been found that poorer households are proportionately more reliant on wetlands resources for their livelihoods, although access to those resources may not be evenly shared. An example would be the fishing concession system whereby rights to favoured locations are auctioned to the highest bidder, who may then use efficient gears to make huge catches (up to one ton per day) but exclude others from access to that resource. Poorer households with fewer coping strategies or options open to them are thus most likely to be negatively impacted by any decreases in natural resource availability, further economically marginalising the most vulnerable households.

Contrary to popular opinion amongst planners and policy-makers, most villagers should not be considered primarily agriculturalists, but more appropriately "wetland product harvesters" and only part-time, seasonal farmers. This becomes apparent from observations of the relative time spent by most households on culture-based activities, as opposed to hunting/fishing/gathering activities (KKU, 1996). The most significant

and dominant habitat feature of the floodplain zone is the *paa boong paa thaam* (or seasonally-inundated forest) where much of the wetlands products are harvested within and from, at various times of the year. In the flood season, the *paa boong paa thaam* is usually submerged for several months and many species of fish (both short and long-distance migratory species) use it to feed, propagate and as a nursery ground for juveniles. At the end of the rainy season and as water levels recede during September to December, the fish are intercepted at bottlenecks like lake exits or stream mouths as they return to the mainstream, using a wide variety of fishing gears. In the dry season, the *paa boong paa thaam* becomes a mosaic of various aquatic and terrestrial wetland habitats, which are extensively harvested for diverse edible aquatic organisms and terrestrial food, medicinal or household use items, fuel wood, cultural uses, etc. As the rains start and the river levels rise, the villagers use the forest to dig bamboo shoots and collect a wide variety of vegetation and fungi for home consumption and sale, before the river spills over its banks once more around July to August. Sometimes referred to as a villagers' "supermarket", the seasonally-inundated forest and associated wetlands are far more than that, as a market implies cash expenditure to obtain the products within, whereas the wetlands are more egalitarian, largely giving up their wealth to all for free. However, large-scale fisheries which have been semi-privatised remain the exception to this rule.

BOX 6. Annual Flooding – Friend or Foe?

Due to the unusual topographical characteristics of a large part of the lower basin, the Songkhram floodplain is flooded each year by two main mechanisms: a) water flows derived from precipitation and runoff within the Basin and, b) by a reversal of flow from out of the Mekong caused by height differentials between the water levels of the Mekong mainstream and the Songkhram floodplain. Hence, occasionally during the rainy season the flow of the lowest part of the Songkhram river actually reverses and waters from the Mekong mainstream flow up and onto the floodplain of the Songkhram, bringing with it sediments and nutrients. This flow reversal is apparently noticed up to 100 km upstream from the mouth of the Songkhram, but is variable each year dependent on the height of the Mekong flood. This makes the LSRB appear in the wet season like a smaller version of Cambodia's Great Lake with extensive floods across a broad floodplain followed by a rapid explosion of aquatic and terrestrial life as a result of nutrients being concurrently deposited by inflow and released from flooded soils. This phenomenon is sometimes known as "the flood pulse concept" (FPC) (Junk et al., 1989) and refers to the lateral exchange of water, nutrients, and organisms between the main river channel and the connected floodplain. The floods could be likened to an "engine" which helps power the whole floodplain ecosystem.

Despite the natural phenomena of annual flooding in the LSRB, it is frequently cited in official government reports as a "natural disaster" which warrants requests for emergency relief supplies and compensation for lost agricultural production (e.g Aegakhon, 2002). Yet, there is little evidence to suggest that the floods cause more than minor material damage to private property and some losses to rice crops that are planted in low-lying areas regularly prone to flooding. The perceived problem of annual flooding has been one of the prime justifications given for the need to implement the Songkhram Project (see Box 3) through construction of a low head dam with liftable water gates near the Mekong confluence in Tha Utaen District, Nakhon Phanom (DEDP, 1995). The dam was designed to exclude water flowing out of the Mekong

during the rainy season, but would have resulted in the permanent inundation of an estimated 255 km^2 upstream of the dam structure, comprising *paa boong paa thaam*, community forest and agricultural land, and would have required the relocation of at least seven villages, containing more than 711 households (KKU, 1996). Ironically some of the most fertile and productive land for local villagers would have been lost to the reservoir, in order to irrigate infertile and marginal soils on higher terraces. According to a questionnaire survey of 53 farmers in five Lower Songkhram villages utilising the lowland floodplain for agriculture, only one person cited "Floods" as a problem, the rest acknowledging it as an integral part of the annual cycle that brought them many benefits (Blake, 2001). Another likely benefit of the floods not hitherto considered is that the Lower Songkhram River Basin flooding is acting as a "pressure release valve" for the Mekong by storing excess water flowing during times of extreme flow and slowly releasing it, thus ameliorating the downstream flood situation. Hence, efforts to reduce or control the Songkhram floods would most likely result in just moving the flood elsewhere, where it may be more damaging to communities and the economy.

While the farm gate price of most staple agricultural produce, including rice, has stayed roughly stable, or fallen in real terms over the last two decades, the price of many wetland products has become proportionately more valuable, particularly riverine fish, mushrooms and certain leaves and medicinal herbs due to relative scarcity, while demand has stayed constant or even increased. Hence, this puts additional pressure on these resources, as they have become more attractive to be sent to distant markets keen for "exotic" or "healthy and wild" products. There has also been a trend of outside groups coming in to the area to catch fish, gather bamboo shoots, mushrooms and other forest products, some reportedly coming from as far away as Khon Kaen. Hence, some villagers complain that it is becoming increasingly harder to catch fish or other aquatic organisms and gather certain forest products, even for home consumption, because of the increased competition and scarcity of resources.

By contrast, the input costs associated with agriculture, especially labour, fuel, pesticides and fertiliser have all steadily risen over the last 20 years, eroding profit margins and making agriculture less attractive than ever as a livelihood option. Some villagers complain that agriculture is an occupation that *costs* them money, rather than earns them money, and is often underwritten by cash coming from off-farm or overseas remittances (Actionaid, 2003). Hence, rice cultivation is mainly practiced for subsistence purposes only, thus avoiding the costs of rice purchase and if there is a surplus after the next harvest, then it may be sold. One farmer related how he would carry on planting dry season rice, no matter how high the price of fuel or other inputs became, but admitted that he was only able to do this as his children were sending money home from Bangkok and this was the reason he could subsidise the activity (personal communication, Ban Naa Jan, Sri Songkhram District, 28 March 2005). Most farmers near the floodplain who do not have access to upper terrace rice paddies, are only able to plant dry season rice due to the risks of crop loss from flooding associated with the rainy season crop. The area of rice grown per family rarely exceeds 10 rai and yields are generally low at around 250–400 kg / rai (1.56–2.5 T/ha), partly reflecting low external inputs and a risk avoidance strategy by the farmers (Blake, 2001).

Despite the tough economic realities of agriculture in general and rice cultivation in particular, plus the local physical and agro-ecological constraints mentioned, expansion of irrigated agriculture is still seen as a cornerstone goal of state-led water management policies and goals, principally through the construction of further large-scale irrigation schemes across much of northeast Thailand, including a much-hyped "National Water Grid" project, which would potentially expand irrigation areas to around 90 million rai by 2032 and could cost as much as 400 billion baht (i.e. $US 10 billion) nationwide. Regionally, it would involve pumping water from the Mekong into the Songkhram basin and diverting water from several Laotian rivers under the Mekong into other river basins of northeast Thailand, as well as building further dams, weirs, canals, pipelines and other water control structures on the remaining unregulated stretches of rivers. The model proposed recommends promoting planting of high value, niche market crops (through "*aggressive on-farm visits*") once the Water Grid is in place and creating private companies to market the produce domestically and abroad (Anon.,2005). The potential social and environmental costs and risks of this scheme have yet to be estimated.

