Appendix 3

Terrestrial wildlife study report

Terrestrial wildlife survey

for

The Lower Se San 2HH project, Stung Treng province, Cambodia

Prepared by

Mr. Ros Bansok, Biological Engineer

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Contents

Abbreviation

ADB	Asia Development Bank
Danida	Danish International Development Assistance
DDF	Deciduous Dipterocarp Forests
FA	Forestry Administration
IUCN	The World Conservation Union
LMDFE	Lower Mekong Dry Forest Ecoregion
LSP	Lower Srepok River
LSS	Lower Sesan River
LWS	Lomphat Wildlife Sanctuary
MAFF	Ministry of Agriculture, Forestry and Fisheries
MDF	Mixed Deciduous Forests
MoE	Ministry of Environment
NTFPs	Non-Timber Forest Products
PA	Protected Area
PF	Protected Forest
PPWS	Phnom Prich WIldlife Sanctuary
RGC	Royal Government of Cambodia
SBCA	Seima Biodiversity Conservation Area
SEF	Semi-evergreen Forest
SFLC	Social Forest Land Concession
UNDP	United Nations Development Program
VNP	Virachey National Park
WWF	World Wide Fund for Nature
WCS	Wildlife Conservation Society

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1. Introduction

The needs for economic development are considered a high priority for developing countries in order to contribute to poverty reduction and ensuring a long term sustainable development strategy *(National Strategic Development Plan 2006-2010)*. While such development comes up with both positive and negative impacts and if the plans are ignored the consequences of the developments may have long term adverse effects to the environment and society and this is because of resulting from development for short term benefits, for instance forest exploitation without considering on its impact behind and may results in drought or flood for long period of time.

In recent years, Cambodia is on the way up in terms of development. For instance, the infrastructure of road networks has been improved along with schools and bridges in particular. Currently, there are several proposed development projects in Cambodia concerning the construction of hydro-electricity dams which will be located in areas with high potential for dams in the country[1].

This study has been focused on the environmental impact assessment on terrestrial wildlife of the proposed resettlement areas and in reservoir area for the Lower Sesan II Hydropower dam in Stung Treng province.which is part of the hydropower dam masterplan for Cambodia[2]. Furthermore, the entire catchments in the northeast and eastern were also assessed and analyzed. The assessments of the catchments are to look into the entirely aggregate of the impact which associated with the impact from the dam project and resettlement areas. The dam will impact wildlife along both the Sesan and Srepok Rivers which are major tributaries of the Mekong River. The rivers' habitats support biodiversity richness especially aquatic species of fishes, reptiles and waterfowl in the northeast and eastern part of the country *(WWF, Khou Eang Hourt per.com, 2008 and Mekong River Commission, Mekong Fishes, 2002)*. The whole area of east and northeast Cambodia have significant conservation values for the Lower Mekong Dry Forest Ecoregion (LMDFE), due primarily to rich of biodiversity and support variety of flora and fauna and its ecosystems. The large area of mixed deciduous and dipterocarpus forest, however, are under threat of habitat degradation and fragmentation, especially those forest areas where they can be accessed by roads *(Robert Timmins and Ou Rattanka, et.al.,2001)*. The selective logging, land grabbing and hunting for local consumption are visible and disturb the habitats for wild animals.

2. Previous wildlife research and surveys

There have been several wildlife research and surveys undertaken in the catchments of the Sesan and Srepok Rivers which are mainly focused on the forest types, habitat

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[1] *There are presently several proposed hydropower dams in Cambodia, at least 29 sites countrywide including in the Cardamom Mountains and in the northeast and east of Cambodia in the Mekong and its tributaries such as Sesan and Srepok Rivers. (Ministry of Industry, Mine and Energy, Cambodia, - The Master Plan Study of Hydropower Development in Cambodia, 2007).*

[2] *The proposed hydropower dams are located along the Sesan and Srepok Rivers. There are, at least considered about five cascades of the hydropower sites in those rivers.*

characteristics and wildlife conservation values. Those research/surveys identify the existing issues and the presence of a variety of flora and fauna species in the river catchments (see below for details). The findings are significantly important for conservation values both nationally and internationally. The research and surveys that have been undertaken include:

- Status of conservation of globally threatened primates in the Seima biodiversity conservation area, Cambodia, (Danida and US Fish & Wildlife Service, 2007).
- Biodiversity conservation corridors initiative (Pilot Site Implementation, Status Report, Greater Mekong Subregion, ADB, 2007).
- Biodiversity vision for the Lower Mekong Dry Forest Ecoregion (WWF Greater Mekong-Cambodia Country Program, 2006).
- A survey for wild cattle and other large mammals and feasibility of establishing a pilot game reserve in O'Yadav district, Ratanakiri province (Forestry Administration, Wildlife Protection Office, 2006)
- Biological assessment of the Lower Mekong Dry Forest Ecoregion, (WWF, 2005).
- Abundance, distribution, and reproductive success of Sanbar nesting birds below the Yali Falls Hydropower Dam on the Sesan River, northeastern Cambodia (Supported by WWF, Danida, WCS and BirdLife International, 2004).
- Report on first participatory biodiversity assessment, eastern plains, Cambodia, by WWF MOSAIC Eastern Plain Team, 2003.
- Directory of important bird areas in Cambodia (in Sesan River, Lumphat, Upper Srepok Catchments, Mondulkiri lowland, BirdLife International 2003).
- Initial assessment of community resource use in four communities in Mondulkiri province (WWF, MoE and MAFF, 2001).
- The importance of Phnom Prich Wildlife Sanctuary and adjacent areas for the conservation of tigers and other key species (WWF, 2001)
- The forest of the Lower Mekong Ecoregion Complex (WWF, 2001)
- Toward a vision for biodiversity conservation in the forests of the Lower Mekong Ecoregion Complex, 2001.

The findings from those researches and surveys have addressed the significant consideration for conservation values of the biodiversity, especially wildlife protection of the entire catchments in the northeast and east of the cuntry. Any development efforts, therefore, occur in the LMDFE of the northeast and eastern part of Cambodia can be seen as additional aggregation the impact to the biodiversity not only direct threat to increase habitat loss, fragmenting and diminishing the habitats but also threat to wildlife movements/migration within the limited area. It is noted that Lower Mekong Dry Forest Ecoregion (LMDFE) is located at the northeast and eastern Cambodia and Cardamom Mountains, in the west and southwestern part is a part of LMDFE as well.

3. Study area

The study area is located along the Sesan and Srepok Rivers in Stung Treng and Ratanakiri Provinces (see figure....). The existing data in relation to the Srepok and Sesan catchment areas have been mainly used to assess and analyze on the status of wildlife. In

addition, some field observations were made recently in April 2008. Almost two weeks from observations conducted by national ecologist through supervision and Consultative Sub-agreement with Key Consultant Cambodia (KCC). Ltd., within the proposed resettlement sites and the proposed reservoir in the Lower Sesan and Lower Srepok Rivers in Stung Treng province.

The Sesan River originates in the mountainous central region of Vietnam, and the Srepok River originates in the southwest highlands of Vietnam before they both run downward to northeast Cambodia. There are four sites proposed for resettlement sites where they are located at the Lower Sesan (LSS) and Lower Srepok Rivers (LSP), Stung Treng province. Amongst the proposed four resettlement sites, there are two sites situated along the Lower Srepok's riverbank on the south of the river-body and another two sites are on the north, along the riverbank of Lower Sesan River, and those resettlement sites are in Sesan district, Stung Treng province.

The Sesan River runs downward from the northeast of the country by passing near Virachey National Park (VNP), Ratanakiri province while the Srepok River runs from the eastern Cambodia and then passing through the Lomphat Wildlife Sanctuary (LWS) in Ratanakiri province before they converge, about 20km upstream of the provincial town of Stung Treng. Both rivers then converge with the Sekong river before that river merges with the Mekong River.

The proposed resettlement sites are in the Sesan district, Stung Treng province. The sites are surrounded by the dry forest of mixed deciduous and dipertocarpus forest. Accessibility to the sites can be reached either on foot but there are several trails or tracks for ox-cart, in according to the recent observation conducted on April 2008.

National Road No.78 connects from National Road No.7 about 10kms south of Stung Treng and runs eastward to the provincial town of Banlung, Ratanakiri province. This road passes through the forest area which is located between the Lower Sesan and Lower Srepok Rivers. The forests in this area are mostly disturbed and damaged primarily due to road building and fragmentation of the forest in this area. The conversions of forest land into agricultural activities and other development purposes on both sides of the road are visibly evident and it is very damaging to the wildlife habitat on which they depend for their home. One resettlement of the Lower Srepok River is situated closely the National Road No. 7, also under degradation from land encroachment for agricultural land and other forms of land use, for instance, clearing land for speculation opportunity. Recently field observation, brief discussion with two old people met at the site, they said that due to some information hinted in relation to resettlement that why it is leading certain concerns over clearing forest for land. Additionally, the other three resettlements have the same threats of the selective logging, and hunting as well as some certain signs of land grabbing.

4. Methods

The designed method for undertaking the field survey focused on assessing the habitat rather than directly assess wildlife. Such an assessment method can indicate the presence and absence of the wildlife within the proposed sites. In addition, the existing data and information from the previous surveys can be used to further assess wildlife upstream and in the Sesan and Srepok river catchments as a whole. Therefore, during field survey, three tools were used in the assessment;

- A transect line (1000m long by 10m wide in various locations). The transect was used to record about certain disturbances caused by wild-animals and/or human activities inside the areas, for instance, digging, grazing, scratching from animals and/or fire scar including other associated evidences such as tracks, nearby water sources of pond/lake and so on. Such data is useful to identify the level of disturbance which occurs in particular area of the resettlements.
- Species counting and measuring of tree density (quadrat of 35meter radius in various locations). This method used to identify a number of plant species occurs in the particular habitat, for example in the dry deciduous dipterocarp forest and it is indicating about tree density as well.
- Anecdotal discussion with key local informants and conservationists/experts

It is noted that the team consists of five people during the field observation, conducted from 4th to 17th of April 2008. The team worked together and moves from one site to another site. Additionally, brief dialogues with key informants, especially hunters, and elderly people were made in order to get some information in relation to wildlife status of the surrounding areas.

Each transect was applied in the four resettlement sites and two other sites downstream of the LSS and LSP Rivers in order to observe/detect the evidences of animals (see figure... showing transect locations). The observations within the transect focused on the disturbances from wild animals, for instance: footprints, digging, grazing and voices, as well as other key factors such as places of salty soil, ponds/lakes, trails/tracks, cultivation, ring-barking, partial clearing, fires, and selective logging and so on). Both disturbances from wildlife and human activities gave certain evidence in relation to the wildlife status in the area.

Species counting and measuring tree density was conducted to identify the species diversity of the forests. However, forests in the northeast and eastern Cambodia mostly represent of the deciduous dipterocarp forest (DDF) in the Lower Mekong Dry Forest Ecoregion (LMDFE) *(2006, WWF; Biodiversity Vision for the Lower Mekong Dry Forest Ecoregion)*. Meanwhile, short discussions with key informants, especially local hunters, elderly people and rangers were made during the recent field observation[3]. Additionally,

[3] *Key informants are in the Phluk, Srae Kor and Talat communes where they are located at the Lower Sesan River and other informants in the Kbal Romeas (Chrab and Krabei Chrum villages) of Lower Srepok River.*

further discussions were arranged with local experts and/or conservationists in the conservative program and site managers[4].

5. Results and discussion

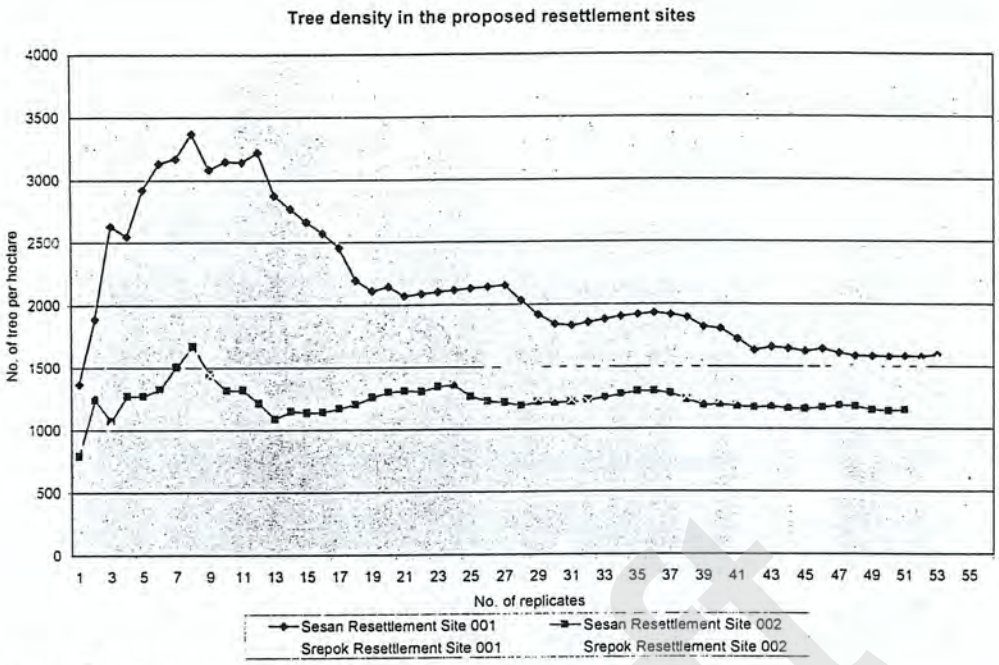
5.1. Major types of flora and fauna

Generally, the major forest types in the northeast and eastern Cambodia are classified as dry forest of deciduous dipterocarp forest (DDF) but also include other habitat types such as mixed deciduous forest (MDF), and semi-evergreen forest (SEF) as well. The flora species occur in this forest type is not as much diverse as other forest types, for instance, mixed evergreen and evergreen forests. However, such forest type supports variety of large wild animals and its preys because of it covers a huge size in the northeast and eastern part of the country which has a relatively low population density.

The species in the family of Dipterocarpaceae is the dominant species which occur in this forest type. The deciduous dipterocarp forest typically has open canopy and individual tree stand sparsely and the tall species consists of *Dipterocarpus obtusifolius, Dipterocarpus tuberculatus, Dipterocarpus intricatus, Hopea ferra, Hopea odorata, Shorea obtusa Shorea siamensis, Pterocarpus pedatus, Dalbergia bariensis*. Understory is dominated by grassy, shrubs and subshrub and short bamboo, indicated from survey and *(C. Daltry & Frank Momberg, Cardamom Mountains; Biodiversity Survey, 2000)*.

Figure 1 Tree density in the deciduous dipterocarp forest

[4] *NGOs include the World Wide Fund for Nature, and BirdLife International. In addition, discussions via phone by KCC with site managers who come from Lomphat and Phnom Prich Wildlife Sanctuaries, and Virachey National Parks were made.*



Source: Survey team, April 2008

Previous surveys indicate that LMDFE in the northeast and eastern part of the country is internationally recognized and as global biodiversity assets for support of large wild animals as listed in the IUCN Red Data Book as threatened with global extinction (IUCN, 2003). The large mammals include *Kouprey*, tiger, Asian elephant, Banteng, wild water buffalo, eld's deer, golden cat, fishing cat, black bear and gibbons.

The Figure 1 shows a sparse density of the mature trees (circumference measured is bigger than 40cm or Diameter at Breast Height (DBH) is bigger than 12.7cm), wichi represent in the deciduous dipterocarp forest. Within this tree density give more open space and ground understory covers with short bamboo and other vegetable for animal diet for prey and it is also favorable for carnivorous species to hunt its preys. Additionally, it also provides suitable habitat for animals of preys to escape and for their home. As discussed with elderly people and hunters, certain species often spend time for food and during the delivery stage such as Banteng, Gaur and Deer.

5.2. Srepok resettlement area

5.2.1. Habitat characteristics

The KCC site survey found that the entire forest area in and around the Srepok resettlement area is characterized by deciduous dipterocarp forest, and the understory species are dominanted by shrubs, subshrubs, and short bamboo. The trees which occur within this habitat is relatively sparse and small in circumference but the larger size of girth are under selective cutting especially species with high commercial values for construction materials. Generally, within such habitat of deciduous dipterocarp forest has

average height in between 7.5m to above 18m of the canopy trees. The emergent trees have average height of approximately 23m.

The habitat extends largely on the southern side of the Srepok River and it is a vast habitat which connects to two protected areas which are managed by the MoE: the Lomphat Wildlife Sanctuary in Ratanakiri Province and Phnom Prich Wildlife Sanctuary; and the Seima Biodiversity Conservation Area (SBCA)[5] in Mondulkiri Province which is a Protected Forest and is managed by the Forest Administration. The two protected areas and SBCA Protected Forest are upstream of the proposed sites for resettlements in the Lower Srepok River. Furthermore, the catchments continue expending into the southern Vietnam where it is considered as transboundary forest area. Therefore, the forests cover a large area in the eastern part of Cambodia and southern Vietman and this gives favorable conditions for large populations of wildlife, especially large animals such as Kouprey (*Bos sauveli*), Asian Elephant (*Elephas maximus*), Tiger (*Panthera tigris*), Eld's Deer (*Cervus eldii*), and so on. However, this habitat is also damaged and fragmented due primarily to the roads have been built through such habitat. Additionally, the obtained information also addressed about the social forest land concession outside protected areas can be seen as a vast conversion for development and go along with other land grabbing for speculation *(CEPA per.com, 2008)*. However, certain maps indicate about area of Social Forest Land Concession (SFLC) were not revealed in relation to how large of the areas have been used under such concession.

5.2.2. Forest products

The KCC study team found that the collection of non-timber forest products (NTFPs) such as resins, wildfriuts and honey are not so active in the project area but selective logging is undertaken in according to field observation. Several tracks/trails give more access into the deep forest for logging and wildlife hunting as well. Noises from chainsaws could be heard in the forest and woodpiles were visible when the KCC study team was working in the areas. The selective logging of precious wood and the first quality wood for local consumption is still prevailing in the vast forest.

5.2.3. Wildlife

At the Srepok resettlement sites, there was no significant evidence of wild animals, especially large animals occurring within the transect line. Signs of animal digging from wildpig, grazing from cattle (Banteng, Gaur or Deer) and other disturbance from animals

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[5] *Seima Biodiversity Conservation Area (SBCA) is the protected forest established in 2002 and managed by Forestry Administration (FA) which is under decree of the Ministry of Agriculture, Forestry and Fisheries. The total size of the conservation area is 3,034km^2. Currently, there are two protected forests established and under management from FA and these areas are namely; Seima Biodiversity Conservation Area and Mondulkiri Protected Forest. Additionally, two protected areas were designated under Royal Degree on November 1993 and they are managed by Ministry of Environment. Both protected areas and protected forests have been under several researches and surveys. Most surveys/researches have been done through cooperation between donors funded projects/programs with the Ministry of Environment and MAFF.*

were not seen. There was not place for salty soil found during the surveys at the transect site. However, forest birds, especially bulbuls, woodpeckers, hornbills, sunbirds, and mynas are still common in this forest. Due to human activities access through this area can give evidence of disturbance to wildlife. There are several trails/tracks inside the forest area that allow more access for hunting. A few lizards (water monitors) were sold in the village while the study team passed through. In addition, the status of wildlife and wood products has been in strong decline for the last ten years (*Phork, ranger to Virachey National Park per.com*). However, large wild-animals such as Banteng (*Bos javanicus*), Gaurs (*Bos gaurus*), Bears, Elephants and Gibbon are still at large elsewhere in the northeast and eastern Cambodia but they are under pressures from human disturbance.

5.3. Sesan resettlement area

5.3.1. Habitat characteristics

The forest type is typically of deciduous dipterocarp forest as already described above. The proposed resettlement sites at the Sesan River are located on the northern side of the river, and they are a few kilometers away from the riverbank (see Map.....). This area is located in between the Sesan and Sekong Rivers and also extends north and north-eastward towards the Virachey National Park in Ratanakiri Province. Virachey National Park covers and supports a vast size of forest types including semi-evergreen and evergreen forest and it extends to the far northeast into the mountainous central Annamites in Vietnam. It is also adjacent to the Xe Pian protected area in Laos in the far north. The whole area can be considered as transboundary of the LMDFE of the Indochinese countries. In addition, the forest habitats support a large population of wildlife, in particularly the globally threatened species[6] of large mammals and other endangered species for conservation values.

The forest area of the resettlement site was previously under a logging concession of large-scale operation *(Head of Srae Kor Commune per com. April, 2008)* so that large trees of high commercial value have been logged and fragmented habitats. Hunting activities were also rampant without controlling or monitoring from the competent authorities. The large wild animals, for instance, Banteng, Gaur, Deers and wildpigs were usually poached. The gunfire was heard in the forest around the villages at night time and most hunting was for food and local consumption except products from tiger and bear which was made for sale (*Former head of commune in Srae Kor per.com, 2008*).

Currently, the forests at the Sesan resettlement sites are disturbed because trails/tracks provide easy access within the area. The negative impacts from human activities can be an indicator to address on wildlife disturbance within the area in which go along with rampantly selective logging.

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[6] *Globally threatened species include a population of large animals such as Banteng, Gaur, Elephant, Wild Water Buffalo, Tigers, Bear, Eld's Deer, Sambar Deer, Gibbons, Pangolins, group of primates as well as group of birds, for instance, Ibises, Storks, Fisheagles, Vultures, Peafowl and so on. For further detailed in the attached Appendix.*

disturbance. For instance, selective loggings are considered as major causes and tracks provide more accessible for other human activities such as hunting in area vicinity, and land grabbing. The proposed areas for resettlements may needs certain development of infrastructures such as roads, health centers, and other necessary facilities within/inside the resettlement areas in order to ease public accessibility in and out.

5.4.4 Downstream area

There are uncertain data existing in relation to the previous surveys in the downstream area. The area supposed to be downstream for the resettlements of the Dam Project is mostly located in Stung Treng territory of the Lower Sesan and Lower Srepok Rivers. According to recent observations and dialogues with key informants in the targeted areas of the resettlements and other involved stakeholders indicated that most existing forest area are given for a so-called Social Forest Land Concessions (SFLC). The purposes of the SFLC are used for agro-industrial crops such as cassava, rubber plantation, cashew trees, and other tree plantations. These types of land uses are unlikely to be favorable for wildlife and its habitats. In addition, the proposed resettlements of the Dam Project may have some significant effects to the downstream, especially fish migration/movements. However, it is unlikely to impact directly to the loss of forest habitats and threat to wildlife at the downstream, especially large wild animals.

6. Present status of terrestrial ecology

As addressed from the previous researches/surveys within the LMDFE[7], there are existing problems and issues have continued to increase the biodiversity loss in the northeast and eastern Cambodia. Both inside the protected areas and outside the protected areas have been under threat from unsustainable exploitation of natural resources, and wildlife hunting in particular. If one looks at the whole area of the northeast and eastern Cambodia as a part of Lower Mekong Dry Forest Ecoregion (LMDFE) which includes the resettlement areas, there are several existing issues and problems considered as key factors in leading to natural resource depletion. These issues are:

6.1. Logging and NTFP collection

Most researches undertaken have identified logging and collection of non-timber forest products as major issues and causes of biodiversity loss and resulting in degradation for wildlife habitat in particularly.

The whole forest area in northeast and eastern Cambodia was previously under logging concessions except the protected areas but they have been under illegal logging too.

[7] Most surveys/researches activities have been conducted under cooperation between Government Institutions of the Ministry of Environment and Forest Administration with the donors-funded programs such as World Wide Fund for Nature (WWF), BirdLife International, The World Conservation Union (IUCN) and other associated activities.

Habitat loss represents the greatest long term threat to the integrity of biodiversity throughout the forest of the Lower Mekong. The selective loggings are being continued of small-scale operation but widespread in the forest where the products can be extracted availability.

Evidence of the selective logging was seen within the survey areas and occasionally a few trucks with a full load of logs on the national road No. 78 in between Ratanakiri province and Stung Treng province were seen. Additionally, according to a press release on 30th April 2008, from local newspaper of *Kohsantepheap Daily News* referring to a collapse of Srepok's Bridge it is indicated that the logging activities in the northeast and eastern Cambodia can lead to forest fragmentation and habitat threatening.

Effects of direct loss of large trees might be of only minor consequence to the majority of large mammals and bird communities. However, indirect effects of logging, particularly increased access to remote areas, could be much more severe and affect a much larger range of the natural community (*Robert Timmins & Ou Rattanak et.al, 2001*). In addition, the associated activities of woodcutters and NTFPs collectors also involve in hunting, fishing and land grabbing because of the accessible favors through tracks/trails available into the forest. Those activities are harmful and disturb to wildlife. Most NTFPs products within the Lower Mekong Dry Forest are resin of the large trees (Dipterocarpus species).

Non-timber forest products (NTFPs) consist of wild-fruits, vegetable, honeys, rattan, bamboo and parts of plants for traditional medicines and they are extracted for support livelihood.

Therefore, in conclusion, logging and collecting NTFPs which are associated with other activities of hunting and resource exploitation have resulted in continuing to significantly harm biodiversity, especially through the overexploitation of natural resources.