Yet even without this large scale infrastructure project, there are numerous small and medium irrigation schemes being planned in the Songkhram Basin, which will further regulate the natural hydrology of the river and potentially disrupt or destroy ecosystems and key biodiversity habitats. Although there are several, seemingly uncoordinated, master plans being drawn up by the Department of Water Resources through consultant companies which divide the Songkhram Basin as a whole into several sub-basins, each plan tends to make the same basic assumptions about water needs and solutions, i.e. that water for agriculture is lacking and rainy season flooding are two major problems which must be solved by engineering interventions. They make no attempt to analyse the success or failure of existing irrigation schemes or consider that there might be other factors beyond the mere existence of water that determine the decisions that farmers make in practicing agriculture (or not). Likewise, they fail to consider the alternative uses of the water beyond agriculture, especially in maintaining wetlands functions and services and environmental flow considerations. It is notable that the Nam Songkhram Project, which proposed constructing a large dam near the mouth of the Songkhram river and creating a 255 km^2 reservoir is still discussed in one plan currently being considered, while maps proposing future plans show the mainstream lower Songkhram river with dams/weirs and large reservoirs drowning presently healthy *paa bung paa thaam* at three separate locations (DWR, 2004a and 2004b).

This sectoral approach stands in marked contrast to the cross-sectoral planning approach taken by representatives from 30 local communities in analysing common problems and proposing a plan for solving them and using remaining natural resources sustainably and wisely (Anon., 2004). Rather than proposing to build more large infrastructure projects, the participants identified a lack of efficiency of the existing irrigation systems and the limited suitability of irrigation schemes due to lack of involvement in the planning process by local communities as the major problems concerning water management for agriculture. They proposed improving the efficiency of existing systems and researching water management for consumption using local knowledge in order to develop locally appropriate water management methods that do not have major impacts on ecosystems.

In 2004 alone, two large dams (described in project literature as "weirs") have been built on the middle reaches of the Songkhram river between Ban Dung District of Udon Thani Province and Ban Muang District of Sakhon Nakhon (See Annex 2). Originally proposed by the Accelerated Rural Development Department to irrigate a total of 48,000 rai (7,680 ha) and provide annual economic benefits of 105 million baht, the two projects have been transferred to the responsibility of the Department of Water Resources (DWR), since the disbanding of the ARD two years ago. The Department of Water Resources (DWR) has subsequently transferred responsibility for the dams to the local Tambon Administration Organisations (TAOs) having first built extensive flood embankments along both banks of the river upstream of the dams. It seems likely that these dams will provide limited (or zero) irrigation benefit in 2005 (there are presently no pumps or delivery canals in evidence) and the adjacent land is prone to salinisation (See Photo 28), a fact that should have been well known to developers before their construction. It is too early to say exactly what impact they will have on fish migrations or the natural hydrology of the river but it was noted in mid-February 2005 that there was virtually no flow being released below the lower of the two dams at Ban Nong Gaa (See Photo 5) and there were no fish pass facilities fitted to the design. Hence, the river is now effectively divided into non-continuous, discrete riverine sections in its middle and upper reaches and natural flows are impeded, causing a proportionately higher ecological and hydrological impacts in the dry season than wet. It is not apparent if any Environmental or Social Impact Assessments were conducted before either of these dams were built, and thus simple baseline data that could be used in post-facto studies would probably not be available.

In addition to the threat of inappropriate water infrastructure projects and changes to hydrological patterns, the LSRB wetlands are also under threat from numerous other sources, mostly occurring from outside the immediate resource-users control. This is not to deny that unsustainable harvesting practices (especially in the fishing sector) and resource degradation by the users themselves is not occurring and needs to be addressed, but the five root causes[20] identified in the MWBP Project Brief Final Draft (2000), lay near the heart of the loss of structure, function and composition of the Songkhram wetland ecosystems. If the unsustainable resource use issues are going to be tackled in the Lower Basin, they cannot be done in isolation of addressing wider water management, pollution, inappropriate land use and habitat management practice issues throughout the Songkhram Basin in an integrated, holistic and inclusive manner, where the voices of disparate resource users, including the poor and marginalised groups are taken into account.

[20] The five root causes were listed as: 1. Unco-ordinated sectoral approaches to wetland planning at national and regional level; 2. weak policy framework and unsupportive economic environment for wetland biodiversity conservation and sustainable use; 3. Inadequate awareness and information baseline on which to base wetland policy, planning and management decisions; 4. Inadequate human and technical resources available for wetland biodiversity conservation; and 5. Lack of options over use of natural resources by local communities.

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Annex 1

Beung Khong Long (BKL) Wetland Site[21]

Background and Basic Data

Formerly designated a Non-hunting Zone under the Royal Department of Forestry, Beung Khong Long (BKL) became a Ramsar Site on 5 July 2001

Height above sea level	160 m
Surface Area	22.14 km^2
Max length	13 kms
Max. width	2 kms
Max. depth	6 m
Average depth	0.5 – 1.0 m

Summary of Important Features:

- Is a large permanent wetland (13 x 2 kms) and has many distinctive islands scattered across it
- Is a habitat for many bird species, which have important ecological significance.
- It is a conservation zone for biodiversity and helps to provide refuge to several endangered species of fish and birds.
- It is a staging place and refuge for migratory birds – over 30 spp. – during the cool season, which shows the importance of BKL as a bird conservation site, located along the migratory route of the 'East Asian Flyway'. It could be classified as an important wetland refuge for birds during a critical stage of their life cycles
- It is a wetland of international significance and it is appropriate that it is recognised as such and has a conservation plan made.

Biodiversity in the Beung Khong Long Area

Aquatic plant communities

23 aquatic plant species have been identified, none of which are considered threatened or endangered.

Made up of three types:

- Shallow water communities (incl. Submerged plants, floating plants and emergent plants). E.g. *Utricularis, aurea, Hydrilla verticillata, Salvinia cucullata, Nelumbo nucifera, Nymphaea lotus, Nymphoides, indica, Limnocharis flava, Jussiaea repens, Nepenthes* sp
- Open water communities
- Overlaying dense and floating communities

Fish

In surveys conducted by Dr Chavalit Vithayanon (Department of Fisheries) between 1998 and 2000, a total of 66 spp. of fish from 23 families have been identified from BKL, of which 6 spp. are considered endemic to the Mekong Basin, namely *Clupichthys aesarnensis, Boraras micros, Rasbora spilocerca, Brachygobius sp,*

[21] (Source: OEPP, 2002. Biodiversity in Beung Khong Long Wetlands, Office of Environmental Policy and Planning, Ministry of Science, Technology and Environment, Bangkok. 76 pp.)

Odontobutis auramus, and *Tetraodon leiurus*. Two species, namely *Kryptopoterus bicirrhis* and *Clarius batrarchus* have been classified as vulnerable species, while *Betta smaragdina* and *B. splendens* have been classified as species threatened in the wild.

Local fishers report that various non-native aquaculture species have been stocked in BKL from time to time and occasionally appear in catches, such as *Oreochromis niloticus, Cyprinus carpio* and *Labeo rohita*. They further report that catches of some native species have declined and some are only rarely caught.

Birds

Surveys between 1998 and 2000 have found a total of 67 spp. of bird from 28 families. Some are resident species, while others are seasonal visitors. Of the species found, 3 spp are considered 'endangered' and another 3 spp. are 'vulnerable'.

TABLE 1. List of bird species found in the area of the Bung Khong Long Non-Hunting Zone.