Figure 3 Collapsed of the Srepok"s Bridge caused by logging truck

Source: Photo from Koh Santepheap Webpage (www.kohsantepheapdaily.com.kh)

6.2. Land uses

The survey team saw several signposts of land grabbing and encroachment was seen within the survey sites and in the vicinity of the resettlement areas. Threats from conversion of forest land into non-forest land are widespread in northeast and eastern Cambodia including the resettlement sites, especially where the forest area can be easily accessed. Existing tracks/trails and roads built during the logging concession time have resulted in forest clearance for variety of land use forms and being considered as significant impacts to forest loss of wildlife habitats in particularly.

The social forest land concession (SFLC)[8] can also significantly affect land use impacting wildlife habitat. Additionally, a huge conversion of forest land along the roadsides of national road No. 78 and adjacent roads have another contributed to direct loss of wildlife habitat.

Figure 4 Clearance along the roadsides, downstream of Lower Sesan River

[8] *There are several forest areas in Stung Treng, Ratanakiri and Mondulkiri provinces that have been granted as social forest land concessions by the Royal Government of Cambodia (RGC). Most of SFLCs have been used for agro-industrial crop developments such as cassava, and monospecies planting of cashew trees, and tree plantation (eucalyptus and acacia sp) as well as rubber plantations.*

Source: survey team, April 2008

In addition, recent developments of the village roads where they are connected from the main roads have also resulted in jeopardizing and/or fragmenting the habitat and leading to large-scale potential of encroachment, for instance, settlement, agricultural land and often involve in speculation as well. The forests today are being diminished and divided into isolated areas. As results, such encroachment have involved in commercial interests of speculation. A continued loss of habitat in addition to capture/hunting may leads to the eventual extinction of the large animals of the globally threatened species within the next decade.

In conclusion, if the present threats and unsustainable land use are not intervened and/or mitigated, the unique biodiversity of the Lower Mekong Dry Forest Ecoregion is unlikely to persist into the future and tragedy of nature would be soon looming.

6.3. Anthropogenic activities

Impacts caused by human activities can be considered as adversely effects to environment and resource depletion. A slash and burn of shifting cultivation and other forms of clearance for land, for instance, killing trees by pruning bark around the treebase and then kept for a while before setting fire. In addition, inflow of local migrants from elsewhere may lead to land expansion for settlements and agricultural land and eventually

involved in land speculation because of opportunity of land business are lucrative at the present.

Furthermore, mining exploitation, occurs inside the Phnom Prich Wildlife Sanctuary, Mondulkiri province where locate at upstream of Srepok River is another significant effects to cumulatively accelerate the habitat loss in the area. Random clearance of forest and digging for gold mining has resulted in fragmenting habitats. In addition, the excavating of gold mining underneath the forests could be resulting in landslide and damage to forest as well. The pollution.can be another indication which associated with environmental consequences of water quality. The gold miners in this forest area they also involve in hunting for their food (*Vichaboth, per.com, 2008*). However, no any reports of environmental impact assessment (EIA) of the gold mining exploitation are obtained. Such situations observed within the proposed resettlement areas are mostly indicated certain activities caused by human activities such as land clearance for ownership. Several signposts for land grabbing inside the resettlements were clearly seen. As earlier indication, the purposes of land grabbing and/or other kinds of conversion of forest land are certainly involved in speculation of commercial interests as well.

6.4. Hunting

Current hunting levels for some species in northeastern Cambodia have increased from previous decades and the already relatively small population of Banteng, Gaur and Asian Elephants could decline at even faster rates (*Robert Timmins & Ou Rattanak et.al, 2001*). The large wild-animals of the ungulate population such as Banteng, Kouprey, Gaur, Wild Water Buffalo, Eld's Deer and other carnivores have faced direct persecution from hunting and limited habitats to escape from those threats. Additionally, high market values of wildlife products for food and folklore of medicinal power have resulted to wildlife declination. The state of wildlife population in the northeast and eastern Cambodia is the greatest immediate threats (*Biodiversity vision for the Lower Mekong Dry Forest Ecoregion, WWF Greater Mekong, Cambodia Program, 2006*).

Findings from surveys show proof that hunting for local consumption of small species are still at large the in villages of the survey sites. Fresh and dried meats and other wildlife products are available at the market and restaurants in provincial town of Stung Treng province (*CEPA, per.com, 2008*).

7. Predicted impacts on resettlement sites

There are some key factors selected for critical consideration on the prediction of impacts to wildlife in the surrounding and catchments of the proposed hydropower dams in Sesan and Srepok Rivers. The below table describe about significant impacts that can be considered as critical concerns to threaten the wildlife.

Table 1 Description of predicted impact from the project

No.	Categories	Description of impact
Physical Environment		
1	Water resources	During the construction of dam, the water resources downstream will become less and less. While after construction, the volume of water of the upstream area will increase and lead to flooding of the surrounding area immediately upstream of the dam site. The riparian forest and other forests, especially the deciduous dipterocarp forest will be under permanently inundated and resulting in loss of forests. The forests loss is obviously seen to diminish the habitats of wildlife. Furthermore, the detritus of the death trees and other decomposed materials will cause some change of the water quality in the reservoir and may take several years to recover and will effect fish as well. In addition, the increasing sedimentation loads into rivers caused by deforestation, infrastructure development of roads, agricultural practices and do mining can result in increasing water pollution into the rivers. This can be considered as an associated indication on the change of water quality of the physical parameters especially.
2	Landscapes	The loss of forest, settlements and associated paddy fields due to inundation upstream of the dam will lead to a change in the surrounding landscape. The resettlement areas will also lead to loss of landscape because of the conversion of forests to resettlement areas. Additionally, soils/rocks materials will be dredged and/or excavated around the areas for dam construction and this is also resulting in change of the surrounding geographical features and its landscapes. Mining exploitation of the upstream catchments has resulted in fragmenting forest and leading to water pollution as well.
3	Fragmenting forests and habitat degradation	A recent renovation of national road No 78 to Ratanakiri province from where it connects with the national road No. 7, runs through a large area of forest. This road provides more access and creates opportunities for land grabbing along both sides of the road. This is leading to loss of the forests and is also a direct threat to wildlife and its habitats. Furthermore, there are several small roads that have been constructed connecting to the main national road No. 78. These roads are considered as some significant concerns of habitats fragmentation and associated with land

No.	Categories	Description of impact
		encroachments as well. The wildlife habitats are gradually being plagued and diminished due primarily to the road networks provide not only more accessible for conversion of forests but also directly disturb to wildlife and its habitats. In addition, the inflow of local immigrants from elsewhere in the country is also considered as another indicator to pressure on natural resources because of the poverty and their basic needs for daily livelihood. This is, therefore, leading to overexploitation of the resources.
4	Existing anthropogenic activities and their settlements	According to the human population density, northeast and eastern part of the country is relatively in small density and sparse but their settlements are widespread in the forest area and they almost rely on the natural resources such as collecting forest and non-timber forest products (NTFPs), wild meats and other resources for support their daily livelihoods. The expansion of paddy farms and other land uses can lead to loss of the forest area gradually. Furthermore, intentional setting of fires as hunting techniques and/or shifting cultivation cause habitat depletion and pose threat to wildlife. As such the resettlement areas will likely have quite a large impact on the surrounding forests.
5	Protected areas and protected forests[9] at the upper catchments	It is expected that forests outside the protected area (PA) and protected forest (PF) may soon become the target of development efforts. As results, there will no longer be forests outside the PA&PF leading to habitat loss or fragmentation of habitat into isolated small patches of forests. The last stronghold of wildlife populations are inside the PA&PF. Unfortunately, there is not enough corridor established in between PA&PF and this is leading to limited distribution of wildlife, especially the large animals. In addition, if do looking for management in place inside the protected areas and/or protected forest at the present is lack of material and financial assistance in order to meet the conservation efforts and this might result in critical issues to wildlife protection. There are several settlements locate inside the PA&PF so that it is recommended that

[9] *Protected area is under responsible for the Department of Nature Conservation and Protection (DNCP) while the outside protected areas and protected forest is under responsible for the Forestry Administration. However, both protected area and protected forest share common objectives and goals for conservation.*

No.	Categories	Description of impact
		management plan should be considered both improving livelihood alternatives through conservation program in order to meet the basic needs and conservation targets too.
Biological Environment		
6	Forest resources	The forest areas close to the Sesan and Srepok Rivers immediately upstream of the proposed dam will be under permanent inundation. Therefore, a vast area of the riparian and forest vicinity will no longer be forest leading to a loss of habitat and pose threats to wildlife as well. Furthermore, the fragmentation in which caused by roads impacts are another indicator to make forest area in the northeast and eastern Cambodia to become smaller. Meanwhile, conversion of forest area into the social forest land concessions (SFLC) can be considered as critical issues in relation to wildlife habitats. Most of forest land concession areas are located in Stung Treng province, where it is considered as downstream of the proposed hydropower dams in Sesan and Srepok Rivers. In northeast and eastern Cambodia, there are forest areas under the names of Social Forest Land Concessions. Therefore, the entire aggregation of forest losses have resulted in increasing the habitat loss and this is not only consideration from single impact from the resettlements of the dam project but also other associated development efforts as a whole. The entire of existing issues/problems to the forest (such as selective logging, habitat fragmentation, land grabbing, infrastructure developments and other disturbances) have resulted in depleting not only to the forest resources but also effect to wildlife population and its habitat. This issue will be particularly a threat around the resettlement areas In addition, the proposed hydropower dam will lead to more critically significant effects to the forests which will be flooded, especially forest habitats nearby of the riverbank because of the water volume become larger size.
7	Wildlife	a) *Large mammals and small mammals*: the impacts from random settlements, forest fragmentation, road networking and other pressures from human activities, hunting and land encroachment can be a critical disturbance to large animals and its habitats. The habitats of large animals become small and smaller and leading to limited areas for their refuges. While, there are four protected areas upstream, the catchments are considered as last frontier for their habitats. However, the status of wildlife population depends on the management level in order to ensure for wildlife protection

No.	Categories	Description of impact
		in the whole area of the northeast and eastern Cambodia. b) *Birds*: the habitats of large waterfowl such as Grey headed Fisheagle, Woolly-necked Storks, and Ibis species will be under threat from the dam project due to changing of their nesting areas and food availability. Additionally, other birds (wader species) may loss their ground nesting while they also face competing else-where for new habitats. Other ground birds of junglefowls and pheasants may limited their distribution range while their habitat loss/change. *c) Reptiles and amphibians*: There is no significant impact or change of these species because of they are adaptable to aquatic habitats. However, the changes of water quality that is caused by death detritus of vegetation and other materials may result in significant effects. *d) Other living organism*: There will be several significant effects to most other living organisms because of the habitat degradation and fragmentation.

8. Measures taken and mitigation

8.1. Options for resettlement sites

Currently, the resettlement sites have been proposed in the forest areas and they are situated a little further from the riverbanks (see figure....). There is no existing infrastructure but cart-tracks and trails provide access to the areas. There are no appropriate roads, water resources or other infrastructure facilities. Accessibility, transportation, communication and other facilities are obviously seen as a difficulty and it is nearly impossible to access in or out of the resettlement areas during the wet season as the level of water in both rivers (Lower Sesan and Lower Srepok Rivers) can pose a risk at anytime for crossing the rivers.

In addition, the approaches to the resettlement areas require crossing rivers except one resettlement site of the Lower Srepok River which is located adjacent to national road No. 78. This one site can be considered as having more opportunities than the other areas in terms of facilities such as transportation, accessibility and communication and so on.

Considering the resettlement site locations, it is recommended that the proposed resettlement sites should be placed along the roadsides of the national road No. 78. This road runs through the forests in between Lower Sesan and Lower Srepok Rivers and up to the northeastward to Ratanakiri province. The forests locate along the roadsides can provide space available for such resettlement sites, in according to the existing population

density and land for agricultures. The resettlements along the roadside of National Road No. 78 should be located off the Srepok's Bridge along the way upward to Ratanakiri.

The table below shows on the population and other agricultural land and rice production in relation to three communes in Sesan district, in which under planning of resettlement sites of the Lower Sesan and Lower Srepok Rivers.

Table 2 Population and agricultural land and crops

Province	District	Commune	No. of villages	No. of families	Total population	Paddy field (ha)	Rice production (tone)
Stung Treng	Sesan	Kbal Romeas	4	620	2865	442	663
Stung Treng	Sesan	Srae Kor	2	311	1334	624	936
Stung Treng	Sesan	Ta Lat	4	618	2849	951	1426.5
Total			10	1,549	7,048	2,017	3,025.5

Source: Seila Commune Database, Stung Treng province, 2005

The important reasons of this option because of the resettlement sites along the roadsides of the national road No. 78 can provide more opportunities to local people whom under the plan of such resettlement. These opportunities include

- The existing infrastructures such as roads, primary school, and health center and commune headquarter can provide more favorable conditions in terms of mean of transportation, communication, accessibility to elsewhere and other services.
- Less disturbances and threats to wildlife population and its habitat if compared to the proposed resettlement sites.
- Reducing costs of transportation and easily access to elsewhere for businesses, for instance, selling agricultural products and other exchange items for livelihoods and seeking job opportunity outside.
- The settlements along the roadside may less negative impacts to wildlife threaten and habitat loss from conversion the forest.

8.2. Summary of impacts and suggested mitigation measures

Based on the field observations and existing data base analysis of the catchments in the down stream and upstream areas of the Srepok and Sesan Rivers, there are several key impacts from the dam development posing threats to wildlife and its habitats. These are:

Table 3 Summary of impacts to wildlife and habitats

No.	Categories	Threats to wildlife and habitats
1	Water resources and water quality	1. Increasing water volume of catchments = habitat loss and threat to wildlife; 2. Water quality changes = short term pollution but decreasing fish population and distribution
2	Landscapes	3. Change of geographical features due to excavating soils, rocks and other materials for construction = habitat loss and threat to wildlife;

No.	Categories	Threats to wildlife and habitats
3	Fragmenting forest and habitat degradation	4. Isolated forests = threat to wildlife 5. Land grabbing = habitat loss and threat to wildlife 6. Encroachment for settlements and agricultural land and associated activities = habitat loss and threat to wildlife population; 7. Intentionally set fire for hunting = degraded habitat and threat to wildlife 8. Mining exploitations have resulted in habitat depletion and threat to wildlife as well.
4	Logging and NTFPs collection	9. Habitat loss due primarily to fragmentation 10. Wildlife threaten 11. Diminishing habitat and pose pressure to wildlife
5	Hunting	12. Direct threats to wildlife and leading to extinct of the globally threatened species in particularly 13. Pose pressures to animal diet because of limited food diet 14. Habitat degradation caused by fire for hunting
6	Protected areas and protected forests	15. The PA&PF can be considered as last safe stronghold and/or natural zoo but the existing concerned issues have further continued and resulted in threat to wildlife and habitat. Finally, wildlife population is decreasing and habitat degradation. It is unlikely different to the area outside PA&PF, but level of threats may lesser speed than outside PA&PF. Therefore, level of management system might pose a critical significance to wildlife population within territory of PA&PF or the last wildlife stronghold under threats and resulting to deplete even extinct of the globally endangered species.
7	Proposed resettlement sites and hydropower dam of LSS and LSP	16. Habitat loss (further diminishing habitat through conversion into settlements and inundation) 17. Threats to wildlife population with limited habitat and then pressure on food diet of animals. 18. Adding negative effects that associate with the existing negative effects may have critical situation to wildlife population and their habitat.

As addressed in the above conclusion it is clear that existing issues/problems and additional impacts from the proposed hydropower dam and resettlement areas will fragment and deplete wildlife habitats and wildlife density. The loss of habitats, threat to wildlife and finally wildlife becomes in a severe situation leading to species extinction.

It is also expected that other development efforts in the northeast and eastern Cambodia may further cumulate to adversely affect to the natural resources and environment in this

area. Therefore, in relation to establish resettlement sites and hydropower dam construction, the project owner and competent authorities should undertake take the following mitigation measures:

- Develop a proper land use planning for resettlement
- Build more access roads to ease transportation and other facilities inside the resettlements in term of public facilities.
- Provide incentive involve in integrated agricultural activities. This requires improving of the livelihood alternatives against to basic needs and reducing adverse impact to wildlife and its habitat
- Compensate for individual households' assets and public interests for resettlement.
- Set up warning system of flood control. This is important for such resettlement areas where they close to the inundation basin.
- Monitor changes in wildlife density and its required habitats through the management efforts in protected areas and protected forests, so that ensure to wildlife protection.
- Build Trust Fund for wildlife awareness to strengthen conservation efforts
- Build more corridors connect between protected areas and protected forest where it is possible for the movement/migration of wildlife in the areas of the northeast and eastern Cambodia.
- Strengthen management systems both inside the protected areas and protected forests. Additionally, tree plantation and fuelwood consumption should be considered into the natural resource action plans.

Obviously, the conversion of forest lands into resettlements may result in certain changes of ecosystem in the area, especially to wildlife population and its habitats as well. Additionally, hydropower project may also result in adversely environmental impact not only to biodiversity but also to socioeconomic of the local population. In association with the cumulative impacts, it is recommended that socioeconomic impact should be included as well. However, it is just aggregated impacts and the whole impact to the wildlife and habitat is unlikely to come from such single development because the whole areas still support a vast forest land with low density of human population. Additionally, it seems less impact the upper catchments where they support a rich biodiversity of wildlife and other ecosystems in the protected areas and protected forests.

The catchments of the upper areas have been identified as significant potential for conservation values of wildlife species, especially the globally endangered species. Most of the upper catchments have been designated as protected areas (PAs) and protected forests (PFs), so that wildlife safety through the management and protection efforts. It is also recommended to create specific corridor in order to ease the movement or migration of wildlife within the areas in the northeast and east of the country. However, the areas of the downstream are likely to impact from the integrated development efforts such as conversion of forest land into development purposes but the impact from the resettlements and Dam Project seem to be less but more detailed of the cumulative for a

whole area of the LMDFE in the northeast and eastern Cambodia may significantly considered.

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- 2001, Robert Timmins and Ou Rattanka.; The Importance of Phnom Prich Wildlife Sanctuary and Adjacent Areas for the Conservation of Tigers and other Key Species.
- 2001, Michael Baltzer, Nguyen Thi Dao, Robert Shore, James Hardcastle, Barney Long, Kristin Clay and Jenny Springer., The Forest of the Lower Mekong Ecoregion Complex. Worldwide Fund for Nature (WWF)
- 2000, Jenny C. Daltry & Frank Momberg,. Cardamom Mountains; Biodiversity Survey

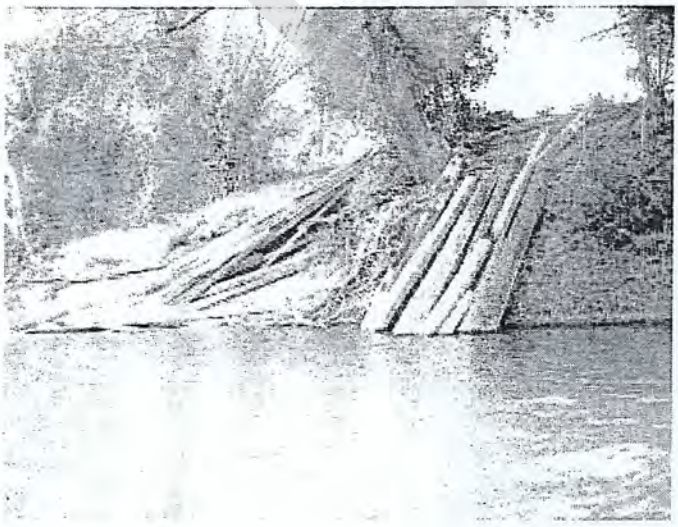
Appendix

Figure 5 Deciduous Dipterocarp Forest in the proposed resettlement sites

The forests in this habitat are remaining a large number of small trees. The large trees of the high commercial value are under selective logging. The proposed resettlement sites are located along the Lower Sesan and Lower Srepok Rivers, in Stung Treng province. Generally, it is said this type of forest supports large population of wildlife of large mammals including carnivorous species and its preys as well. However, there are several disturbances currently occur within this habitats, due primarily to accessibility is prevailing.

Source: *photo by team, field observation on April, 2008.*

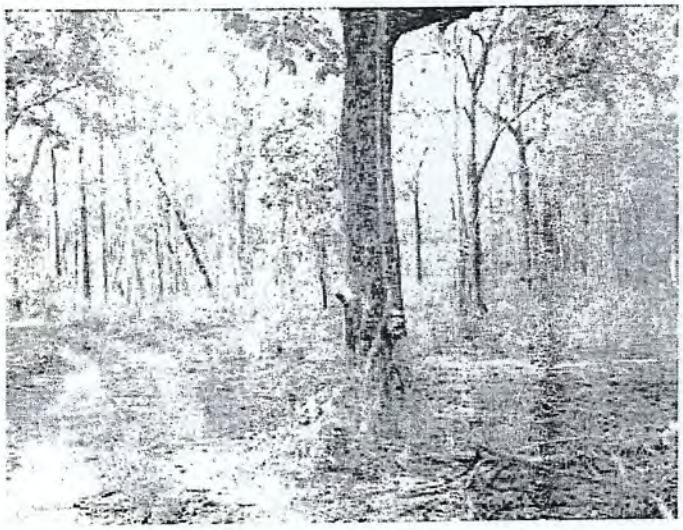
Figure 6 Selective logging occurs surrounding in resettlement sites



The selective logging in the surrounding of resettlement sites and vicinity are often seen and heard of the chainsaw voice. No any monitoring measure taken during the field observations. The large trees of previous wood and first quality wood have been logged.

Source: *photo by team, field observation on April, 2008.*

Figure 7 Existing trails/track access into forest



Ox-cart tracks and trails are considered the main treats to forest resources and wildlife habitats as well as wildlife population. The tracks provide more accessible into the forest for logging, hunting and possibly involve in land grabbing and encroachment.

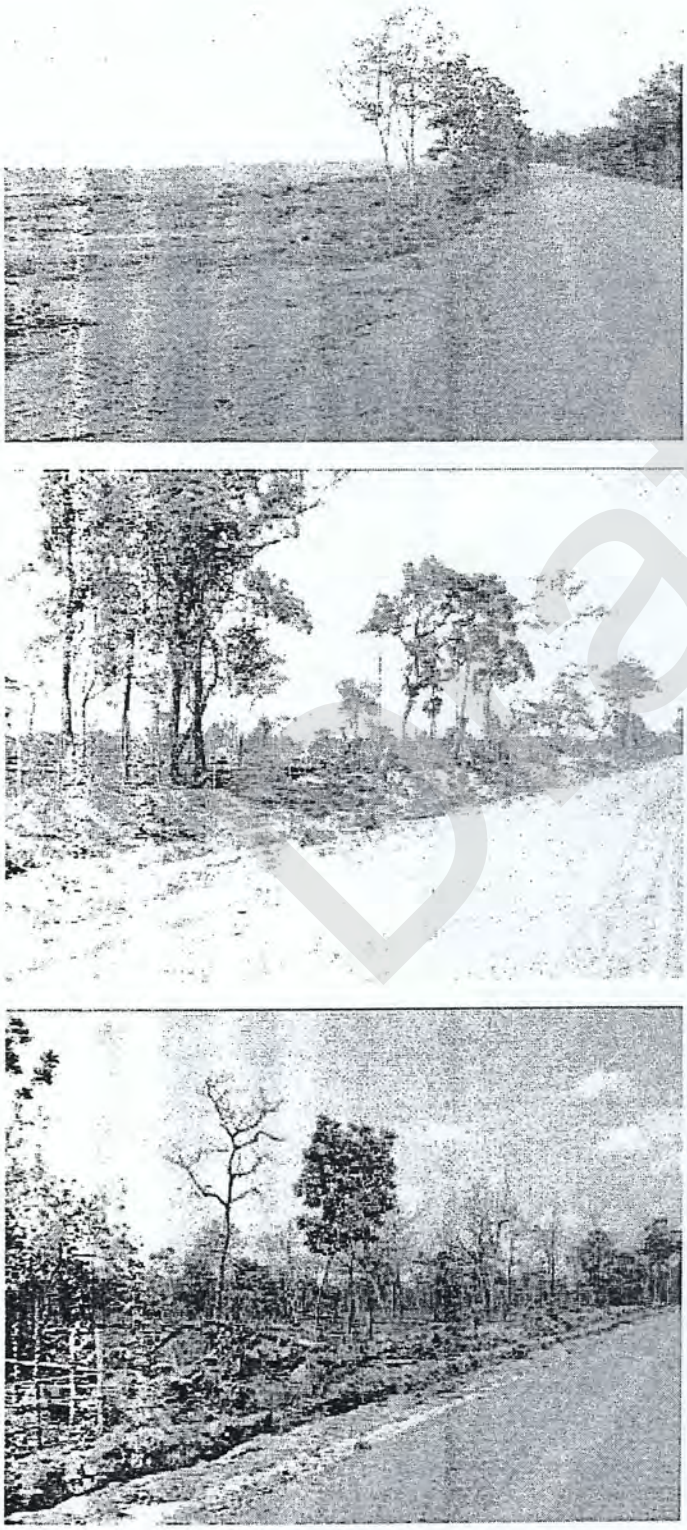
Source: *photo by team, field observation on April, 2008.*

Figure 8 Villages' roads connect from the national road No. 78

The village's roads were built in connecting from the main road and this is leading to fragment of habitats. The development efforts occur within the area might provide more accessible and opportunities involve in land encroachment and speculation as well.