Scientific Name	Common Name	Occ.	Habit	Cons. Status
Order: Podicepediformes				
Family: Podicipedidae				
Tachybaptus ruflicollis	Little Grebe	R	1	
Order: Ciconiiformes				
Family: Ardeidae				
Ardea cinerea	Grey heron	N	2	EN
A. purpurea	Purple heron	N,B	2	EN
Ardeola bacchus	Chinese pond heron	N	2	
Babulcus ibis	Cattle egret	R	2	
Egretta alba	Great egret	R,N	2	
E. intermedia	Intermediate egret	N	2	
E. garzetta	Little egret	R,N	2	
Ixobrychus sinensis	Yellow bittern	R	2	
I. cinnamomeus	Cinnamon bittern	R	2	
Order: Anseriformes				
Family: Anatidae				
Anas querquedela	Garganey	N	1	
Nettapus coromandelianus	Cotton pygmy-goose	R	2	NT
Aythya baeri	Baer's pochard	N	1	VU
Dendrocygna javanica	Lesser whistling duck	R,N	2	
Order: Falconiformes				
Family: Accipitridae				
Elanus caeruleus	Black shouldered kite	R	6	
Milvus migrans	Black kite	R,N	6	EN
Haliastur Indus	Brahminy kite	R	6	NT
Circus melanoleucus	Pied harrier	N	6	
C. spilonotus	Eastern marsh harrier	N	6	
Order: Galliformes				

Family: Phasianadae				
Gallus gallus	Red jungle fowl	R	3	
Order: Gruiformes				
Family: Rallidae				
Gallinula chloropus	Common moorhen	R,N	1	
Porphyrio porphyrio	Purple swamphen	R	2	
Order: Charadriiformes				
Family: Jacanidae				
Hydrophasianus chirurgus	Pheasant-tailed jacana	R,N	1	
Metopidius indicus	Bronze-winged jacana	R	1	
Family: Laridae				
Chlidonias leucopterus	White-winged tern	R,B	1	
Family: Charadriidae				
Vanellus cinerus	Grey-headed lapwing	R	2	NT
Charadrius dubius	Little ringed plover	R,N	2	
Family: Scolopacidae				
Tringa glareola	Wood sandpiper	N	2	
Actitis hypoleucos	Common sandpiper	N	2	
Gallinago stenura	Pintail snipe	N	2	
G. gallinago	Common snipe	N	2	
Order: Columbiformes				
Family: Columbidae				
Streptopelia chinensis	Spotted dove	R	3,4	
Order: Cuculiformes				
Family: Cuculidae				
Centropus sinensis	Greater coucal	R	4	
Order: Coraciformes				
Family: Alcedinidae				
Alcedo atthis	Common kingfisher	R,N	2	
Halycon smyrnensis	White-throated kingfisher	R	2	
H. pilcata	Black-capped kingfisher	N,B	2	
H. chleris	Collared kingfisher	R	2	
Family: Meropidae				
Merops orientalis	Green bee-eater	R	7	
Family: Coraciidae				
Coracias benghalensis	Black-billed roller	R	4,7	
Order: Piciformes				
Family: Megalaimidae				
Megalaima lineata	Lineated barbet	R	4	
Order: Apodiformes				
Family: Apodidae				
Cypsiurus balasiensis	Asian palm-swift	R	5	
Apus affinis	House swift	R	5	
Family: Hirundinidae				
Riparia riparia	Sand martin	R	5	

Hirunda tahitica	Pacific swallow	R	5	
Order: Passeriformes				
Family: Motacillidae				
Anthus novaseelandiae	Richard's pipit	R	2,4,7	
Motacilla alba	White wagtail	N	2,3,7	
M. cinerea	Grey wagtail	N	2,3,7	
M. flava	Yellow wagtail	N	2,3,7	
Family: Pycnonotidae				
Pycnonotus finlaysoni	Stripe-throated bulbul	R	4	
P. blanfordi	Streak-eared bulbul	R	4	
Family: Dicruridae				
Dicrurus macrocercus	Black drongo	R,N,B	4,7	
D. aeneus	Bronze drongo	R	4	
Family: Corvidae				
Corvus macrorhynchos	Large-billed crow	R	4	
Family: Sylviidae				
Acrocephalus arundinaceus	Great reed warbler	N	8	
Family: Turcidae				
Prinia hodgsonii	Grey-breasted prinia	R	8	
Lurcinia calliope	Siberian ruby throat	N	8	
Copsychus saularis	Oriental magpie-robin	R	4	
Saxicola torquata	Stonechat	N,R	7	
S. caprata	Pied bushchat	R	7	
Monticola solitarius	Blue rock-thrush	N	7	
Lanius cristatus	Brown shrike	N	4	
L. schach	Long-tailed shrike	R	4	
Family: Sturnidae				
Sturnus nigricollis	Black-collared starling	R	4,7	
Acridotheres favanicus	White vented myna	R	4,7	
A. tristis	Common myna	R	4,7	
Family: Passeridae				
Passer flaveolus	Plain-backed sparrow	R	4,7	
Family: Estrilididae				
Lonchura punctulata	Scaly-breasted munia	R	4,7	

KEY

Occ. = Occurrence
R = Native bird species
N = Migratory bird species that does not breed in Thailand
B = Migratory bird species that passes through Thailand

Feeding Habit
1 = Waterfowl
2 = Wader
3 = Ground feeder
4 = Tree feeder

5 = Wing feeder (insect eater)
6 = Gliding bird
7 = Open area feeder
8 = Shrub and meadow feeder

Conservation Status
EN = Endangered
NT = Near threatened
VU = Vulnerable

Amphibians
6 spp. have been identified from three families

Reptiles
10 spp. from eight families have been identified during surveys, including snakes

Mammals
Only 2 spp. of rodent were found – *Callosciurus finlaysonii* and *Tamiops mcclellandi* – during night surveys near Don Sawan Island. Villagers report that there are still rabbits, mongooses, mouse deer and jackals in the vicinity of the lake.

Factors (past, present or potential) adversely affecting the site's ecological characteristics, including changes in land use and development projects:

The disturbance and threats at BKL can be classified into three categories:

1. Fishing – several local fishers use the bird sanctuary areas between the islands and shoreline, which are supposed to be protected and out of bounds;
2. Illegal bird hunting at night;
3. Burning of habitat around the lake margins by fishermen making cooking fires and forgetting to extinguish them.

Conservation measures taken
In August 1982, BKL was declared a non-hunting area by Royal Forestry Department (RFD). At present, an area of about 150 m radius around Don Sawan island has been declared a non-fishing area to protect aquatic birds from disturbance by fishing activities. A nature trail around the perimeter of Don Sawan of about 600 m length was established in 1999 for bird watching and for the study of aquatic plants. Outside the non-state sector, Don Mor Thong monastery has established an area of about 0.64 km^2 as a religious "forgiveness area", where birds and fish can not be hunted or caught.

Social and Economic Condition of Local Communities

Land Use

Land Use Classification	Area (Rai)	%
Villages	14,395.71	3.55
'*paa daeng rang'* (dry deciduous) forest	35,300.42	8.71
Mixed '*paa daeng rang*' forest	11,550.01	2.85
'mai pum' (shrub) forest	14,003.89	3.45

Grassland mixed with '*mai pum*' forest	9,791.71	2.42
Eucalyptus plantations	267.14	0.07
Mixed landuse farms	832.78	0.21
Field crops	160,145.78	39.50
Rice fields	127,154.95	31.37
Seasonally inundated area	6,594.43	1.63
Permanent water bodies	25,297.54	6.24
TOTAL	**405,334.36**	**100.00**

Economic and Social Conditions

From a survey conducted in twelve villages around BKL which interviewed 135 households, it was found that 57.78 % of respondents were born outside the locality and migrated into the area from other provinces, mostly post-1975. Around this time the area was cleared of valuable timber by commercial logging companies and large-scale in-migration of villagers from other provinces followed, particularly Roi-Et, Ubon Ratchatani and Kalasin. These migrants took advantage of the relatively abundant natural resources and land available for agriculture.

The new settlers made rice fields, planted commercial field crops and raised buffalo. At that time, fish were plentiful as the population was still sparse, there were no weirs or dams and fish from the Nam Songkhram were able to migrate up into BKL to spawn. Bird species were plentiful, especially piscivorous birds and even peacocks lived on the islands. In the wet season the various islands were flooded, but in the dry season they were exposed and had verdant vegetation. After a weir was built at the outlet, this artificially raised the water level in the dry season, in turn flooding former bird habitat on the islands. The extra water stored in the dry season is used for village water supply and agriculture, which provides economic benefit but there is a concurrent loss of dry season terrestrial habitat and formerly productive land.