Source: *photo by team, field observation on April, 2008.*

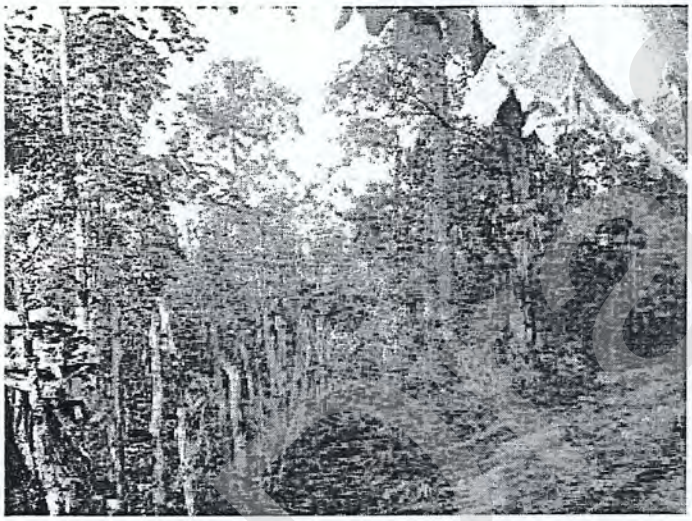
Figure 9 Habitat loss caused by road building



The roads impact may result in a vast size of forest area along the roadside disappear and this is due primarily to several key factors of forest management and development needs. The fragmentation of forests through such encroachment have resulted in long term impact to wildlife threatens and its habitats.

Source: *photo by team, field observation on April, 2008.*

Figure 10 Conversion and land grabbing for commercial interests



Roads provide more accessible to encroach forests and altering into non-forest area. The applied methods for killing tree for land, by pruning barks around the tree-base. After months the pruned trees dry-out and then death because of no water supply to nutrient the entire tree.

Source: *photo by team, field observation on April, 2008.*

Figure 11 Banteng

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

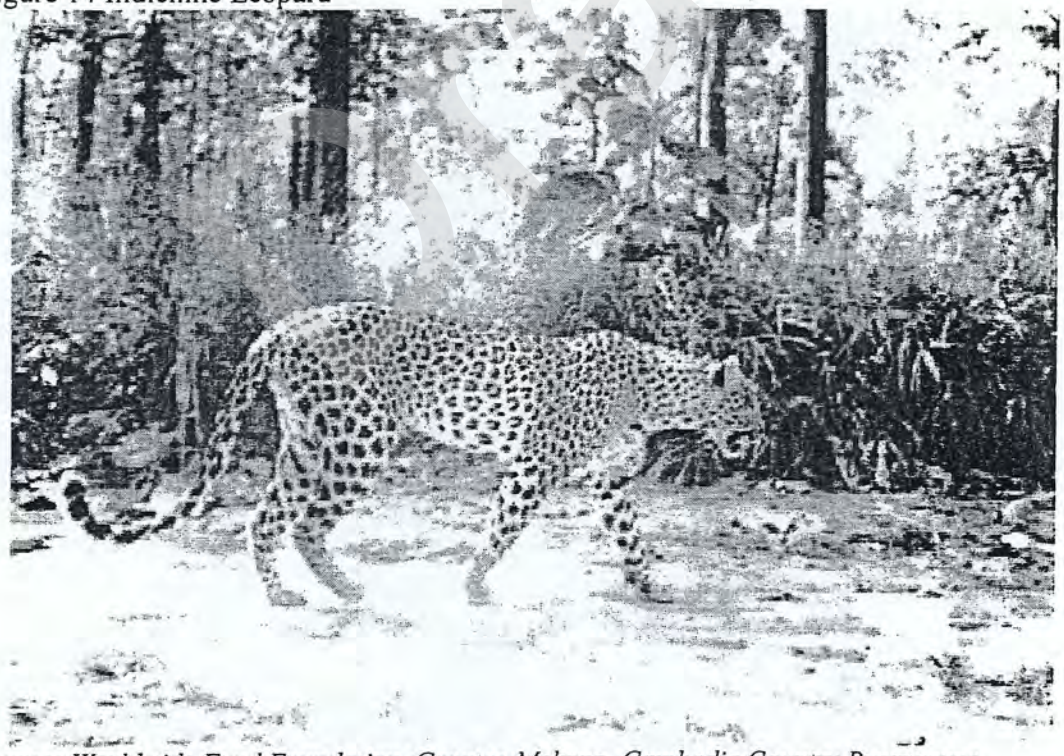
Figure 12 Gaurs

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 13 Wild water buffalo

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 14 Indichine Leopard



Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 15 Blackbear

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

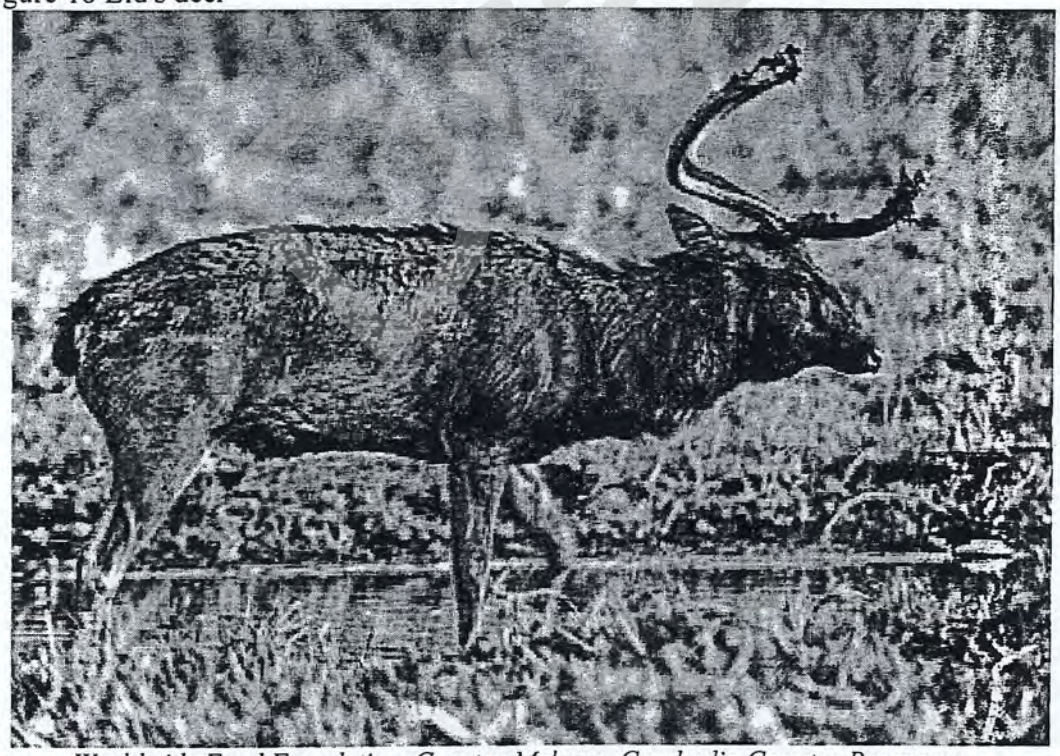
Figure 16 Asian Elephant

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 17 Sambar deer

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 18 Eld's deer



Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

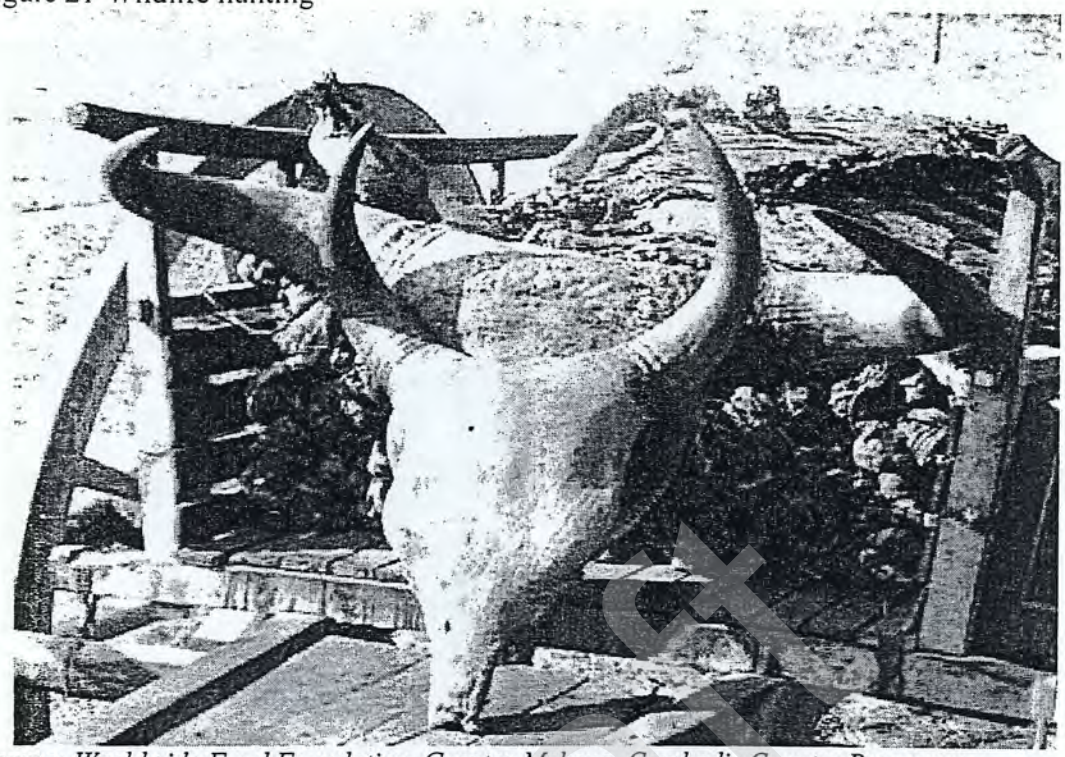
Figure 19 Tiger

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 20 Otters

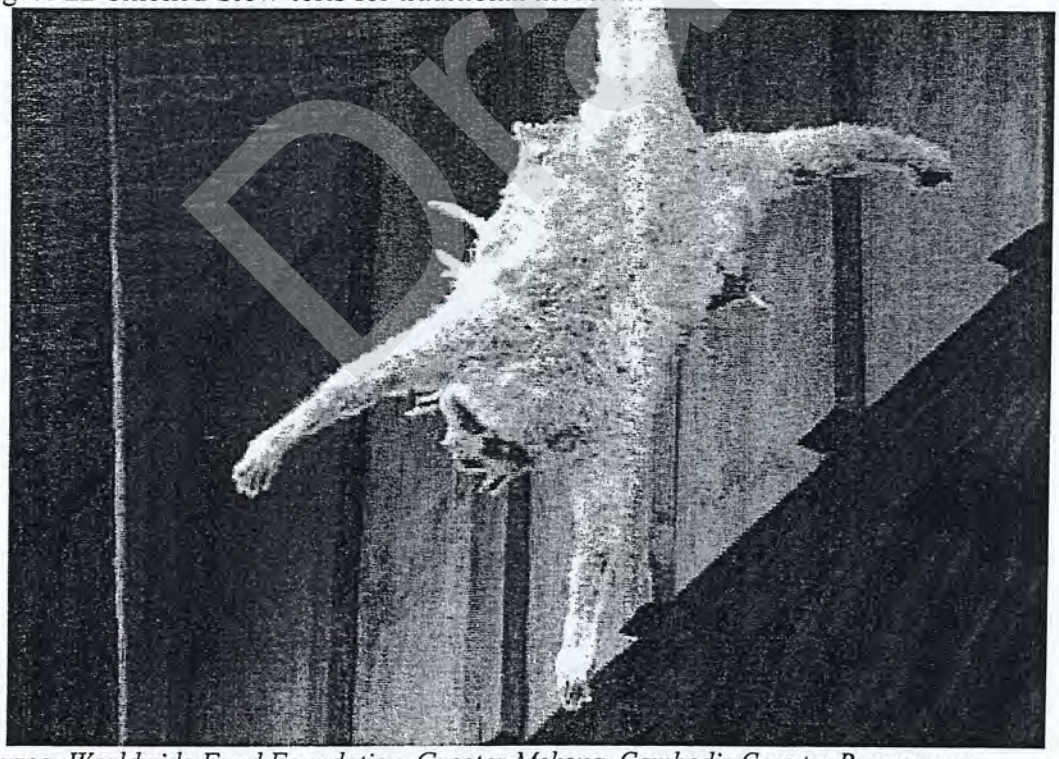
Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 21 Wildlife hunting



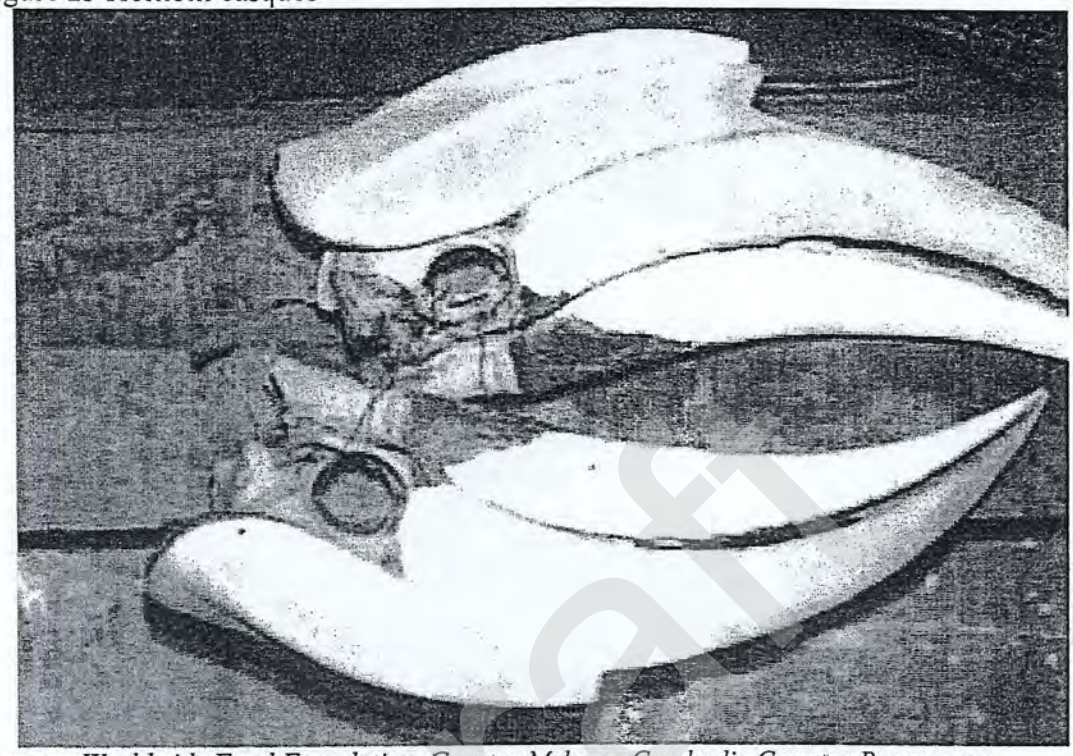
Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 22 Smoked Slow-loris for traditional medicine



Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 23 Hornbill casques

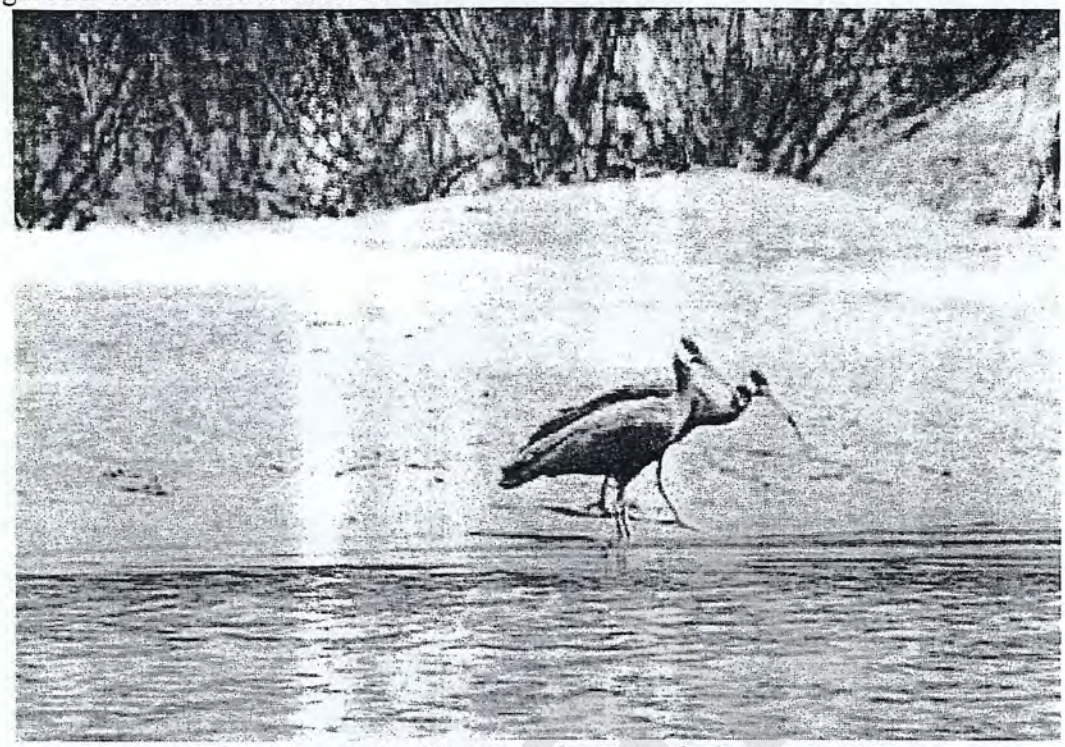


Source: Worldwide Fund Foundation, Greater Mekong. Cambodia Country Programme

Figure 24 Woolly-necked Stork

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 25 White-shouldered Ibis



Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

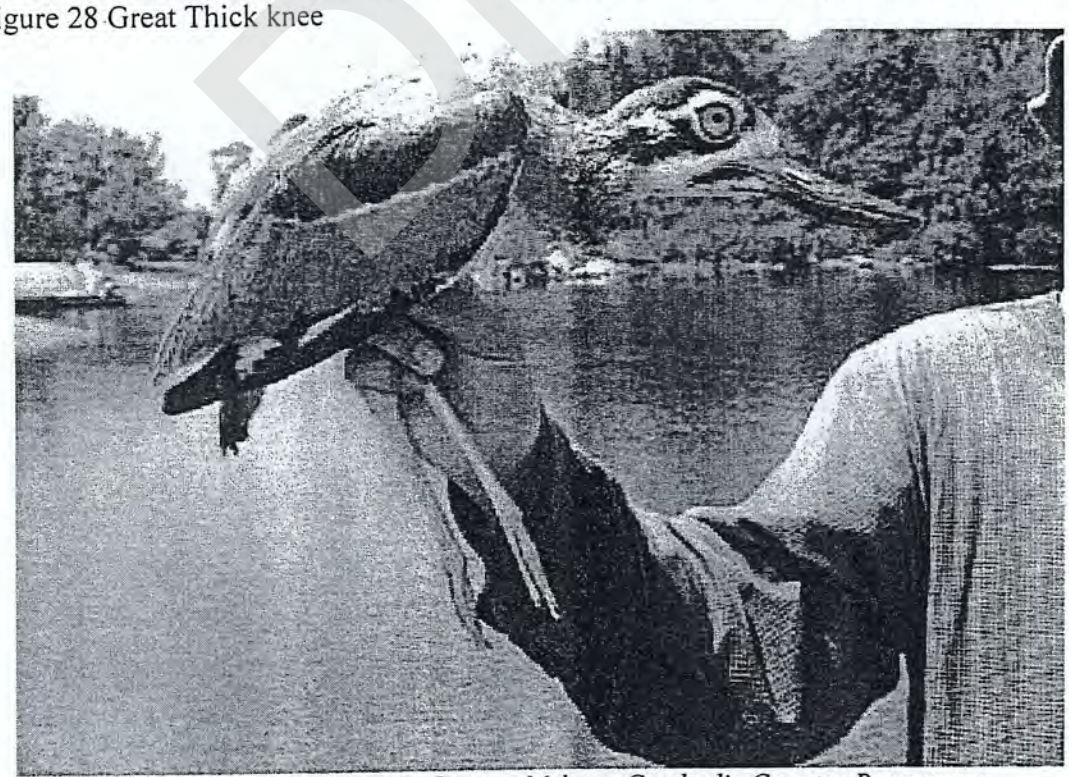
Figure 26 Grey headed Fisheagle

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 27 Red-headed Vulture

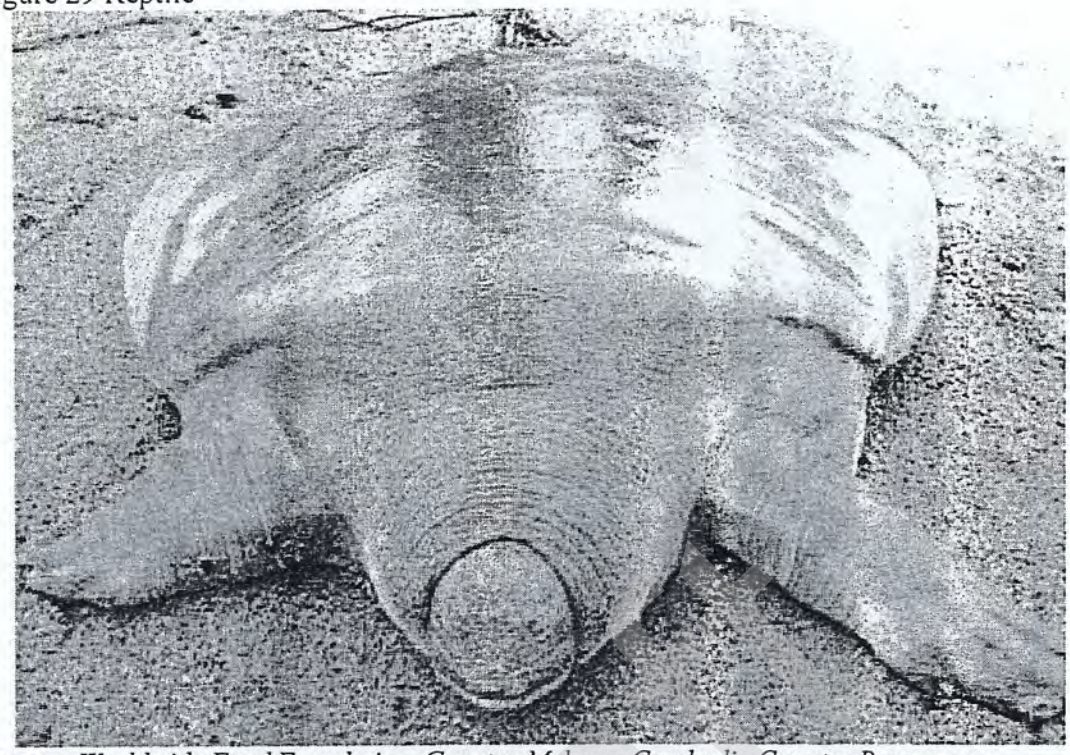
Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 28 Great Thick knee



Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Figure 29 Reptile



Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

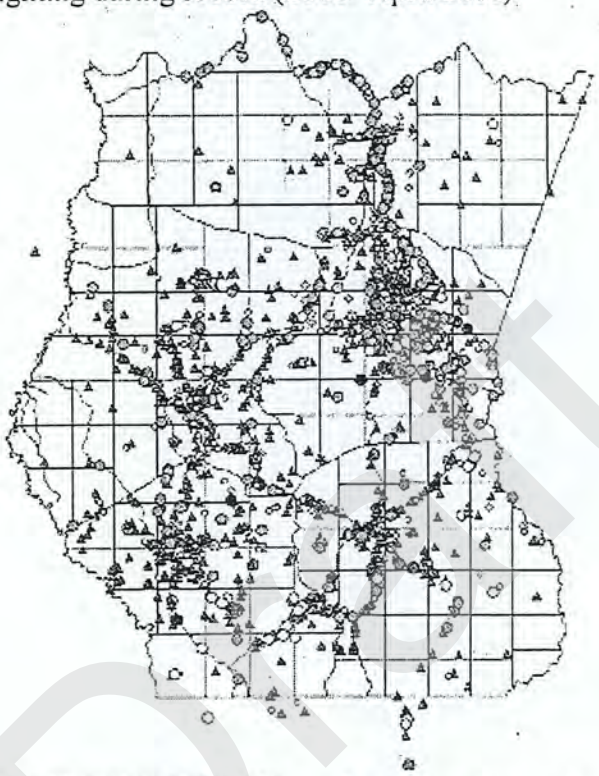
Figure 30 Catchments of the Srepok, Phnom Prich Wildlife Sanctuary

Source: Worldwide Fund Foundation, Greater Mekong, Cambodia Country Programme

Additional note on wildlife observations in the catchments (Mondulkiri Protected Forest, Srepok Wilderness Area)

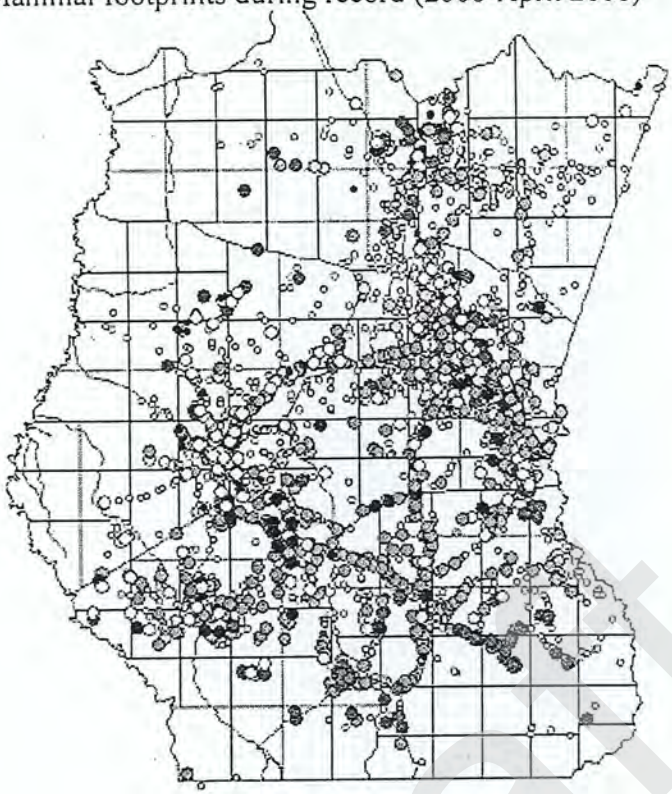
Source: WWW Greater Mekong Cambodia Country Programme

Figure 31 Mammal sighting during record (2006- April 2008)



- Small Asian Mongoose Sighting for 01 Jan 2006 to 01 Apr 2008
- Gibbon.spp Sighting for 01 Jan 2006 to 01 Apr 2008
- Otter spp. Sighting for 01 Jan 2006 to 01 Apr 2008
- Wild water buffalo Sighting for 01 Jan 2006 to 01 Apr 2008
- Wild Pig Sighting for 01 Jan 2006 to 01 Apr 2008
- Sun Bear Sighting for 01 Jan 2006 to 01 Apr 2008
- Stump-tailed macaque Sighting for 01 Jan 2006 to 01 Apr 2008
- Silvered Langur Sighting for 01 Jan 2006 to 01 Apr 2008
- Siamese hare Sighting for 01 Jan 2006 to 01 Apr 2008
- Sambar Sighting for 01 Jan 2006 to 01 Apr 2008
- Red Muntjac Sighting for 01 Jan 2006 to 01 Apr 2008
- Pig-tailed Macaque Sighting for 01 Jan 2006 to 01 Apr 2008
- Long-tailed Macaque Sighting for 01 Jan 2006 to 01 Apr 2008
- Leopard Sighting for 01 Jan 2006 to 01 Apr 2008
- Large-toothed Ferret Badger Sighting for 01 Jan 2006 to 01 Apr 2008
- Gaur Sighting for 01 Jan 2006 to 01 Apr 2008
- Fishing Cat Sighting for 01 Jan 2006 to 01 Apr 2008
- Eld's Deer Sighting for 01 Jan 2006 to 01 Apr 2008
- Douc Langur Sighting for 01 Jan 2006 to 01 Apr 2008
- Dhole Sighting for 01 Jan 2006 to 01 Apr 2008
- Civet spp. Sighting for 01 Jan 2006 to 01 Apr 2008
- Banteng Sighting for 01 Jan 2006 to 01 Apr 2008
- Asiatic Jackal Sighting for 01 Jan 2006 to 01 Apr 2008
- Asian Elephant Sighting for 01 Jan 2006 to 01 Apr 2008
- swap_posts
- swap_road
- swa_block_management

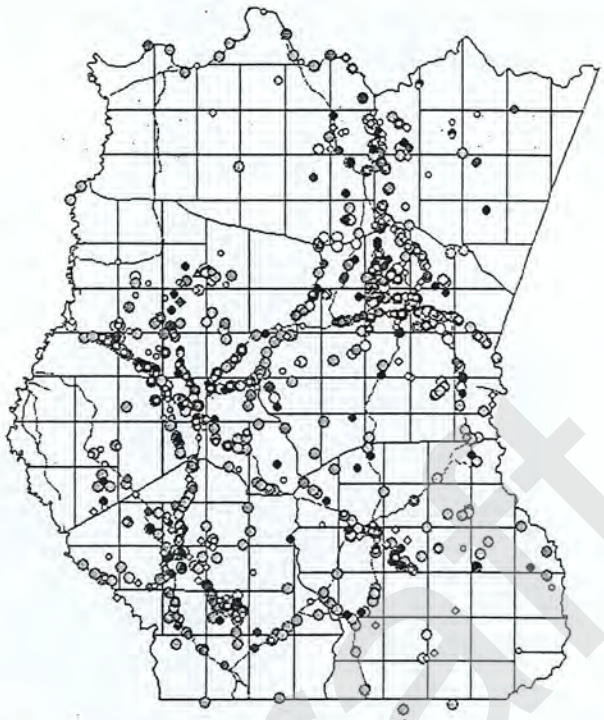
Figure 32Mammal footprints during record (2006-April 2008)



Legend of Mammals record

- Leopard cat Sleeping Sign for 01 Jan 2006 to 01 Apr 2008
- Otter spp. Footprint for 01 Jan 2006 to 01 Apr 2008
- Wild water buffalo Footprint for 01 Jan 2006 to 01 Apr 2008
- Wild Pig Footprint for 01 Jan 2006 to 01 Apr 2008
- Tiger Footprint for 01 Jan 2006 to 01 Apr 2008
- Tiger Dung for 01 Jan 2006 to 01 Apr 2008
- Sun Bear Footprint for 01 Jan 2006 to 01 Apr 2008
- Sambar Footprint for 01 Jan 2006 to 01 Apr 2008
- Red Muntjac Footprint for 01 Jan 2006 to 01 Apr 2008
- Long-tailed Macaque Footprint for 01 Jan 2006 to 01 Apr 2008
- Leopard Footprint for 01 Jan 2006 to 01 Apr 2008
- Gaur Footprint for 01 Jan 2006 to 01 Apr 2008
- Fishing Cat Footprint for 01 Jan 2006 to 01 Apr 2008
- Eld's Deer Footprint for 01 Jan 2006 to 01 Apr 2008
- East Asian Porcupine Footprint for 01 Jan 2006 to 01 Apr 2008
- Dhole Footprint for 01 Jan 2006 to 01 Apr 2008
- Civet spp. Footprint for 01 Jan 2006 to 01 Apr 2008
- Banteng Sleeping Sign for 01 Jan 2006 to 01 Apr 2008
- Banteng Footprint for 01 Jan 2006 to 01 Apr 2008
- Asiatic Jackal Footprint for 01 Jan 2006 to 01 Apr 2008
- Asian Elephant Footprint for 01 Jan 2006 to 01 Apr 2008
- swap_post
- swap_road
- swa_block_management

Figure 33 Bird sighting record (2006-April 2008)



- Woolly-necked Stork Sighting for 01 Jan 2006 to 01 Apr 2008
- White-winged Duck Sighting for 01 Jan 2006 to 01 Apr 2008
- White-shouldered Ibis Sighting for 01 Jan 2006 to 01 Apr 2008
- White-rumped Vulture Sighting for 01 Jan 2006 to 01 Apr 2008
- White-rumped Vulture Nest for 01 Jan 2006 to 01 Apr 2008
- White-rumped Vulture Footprint for 01 Jan 2006 to 01 Apr 2008
- Slender-billed Vulture Sighting for 01 Jan 2006 to 01 Apr 2008
- Silver Pheasant Sighting for 01 Jan 2006 to 01 Apr 2008
- Sarus Crane Sighting for 01 Jan 2006 to 01 Apr 2008
- Red-headed Vulture egg for 01 Jan 2006 to 01 Apr 2008
- Red-headed Vulture Sighting for 01 Jan 2006 to 01 Apr 2008
- Red-headed Vulture Nest for 01 Jan 2006 to 01 Apr 2008
- Red-Wattled Lapwing Sighting for 01 Jan 2006 to 01 Apr 2008
- Red Junglefowl Sighting for 01 Jan 2006 to 01 Apr 2008
- Owl Sighting for 01 Jan 2006 to 01 Apr 2008
- Oriental Pied Hornbill Sighting for 01 Jan 2006 to 01 Apr 2008
- Mongoose Sighting for 01 Jan 2006 to 01 Apr 2008
- Little Cormorant Sighting for 01 Jan 2006 to 01 Apr 2008
- Lesser Whistling Duck Sighting for 01 Jan 2006 to 01 Apr 2008
- Lesser Fish Eagle Sighting for 01 Jan 2006 to 01 Apr 2008
- Lesser Adjutant Sighting for 01 Jan 2006 to 01 Apr 2008
- Kite Sighting for 01 Jan 2006 to 01 Apr 2008
- Green Peafowl Sighting for 01 Jan 2006 to 01 Apr 2008
- Greater Adjutant Sighting for 01 Jan 2006 to 01 Apr 2008
- Great Slaty Woodpecker Sighting for 01 Jan 2006 to 01 Apr 2008
- Great Hornbill Sighting for 01 Jan 2006 to 01 Apr 2008
- Giant Ibis Sighting for 01 Jan 2006 to 01 Apr 2008
- Eagle spp. Sighting for 01 Jan 2006 to 01 Apr 2008
- Darter Sighting for 01 Jan 2006 to 01 Apr 2008
- Crested Serpent Eagle Sighting for 01 Jan 2006 to 01 Apr 2008
- Chinese francolin Sighting for 01 Jan 2006 to 01 Apr 2008
- Black-necked Stork Sighting for 01 Jan 2006 to 01 Apr 2008
- Bengal Florican Sighting for 01 Jan 2006 to 01 Apr 2008
- swap_posts
- swap_road
- swa_block_management

Additional note on wildlife observations in the catchments in Phnom Prich Wildlife Sanctuary, Mondulkiri province

Source: WWW Greater Mekong Cambodia Country Programme

Figure 34 mammal footprints

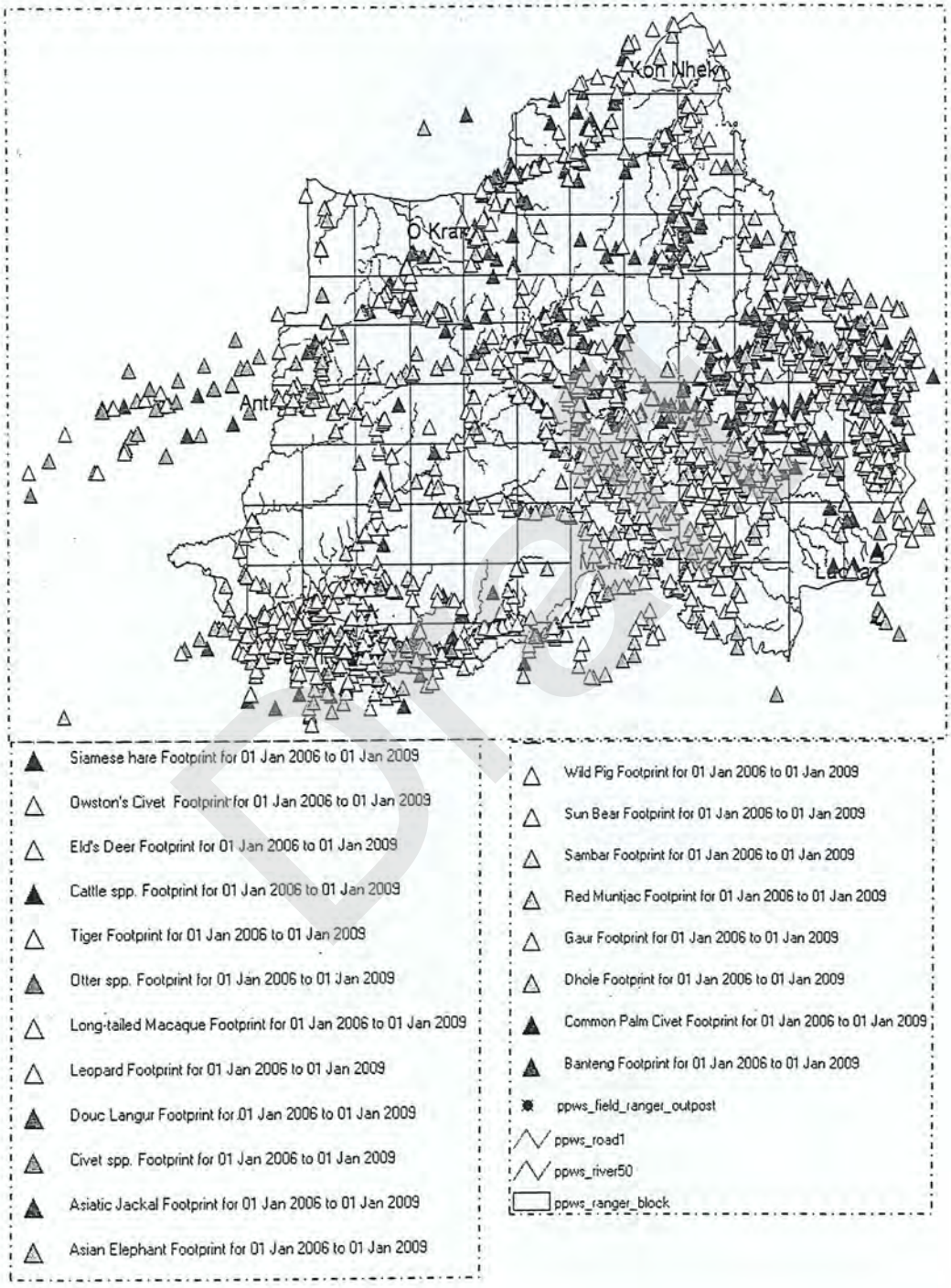


Figure 35 Map of mammal sights

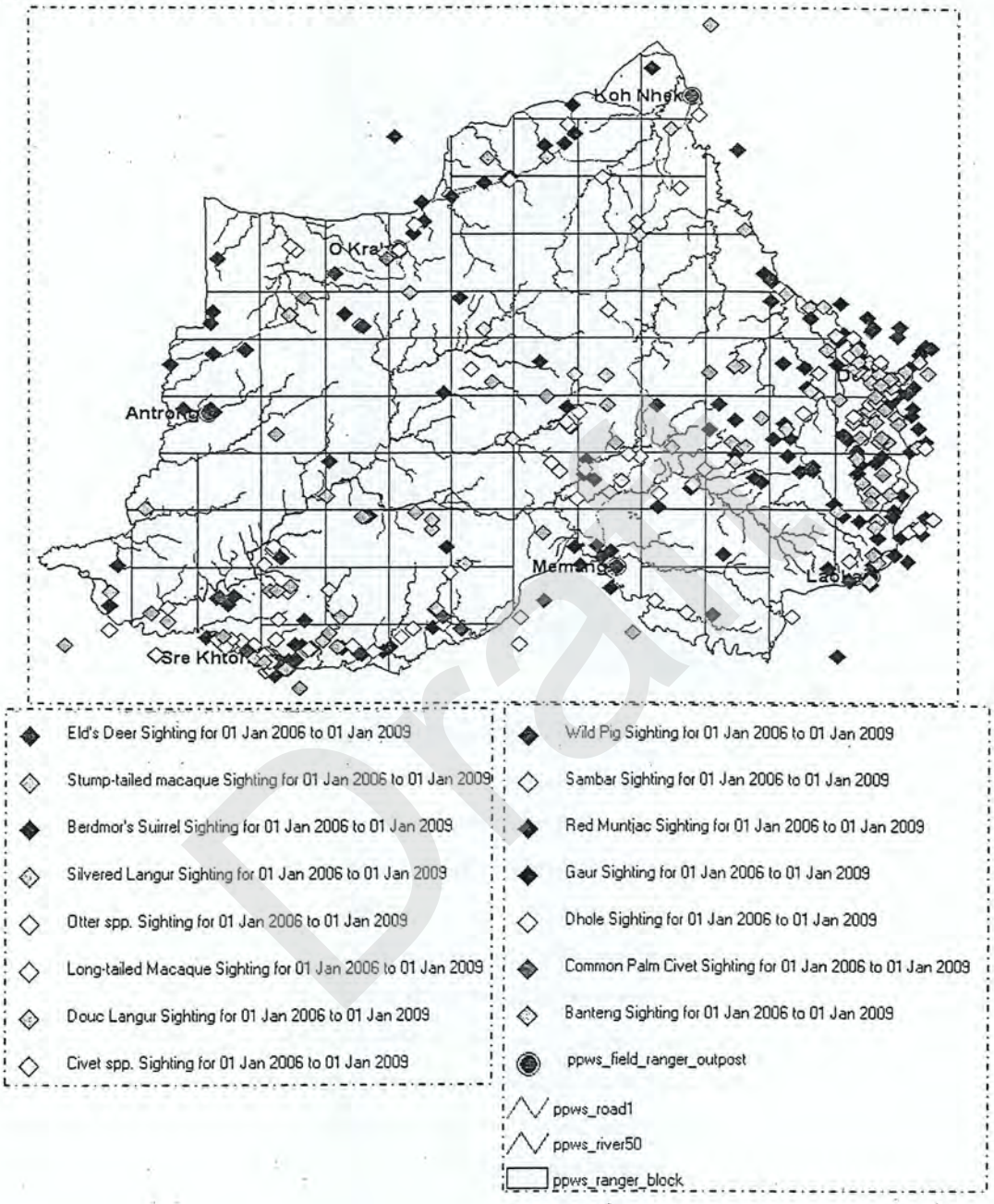


Figure 36 Map of bird sighting

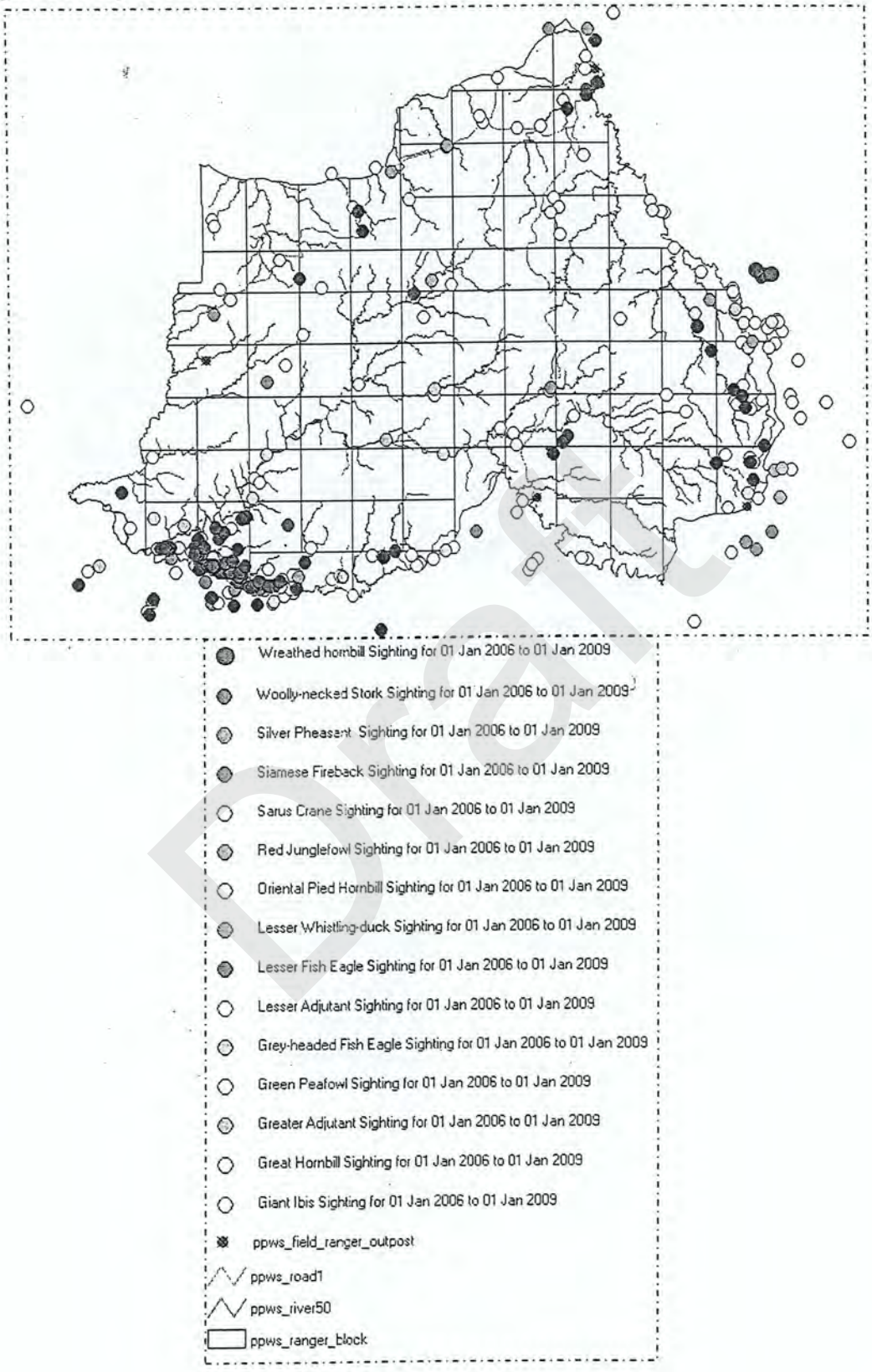
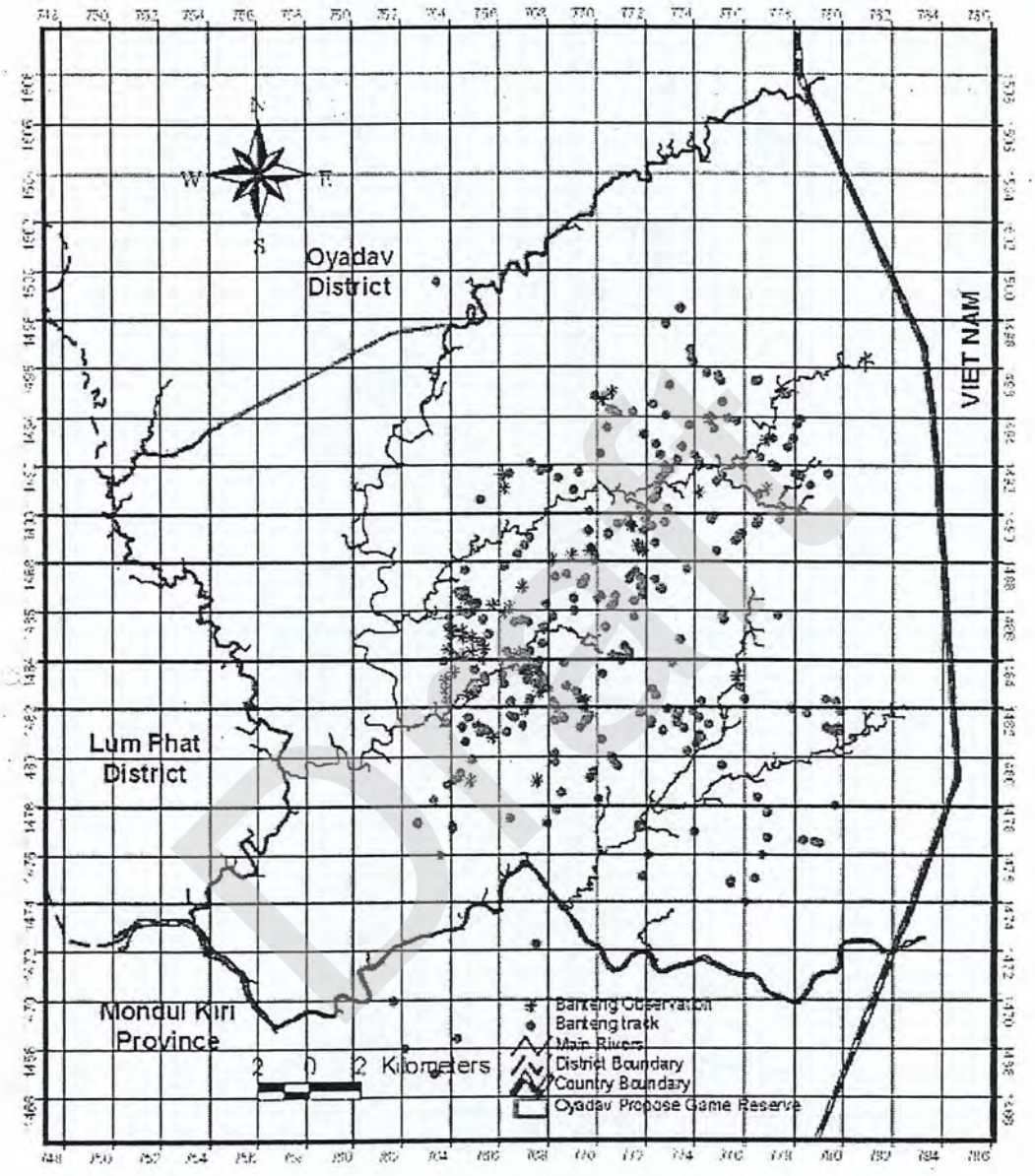
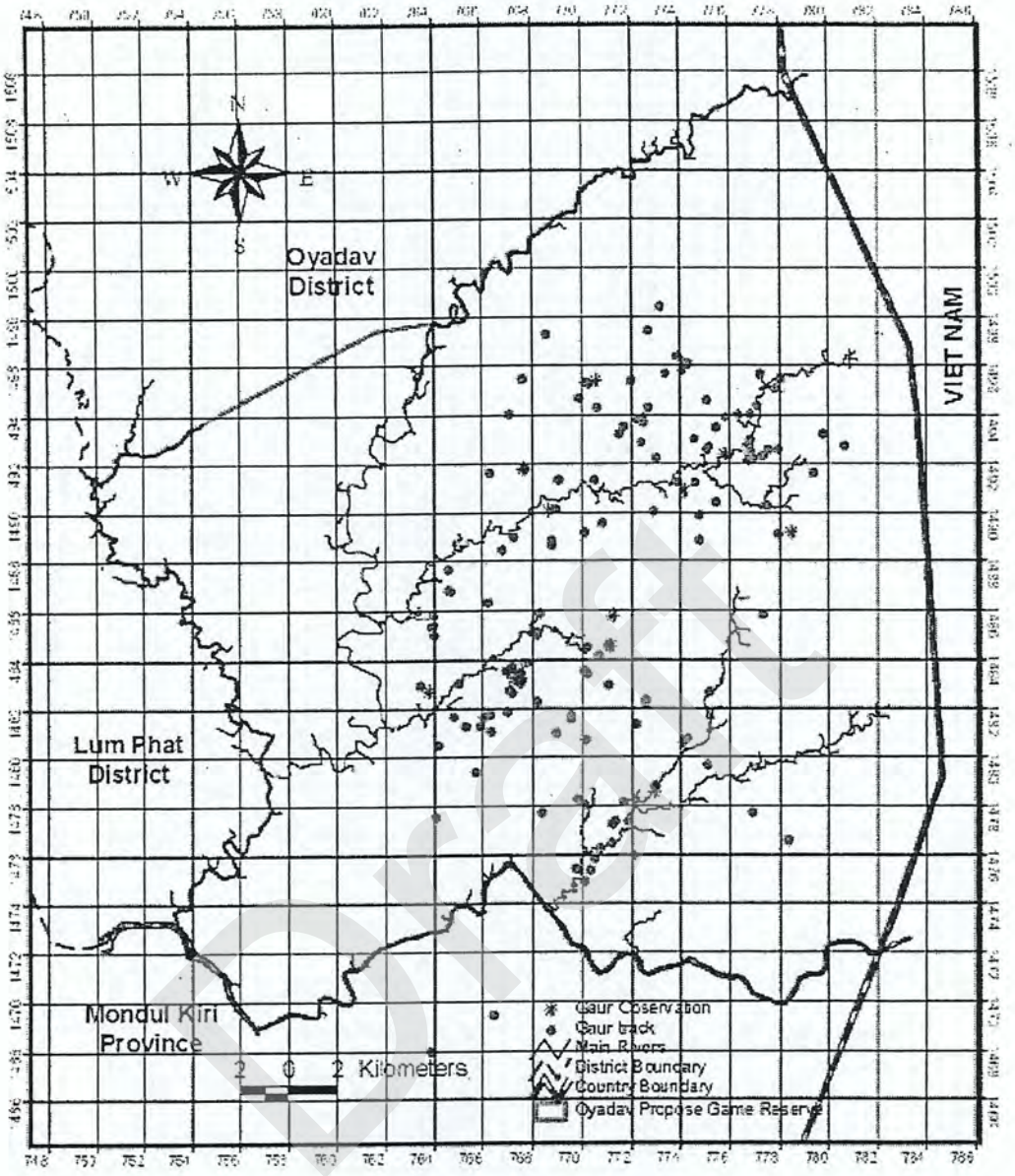