Communications and public infrastructure

There is a road skirting the entire lake linking the various villages. It is a dirt road in places, but bituminised through all the communities. All the villages are connected to mains electricity, have piped water supplies and the larger communities have primary and secondary schools. There are sub-district police stations, health centres and public booths along the roads, making communication.

The average age of villagers is 31.5 years and 51.11 % of the population are aged over 30 years.

Annex 2

Details of Two Irrigation Weirs Recently Built on Middle Nam Songkhram River

PROJECT NAME	Ban Muang Weir	Ban Nong Gaa Weir
PROJECT LOCATION	Ban Muang Moo 1, Ban Muang Sub-district, Ban Dung District, Udon Thani	Ban Nong Gaa, Ban Jan Sub-district, Ban Dung District, Udon Thani
Catchment area (km^2)	1,654	2,286
Average Annual run-off (MCM)	800.49	1,093.70
Water storage capacity (MCM)	4.00	11.00
Area of storage reservoir (km^2)	1.8	4.80
No. of gates	5	6
Height of dam (metres)	3	3
Irrigation potential – rainy season (rai) - dry season	15,000 3,000	33,000 6,600
Estimated 1997 cost of construction (Million Baht)	245	594

(Source: Accelerated Rural Development project document, 1997)

Annex 3

Salt Mining Activities in Nam Songkhram River Basin

Province	District	Sub-district	# of Operations	Quantity of salt produced (tonnes)	Area involved (rai)
Udon Thani	Ban Dung	Ban Chai	49	40,300	595
	Ban Dung	Phon Sung	28	18,500	660
	Ban Dung	Ban Dung-Sri Suttho	104	135,700	1,867
		TOTAL	181	194,500	3,122
Sakhon Nakhon	Ban Muang	Dong Neua	4	?	504
	Ban Muang	Nong Kwang	3	?	1,000
	Waanon Niwat	In-plaeng	2	?	?
	Waanon Niwat	Kud Reua Kham	39	?	840
		TOTAL	48		> 2,344
Nong Khai	So Pisai	Kham Gaew	12	2,000	51
	Phon Pisai	Ban Serm	2	8,160	67
		TOTAL	14	10,160	118

(Source: Pathumpong, T. 2004. Report on the Environmental Quality Situation, Environmental Office, Regional Area 9, Udon Thani. 2002 – 2003 & 2004)

Annex 4

Table of Fish Biodiversity of Nam Songkhram River, Favoured Seasons, Habitat And Distribution

Name of Fish Species	Riverine type		Season found			Portion of Basin		
	Mainstream	Tributary	Dry	Flood rise	Recession	Upper	Middle	Lower
Family: Notopteridae								
Chitala ornata	Y	Y	Y	Y	Y	Y	Y	Y
Notopterus notopterus	Y	Y	Y	Y	Y	Y	Y	Y
Family: Sundasalingidae								
Sundasalanx praecox	Y	N	Y	N	Y	N	Y	Y
Family: Clupidae								
Clupeichthys aesarnensis	Y	Y	Y	Y	Y	Y	Y	Y
Tenualosa thibaudeaui	Y	Y	Y	Y	Y	Y	Y	Y
Family: Cyprinidae								
Paralaubuca barroni	Y	Y	Y	N	Y	Y	Y	Y
Paralaubuca riveroi	Y	Y	Y	N	Y	Y	Y	Y
Paralaubuca typus	Y	Y	Y	Y	Y	Y	Y	Y
Parachela siamensis	Y	Y	Y	N	Y	Y	Y	Y
Parachela williaminae	Y	N	N	N	Y	N	N	Y
Raiamas guttatus	N	Y	N	Y	N	N	Y	N
Osparius koratensis	Y	Y	N	N	Y	N	Y	Y
Amblypharngodon chulabhornae	N	Y	N	Y	N	N	Y	N
Danio aequipinnatus	Y	N	N	N	Y	N	Y	Y
Esomus metallicus	N	Y	N	Y	N	N	Y	N
Luciosoma bleekeri	Y	Y	Y	N	Y	N	N	Y
Rasbora argyrotaenia	Y	Y	Y	Y	Y	Y	Y	Y
Rasbora borapatensis	Y	Y	N	N	Y	Y	Y	Y
Rasbora danioconius	N	N	Y	N	N	N	N	Y
Rasbora paviei	Y	Y	Y	Y	Y	Y	Y	Y
Rasbora trilineata	Y	Y	Y	N	Y	Y	Y	Y
Cyprinus carpio	N	Y	N	N	Y	N	Y	N
Probarbus labeaminor	N	Y	N	Y	N	N	Y	N
Probarbus jullieni	Y	N	N	N	Y	N	Y	N
Amblyrhynchichthys truncatus	Y	N	Y	Y	N	N	Y	N
Cosmochilus harmandi	Y	Y	Y	Y	Y	Y	Y	Y
Cyclocheilichthys apogon	Y	Y	Y	Y	Y	Y	Y	Y
Cyclocheilichthys armatus	Y	N	Y	N	N	N	N	Y
Cyclocheilichthys enoplos	Y	Y	Y	N	Y	Y	Y	Y

Cyclocheilichthys furcatus	Y	Y	Y	N	Y	Y	Y	Y
Cyclocheilichthys repasson	Y	Y	Y	Y	Y	Y	Y	Y
Mystacoleucus atridorsalis	Y	Y	Y	Y	Y	N	Y	Y
Mystacoleucus marginatus	Y	Y	N	N	Y	Y	Y	Y
Puntioplites proctozysron	Y	Y	Y	Y	Y	Y	Y	Y
Puntioplites waandersii	Y	N	N	Y	Y	Y	Y	Y
Sikukia gudgeri	Y	N	Y	N	N	N	N	Y
Barbodes altus	Y	Y	Y	Y	Y	Y	Y	Y
Barbodes gonionotus	Y	N	Y	Y	Y	Y	Y	Y
Barbodes schwanefeldi	Y	N	N	N	Y	N	N	Y
Hypsibarbus lageri	Y	N	N	N	Y	N	N	Y
Hypsibarbus malcolmi	Y	N	N	Y	Y	Y	Y	Y
Scaphognathops bandanensis	Y	N	N	N	Y	N	N	Y
Poropuntius deauratus	Y	N	N	Y	Y	Y	Y	Y
Hampala dispar	Y	Y	Y	Y	Y	Y	Y	Y
Hampala macrolepidota	Y	Y	Y	Y	Y	Y	Y	Y
Puntius brevis	Y	Y	Y	Y	Y	Y	Y	Y
Systomus aurotaeniatus	Y	Y	N	Y	N	N	Y	N
Systomus binotatus	N	Y	N	Y	N	N	Y	N
Systomus orphoides	N	Y	Y	N	Y	Y	Y	Y
Systomus partipentazona	Y	Y	Y	Y	Y	Y	Y	Y
Tynnichthys thynnoides	Y	Y	Y	Y	Y	Y	Y	Y
Aistichthys nonilis	Y	N	N	N	Y	Y	Y	N
Barbichthys nitidus	Y	Y	Y	Y	Y	Y	Y	Y
Cirrhinus macrosemion	Y	Y	Y	Y	Y	Y	Y	Y
Henichorrhynchus siamensis	Y	Y	Y	Y	Y	Y	Y	Y
Dangila lineatus	Y	Y	Y	Y	Y	Y	Y	Y
Dangila spilopleura	Y	Y	N	Y	Y	Y	Y	Y
Labeo erythropterus	Y	Y	N	Y	N	N	Y	Y
Morulius chrysophekadion	Y	Y	Y	Y	Y	Y	Y	Y
Osteochilus hasselti	Y	Y	Y	Y	Y	Y	Y	Y
Osteochilus lini	Y	Y	Y	Y	Y	Y	Y	Y
Osteochilus microcephalus	Y	Y	Y	N	Y	Y	Y	Y
Osteochilus waandersii	Y	Y	Y	Y	Y	Y	Y	Y
Crossocheilus reticulatus	Y	Y	Y	N	Y	Y	Y	Y
Crossocheilus siamensis	Y	Y	Y	Y	Y	Y	Y	Y
Epalzeorhynchos munense	Y	Y	Y	N	Y	Y	Y	Y
Garra cambodgiensis	N	Y	N	Y	N	N	Y	N
Family: Balitoridae								
Nemacheilus longistriatus	N	Y	N	N	Y	Y	N	N
Nemacheilus masyae	Y	N	Y	Y	Y	N	Y	Y
Nemacheilus pallidus	N	Y	N	Y	N	N	Y	N