Figure 37 Banteng's data in the catchments, Oyadav, Ratanakiri province



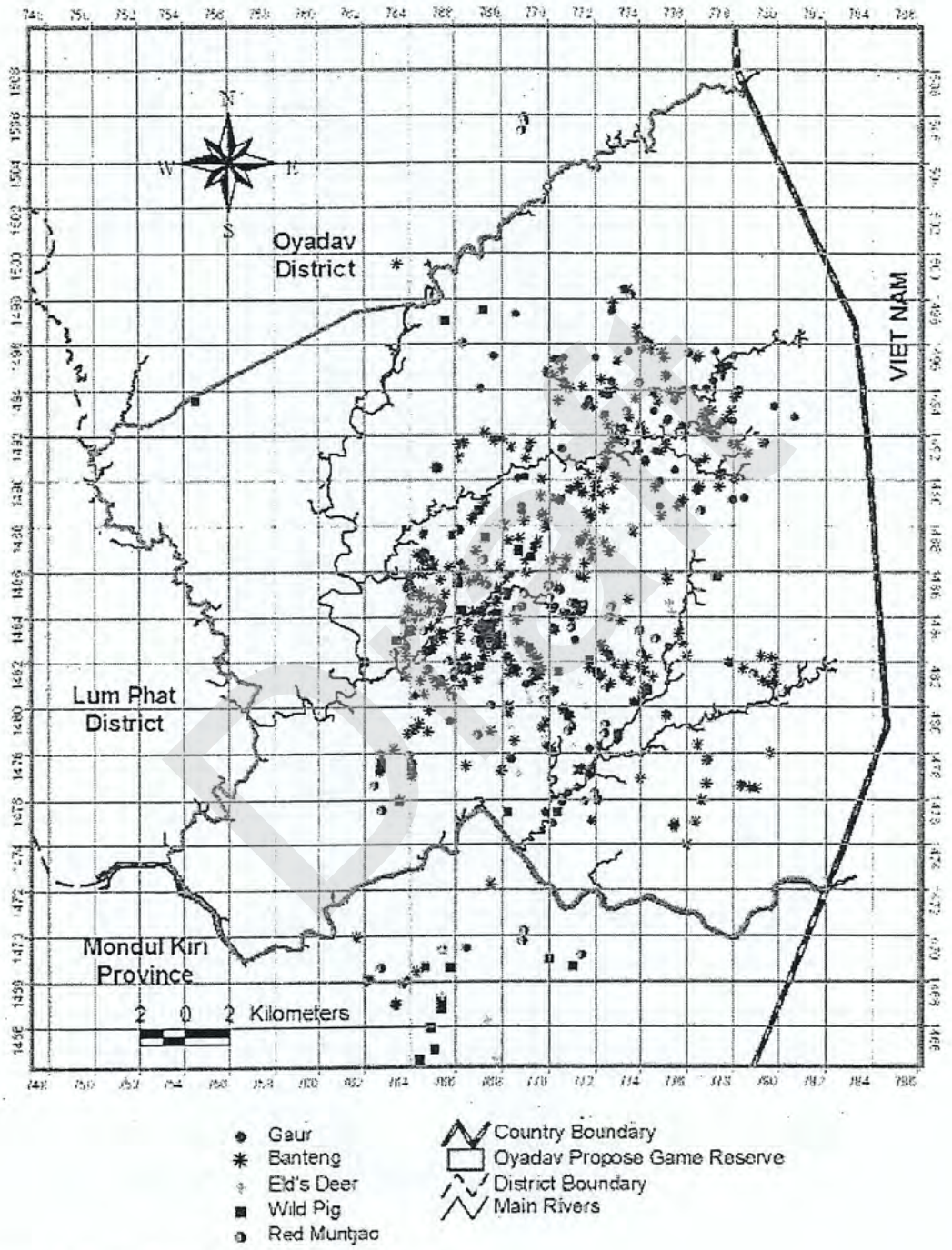
Source: Wildlife Protection Office, 2006

Figure 38 Map of Gaur's data in the catchments, Oyadav, Ratanakiri province



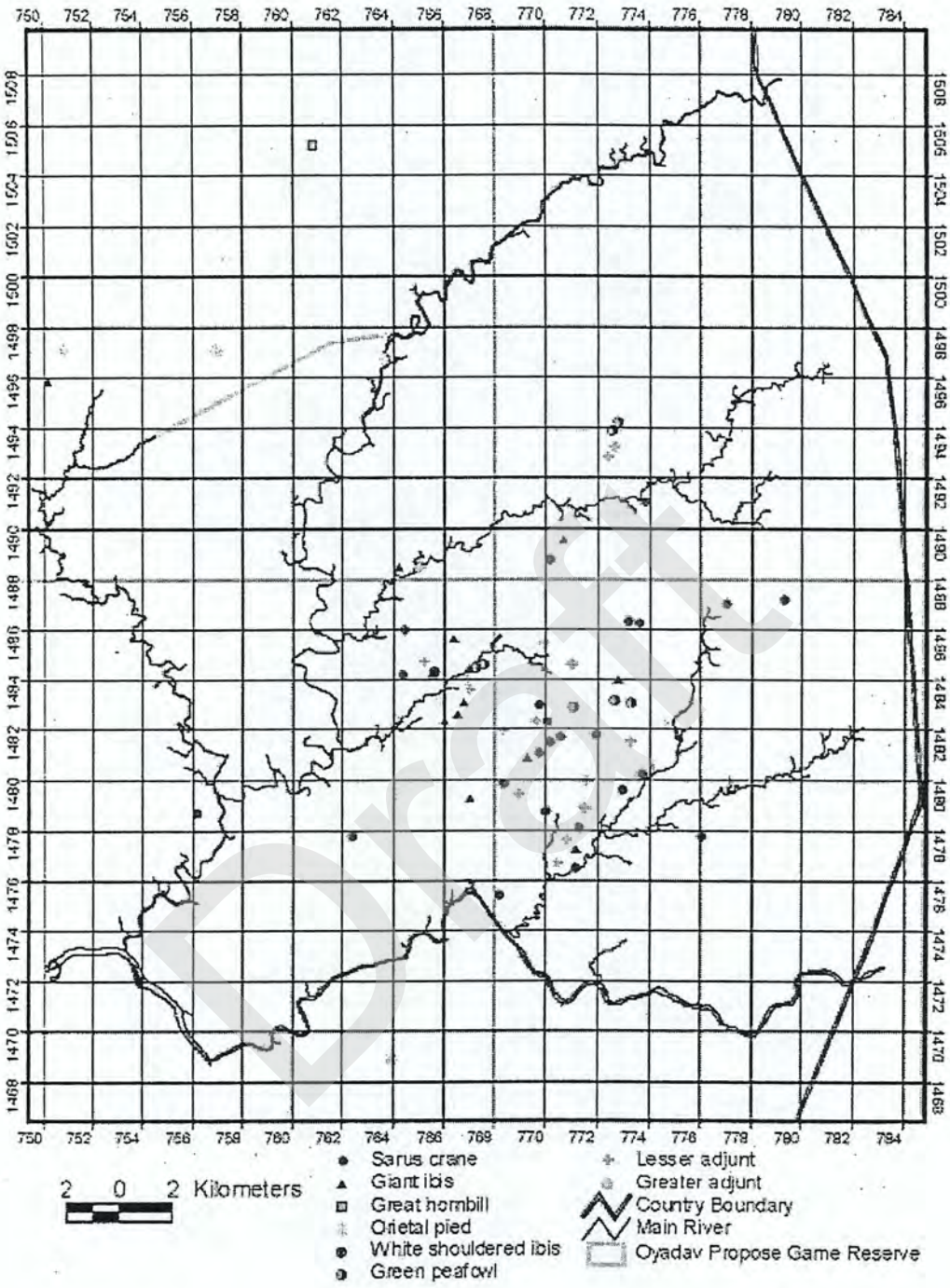
Source: Wildlife Protection Officer, 2006

Figure 39 Map of key mammals in the catchments, Oyadav, Ratanakiri province



Source: Wildlife Protection Officer (WPO), 2006

Figure 40 Map of key birds in the catchments, Oyadav, Ratanakiri province



Source: Wildlife Protection Office (WPO), 2006

Convention

The IUCN (1996) categories of global threat:

CR- Critically Endangered: The species faces an extremely high risk of extinction in the wild in the immediate future.

EN- Endangered: The species is facing a very high risk of extinction in the wild in the near future.

VU-Vulnerable: The species is facing a high risk of extinction in the wild in the medium term future.

DD- Data Deficient: A species for which there is inadequate information to make a direct, or in direct, assessment of its risk of global extinction in the wild. This category does not imply that the species is certainly Globally Threatened, and further data could show that the species is presently secure globally.

LR/nt-Low Risk/near-threatened: The species is close to qualifying for Globally Threatened-Vulnerable. Near threatened (nt) is one of the three sub-categories of the Low Risk (LR) category. Lower Risk is defined as "a taxa, which, when evaluated, does not satisfy the criteria for any categories Critically Endangered, Endangered or Vulnerable". Near threatened is defined as "taxa which do not qualify for Conservation Dependent (the highest sub-categories of Lower Risk), but which are close to qualifying for Vulnerable".

Least Concern: A species which does not qualify for Near-threatened – this applies to all species not in one of the above mentioned categories, but this is only mentioned for those species that were formerly considered Near-threatened.

The CITES Appendix

These categories reflect the level of threat posed by international trade. Unlike global and national threat categories, CITES categories have a regulatory effect in trade between countries that are parties to the Convention on International trade in Endangered Species of Wild Fauna and Flora. Cambodia is ones of these countries, having signed an agreement to be part of this convention.

I = Appendix I:
Species threatened with extinction that are or may be affected by trade. Trade in specimens between parties is only authorized in exceptional circumstances (such as import and export of scientific purposes).

II = Appendix II:
Species, which although not necessarily now threatened with extinction may become so unless trade in specimens is subject to strict regulation in order to avoid over-utilization.

Species may also be listed in Appendix II because their similarity to more threatened species, as an aid to enforcement. Commercial trade in wild specimens listed on Appendix II is permitted between members of the convention, but is controlled and monitored through licensing system.

III = Appendix III:
Species for which trade in wild specimens is permitted, but for which in certain CITES signatory countries requires appropriate regulation and documentation. Note on place names: Throughout this report country names follow The Times Atlas of the World (1999). Local place names largely follow the spelling on the 1:50,000 maps of Cambodia, prepared by the USAMSFE 1964.

Table 5 List of bird species in the northeast and eastern Cambodia

No.	Local names	English and (scientific names)	Status
51	Kreal	Sarus Crane (*Grus antigone*)	
52	Kngor Yeak	Giant Ibis (*Pseudibis gigantea*)	
53	Kngor Khmao	White-shouldered Ibis (*Pseudibis davisoni*)	
54	Tradak Thom	Greater Adjutant (*Leptoptilus dubius*)	
55	Tradak Toch	Lesser Adjutant (*Leptoptilus javanicus*)	
56	Roneal Sar	Milky Stork (*Mycteria cinerea*)	
57	Angkat Khmao	Black-necked Stork (*Ephippiorhynchus asiaticus*)	
58	Karsar	Wolly-necked Stork (*Ciconia episcopus*)	
59	Kngaok Baitong	Green Peafowl (*Pavo muticus*)	VU (IUCN)
60	Tmat Pheh	White-rumped Vulture (*Gyps bengalensis*)	
61	Tmat Tnaot	Long-billed Vutlture (*Gyps indicus*)	
62	Tmat Phleung	Red-headed Vulture (*Sarcogyps calvus*)	
63	Tea Prey Slapsar	White-winged Duck (*Cairina scutulata*)	
64	Popoul Toek	Masked Finfoot (*Heliopais personata*)	
65	Tradevech Tonle	River Lapwing (*Vanellus duvaucelii*)	
66	Totear	Chinese Francolin (*Francolinus pintadeanus*)	
67	Krourch Troungsar	Japanese Quail (*Coturnix japonica*)	
68	Krourch Troungkhmao	Rain Quail (*Coturnix coromandelica*)	
69	Krourch Troungkheov	Blue-breasted Quail (*Coturnix chinensis*)	
70	Moin Prey	Red Junglefowl (*Gallus gallus*)	
71	Moin Toprak	Silver Pheasant (*Lophura nycthemera*)	
72	Sdech Kolid	Siamese Fireback (*Lophura diardi*)	NT (IUCN)
73	Moin Tobaitong Propheh	Germain's Peacock Pheasant (*Polyplectron germaini*)	VU (IUCN)
74	Praveok	Lesser Whistling-duck (*Dendrocygna javanica*)	
75	Krourch Eurt	Barred Buttonquail (*Turnix suscitator*)	
76	Trases Thom Pousar	White-bellied Woodpecker (*Dryocopus javensis*)	
77	Trases Toch Seleurng	Lesser Yellownape (*Picus chlorolophus*)	
78	Trases Thom Seleurng	Greater Yellownape (*Picus flavinucha*)	
79	Trases Damrey	Great-Slaty Woodpecker (*Mulleripicus pulverulentus*)	
80	Keng Kang Toch	Oriental Pied Hornbill (*Anthracoceros albirostris*)	II (CITES)
81	Keng Kang Thom	Great Hornbill (*Buceros biconis*)	NT (IUCN)
82	Poveang	Wreathed Hornbill (*Aceros undulatus*)	II (CITES)
83	Barko	Common Hoopoe (*Upupa epops*)	
84	Teav Keov	Indian Roller (*Coracias benhalensis*)	
85	Chachat Krem	Commom Kingfisher (*Alcedo atthis*)	
86	Kevkork	Stork-billed Kingfisher (*Halcyon capensis*)	
87	Chachat Sarkhmao	Pied Kingfisher (*Ceryle rudis*)	
88	Tradev Toch	Green Bee-eater (*Merops orientalis*)	
89	Tavao	Asian Koel (*Eudynamys scolopacea*)	
90	Tokakor	Green-billed Malkoha (*Phaenicophaeus tristis*)	
91	L'ort Thom	Greater Coucal (*Centropus sinensis*)	
92	L'ort Sbov	Lesser Coucal (*Centropus bengalensis*)	
93	Seksoam	Alexandrine Parakeet (*Psittacula eupatria*)	II (CITES)
94	Sek Art	Blossom headed Parakeet (*Psittacula roseata*)	II (CITES)
95	Klaeng Slak	Barn Owl (*Tyto alba*)	II (CITES)
96	Popleakchang	Large-tailed Nightjar (*Caprimulgus macrurus*)	

No.	Local names	English and (scientific names)	Status
97	Popleaktoch	Indian Nightjar (*Caprimulgus asiaticus*)	
98	Lolorkbay	Spotted Dove (*Streptopelia chinensis*)	
99	Popul Kbalprapheh	Pink-necked Green Pigeon (*Treron vernans*)	
100	Moin Toek	White-breasted Waterhen (*Amaurornis phoenicurus*)	
101	Khlom	Watercock (*Gallicrex cinerea*)	
102	Torm	Purple Swamphen (*Porphyrio porphyrio*)	
103	Prahit Khmao	Bronze-winged Jacana (*Metopidius indicus*)	
104	Trodevech Toul	Red-wattled Lapwing (*Vanellus indicus*)	
105	Ro-art Khmum	Oriental Honey-buzzard (*Pernis ptilorhyncus*)	II (CITES)
106	Steang Lolork	Black-shouldered Kite (*Elanus caeruleus*)	II (CITES)
107	Kleang Chableurng Kramao	Brahminy Kite (*Haliastur indus*)	
108	Orkbal Prapheh	Grey-headed Fish Eagle (*Ichthyophaga ichthyaetus*)	NT (IUCN)
109	Orktoch	Lesser Fish Eagle (*Ichthyophaga humilis*)	NT (IUCN)
110	Tmat Khmao	Cinereous Vulture (*Aegypius monachus*)	NT (IUCN)
111	Ork Pushprey	Crested Serpent Eagle (*Spilornis cheela*)	II (CITES)
112	Ro-art Tonsay	Eastern Marsh Harrier (*Circus spilonotus*)	II (CITES)
113	Steang Slapchek	Shikra (*Accipiter badius*)	II (CITES)
114	Steang Tochslapsrouch	Collared Falconet (*Microhierax caerulescens*)	II (CITES)
115	Smohn	Darter (*Anhinga melanogaster*)	NT (IUCN)
116	Khaek Toektoch	Little Cormorant (*Phalacrocorax niger*)	
117	Kokroung Toch	Little Egret (*Egretta garzetta*)	
118	Krasar Prapheh	Grey Heron (*Ardea cinerea*)	
119	Krasar Thnung	Purple Heron (*Ardea purpurea*)	
120	Kokroung Thom	Great Egret (*Casmerodius albus*)	III (CITES)
121	Kokroung	Intermediate Egret (*Mesophoyx intermedia*)	III (CITES)
122	Korko	Cattle Egret (*Bubulcus ibis*)	III (CITES)
123	Korkbal Thnaotchas	Chinese Pond Heron (*Ardeola bacchus*)	
124	Krasar Svay	Little Heron (*Butorides striatus*)	
125	Khvek	Black-crowned Night Heron (*Nycticorax nycticorax*)	
126	Kork Matestom	Cinnamon Bittern (*Ixobrychus cinnamomeus*)	
127	Chorng Chortkhev	Red-billed Blue Magpie (*Urocissa erythrorhyncha*)	
128	Trameak Khlar	Racket-tailed Treepie (*Crypsirina temia*)	
129	Khaek	Large-billed Crow (*Corvus macrorhynchos*)	
130	Chek Tum	Black-naped Oriole (*Oriolus chinensis*)	
131	Chek Tumkbal Khmao	Black-hooded Oriole (*Oriolus xanthornus*)	
132	Kanhcheaksla	White-browed Fantail (*Rhipidura aureola*)	
133	Kanhcheaksla Khmao	Pied Fantail (*Rhipidura javanica*)	
134	Antep Prapheh	Ashy Drongo (*Dicrurus leucophaeus*)	
135	Antep Khaek	Crow-billed Drongo (*Dicrurus annectans*)	
136	Kantrop Kantrai	Greater Racket-tailed Drogon (*Dicrurus paradiseus*)	
137	Popech Bontulkbalkhmao	Black-naped Monarch (*Hypothymis azurea*)	
138	Lvear Chek	Oriental Magpie Robin (*Copsychus saularis*)	
139	Lvear Chekprey	White-rumped Shama (*Copsychus malabaricus*)	
140	Kanhchreach Smasar	White-shouldered Starling (*Sturnus sinensis*)	
141	Kraling Kralorng	Black-collared Starling (*Sturnus nigricollis*)	
142	Sarekakeov Kor	Common Myna (*Acridotheres tristis*)	

No.	Local names	English and (scientific names)	Status
143	Sarekakeov Krabei	White-vented Myna (*Acridotheres grandis*)	
144	Sarekakeov Vorng	Hill Myna (*Gracula religiosa*)	
145	Tracheakam	Barn Swallow (*Hirundo rustica*)	
146	Popech Kbalkhmao	Black-headed Bulbul (*Pycnonotus atriceps*)	
147	Popech Kampoykhmao	Black-crested Bulbul (*Pycnonotus melanicterus*)	
148	Popech Chong Khorngsar	Sooty-headed Bulbul (*Pycnonotus aurigaster*)	
149	Popech Mouthleurng	Stripe-throated Bulbul (*Pycnonotus finlaysoni*)	
150	Chab Krorch	Yellow-vented Bulbul (*Pycnonotus goiavier*)	
151	Popech Khmao	Black Bulbul (*Hypsipetes leucocephalus*)	
152	Chab Dangkovsar	Plain Prinia (*Prinia inornata*)	
153	Chab Dangkovthom	Brown Prinia (*Prinia polychroa*)	
154	Chab Kanlorng Phneksar	Oriental White-eye (*Zosterops palpebrosus*)	
155	Chab Donta Chortkhmao-sar	Black-browed Reed Warbler (*Acrocephalus bistrigiceps*)	
156	Chab Donta	Oriental Reed Warbler (*Acrocephalus orientalis*)	
157	Chab Kandoeng Srok	Common Tailorbird (*Orthotomus sutorius*)	
158	Chab Kandoeng Pery	Dark-necked Tailorbird (*Orthotomus atrogularis*)	
159	Krouch En	Indochinese Bushlark (*Mirafra marionae*)	
160	Chab Kanlorng	Olive-backed Sunbird (*Nectarinia jugularis*)	
161	Chab Phtes	Eurasian Tree Sparrow (*Passer montanus*)	
162	Chab Srok	Plain-backed Sparrow (*Passer flaveolus*)	
163	Khtutdei Prey	Forest Wagtail (*Dendronanthus indicus*)	
164	Khtutdei Sar	White Wagtail (*Motacilla alba*)	
165	Khtutdei Leurng	Yellow Wagtail (*Motacilla flava*)	
166	Khtutdei Propheh	Grey Wagtail (*Motacilla cinerea*)	
167	Krouch Encheurngveng	Richard's Pipit (*Anthus richardi*)	
168	Krouch Ensre	Paddyfield Pipit (*Anthus rufulus*)	
169	Krouch Enchnort Khmao	Olive-backed Pipit (*Anthus hodgsoni*)	
170	Krouch Enkhnorng Chnort	Red-throated Pipit (*Anthus cervinus*)	
171	Chab Changkrorng	Scaly-breasted Munia (*Lonchura punctulata*)	

Table 6 List of reptile species in the northeast and eastern Cambodia

No.	Local names	English and (scientific names)	Status
1	Krapeu Phnom	Siamese Crocodile (*Crocodylus siamensis*)	CR (IUCN)
2	Anderk Kbalthom	Big-headed Turtle (*Platystemon megacephalum*)	EN (IUCN)
3	Anderk Bedmuk	Indochinese Box Turtle (*Cuora galbinifrons*)	CR (IUCN)
4	Anderk Prich	Elongated Tortoise (*Indotestudo elongata*)	EN (IUCN)
5	Anderk Bedmuk Snorkhmao	Asian Box Turtle (*Cuora amboinensis*)	VU (IUCN)
6	Anderk Sakal	Malayan Snail-eating Turtle (*Malayemys subtrijuga*)	VU (IUCN)
7	Anderk Kha-ek	Black Marsh Turtle (*Siebenrockiella crassicollis*)	VU (IUCN)
8	Anderk Krabei	Yellow-headed Temple Turtle (*Hieremys annandalii*)	EN (IUCN)
9	Kanteay Asy	Asian Softshell Turtle (*Amyda cartilaginea*)	VU (IUCN)
10	Kanteay Kbalchep	Asian Giant Softshell Turtle (*Pelochelys cantorii*)	EN (IUCN)
11	Push Thlantoch	Burmese Python (*Python molurus bivittatus*)	N-t (IUCN)
12	An Sorng	Water Monitor (*Varanus salvator*)	II (CITES)
13	Tra Kort	Bengal Monitor (*Varanus bengalensis*)	I (CITES)
14	Push Thlanthom	Reticulated Python (*Python reticulatus*)	II (CITES)
15	Pushprey Kandor	Common Rat Snake (*Ptyas mucosus*)	II (CITES)

No.	Local names	English and (scientific names)	Status
16	Push Vekroneam	King Cobra (*Ophiophagus hannah*)	II (CITES)
17	Push Vekrabei	Monocled Cobra (*Naja kaouthia*)	II (CITES)
18	Push Vekdombok	Indochinese Spitting Cobra (*Naja siamensis*)	II (CITES)
19	Push KrayVeng	Banded Krait (*Bungarus fasciatus*)	
20	Push Kray Khlei	Malayan Krait (*Bungarus candidus*)	
21	Push Prey	Indochinese Ratsnake (*Pytas korros*)	
22	Pushprey Kantuykrahom	Red-tailed Green Ratsnake (Gonyosoma oxycephalum)	
23	Push Chan Lmorm	Bocourt's Water Snake (*Enhydris bocourti*)	
24	Push Kachan	Tay Ninh Water Snake (*Enhydris innominata*)	
25	Push Krayrussey	Bamboo Pit-viper (*Trimeresurus stejnegeri*)	
26	Push Khseko	Striped Keelback (*Amphiesma stolata*)	
27	Push Chheur	Tentacled Snake (*Erpeton tentaculatum*)	
28	PoPleakbal-Orch	Barron's Kukri Snake (*Oligodon barroni*)	
29	Popleak Prapheh	Banded Kukri Snake (*Oligodon fasciolatus*)	
30	Popleakhmao	Cambodian Kukri Snake (*Oligodon mouhoti*)	
31	Popleak Prey	Inornate Kukri Snake (*Oligodon inomatus*)	
32	Push Angkachmeas	Striped Kukri Snake (*Oligodon taeniatus*)	
33	Push Toker	Common Wolf Snake (*Lycodon capucinus*)	
34	Push Khseko Leurng Baitong	Golden Tree Snake (*Chrysopelea ornata*)	
35	Push Khseko Kbalchnortsar	Mountain Bronzeback (*Dendrelaphis subocularis*)	
36	Push Hanukman Baitong	Green Cat Snake (*Boiga cyanea*)	
37	Push Slabkankeb	Chequered Keelback (*Xenochrophis piscator*)	
38	Pushtrei Srakathom	Dog-faced Water Snake (*Cerberus rynchops*)	
39	Toker	Tockay (*Gekko gecko*)	
40	Bongkuy Prey	Scale-bellied Tree lizard (*Acanthosaura lepidogaster*)	
41	Bongkuy Pokmeat	Moustached Lizard (*Calotes mystaceus*)	
42	Kantrorng	Water Dragon (*Physignathus cocincinenus*)	
43	Thlen Kantuyveng	Long-tailed Sun Skink (*Mabuya longicaudata*)	
44	Thlen Kantuykrahom	Common Butterfly Lizard (*Leiolepis belliana*)	

Table 7 Plant species in the deciduous dipterocarp forest

No.	Local names	Scientific name	Life-form	Status
1	Russey Prich	*Arundinaria falcate* Nees.	Bamboo	
2	Russey Thom	*Bambusa sp.*	Bamboo	
3	Cha Huoy	*Zingiber sp.*	Herb	
4	Phrang	*Cycas siamensis*	Herb	
5	Ang Krong	*Ziziphus cambodiana* Pierre.	Shrun	
6	Bay Kdang	*Ixora sp.*	Shrub	
7	Ampok		Small tree	
8	Kandaol	*Careya sphaerica* Roxb.	Small tree	
9	Krong	*Aporusa sp.*	Small tree	
10	Lveak	*Strychnos sp.*	Small tree	
11	Beng	*Afzelia cochinchinensis*	Tree	
12	Cha		Tree	
13	Chambak	*Irvingia oliveri* Pierre	Tree	

No.	Local names	Scientific name	Life-form	Status
14	Chhlik	*Terminalia alata* Hyn.Roth	Tree	
15	Khlong	*Dipterocarpus tuberculatus* Roxb.	Tree	
16	Khsev	*Terminalia pierrei* Gagnep.	Tree	
17	Lngieng	*Cratoxylum prunifolium* Dyer.	Tree	
18	Neang Nuon	*Dalbergia bariensis* Pierre	Tree	
19	Pon	*Spondias sp.*	Tree	
20	Pong Ro	*Schleicheria trijuga*	Tree	
21	Popel	*Hopea recopei*	Tree	
22	Pramdom Leung	*Terminalia mucronata* Craib.	Tree	
23	Pring	*Eugenia sp.*	Tree	
24	Roka	*Bombax ceila* L.	Tree	
25	Rang Anlok	*Barringtonia longipes* Gangep.	Tree	
26	Rang Phnom	*Shorea siamensis* Miq.	Tree	
27	Slaeng	*Strychnos nux-vomica* L.	Tree	
28	Sokram	*xylia xylocarpa* Taub.	Tree	
29	Sralao	*Lagerstroemia sp.*	Tree	
30	Sramor	*Terminalia chebula* Retz.	Tree	
31	Svay Prey	*mangifera aff. duperreanna* Pierre.	Tree	
32	Tbaeng	*Dipterocarpus obtusifolius*	Tree	
33	Thlork	*Parinari annamensis* Hance.	Tree	
34	Thnung	*Pterocarpus pedatus* Pierre.	Tree	
35	Slaeng Poir	*Bauhinia sp.*	Vine	
36	Kuy	*Willoughbeia cochinchinensis* Pierre.	Liana	
37	Kreurl	*Melanorrhera laccifera*	shrub	
38	Tro Yeoung	*Diospyros helferi*	Tree	
39	Korki Daek	*Hopea helfera*	Tree	
40	Korki Msao	*Hopea odorata*	Tree	
41	Phchek	*SHorea obtusa*	Tree	
42	Trach	*Dipterocarpus intricatus*	Tree	
43	Kantout Prey	*Phyllanthus emblica*	Shrub	
44	Cheurng Kor	*Tetracera scadens*	Tree	
45	Chher Sraeng	*Cananga latifolia*	Tree	

Appendix 4

Socio-Economic survey report

KINGDOM OF CAMBODIA
Nation Religion King

SOCIO-ECONOMIC REPORT
for
LOWER SE SAN 2 HYDROPOWER PLANT

By May Simorn, Socio-Economist

April, 2008

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1. BACKGROUND

1.1 Description of the project area

The Se San River is widely known as one of the largest tributaries of the Mekong River. It originates in the central highlands of Gia Lia and Kon Tum provinces in Vietnam. It runs through two provinces (Ratanakiri and Stung Treng) in the northeastern Cambodia, where it finally joints with the Srepok[1], 20 km upstream, and Sekong[2] rivers before ending up in the Mekong River in Stung Treng province. In Ratanakiri province, the Se San River flows through four districts: Oyadao, Andong Meas, Traveng and Veun Sai. In Stung Treng province, it flows through only Se San district. Of the total catchment area 18570 km^2 of the river, 6960 km^2 are inside Cambodia. It has been reported that the river is the home and way of life for people and animals, especially aquatic animals for several years (SWECO 2006). The people living along the river originate from different ethnic groups, traditions, and cultures in which indigenous minority groups form the majority. The indigenous minority groups include Jarai, Lao, Kreung, Kavet, Lun, Tampuon, Kachok, Phnong, Kuoy, Khek, Stieng and Prov with Khmer forming the majority and living along the Se San River (3S Rivers Protection Network 2007). The detailed villages, the places where will be flooded by the project area, of the two districts are as shown in figure 1.

1.2 Objective of the study

The aim of the study was to create an extensive and realistic picture of the socio-economic situation of the project area. However, the main objective was to achieve a great understanding of the socio-economic and environmental factors and to help development actors understand how people in this area make a living, and in particular how they use and manage natural resources.

1.3 Scope and limitations

Due to the fact that time was limited, the study was conducted for only five months starting from February to June, 2008 which was during the dry season period. The study covered investigation of overall social-economic aspects such as population, ethnicity and religions, Age, gender and education, infrastructure, land use and ownership, agricultural productivity, livelihoods, natural resources, Water consumption and Sanitation, health. Also resettlement and its issues and impacts from lower se san 2 hydropower plant during the construction of this hydropower plant and after its operation were also discussed, extracting from previous experiences which occurs on Cambodia through upstream dams located in Vietnam.

2. METHODOLOGY

2.1 Description of obtaining data

In order to fulfill the defined objective, socio-economic information was collected through review of existing databases as well as through original data gathering via village-level expert's interview. As a result, the study is divided into two main components:

a) Review and analysis of other sources of information, consisting of literature reviews; and
b) Village-level expert's interview.

Literature reviews and other information sources completely form the secondary data source. In addition, information derived from village-level expert's interview produce mainly quantitative data (figure 2b), while public consultations focus strongly on qualitative data (figure 2a). Village-level expert's interviews provide detail information about household characteristics, occupation, daily livelihood, income status, water consumption, health and other allied aspects in family. Public consultations give overall ideas and comments on the project if those agree with such development project or disagree with it, providing their own reasons.

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[1] Srepok River flows from Vietnam through first Mondulkiri and then Ratanakiri Province into Stung Treng Province.
[2] Se Kong River runs from Laos into Cambodia

Number	Village
1	Ta Lat
2	Rum Poit
3	Svay Rieng
4	Khsach Thmey
5	Srekor Muoy
6	Srekor Pir
7	Phluk
8	Ban Bung
9	Krobei Chrum
10	Kbal Romeas
11	Sre Sronok
12	Srepok
13	Phum Muoy
14	Phum Pir
15	Phum Bei

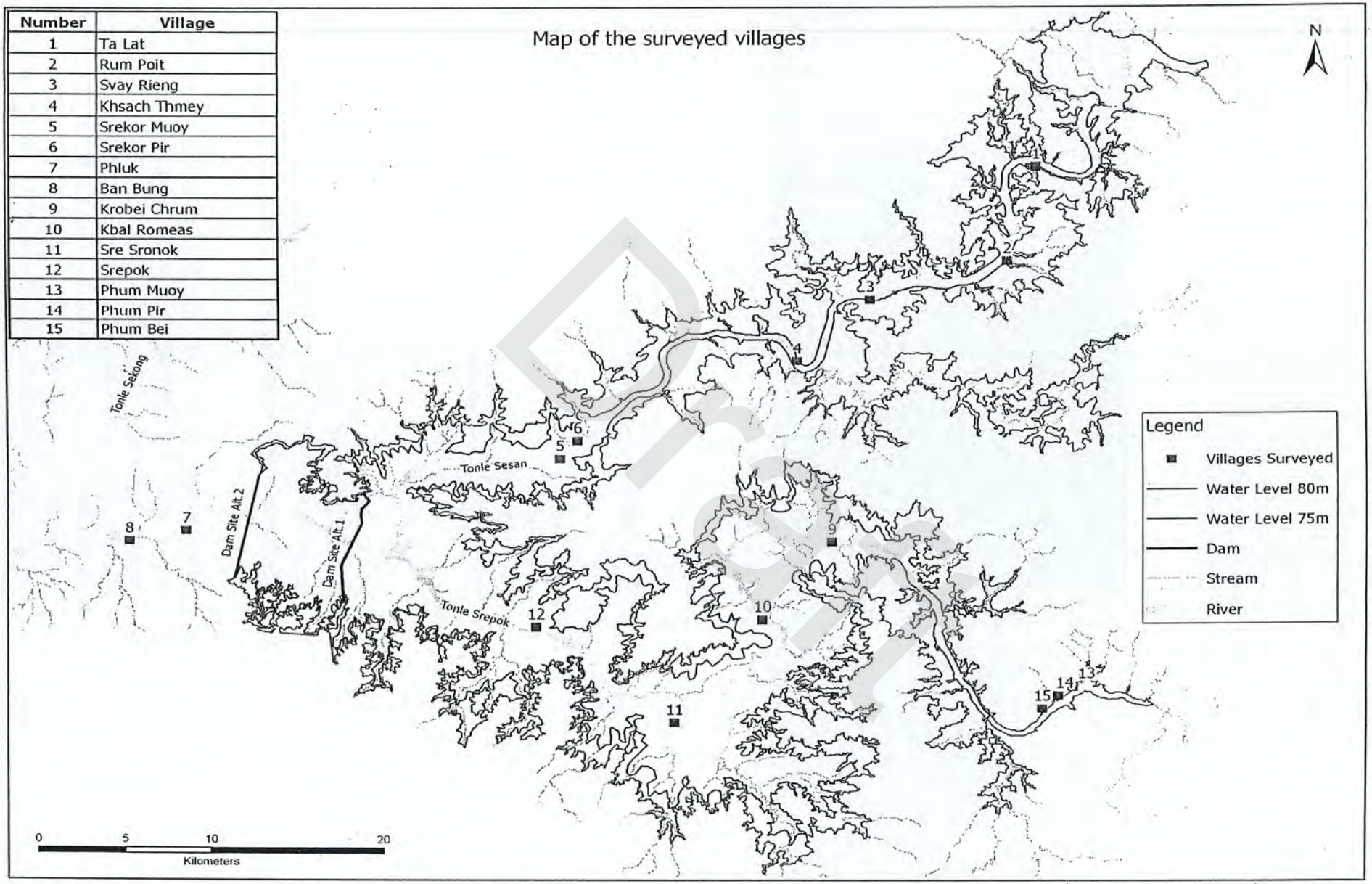

Figure 1 Map of the surveyed villages in the project area

Meanwhile, during the studied period, any relevant key informants in each village and commune were interviewed by the KCC's expert team in order to give more in-dept information from the project area. Of these, there are known as the primary data sources. In combination of review and analysis of other sources of information such as profile commune by commune, previous studied reports and village-level expert's interview and public consultation through analyses made both quantitative and qualitative data. As a result, such different components of socio-economic data complement each other and give a wider and firmer information for the whole study as shown in figure 3.

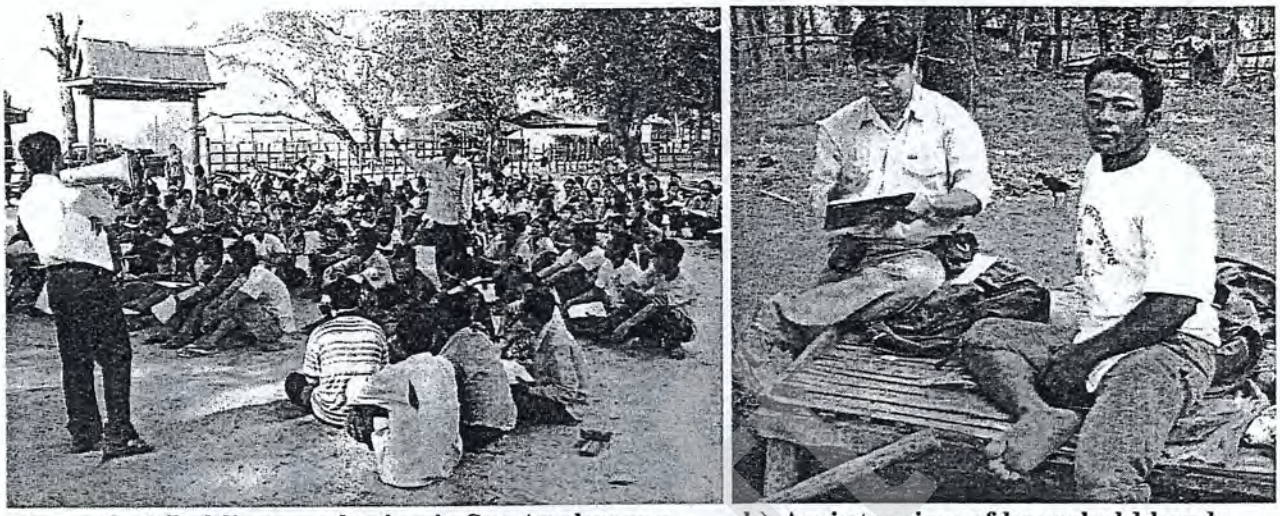

Figure 2 a) Public consultation in Sre Angkrorng b) An interview of household head

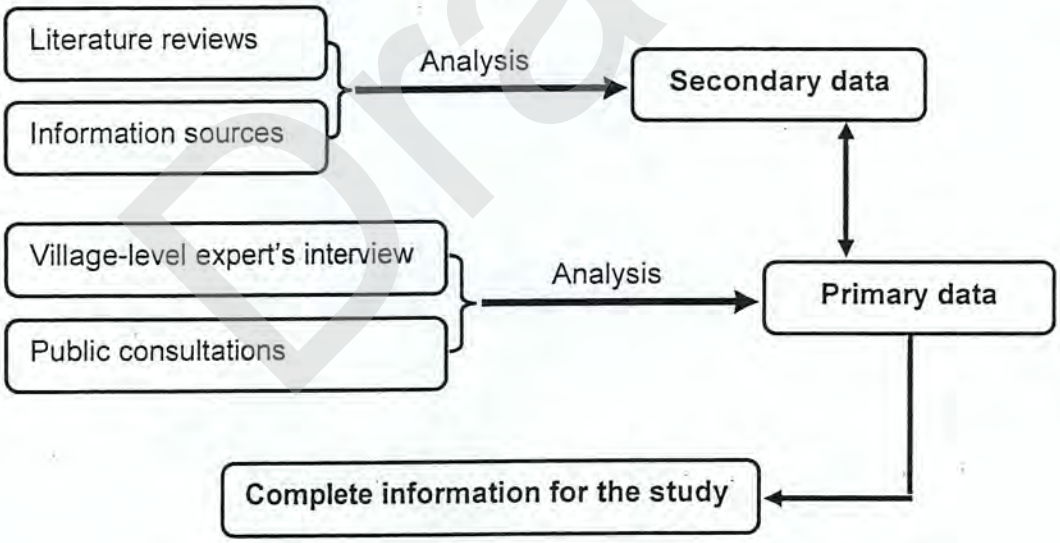

Figure 3 Flow of data processing for the study

2.2 Study process

The process of the study started from contacting relevant provincial departments, local authorities such as district governor, head of land management and urban planning office, head of environmental office, head of fishery office etc. From these contacted persons, some of the background information were obtained. Thus, such data partly gave the supports to the secondary data. At the mean time, some more important data were also collected from any other sources such as commune profiles, district profiles, and overall information of Stung Treng and Ratanakiri provinces and previous studied reports. As a result, such kinds of data were interpreted into easily understandable way. Of this, they are mainly formed the secondary data. Then, the first field-sites

visit was conducted for one-week period. During this period, field observation and livelihood aspect of local people in the villages was observed so as to organize the questionnaire which reflects living condition in the project area. After coming back from the visit, the analysis tool was developed so as to get clear and extensive picture of socio-economic condition reflected the project area. After that, two groups of expert went to the field sites in order to conduct village-level interviews and to do public consultations in all the relevant villages. These are the major sources of primary data for real understanding the interactions between socio-economics, the river and other natural resources as well as to ensure the participation of local people. Finally, the results of the study are reflected the obviously and clearly picture of natural resources and of people living along the river. However, samples of the study was carried out in a total of 15 villages in 5 communes within 2 districts, Se San and Koun Mom districts of Ratanakiri and Stung Treng provinces as shown in table 1.

Table 1 Number of households in each village and its selected samples

District	Commune	Total household	Village	Total household	Sample
SE SAN	Talat	636	Talat	72	7
			Rum Poit	53	5
			Svay Rieng	256	25
			Khsach Tmey	255	25
	Srekor	323	Srekor Muoy	165	16
			Srekor Pir	158	15
	Phluk	264	Phluk	196	19
			Ban Bung	68	7
	Kbal Romeas	434	Krobei Chrum	177	17
			Kbal Romeas	106	10
			Sre Sronok	104	10
			Srepok	47	4
KOUN MOM	Sre Angkrorng	316	Phum Muoy	91	9
			Phum Pir	113	11
			Phum Bei	112	11
			Total	**1973**	**191**

M. Err 6.75 C.I 95%

2.3 Data Analysis

Data analyses were set to comply with the objectives. Since there is no an in-dept analysis tool was used in this study, the data were analyzed as only average and percentage using SPSS software 14.0. Prior to analysis, those data were rechecked, arranged, and classified into groups. Finally, the output from analysis was used as the result of the study.

3. PROJECT AREA PROFILE AND SOCIO-ECONOMIC ASPECTS

3.1 Introduction

This part provides and analyzes information of general socio-economic aspects. The information described is partially generated from the commune profiles obtained in the year 2007 and other previous studied reports. However, all relevant aspects can not be derived comprehensively from only these sources. That means that these sources just give important background information of the project area. Thus, it is necessary to additionally analyze primary data obtained from the interviewed households and public consultation in order to get overall relevant picture representing the overall aspects. Since the project area consists of five communes within two districts, the subtitles here like Population, Age, gender and education, Ethnicity and religions, Infrastructure, Land use and ownership, Agricultural productivity, Natural resources, Livelihood, Water

consumption and sanitation, Health, Resettlement and Issues, and Impacts from the Hydropower Plant are described as commune by commune so as to get clear aspects of the project area. This kind of approach allows independent review of each commune and comparison between them.

3.2 Population

In Talat commune, there are four villages: Talat, Rum Poit, Svay Rieng, and Khsach Tmey. The population is 636 families with total people of 2915 persons. Of the total population, women contributed about 51% or 1477 persons.

In Srekor commune, there are two villages: Srekor Muoy and Srekor Pir. There are 323 families with total population of 1477 persons. Of the total population, women contributed 50.6% or 748 persons.

In Phluk commune, there are two villages named Phluk and Ban Bung. The population is 264 families with total population of 1092. Of the total population, women contributed 50% or 549.

In Kbal Romeas commune, there are four villages: Krobei Chrum, Kbal Romeas, Sre Sronok and Srepok[3]. The population is 434 families with total population of 2060. Of the total population, women contributed 49% or 1014.

In Sre Angkrong commune, there are three villages: Phum Muoy, Phum Pir and Phum Bei. The population is 316 families with total population of 1610. Of the total population, women contributed about 51% or 819 persons. Furthermore, the average family size in the project area ranged from 4.1 to 5.2 persons. All of the above-described statistics are summarized in table 2.

Table 2 Population in the project area in the year 2007

Commune	Village name	Total family	Population	Female	Family size
Talat	Talat	72	359	180	5.0
	Rum Poit	53	221	111	4.2
	Svay Rieng	256	1172	601	4.6
	Khsach Tmey	255	1163	585	4.6
Srekor	Srekor Muoy	165	749	376	4.5
	Srekor Pir	158	728	372	4.6
Phluk	Phluk	196	803	402	4.1
	Ban Bung	68	289	147	4.3
Kbal Romeas	Krobei Chrum	177	798	407	4.5
	Kbal Romeas	106	538	265	5.1
	Sre Sronok	104	529	245	5.1
	Srepok	47	195	97	4.1
Sre Angkrorng	Phum Muoy	91	448	225	4.9
	Phum Pir	113	582	312	5.2
	Phum Bei	112	580	282	5.2

Source: Commune profiles, 2007

3.3 Ethnicity and religions

This part provides information about religions and ethnicity as derived from profiles of the communes and household survey by experts respectively. It is reported by 3S Rivers Protection Network, 2007 that there are nine ethnic minority groups known as indigenous people. Although there are several different ethnic groups living in the villages along the Se San River, there are very

[3] In Chrop village, there are two villages combined together: Srepok and Ousangkruos. Since the project area will flood only on Srepok village, resulting this village was selected as one of the studied villages.

few found in the project area, all of them are Jarai, Lao, Kreung, Phnong and Prov. Figure 4 shows the percentage of the ethnic minority groups interviewed in the project area.