Family: Cobitdae								
Botia beauforti	Y	N	Y	N	Y	Y	Y	Y
Botia caudipunctatus	Y	Y	N	N	Y	N	Y	Y
Botia eos	Y	Y	Y	Y	Y	Y	Y	Y
Botia helodes	Y	Y	Y	N	Y	Y	Y	Y
Botia lecontei	Y	Y	Y	N	Y	Y	Y	Y
Botia modesta	Y	Y	Y	N	Y	Y	Y	Y
Botia morleti	Y	Y	N	N	Y	N	Y	Y
Acanthopsis choirorhynchos	Y	Y	Y	Y	Y	Y	Y	Y
Pangio angularis	Y	Y	N	N	Y	N	Y	Y
Lepidocephalychtyhys birmanicus	N	Y	N	Y	N	N	Y	N
Family: Gyrinochelidae								
Gyrinocheilus aymonieri	Y	N	N	N	Y	N	N	Y
Family: Bagrichthydiae								
Bagrichthys macrocanthus	Y	N	N	Y	N	N	Y	N
Family: Bagridae								
Heterobagrus bocourti	Y	Y	Y	Y	Y	Y	Y	Y
Leiocassis siamensis	Y	Y	Y	Y	Y	Y	Y	Y
Mystus atrifasciatus	Y	Y	Y	Y	Y	Y	Y	Y
Mystus multiradiatus	Y	Y	Y	Y	Y	Y	Y	Y
Mystus mysticetus	Y	Y	Y	Y	Y	Y	Y	Y
Mystus singaringan	Y	Y	Y	Y	Y	Y	Y	Y
Hemibagrus nemurus	Y	Y	Y	Y	Y	Y	Y	Y
Hemibagrus wyckii	Y	N	N	N	Y	N	N	Y
Hemibagrus wyckoides	Y	Y	N	Y	Y	Y	Y	Y
Family: Siluridae								
Belodontichthys dinema	Y	N	N	N	Y	Y	Y	Y
Micronema apogon	Y	Y	N	Y	Y	Y	Y	Y
Micronema bleekeri	Y	N	N	Y	Y	Y	Y	Y
Micronema micronema	Y	Y	Y	Y	Y	Y	Y	Y
Kryptopterus cheveyi	Y	Y	Y	Y	Y	Y	Y	Y
Kryptopterus cryptopterus	Y	Y	Y	Y	Y	Y	Y	Y
Kryptopterus limpok	Y	N	N	N	Y	Y	Y	Y
Kryptopterus moorei	Y	Y	N	N	Y	Y	Y	Y
Ompok bimaculatus	Y	Y	Y	Y	Y	Y	Y	Y
Ompok hypopthalmus	Y	Y	Y	N	Y	Y	Y	Y
Wallago attu	Y	N	N	Y	Y	Y	Y	Y
Wallago leeri	Y	N	N	N	N	Y	N	Y
Family: Schilbeidae								
Laides hexanema	Y	Y	Y	Y	Y	Y	Y	Y
Family: Pangasiidae								
Pangasianodon gigas	Y	Y	N	Y	Y	Y	Y	Y

Helicophagus waandersii	Y	Y	N	Y	Y	Y	Y	Y
Pteropangasius pleurotaenia	Y	Y	Y	Y	Y	Y	Y	Y
Pangasius bocourti	Y	N	N	N	Y	Y	Y	Y
Pangasius conchophilus	Y	N	N	N	Y	N	Y	Y
Pangasius larnaudii	Y	Y	N	N	Y	Y	Y	Y
Pangasius sanitwongsei	Y	N	N	Y	N	N	Y	N
Family: Akysidae								
Akysis varius	Y	N	N	N	Y	N	Y	N
Family: Sisoridae								
Bagarius yarelli	Y	N	Y	N	Y	Y	N	Y
Family: Clariidae								
Clarias batrarchus	Y	Y	Y	N	Y	N	Y	Y
Clarias macrocephalus	Y	Y	N	N	Y	Y	Y	Y
C. macrocephalus x C. gariepinnus	Y	N	N	N	Y	N	N	Y
Family: Phallostethidae								
Phenacostethus smithi	N	Y	N	Y	N	N	Y	N
Family: Oryziidae								
Oryzias mekongensis	N	Y	N	Y	N	N	Y	N
Family: Belonidae								
Xenentodon cancilla	Y	Y	Y	Y	Y	Y	Y	Y
Family: Syngnathidae								
Doryichthys martensii	N	Y	N	Y	N	N	Y	N
Family: Synbranchidae								
Monopterus albus	Y	Y	N	N	Y	Y	Y	Y
Family: Chauriidae								
Chaudihuria caudata	N	Y	Y	N	Y	Y	Y	Y
Family: Mastacembelidae								
Macrognathus circumcinctus	Y	Y	Y	N	Y	Y	Y	Y
Macrognathus siamensis	Y	Y	Y	Y	Y	Y	Y	Y
Macrognathus armatus	Y	Y	Y	Y	Y	Y	Y	Y
Family: Chandidae								
Parambassis notatus	Y	Y	Y	Y	Y	Y	Y	Y
Parambassis wolffii	Y	N	Y	N	Y	N	Y	Y
Family: Lobotidae								
Datnoides microlepis	Y	N	N	N	Y	Y	Y	Y
Family: Toxotidae								
Toxotes microlepis	Y	Y	Y	Y	Y	Y	Y	Y
Family: Nandidae								
Nandus nandus	Y	Y	Y	N	Y	N	Y	Y
Pristolepis fasciata	Y	Y	Y	Y	Y	Y	Y	Y

Family: Cichlidae								
Oreochromis niloticus	Y	Y	Y	Y	N	Y	Y	Y
Family: Eleotridae								
Oxyeleotris marmoratus	Y	Y	Y	Y	Y	Y	Y	Y
Family: Anabantidae								
Anabas testitudineus	Y	Y	Y	N	Y	Y	Y	Y
Family: Belontiidae								
Betta smarigdina	N	Y	N	Y	N	N	Y	N
Trichopsis pumila	N	Y	N	Y	N	N	Y	N
Trichopsis vittata	Y	Y	Y	Y	Y	N	Y	Y
Trichogaster pectoralis	Y	Y	N	N	N	Y	Y	Y
Trichogaster trichopterus	Y	Y	Y	Y	Y	N	Y	Y
Family: Channidae								
Channa micropeltes	Y	Y	Y	N	Y	Y	Y	Y
Channa orientalis	N	Y	N	N	Y	Y	Y	N
Channa striata	Y	Y	Y	Y	Y	Y	Y	Y
Family: Soleidae								
Euryglossa harmandii	Y	Y	Y	Y	Y	Y	Y	Y
Family: Tetradontidae								
Tetradon cambodgiensis	Y	Y	N	Y	Y	N	Y	Y
Tetradon leiurus	Y	Y	N	Y	Y	N	Y	Y
Tetradon nefastus	Y	N	N	N	Y	N	N	Y
Tetradon suvatti	Y	N	Y	N	Y	Y	N	Y

Source: Boonyaratpalin, M., K. Kohanantakul, B. Sricharoendham, T. Chittapalong, A. Termvitchagorn, W. Thongpun and M. Kakkaew. 2002. Ecology, Fish Biology and Fisheries in the Lower Nam Songkhram River Basin. P. 491 – 514. In: Journal of Fisheries. Vol. 55, No. 6, November – December, 2002. (In Thai)

Annex 5

2004/05 Agricultural Statistics for Districts Lying Fully or Partially in Lower Songkhram River Basin of Nakhon Phanom Province

(Source: Dept. of Agricultural Extension, Nakhon Phanom, 2005)

Crop: Rainy season glutinous rice

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Sri Songkhram	110,958	410
Tha Utaen	65,427	312
Naa Waa	71,684	401
Naa Thom	46,283	318

Crop: Rainy season non-glutinous rice

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Sri Songkhram	108,973	370
Tha Utaen	18,073	334
Naa Waa	79,882	402
Naa Thom	11,548	320

Crop: Dry season glutinous rice

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Sri Songkhram	4,365	-
Tha Utaen	3	-
Naa Waa	247	-
Naa Thom	6,300	-

Crop: Dry season non-glutinous rice

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Naa Waa	124	-

Crop: Cassava

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Tha Utaen	147	-
Naa Thom	754	2,750

Crop: Sugar cane

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)

Sri Songkhram	250	6,000
Tha Utaen	80	-

Crop: Factory grade tomatoes

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Sri Songkhram	760	-
Tha Utaen	10	-
Naa Thom	500	-

Crop: Chilli (*prik kee noo*)

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Sri Songkhram	87	1,120
Naa Waa	5	-
Naa Thom	5	-

Crop: Shallots

DISTRICT	Area Planted (Rai)	Mean Yield (kg / rai)
Sri Songkhram	15	605
Tha Utaen	20	1,560
Naa Waa	7	-

Annex 6

Ecosystems and Habitat Classification System in the Lower Songkhram River Basin, as Identified by Tai Baan Researchers

(Source: Tai Baan research report, 2004)

ECOSYSTEM - HABITAT	BRIEF DESCRIPTION	BIODIVERSITY PRESENT	MAIN USES
1.Upper floodplain ecosystem	Higher ground that rarely, if ever floods, and surrounds the floodplain		
1.1 *Dong*	Forested area; higher & wider than *dawn, ba, pon, kog*. Many types of tree, mostly large spp. In rainy season, dense & moist forest, but open forest in dry season	Fauna: birds, rats, squirrels, wild chicken, rabbits and Asiatic jackal	Harvesting NTFP's, medicinal herbs, etc. Raising livestock
1.2 *Kog*	Area underlain by laterite soils. Deciduous forest, dipterocarp trees mostly. Relatively small area with uneven land surface. In dry season, very dry with grass being main groundcover plant		Mostly used for livestock raising Hunting Collecting NTFPs, like mushrooms in wet season Limited agriculture, like rain fed rice cultivation
1.3 *Dawn*	Flat land alternating with small hillocks at about the same height as *pon*, jutting into the *paa thaam*. Consists of large trees, interspersed with smaller trees. Occupies a smaller area than *dong* and is lower. Often located nearby to villages and may be sub-divided into further categories: i.e. *dawn soong* (upper forest) and *dawn lum* (lower forest)	Fauna: squirrels, monitor lizard, monkeys (in past), gibbons (in past), wild chickens, birds, rats and snakes *Dawn soong* tree species: *dton yaang* (Dipterpcarpus sp.); *dton pradoo* (Pterocarpus macrocarpus); *khaen*; *saad* (Dipterocarpus obtusifolius).	Collect NTFPs Medicinal herbs Firewood Collect vegetables & dig tubers *Dawn puu taa* is sacred place with special ceremonies held in Feb and May each year *Dawn paa chaa* is for cremations *Dawn tamlae liang sad* – livestock raising forest
1.4 *Pon*	Soil that is derived from old termite mounds. Has local names, according to the area or type of trees growing there e.g. *pon nong thaam, non yaa maa*. Vary in size from 0.5 – 5	Rainy season refuge for worms, rats and snakes	Livestock raising year round

	rai.		
1.5 *Kui*	Area close to and above Nam Songkhram river, but below *pon* level. Inundated during exceptional floods. Has width of less than 50 m, but unlimited length like a raised bank. Vegetation consists of grass and vines mostly		Spawning and feeding habitat for fish during floods Villagers collect vines to make fish traps and implements During flood recession used to raise livestock and collect vegetables
1.6 *Non*	A raised area, about the same height as d*awn, kui* or *pon*. Mostly deciduous, hardwood trees growing	Tree types: *saad* (Dipterocarpus obtusifolius), *daeng* (Xylia kerri), *pai gasa* (Bambusa sp), dton hoo ling (Sarcolobus globosus), *maag mao, dton kii lao, dton bluay, naam kawn, yaa faek*. Fauna: rats, bats, lizards, crickets, birds and grasshoppers	During flood rise, *non* are used as refuges for various animals Livestock grazing Fuelwood gathering and charcoal making Hunting Collecting wild vegetables and mushrooms In some instances, converted to agricultural land or village site
Ba	Flat area, lying between *kog* and rice fields, generally with small to medium size trees. Maybe deciduous or mixed forest. Three *ba* found in study area	Tree types: *dton saad* (Dipterocarpus obtusifolius), *dton kamek, naam taeng, pawg*	Same uses as *non* and *kog* Esp. mushroom collecting and digging tubers at start of rains
2. Lower floodplain ecosystem	Lower lying land that only floods at the peak flood season, but not completely		
2.1 *Sawm*	Lies at the source of streams, and is a channel similar to *hawng*, but smaller and only covered with water during heavy floods. During the dry season, they are usually dry and will appear as a water drainage channel with surrounding vegetation		Some locations have permanent water seepage which can be utilized for *naa prang* or vegetable cultivation. Often *tao* (filamentous algae) can be found around them which is eaten by villagers.
2.2 *Kham*	Small basin that is similar to *sam* but broader. In the dry season it is more likely to dry up, because the mud is shallower and tends to lie at higher elevations.	Flora: e.g. ferns, *pak gud, pak nam, dakrai nam* (water citronella) Fauna: many types of aquatic organism e.g. eels, frogs, snakes,	Source of many food types year round

	Kham are often found in the area between lowest floodplain and non, or around the source of *hawng* or behind *sawm.* Will flood during the peak floods.	leeches and worms	
2.3 *Sam*	Is a small area basin, similar to *hawng*. Soil in the area is composed of deep mud, but shallower than *dum*. Water seeps out of the area continuously making it constantly wet. Usually found between *sawm* and hawng on the edge of flat grasslands that are contiguous with *thaam*, or on the edge of *ba* and *thaam* areas. Length may be 180 – 200 m	Flora: types of grass and *pak kii baw* Fauna: Same as *kham*	Same as *kham*
2.4 Saang	Human-made water source, built by digging out small wells, and using the water for drinking, when villagers go out to the fields. Mostly found in the shade of trees, as the tree roots help to draw up water to the surface. If one digs down not very deep, water can be found seeping up to the surface continuously. The depth of *saang* varies according to locality, e.g. in *non, kog, dong, ba* they are deep; but on *thaam, boong*, on edge of Nam Songkhram river, streams, lakes or channels they are shallower.		
2.5 *Tong* or *tung naa*	Low-lying, flat areas which may or may not be flooded annually, with trees similar to the *paa thaam*.	Tree types: perennial species such as *dton saad* (Dipterocarpus obtusifolius), *dton tom , pai* (Bambusa sp.), *hoo ling* (Sarcolobus globosus), *dton siew* (Desmodium renifolium), *gadon*	Agriculture – rice fields Livestock raising in dry season During wet season, collecting many species of aquatic organism Important feeding and spawning ground for fish