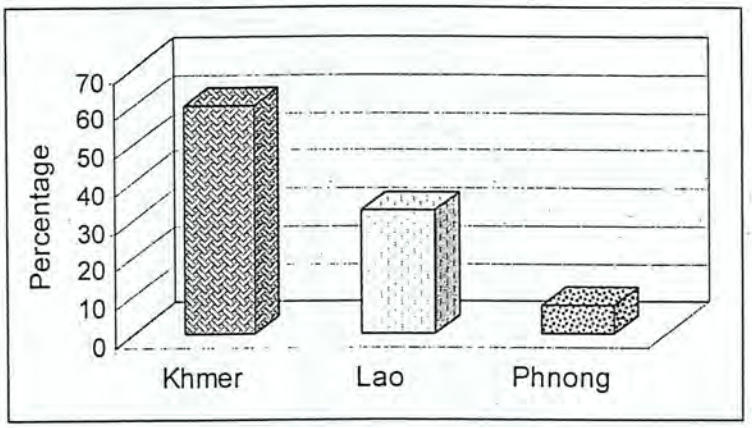

Figure 4 Ethnicity in the project area

Although few ethnicities like Jarai, Lao, Kreung, Phnong and Prov were reported by 3S Rivers Protection Network 2007 as described above, but some of those were not met so that they could not be interviewed during the field study. Therefore, the interviewed persons were only Khmer, Loa, and Phnong. The highest percentage in the project area is Khmer, contributing around 60% of the total interviewed people, followed by Lao living almost all in Srekor (contribute about 33%), and Phnong living mostly in Kbal Romeas village (contribute approximately 7%).

3.4 Education

Education sector is being improved, resulting of growing slowly. The education level and literacy rates amongst women are usually much lower than that of men. Also, differences between urban and rural areas have been found to be significantly different (CIPS 2004). Since education is one of the most important sectors, it is necessary to highlight it, reflecting back from the project area.

However, prior to providing a description of illiteracy rates, it should be focused attention on school facilities. In view of this, no high school was found in the project area. However, there are two secondary schools were found in Sre Angkrorng and Srekor communes. In Srekor, the secondary school is close to its villages, and it will be impacted by the dam if constructed. On the other hand, in Sre Angkrorng, the distance from its villages to the Trapaingkrahom secondary school is approximately 22 km. This school will not be likely to be impacted by the dam, but it is mentioned here just acknowledge about the educational facility in the project area. In all communes, there are primary schools (Table 3). The number of primary schools depends on the location of those villages. For instance, in Kbal Romeas; since the distance from one village to another is far, primary school is consecutively constructed in all villages in order to facilitate education facilities in the commune.

Table 3 Number of schools and teachers

Commune	Primary School	# of classroom	Secondary School	# of classroom
Talat	4	21	0	0
Srekor	1	7	1	5
Phluk	2	12	0	0
Kbal Romeas	4	32	0	0
Sre Angkrorng	1	4	0	0

Source: Stung Treng provincial department for education, 2007

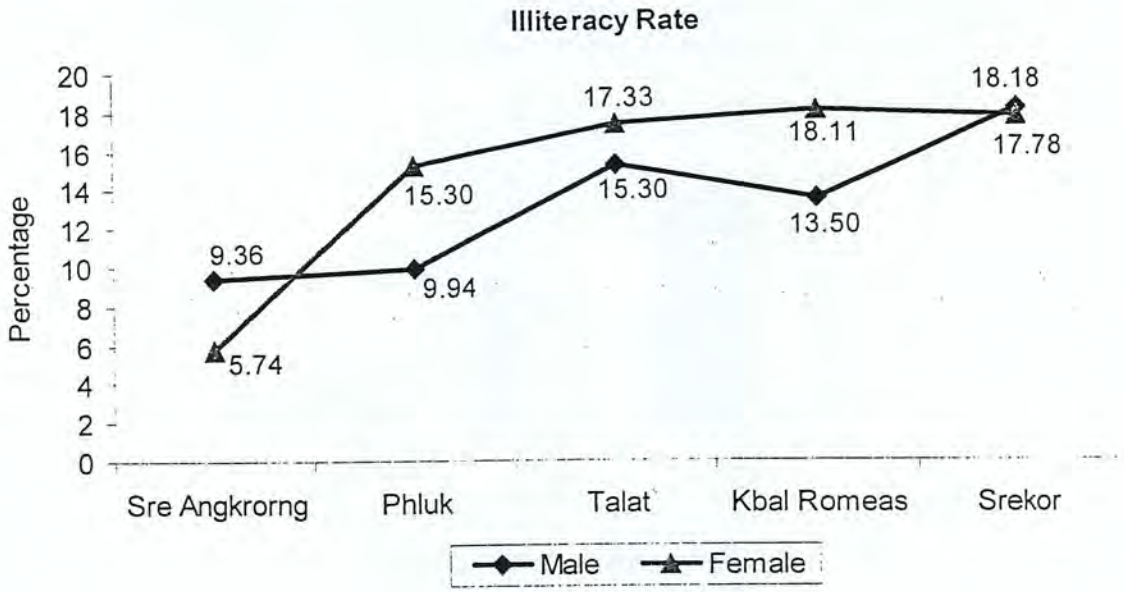

Figure 5 Illiteracy rates according to gender and the communes

Figure 5 presents information on illiteracy and level of education according to genders. The illiteracy rates were calculated from the male and female population having ages 15 - 60 years in each village, respectively. However, the percentage of female illiteracy is higher than male one in three communes: Phluk, Talat, and Kbal Romeas. The percentage of both male and female is similar in case of Srekor since this commune is mostly Lao population, resulting has no significantly different illiteracy between male and female. However, it is quite different in Sre Angkrorng that male illiteracy is higher than female. On the country basis, the education level and illiteracy rates among women are in the whole country very much higher than those among men. Average percentage of illiteracy rates in all communes is explained in figure 6.

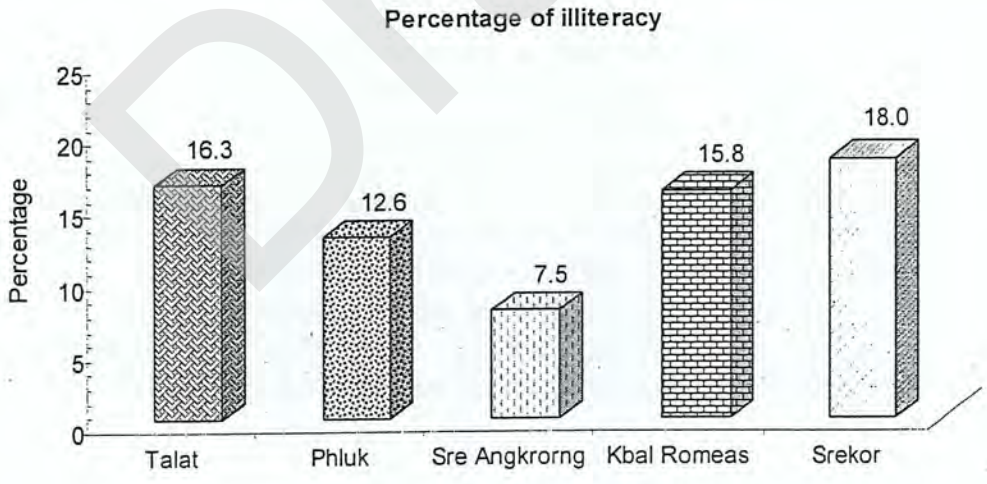

Figure 6 Percentage of illiteracy in the project area

Although there are many primary schools in the project area, the number of students continuing their education in secondary school and high one are very few. Generally they dropped down the schools when they finished grade 1-5 or only primary school. As a result, percentage of illiteracy is high (figure 6). The figure 6 shows average percentage of illiteracy rates of male and female in each commune. In Sre Angkrorng, the percentage is so small 7.5% compared to that of others. On one side, it may be due to the fact that the commune is close to the Trapaingkrahom secondary school in Koun Mom district center, the place where is about 22 km from the commune. On the

other side, it may indicate that parents have valued their children's study since the early time so that children are able to study more. In addition, after graduating primary school, school boys/girls are able to continue their studying at secondary level. Obviously, many school boys/girls are studying at the secondary school. In Phluk, the average percentage is 12.6%. This may be due to this commune is near provincial town, the place where is many schools located. Thus, education facilities may be better than that of other communes in the project area so that literacy rate is high. In Kbal Romeas, the percentage of illiteracy is 15.8% higher than the two communes as described above. This is due to the fact that basic facilities of education is lower than that of those two communes, while the other reason may be due to parents pay less attention on study of their chidren, and poverty. Some of families within the commune are minority groups such as Phnong, Prov, Kreung, Kavet, and Tampuon, respectively. This may contribute to higher illiteracy in the commune. In Talat, the percentage of illiteracy is also high 16.3%. This is because of the commune has only primary schools. One of the major aspects is that parents have never valued and cared of their children's study. Also, irregular teaching and lack of teachers are key roots of high illiteracy rate. In Srekor, the percentage of illiteracy is higher 18% than that of other communes in the project area. This is due to the fact that almost all families are Lao so that they prefer not to learn Khmer. On the other hand, the educational levels of respondents are as expressed in figure 7.

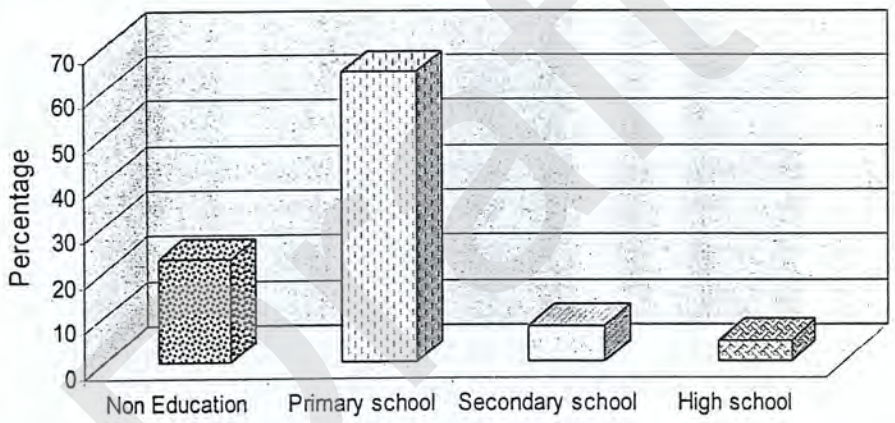

Figure 7 Percentage of educational levels of respondents

The figure 7 shows that very few respondents, mostly household head, studied only in secondary schools and high ones. However, the percentage of their educational levels is high in primary school. Even so, most respondents used to study just only grade 1-2. This indicates that although they used to study in such levels, they could not read and/ or write as well. Thus, it is quite similar to non-education respondents.

The high illiteracy rate can be explained by several reasons. One of the most important reasons is the tradition. It is conventional that in most cases parents don't value and/or care of their children's study, while the other reasons include poverty, irregular teaching due to lack of teachers, and long distances to secondary school and high school. Poverty is considered as one of the root causes. This is due to the fact that those children were always involved in some forms of work, even if they were studying in order to support family's works and/or to earn extra income to supplement daily livelihood. Of this, it significantly contributes to the low level of education in the project area.

3.5 Infrastructure

The infrastructure in the project area is being improved, but road network to some villages is still poor (the road to Svay Rieng, Rumpoit, and Talat). This means that roads in some villages are completely inaccessible during the rainy season. There is, however, a main laterite road to each commune center (figure 8b). Since lack of road network connected from one village to another in [illegible] the Se San River is frequently used for travel and transportation by some

villagers. In Khsach Tmey village, there is a ferry across the Se San River, connecting from one side to another of the village. Motorbikes are mainly used in transportation of people and in transporting goods wherever road access to villages is available.

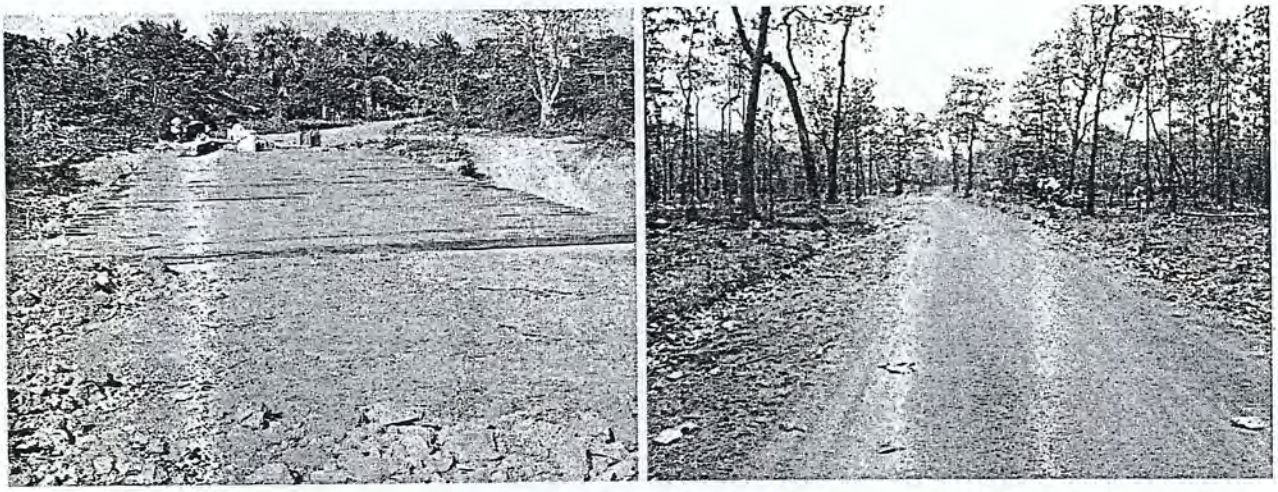

Figure 8 a) Bridge is being constructed in Phluk b) Main laterite road to Kbal Romeas commune

Access to electricity is quite good. In Talat, all people use firewood for cooking and use torch about 50% and kerosene and/or diesel lamps about 40% for lighting. The remaining percentage 10% is electricity. This means that within this commune, people in Khsach Tmey mainly use electricity for lighting. In Srekor, people also use firewood for cooking and use torch about 10% and kerosene or diesel lamps about 80% for lighting. The remaining households around 10% use their own battery and/ generator. In Phluk, it is not different from the above-two communes. People completely use firewood as a source of cooking, while sources of lighting are torch 15%, kerosene or diesel lamps 65%, own battery and/ generator around 10% and electricity about 10%. In Kbal Romeas, People also use firewood 100% as a source of cooking, , while sources of lighting are torch 10%, kerosene or diesel lamps 25%, own battery and/ generator around 15% and electricity about 50%. The relatively more affluent households use electricity is high within this commune. This is due to the fact that 3 out of 4 villages have electric generators and also price for its consumption is affordable for local people. In Sre Angkrorng, it is the same to other communes in the project area. People also use firewood 100% as a source of cooking, while sources of lighting are torch 10%, kerosene or diesel lamps 60%, own battery and/ generator around 10% and electricity about 20%. It seems to be high for electric consumption within this commune. Of the explanations are summarized in table 4.

Table 4 Basic infrastructure

Commune	Use firewood for cooking	Use torch for lighting	Use kerosene and/or diesel lamps for lighting	Use battery and/or generator for lighting	Use electricity for lighting
	Percentage				
Talat	100	25	40	15	20
Srekor	100	10	70	10	10
Phluk	100	15	65	10	10
Kbal Romeas	100	10	25	15	50
Sre Angkrorng	100	10	60	10	20

Source: Key informants by commune, 2007

3.6 Land use and ownership

Paddy field per household varies from commune to another. Based on the field research, it is found that paddy field holdings ranged from 0.5 ha to 12 ha. All of the interviewed households reported that they have their own land holdings, not belonged to parents or rent from others. Table 5 presents the distribution of households owning paddy field by different sizes, and inequality of land ownership. Altogether, in the project area, 2.8 percent hold 0.5 hectare or less, 21 percent hold from more than 0.5 to less than 2 hectare, 59.1 percent hold 2 and 4 hectares and 17.1 percent hold more than 4 hectares. The other 10 households don't occupy paddy field because they are new comers or settlers as shown in Table 5. Regarding to ownership, based on the field study, mostly land ownerships occupied have no official land title. However, they are duly recognized by local authorities at village, commune and district levels.

Table 5 Paddy field holdings

The project area	>0-0.5ha	>0.5-<2ha	2-4ha	>4ha	Total
	Family				
Number of household	5	38	107	31	181
	Percentage				
All the communes	2.8	21	59.1	17.1	100

Table 6 presents the distribution of households owning different size of crop plant land. As a result, 13.7 percent hold 0.5 hectare or less, 44 percent hold from more than 0.5 to less than 2 hectare, 34.2 percent hold 2 and 4 hectares and 7.7 percent hold more than 4 hectares. The other 74 households don't occupy crop land. It is similar to paddy field, almost all the crop land have no ownership certification. Regarding to ownership, based on the field study, mostly land ownerships occupied have no official land title. However, those kind of lands are also duly recognized by local authorities at village, commune and district levels.

Table 6 Crop plant land holdings

The project area	>0-0.5ha	>0.5-<2ha	2-4ha	>4ha	Total
	Family				
Number of household	16	52	40	9	117
	Percentage				
All the communes	13.68	44.44	34.19	7.69	100

Beside these lands use as described above, Land use type can basically be classified as forestry land, and residential land, while the other types detailed are depicted in table 7.

Table 7 Land use in the project area

Commune	Land Use Type	Area (ha)
Kbal Romeas	Bamboo and Secondary forests	3,533.76
	Deciduous forest	41,568.57
	Dry Deciduous (Open) forest	3,029.42
	Evergreen broad leafed forest	7,942.41
	Grassland (undifferentiated)	57.92
	Lakes (<8 ha)	1.90
	Marsh and swamp	277.61
	Mixed forest from evergreen and deciduous species	9,295.68
	River	1,563.73
	Paddy field	896.13
	Riparian forest	4,808.34

	Sand bank	5.15
	Swidden agriculture (Slash and burn)	3.01
	Village garden crop	271.64
	Woodland and scattered trees (C < 10%)	484.89
	Total	**73,740.15**
Phluk	Abandoned field covered by grass	15.30
	Bamboo and Secondary forests	602.26
	Deciduous forest	13,740.82
	Dry Deciduous (Open) forest	2.22
	Evergreen broad leafed forest	3,221.86
	Grassland (undifferentiated)	39.92
	Marsh and swamp	304.04
	Mixed forest from evergreen and deciduous species	14,651.24
	River	967.11
	Paddy field	341.39
	Riparian forest	1,518.48
	Sand bank	27.03
	Swidden agriculture (Slash and burn)	30.57
	Woodland and scattered trees (C < 10%)	143.57
	Total	**35,605.81**
Srae Angkrong	Bamboo and Secondary forests	108.19
	Deciduous forest	28,975.37
	Dry Deciduous (Open) forest	771.90
	Evergreen broad leafed forest	2,013.31
	Flooded shrub	4.23
	Grassland (undifferentiated)	19.75
	Lakes (<8 ha)	7.23
	Marsh and swamp	70.84
	Mixed forest from evergreen and deciduous species	81.84
	River	578.74
	Paddy field	679.55
	Riparian forest	3,492.93
	Woodland and scattered trees (C < 10%)	100.93
	Total	**36,904.79**
Srae Kor	Abandoned field covered by grass	111.15
	Bamboo and Secondary forests	1,711.49
	Deciduous forest	5,742.21
	Dry Deciduous (Open) forest	80.72
	Evergreen broad leafed forest	4,764.93
	Flooded shrub	3.38
	Grassland (undifferentiated)	30.75
	Marsh and swamp	765.04
	Mixed forest from evergreen and deciduous species	24,511.22
	River	821.18
	Paddy field	762.09
	Riparian forest	485.14
	Sand bank	26.41

	Shrubland (undifferentiated)	9.56
	Woodland and scattered trees (C < 10%)	44.95
	Total	**39,870.20**
Ta Lat	Abandoned field covered by grass	756.26
	Bamboo and Secondary forests	5,075.44
	Barren land	3.38
	Deciduous forest	303.99
	Dry Deciduous (Open) forest	53.80
	Evergreen broad leafed forest	18,279.18
	Grassland (undifferentiated)	555.86
	Marsh and swamp	342.99
	Mixed forest from evergreen and deciduous species	10,714.28
	River	1,561.96
	Paddy field	1,269.45
	Riparian forest	446.74
	Sand bank	53.79
	Shrubland (undifferentiated)	119.47
	Swidden agriculture (Slash and burn)	163.14
	Woodland and scattered trees (C < 10%)	3,527.89
	Total	**43,227.60**

Source: JICA, 2000

3.7 Agricultural Productivity

Along the Se San River, people are engaged in rice production, known as upland rice, and crop production for a season per year. Thus, no rice and/or any crop productions are cultivated during the dry season period. This doesn't mean that there is no irrigation facility during the dry season, but rather lack of means to irrigate their fields or it may be their customs, just cultivate only one season, that's enough. On the other hand, the practices of upland rice are generally divided into categories: shifting and permanent cultivation. Shifting cultivation involves clearing forest to plant rice and other crops for 2-5 years before rotating/moving to another place. In most cases, farmers clear areas that were previously cultivated but have been left fallow for several years. Permanent cultivation involves growing rice in the same area every year, typically a small plot of land located nearby farmer's houses (McKenney B. and Prom T. 2003).

Rainfed upland rice is considered as the dominant crop, transplanting from June and harvesting from October to December. The harvesting period is dependent on rice varieties. For instance, early rice is normally harvested after planting for a three-month period, while the late rice is always harvested after planting for a six-month period. The secondary crops are planned in the form of mixed farm. Such kinds of crops are grown without irrigation. This means that although the rice fields are close to the Se San River, but they completely depend on rainwater. Due to its dependence on rainfall, upland rice is transplanted during the wet season and harvested during the end of rainy season or when the rains end, depending on rice varieties and other factors such as rainfall regime, climate conditions. In most upland fields, mixed crops are the planting of rice and a range of other crops including corn, sweet potato, cassava, mung bean, sesam, vegetables and others.

Table 8 Rice yields by commune

Commune	Rainy season rice yields (Ton/Ha)
Talat	2.0
Srekor	1.5
Phluk	1.8
Kbal Romeas	1.5
Sre Angkrorng	1.0

Source: Commune profiles, 2007

The rice yields vary from commune to another as shown in table 8, depending rice species, agricultural practice, types of soil and others. The high rice yields in any commune imply rice soil in that commune. Agriculturally, the darker soils are more fertile than red soils, locating further away from the river, most likely once covered by forest, are better for rice paddies and fruit orchards. Riverside villagers mostly reported that their paddy land was enough to provide them with adequate food in most years. Field observations found a general pattern and distribution of mixed crops throughout the landscape in association with the Se San River. Fruit orchards were quite far from the river and they are more common among villages near the Se San River, providing additional source of income, while home gardens were nearby homesteads and between houses and the river (SWECO 2006). Those crop plants are classified into three categories: plants grown in the home gardens, crop/food plants located behind the houses (backyards), and plants that used to be cultivated nearby river bank and/or along river bank slopes (Table 9).

Table 9 List of crop plants and fruit trees in the project area

Plants grown in the home gardens		Crop plants and fruit trees located behind the houses (backyards)		Plants that used to be cultivated nearby river bank and/or along river bank slopes	
Local Name	Name	Local Name	Name	Local Name	Name
Ampel	Tamarind	Ampel	Tamarind	Ampov	Sugar cane
Chek	Banana	Ampov	Sugar cane	Kh'toem Sor	Spring onion
Chi Angvong	Mint	Chek	Banana	L'mut	Species of Sapotaceae
Chi Kraham	Basil	Chi Angvong	Mint	L'ngo	Sesame
Chi Vansuy	Coriander	Damlong Chhvea	Sweet potatoes	Lpov	Pumpkin
Doerm Dong	Coconut tree	Damlong Kor	Cassava	Mnors	Pineapple
Doerm Ko	Bombax	Doerm Dong	Coconut tree	Mtesh	Chili
Doerm Toekdoh Ko	Milk fruit	Deum Ko	Bombax	Ov Loek	Water melon
Kh'nol	Jackfruit	Doerm Toekdoh Ko	Milk fruit	Pot	Corn
Kh'toem	Spring onion	Kh'nhei	Ginger	Sla	Betel nut
Kroch Chhma	Lemon (lime)	Kh'nol	Jackfruit	Spey	Lettuce
Kroch Pursat	Orange	Kroch Pursat	Orange	Svay	Mango
Kroch Thlong	Pomelo	L'hong	Papaya	Svay Chanti	Cashew
L'hong	Papaya	L'mut	Species of Sapotaceae	Thnam Chuok	Tobacco
L'mut	Species of Sapotaceae	L'ngo	Sesame	Trab Kdeb	Aubergine
Mien	Longan	Mien	Longan	Trakuon	Morning

					glory
Mlou	Peper betel	Sandaek Bay	Mung bean	Trav	Taro
Mtesh	Chili	Seda	Pomelo		
Nonong	Long gourd - 2 (smooth surface)	Sloek Krey	Lemon grass		
Rumchek	Pandan	Speu	Corambole		
Rum dénh	Galanga	Spey	Lettuce		
Sandaek Kuo	Long bean	Svay	Mango		
Sla	Betel nut	Svay Chanti	Cashew		
Sloek Krey	Lemon grass	Thnam Chuok	Tobacco		
Speu	Corambole	Trav	Taro		
Spey	Lettuce				
Svay	Mango				
Svay Chanti	Cashew				
Trob	Species of Solaneaceae				
Trabaek	Guava				
Trab Kdorko	Aubergine				
Tralach	Long gourd - 1 (hairy)				
Trasak	Cucumber				

Note: These crop plants and fruit trees were reported by villagers, recorded during the field studies and compiled here as alphabetically local name order. However, some crops were difficult to determine its names because they were called in Lao language.