		(Careya spinaerica), *pue*, *waa* (Syzygium cumini), *sieow nam* (Phyllanthus taxudiifolius), *kreua kii nang* and *maag saew*. Grass types: *yaa faek, yaa plong* (hymanache) Fauna: lizards, rats, butterflies, herons, mynah birds, pigeons, *nok saew, nok gai naa*, ducks, crickets and other species of insects.	
2.6 *Sog*	Place where water falls down a steep slope causing a deep erosion hole to form. The depth depends on such factors as height of fall, soil characteristics and water volume.		The main use of *sog* is as a pathway for walking up and down the Nam Songkhram banks in the dry season and as a drainage channel in the wet season.
3. Flat lowland ecosystems including temporary and permanent water bodies	Areas of floodplain that vary considerably between the dry and wet seasons as water rises and falls. In the wet season, the area is totally flooded for several months. In the latter dry season, the area will mostly be dry and the soil cracked. Water remains throughout the year in some low lying basins and lakes.		
3.1 *Nawng*	Is a waterbody varying in size from 0.5 rai (800 m2) up to 30 - 40 rai, spreading into the *paa bung paa thaam*. The depth of water varies with locality and season.	Vegetation: Bambusa spp., *dton hoo ling* (Sarcolobus globosus), *maag mao, dton kii lao, pluay, naam khawm, joy, dton grabao, kreua be, dton tom, dton hae*. Many species of fungi. Fauna: many species of aquatic organisms	In dry season, villagers cultivate the banks, raise livestock and practice fishing for as long as there is water in the *nawng*.
3.2 *Huay*	Drainage channels or streams that exit *nawng*, usually about 1 – 3 kms long. They may be small or	Along their banks wide variety of vegetation is found, incl. Bambusa sp., *jawg, nae, sanom,*	In dry season, fishing place, source of tap water, irrigation water, livestock raising and collecting wild vegetables

	large and may link between two *nawngs* or a *nawng* and a *gud*, or to the Nam Songkhram. During the dry season they are generally dry, apart from the larger and deeper *huay*.	*dton tom, hoo ling* (Sarcolobus globosus), *gradon nam* (Barringtonia acutangula), *pak kii naag, pak baw* and *pak kii pla*. Habitat for wide variety of aquatic organisms	In wet season, just used as a fishing ground.
3.3. *Hawng*	Is a watercourse flowing out of *nawng* or *gud*, but is smaller and shallower than *huay*. During the flood period is totally inundated and become invisible on the water surface. They emerge as visible features during the flood recession between late Sept. and early Nov. Hawng assist in the passage and spread of aquatic organisms during the floods. Migrating fish use them for moving out of large rivers to the spawning habitats on the floodplain, like *gud, nawng and huay*.	Bankside vegetation includes: *hoo ling* (Sarcolobus globosus) , Bambusa sp., *sieow* (Desmodium renifolium), *tom, yaa faek* and various types of vegetable. Also a refuge and food source for various types of aquatic animals.	During flood recession, villagers practice bankside agriculture and dry season rice cultivation, when standing water is sufficient Fishing ground
3.4 *Pbag*	Is a continuum of other habitats that are water drainage features, before they enter large rivers, streams, *nawng* or *hawng*. Will generally be referred to by their linking habitat e.g. *pbag-hawng, pbag-boong, pbag-huay*. Generally dries out in dry season or has some shallow water remaining.	Vegetation: *dton tom, hoo ling* (Sarcolobus globosus) , Bambusa sp., *gradon nam* (Barringtonia acutangula), *pak baw, dton waa* (Syzygium cumini), *pak som gung* and various grasses. Terrestrial and aquatic animals found around *pbag*, similar to those found in *huay*.	Popular fishing areas for placing large gears like *gad*, during the flood recession period Livestock grazing in the dry season
3.5 *Sai*	Is used as a compound term together with other ordinary features for a long, narrow watercourse e.g. *sai-hawng, sai-huay, sai-nawng*,	Common plant species found: *dton gradon, hoo ling* (Sarcolobus globosus), *pak kii naag, pbluay*, Bambusa sp. *pak waen, pak kii naag, pak kii baw,*	Villagers practice naa prang in the dry season Raise cows and buffalo Collect wild vegetables

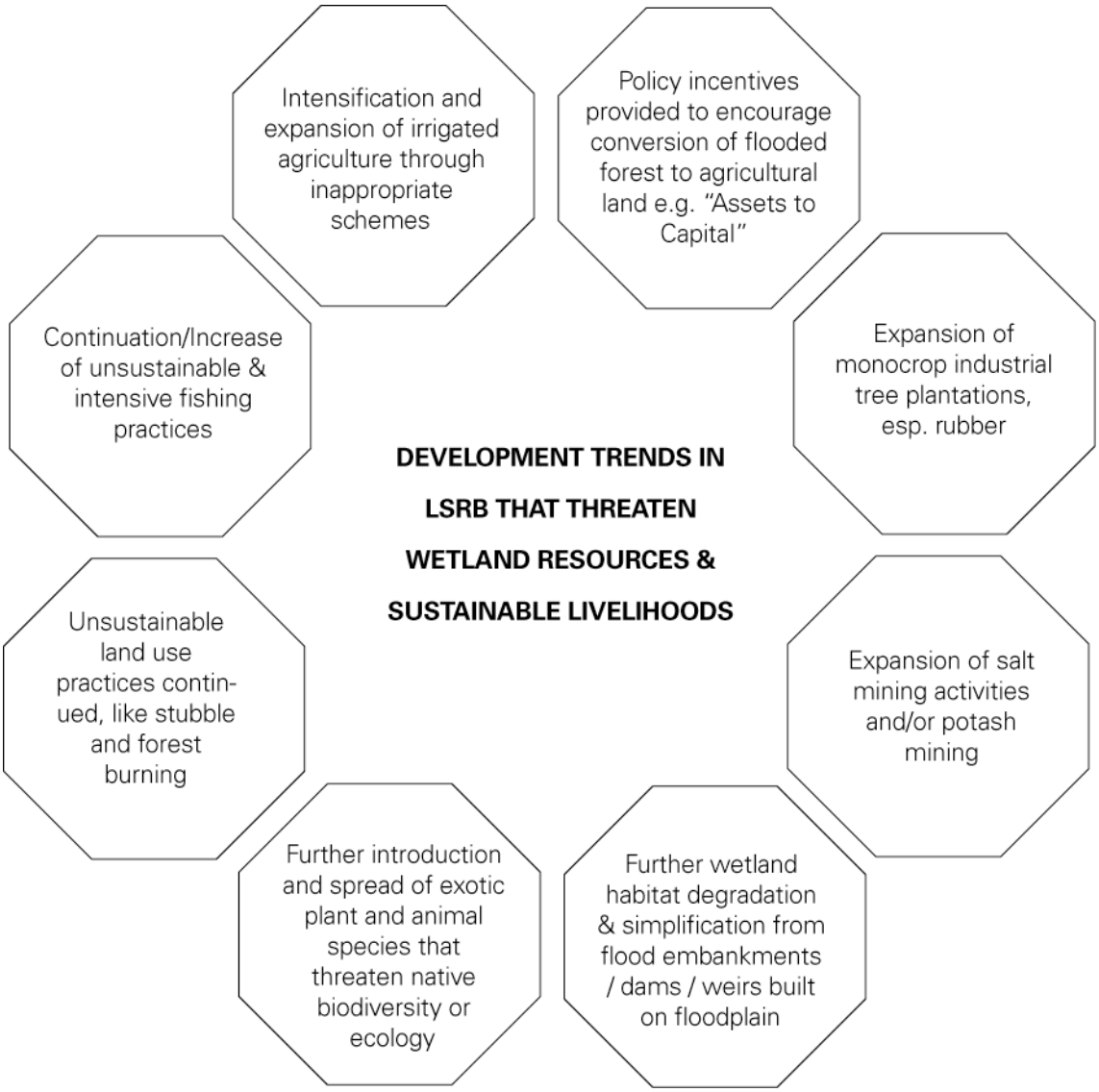
		kreua ben (Terminalia nigrovenulosa), *dton saeng, dton hae, dton grabao, dton gasin, pak dang kom, pak ki baw, pak gaad hawng*. Aquatic plants: *jawg, hnae, sarai nam jeud* (filamentous algae)	
3.6 *Boong*	Area lying along the edge of the Nam Songkhram that is low lying and not as deep as *nawng*. Is flooded in the wet season when the area is one continuous sheet of water, but in the dry season it is dry muddy basin.	Common edible plant species: bamboo shoots, *pak kai hang naag, gled hoi*	In the rainy season is an important fishing ground by villagers using *gad*, gill nets, hooks and traps. In the dry season the bung dries up and it is used for collecting vegetables, livestock raising.
3.7 *Thaam*	Lies above and surrounding *boong* along the Nam Songkhram floodplain. During rainy season will be totally flooded and is an important fish feeding and spawning ground. During the early dry season, the water drains out of the *thaam* into other landscape features like *nawng, huay* and *gud*. Each year it receives a layer of fertile sediment from the floodwaters, which keeps the natural resources of the *thaam* bountiful	Many species of plants, but dominated nowadays by Bambusa sp.	Collect many types of NTFPs esp. fungi and bamboo shoots Raise livestock Clear small areas for agriculture Fishing in floods
3.8 *Gud*	Large perennial lakes found in *paa boong paa thaam* that are larger than nawng, and with deeper water. Formed by river changing course in the past, leaving a cut-off channel behind on the floodplain, no longer connected to the main river, apart from in times of flood. In the flood season, *gud* may be connected to many other types of habitat by means of channels. During the peak floods, the	Important habitats for wide variety of aquatic organisms.	Important sources of livelihood and subsistence wetland products year round During flood recession, exits may be blocked by large fishing gears to harvest significant quantities of fish. The fringing vegetation in the dry season will be verdant and are sources of wild vegetables, bamboo shoots, and vines used in making fishing gear and household items for villagers Also a source of food for wild animals (e.g. birds) and grazing for livestock

	gud disappear as a distinct landscape feature under water.		
3.9 *Doom* or *doon* or *pong*	Habitat found along the edge of Nam Songkhram which has water seeping out of it year round. Similar to *sam,* but the mud is deeper. On first observation the surface mud is hard, but underneath it is soft and act like quicksand if stepped on by people or animals. In rainy season is totally flooded.	Vegetated by grass types and *pak kii baw* across the surface.	Many useful plants around edge can be harvested
3.10 *Nam jan*	Water that flows out of the banks of the Nam Songkhram and is visible during flood recession. Behind the *nam jan*, there is often a spring flowing from a *sam*.		Drinking water source, which can be tapped by a length of bamboo stuck into the ground to guide the water into containers
4. Riverine Ecosystems	Riverine habitats that are visible and obvious in dry season, but disappear in the rainy season under flood waters		
4.1 *Wang*	Pools found in the Nam Songkhram and main tributaries, and are the deepest points of the river channel, varying between 4 – 10 m depth in the dry season. Mostly found on bends of river, opposite areas of beach or rocks. During the rainy season when water is flowing strongly, the flow tends erode the outside of the bend's banks and scour out the bed of the river creating pools.	Important dry season habitat for many species of fish, which are attracted to the deeper, cooler waters	Popular fishing grounds Villagers believe that each *wang* has a guardian spirit, that must be asked permission to fish, before beginning. Some pools are now protected as conservation areas by the village
4.2 Haad	Beaches that are formed of sandy or stony substrate which emerge in the dry season. Sometimes called *khaen*, and can be seen on both banks of the river channel. In shallow water	Many types of aquatic organism, incl. Shrimps, mollusk and fish e.g. *pla raag gluay* (Acantopsis spp.) Vegetation: grass species, *pak kii baw,*	*Haad fuu* are places for people to relax and play by the water's edge during the hot season When covered with water the sandbanks attract shrimp, mollusks and small fish which villagers harvest

	the water will skim over the surface of the substrate faster than deeper areas. Tend to dry out between February and April. During the rainy season, the beaches are submerged under water. Some villages in Sri Songkhram District are able to separate beaches further into 2 sub-types: a/ *Haad fuu* – beach that emerges as a long or wide beach depending on local characteristics b/ *Haad jom* – beaches that remain submerged, but are visible as distinct riverine features, with water less than 1 metre deep.	*pak kii som, pak dang kom*, which appear in certain favoured locations	
4.3 *Gaeng*	Rocks which impede water flow and may be rough surfaced or spikey. Mostly formed from mixed sandstone or laterite.	Aquatic plants: e.g. *tao* (algae) Broad variety of fish species, mollusks, shrimp and aquatic insects	Important fishing grounds
4.4 *Lang* or *hawd*	Area with a water depth of about 2 m (in dry season), with a muddy substrate. Similar to *haad jom*, but *lang* are deeper and usually lie between pools and rocks.	Habitat for *pla nang (*riverine catfish) and many other aquatic organisms	Important fishing area

Annex 7

Development Trends in Lower Songkhram River Basin that Threaten Wetland Resources and Sustainable Livelihoods



Annex 8

Summary of Strengths / Weaknesses and Opportunities / Threats (SWOT Analysis) proposed at a first meeting for BDP committee members on 11 – 15 October 2004, for Sub-basins in the Mekong Basin.

River sub-basin	Weakness / Problems	Strengths / Opportunities
Upper Songkhram Basin	- In the rainy season, a problem of flooding houses / fields exists on both sides of the river - Insufficient water storage / problem of floods - No weirs, dams, reservoirs, for storing water in the dry season	- It is an economically important waterway for agriculture and food - Local people are interested in water resource problems - The river is very long and can nurture much agricultural land
Huay Khong		- Is an upper catchment and source of groundwater - Is able to be developed as a water storage source for the Nam Songkhram Basin
Huay Hee		- Is an upper catchment and source of groundwater - Is able to be developed as a water storage source for the Nam Songkhram Basin
Lower Songkhram Basin	Water is not correctly managed Water storage facilities are insufficient Floods remain in the rainy season and there is a shortage of water in the rest of the year There is not enough surface water sources for agriculture / livestock raising	There are healthy local livelihoods / there are freshwater fishermen making a living. Natural resources, both plant and animal, are healthy, including water, soil and forest
Nam Yam	In the rainy season the water flows inconveniently causing floods, as it lacks an irrigation system The local ecosystems are degraded Lacks continuous development and shortage of water in the dry season	- There is water year-round - The area is fertile and suitable for agriculture
Nam Oon	Lacks group coordination and those responsible to follow up on the quantity and quality of water Water shortages and floods	- Water flows in all seasons, except if there is little water left in the dam.

(Source: Dept of Water Resources Newsletter, No. 2, December 2004 – March, 2005)

Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme

The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP) is a joint programme of the four riparian governments of the Lower Mekong Basin – Cambodia, Lao PDR, Thailand and Viet Nam – managed by the United Nations Development Programme (UNDP), the World Conservation Union (IUCN) and the Mekong River Commission (MRC), in collaboration with other key stakeholders. With funding from the Global Environment Facility (GEF), UNDP, the Royal Netherlands Government, MRCS, the Water and Nature Initiative (WANI) and other donors, the programme addresses the most critical issues for the conservation and sustainable use of natural resources in the Mekong wetlands. MWBP aims to strengthen the capacity of organisations and people to develop sustainable livelihoods and manage wetland biodiversity resources wisely. It is a five-year (2004-2009) intervention at three levels – regional, national and local – with demonstration wetland areas in each of the four countries: in the Songkhram river basin, Thailand; in Attapeu province in southern Lao PDR; in Stung Treng, Cambodia; and in the Plain of Reeds in the Mekong Delta, Viet Nam. The programme aims to:

- Improve coordination for wetland planning from regional to local levels
- Strengthen policy and economic environments for wetland conservation
- Generate and share information
- Train and build capacity for the wise use of wetlands
- Create alternative options for sustainable natural resource use and improve livelihoods

MWBP is a partnership between governments, aid agencies and NGOs, and provides a framework for complementary work for wetland conservation and sustainable livelihoods in the Lower Mekong Basin.

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