3.8 Livelihood

Prior to going into more detail in livelihood, it is necessary to introduce such term in advance. A livelihood is defined as consisting of the capabilities, assets, including both material and social resources, and activities required for a means of living. A livelihood is however sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resources (DFID, 1999). Livelihood diversification is regarded as the ways in which individuals and households change their ways of earning an income and surviving (IMM, CFDO and CBNRM LI. 2005).

In Cambodia, livelihood diversification is the most important and a part of life in rural areas. It not only provides earnings to supplement family's usually inadequate main income source but also reduces the risks arising from relying on single source of earning (Ellis 2000). People in the project area are however not different from rural areas elsewhere in the country. That means that they have traditionally engaged in agriculture, depending on a range of activities to secure food and income which include rice, other field crops, home gardening, and livestock production, fishing, forest product collections, wage labour, and small-scale traders and others. Table 10 shows in details both main and secondary occupations in the project areas.

Table 10 Main and secondary occupations of people

Main occupation	Percent
Worker at private companies / factories	0.5
Government employee	11.0
Small shop owner	0.5
Farmer	88.0

Second occupation	
Worker at Private Companies / Factories	1.0
Government Employee	5.8
small-scale trader	3.7
Farmer	5.8
Fishermen	41.9
Motor taxi driver	0.5
Construction worker	2.6
Palm Clamber	0.5
Non timber product	9.9
Hunter	5.8
Businessman	7.9
fish trader	1.6
Rice mill operation	3.1
Timber logging	3.7
Transportation service	4.7
Other	1.6

In this context, this part aims to identify different sources of main income generation and to quantify incomes from them.

3.8.1 Household Income by Source

Apart from regular cultivations on rice and crops and raising animals, villagers are dependent on (i) Salary or wage, (ii)Fishing, (iii) Manual labor, (iv) Income from selling livestock, (V) Income from selling rice and/or grain (vi) Non-timber forest products such as collecting resin and other forest resources (NTFP), (vii) Transportation service provider by boat, power tiller and with a few cases by car, and (viii) Other miscellaneous incomes from other means, such as renting out assets. Total income for a full year period was thus calculated from each source as defined above and combined them together. However, Income has been considered as one of the most difficult variables to calculate from household surveys. In most cases, expenditure is used as a proxy (Chan S. and S. Acharya, 2003). Since expenditure data here cannot be used for analysis of incomes from different sources, income data were still generated for this study. Interviewees were asked to recall their incomes from all possible sources during the past twelve months since a clearly identified reference point (January to December 2007). As a result, it is found that:

- **Salary or Wage**: Salary or wage is defined as those working as governmental officer and or NGO/company staff, obtaining monthly income or salary. In the project area, income from this source is from those working for government or as governmental officer. On the average basis, the annual income from such source is approximately 1,000,000 riel or US$ 250. In Talat, it is found to be lower than that of others. The variations of income suggest the difference numbers of people working as civil servant or other works obtained monthly salary.

- **Rice Milling**: Rice milling is one of the income-earning activities in rural areas. Almost all rice mills are family owned and operated. Spouses and relatives form the main workers. Much of the rice has historically been processed for only domestic consumption. However, this activity now provides low income due to the fact millers operate it and, in return they keep the bran and husk rather than charge a cash fee. Obviously, in all communes of the project area, income from such source is low, which is around 260,000 riel or around US$ 65 per year, compared to most of the income-earning sources.

- **Transportation Service**: The source of this income is considered to be one of the higher income-generating sources in the project area since it provides substantial incomes to supplement their livelihoods. Transportation service here included motor-taxi driver, boat-based transportation service provider, and transportation by ox-cart, car. In Sre Angkrorng and Phluk communes, on the average basis, the income from such source is very similar, which is around 600,000 riel or US$

150. In Talat and Kbal Romeas communes, the income from this source is also similar but higher than the two communes as described above, where is approximately 950,000 riel or US$ 237.5. In Srekor, the income from this source is around 1,400,000 riel or US$ 350. This indicates transportation service within this commune is higher than that of the others. Based on the field study found it is richest one of amongst the communes in the project area.

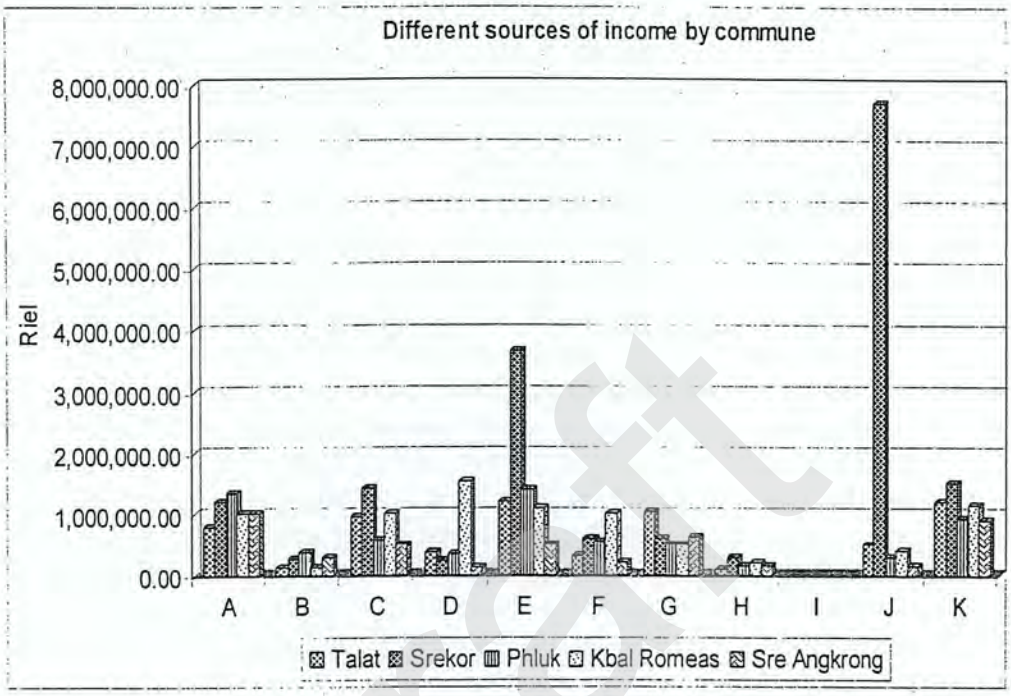

Figure 9 Sources of Income in the project area

A = Salary or Wage, B = Rice Milling, C = Transportation Service D = Manual Labor, E = Selling Livestock, F = Selling Fish, G = Selling Rice, H = Selling Grains, I = Selling Fruits, J = Non-Timber Products, K = Miscellaneous Income

- **Manual Labor**: Income from manual labor refers to those working as construction worker, daily and/or seasonal worker to obtain daily wage and salary. Income from this source varies from commune to commune, while the highest income was found in Kbal Romeas. This may reflect work force within this commune higher than that of the others. On the average basis, the income generating from such source is about 340,000 riel or around US$ 85.

- **Selling Livestock**: Selling livestock is one of most difficult variable incomes because it only occurs when there are necessary and urgent needs, and occupation improvements which included treatment family's member, serious needs (wedding or festival in family), buying staple foods to meet family's needs, increasing business size etc. Of the five communes, income from this source was found lower in Sre Angkrorng. This may imply that necessary and urgent needs are not major concerns and/or lake of livestock for sale. However, it is found to be highest one in Srekor compared to the other communes. This may reflect livestock in this commune is more than that of others, especially buffalos. In addition, it is likely to increase their business size rather than urgent and necessary needs since the commune considered to be richest in the project area.

- **Selling Fish:** it is one of the most commonly income-generating activities, which mostly occurs in rural areas in Cambodia. Although this activity is usual to consider it within the category of agriculture and relevant activities, but it is classified separately because of its importance to the economy since its income contributes around 7 percent of GDP (Sarthi A. et al., 2003). In the project area, the only sources of fish are from the inland water bodies like Se San and Srepok rivers. Fishing is largely carried out in these two sources. On the other hand, fishing is carried out year round. Many do this activity on a seasonal basis (after the harvesting of the wet season crop). The

technology for fishing is completely conventional, which means fishermen simply sailing out in small boats to catch fish using nets. Based on field study found that fishing is still a family-scale productivity activity and most of those people do not earn much more than subsistence. The higher income was found in Kbal Romeas, which is approximately 1,000,000 riel or US$ 250. This may reflect local people within this commune, the place where is widely known as almost all Phnong living, do fishing more than that of the others. Then, such activity of income generation is followed by Srekor, Phluk, Talat, and Sre Angkrorng respectively. The higher income imply that there are two man reasons: 1) Many people do fishing more than other communes, 2) There is different between fisheries resource. There is no different between fisheries resource since those live on the same condition (along Se San and Srepok rivers), the higher income may imply the human activity absolutely involved more than other communes.

- Selling Rice, Grains and Fruits

Selling rice, grains (corn, mung bean, sesame...), and fruits are another income sources, These sources are only generated as income whenever there are lack of basic and/or urgent needs or after it is estimated to remain from year round consumption. Some sell these staple crops after their harvesting period although they are going to be lack at the middle or at the end of the year. This is due to there are more basic and also urgent needs in the family. Instead, they try to make income from other sources to supplement their family during food shortage. In case of selling rice, it is found that on the average basis, there is around 1,000,000 riel or US$ 250 in Talat, while there are similar between the four communes, ranging from 500,000 to 630,000 riel or from 125 to US$ 158. For selling grains, since the staple crops is dominant by upland rice, grains such as mung bean, corn, sesame contribute very small amount. As a result, income from selling these crops is very low (ranging from 100,000 to 300,000 riel or from 25 to US$ 75) compared to other income-earning sources in the project area. However, there are no fruits for selling for income since those fruits are only for family consumption.

- Non-Timber Products Collection

Non-timber forest product collections are one of the most important secondary occupations. It contributes around 10 % after fishing activity. After ending of harvesting period, many go to collect resin and others so as to supplement their subsistence livelihoods. Of the communes, only in Srekor, the income from selling such kind of products is highest compared to that of the others. This implied that in the commune there are more activities related to non-timber products collection.

3.8.2 Poverty Assessment

There are, up to now, no sources of information regarding the exact number of level of poverty in Cambodia. However, based on the poverty map produced by the United Nation World Food Programme in collaboration with the Ministry of Planning, the poverty rate in the project area is lower than 25% poor (Figure 10).

3.9 Natural resources

Geographically, Cambodia's main features include the Mekong River, Tonle Sap Great Lake, extensive floodplain and lowland areas, and the southwestern and northeastern uplands. These features provide plenty to natural resources for Cambodians, especially for rural livelihoods. One of the well-recognized resources is fisheries. Inland fisheries are approximately the fourth most productive in the world. Mostly, households along the Se San River fish year-round, while others fish on a seasonal basis. Either these activities are just for family consumption, or sell for extra income. The second important one is forest resource, which reportedly cover more than half of the country. It thus plays a major role in the wet season by stabilising watersheds and regulating flooding and sedimentation levels. Also, many households living within or near forests typically benefit from forest resources such as resin tapping and fuelwood collection year-round. Generally forest product collection increases during the dry season since those households are not busy with rice cultivation and roads are easier than rainy season (Bruce M. and Prom T. 2003). Some households earn income together from these main resources: fisheries and forest product collection

to supplement their daily livelihoods. Since other natural resources a parts from the two as described above are not so important so that they would not be mentioned here.

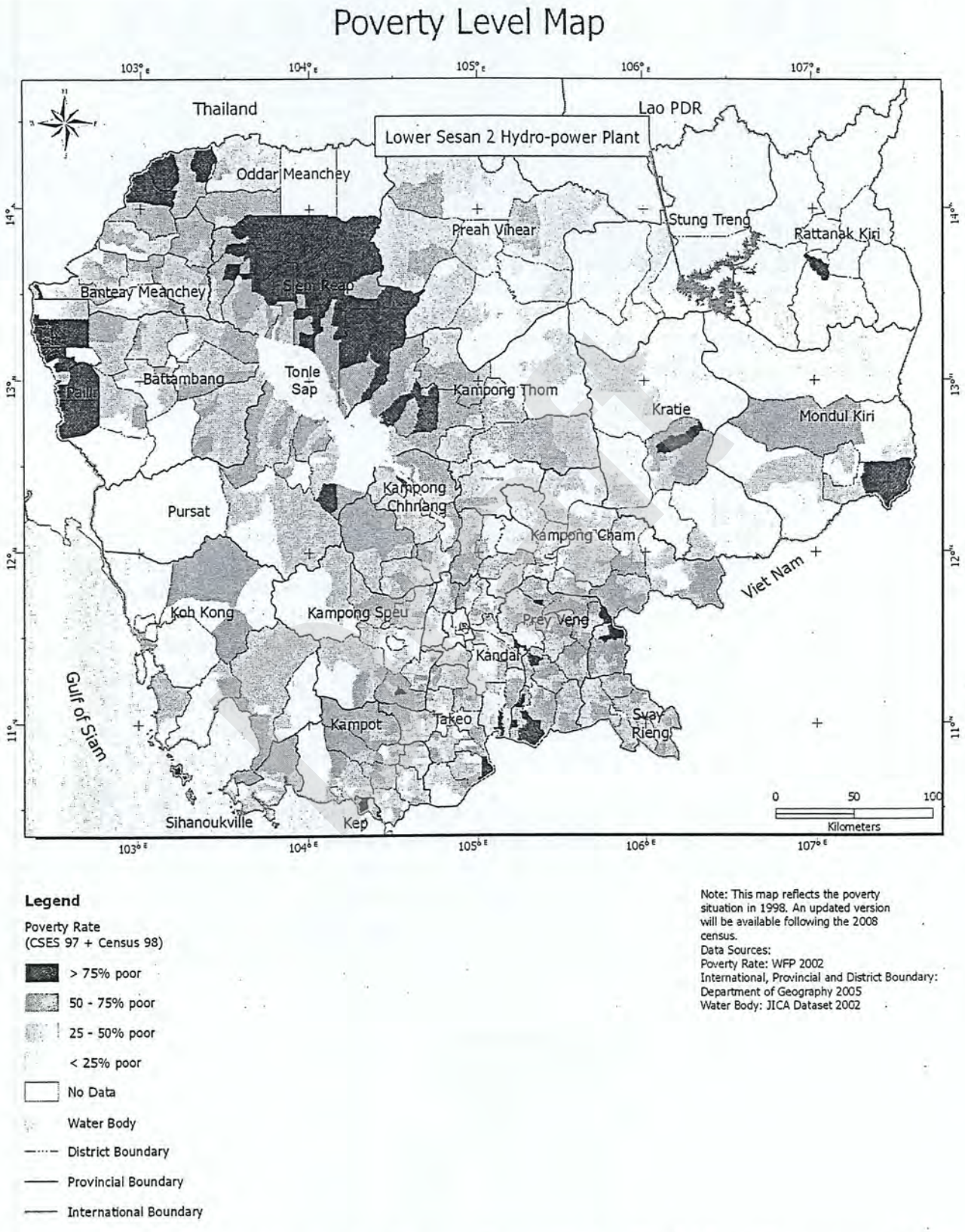

Figure 10 Poverty Map of Cambodia (Source: United Nation World Food Programme, 2003)

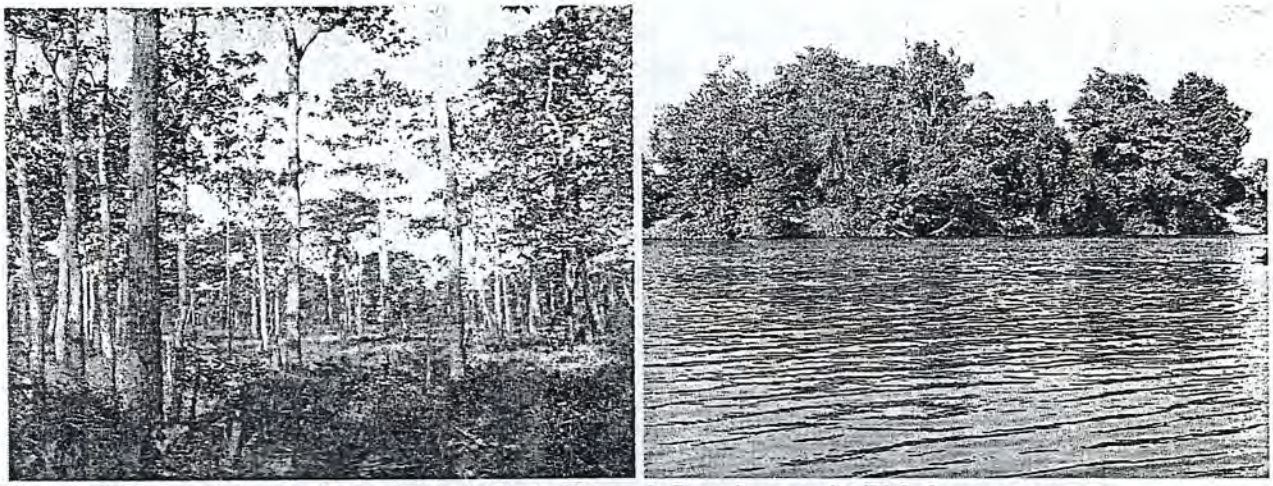

Figure 11 a Deciduous forest near Talat village b Landscape in Phluk commune

3.10 Archaeological/ Cultural site

There are many archaeological/cultural sites in Stung Treng province. However, no any such site was found in the project area. This indicates that there will not affect any archaeological/cultural site if the dam will be constructed.

3.11 Water consumption and Sanitation

All the families in the project area use the rivers (Se San and Srepok) as source for daily consumption. However, very few families use hand-dug wells and borehole wells to supplement their consumption for sometimes. The quantity of water consumption per capita is approximately 47 liters per day which included drinking, cooking, washing and bathing. Meanwhile, more than 95% boiled water prior to drinking. Pig raising is considered as one of major water consumptions if there is any planning for resettlement. On the average basis, the amount of water consumption per pig per day is about 31 liters. Of the total population, there is 41.3% households raised pig from1-2, 24.1% raised 3 pigs and more. The number of pigs raised is based on family economic and traditions. Some animals like cow, ox, and buffalo here don't get involved in water consumption because of the fact that these animals are released to graze freely without any care.

The number of pour flush latrines in each commune is shown in table 11. Of the communes, only Srekor has a lot of pour flush latrines, 38.4% of total families, followed by Talat 5%, Kbal Romeas 4.1%, Sre Angkrorng 0.6% and Phluk 0.4%, respectively. High percentage of the latrines in communes indicates better living standards and knowledge about health care in their families. Meanwhile, people normally dispose household wastes around the house compound. Also, No drainage and solid waste management were found in the project area. Thus, sanitation facilities are still considered to be poor and are in need of development.

Table 11 Flush latrines in the subproject area

Commune	Pour flush latrine	
	Total	% of total family
Talat	32	5.0
Srekor	124	38.4
Phluk	1	0.4
Kbal Romeas	18	4.1
Sre Angkrorng	2	0.6

Source: Commune profiles, 2007

3.12 Health

In Talat commune, there is no health center. If there are patients in the commune, they must come with a very long distance to provincial health center. On the average basis, the average distance from the commune to the health center is about 128.25 km (Talat commune profile 2007). This indicates that no health facility provide for this commune. In Srekor commune, there is also no commune health center. On the average basis, the distance from the commune to the provincial health office is approximately 90 km (Srekor commune profile 2007). In Phluk commune, there is no health center in this commune; it is a nearby Kampun commune health center. On the average basis, the distance from Phluk commune to the health center is just only 8.5 km (Phluk commune profile 2007). It is thus quite easy for people there to find out health service. In Kbal Romeas commune, it is not so different from the above-two communes (Talat and Srekor). The distance from the commune to health center is far. On the average basis, it is about 83.5 km (Kbal Romeas commune profile 2007). Finally, one of the communes with the project area is Sre Angkrorng located in Ratanakiri. There is a health center in this commune, but it seems to be hard for people to find out health service here. Thus, in case of there are patients, those must be brought to Koun Mom district health center located approximately 22 km or to directly provincial health center, where is approximately 54 km from the commune (Sre Angkrorng commune profile 2007).

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Figure 12 Health center in Koun Mom District, Ratanakiri Province

All the communes in project area, it is difficult to find out health service. In stead, some people use locally medical plants for their treatments. Meanwhile, women delivering a birth depend mostly on traditional birth attendants. Since there is no any commune health center in the project area, many key informants such as village chiefs, deputy village chiefs, and village elders were interviewed for such matter. As a result, it is found that there are water-related diseases and mosquito borne ones occurred. Water–related diseases refer to simple diarrhea, severe diarrhea, Dysentery, and skin infection etc, while mosquito borne ones include malaria, and eye diseases. Illnesses are reported to be experienced by the households throughout the year.

Table 12 Major diseases recorded in the project area

No	Disease	Health center	
		Kampun	Koun Mom
1	Simple diarrhea	80	249
2	Severe diarrhea	0	0
3	Malaria	78	10
4	Dengue fever	0	0
5	Skin infection	102	15
6	Eyes diseases	43	21

Source: Health center, 2007

Of the communes, available data was obtained in Kampun and Sre Angkrorng communes, where data on major diseases was recorded as shown in Table 1.12. However, in Kampun, the data on major diseases couldn't represent health condition in Phluk, but it just gives background of what was health status. Thus, the major diseases in Phluk are absolutely lower than what is shown in the table 1.12. As a result, the most common diseases are Skin infection, followed by simple diarrhea, malaria and eyes diseases, respectively. Although the data present Koun Mom health center, but it was duly data recorded only in Sre Angkrorng. The most occurred diseases are simple diarrhea. Eyes diseases, skin infection, and malaria are less contributed in the commune as well. Simple diarrhea is generally attributed to the lack of sanitation and clean water source.

Based on data from the survey found that the most occurred diseases are dysentery followed by skin diseases, typhoid, malaria, and cholera respectively. Basically, the dysentery infection is often passed on through improper hygiene. One of the most common causes of dysentery is not washing the hands after defecating in toilet or around bush located not far from houses. Skin diseases were also high at the time of study. It seems to be hard to conclude the cause of such diseases whether from daily use of water or something else, but one of the most reliable causes is lack of hygiene. The other diseases were common occurring everywhere throughout the country.

3.13 Resettlement and Issues

Prior to discussing about resettlement and its relevant issues, it is necessary to firstly introduce one of the most common questions: who are the Affected Persons by the hydropower dam? Affected Persons are referred to those who stand to lose, as a consequence of the project, all or part of their physical and non-physical assets, including homes, communities, productive lands, resources such as forests, range lands, fishing areas, or important cultural sites, commercial properties, tenancy, income-earning opportunities, social and cultural networks and activities, although impacts are permanent or temporary (ADB 1998). Thus, reflecting back to the project site, it provides overall aspects that people will absolutely be affected by the dam if constructed since those will face the loss of both physical and non-physical assets as described above.

Based on the results from socioeconomic survey found that people in the project area settle for a long time ago, but no any record showed the exact period of their earlier settlement. When asked about the reference period during the last 10 years only 9.9 % or 19 households settled in their current villages. Although very small portion of those used to move, but they moved around their communes not moved from somewhere else. This implies that most of the people living in the project area are indigenous habitants.

Regarding to the hydropower dam information in their communities, 149 households or 78 % have been aware of that there is the hydropower dam will be constructed, while the others not knowing if there is a hydropower dam will be constructed or not. Such information was obtained from multiple sources such as local authority 47%, followed by Vietnamese working groups 35.5%, neighbor 16.8% and relatives 0.7% respectively. Those people mostly (around 93.2%) knew of the information from 1-3 months, counting back from the period of this study. However, almost all people (175 households or 91.6 %) already made a refusal or disagreed with such kind of this dam. They provided various reasons during household interviews that:

- If constructed, the hydropower dam will affect to their current places, the ones where are harmonized, heritage sites, and also affect their current livelihoods. One of the most concerns of those people is the difficulty in making new income-earning opportunities. Thus, such issue should carefully be focused on prior to staring up resettlement. If project development will still necessitate them to relocate their current living locations, and also no choice for them; they needed acceptable compensations on appropriate properties lost in advance. Furthermore, the places, where they are willing to move, are similar to their present locations and also can cultivate rice and other crops.

4. IMPACTS FROM LOWER SE SAN 2 HYDROPOWER PLANT IF CONSTRUCTED

This part provides some information on impacts of Lower Se San 2 Hydropower Plant if constructed. Such information included an assessment from the field reconnaissance and the synthesis from various studies (Fisheries Office 2000, McKenney B. 2001, and revised by SWECO 2006). Thus, it is critically assessed based on the synthesis by comparing with the information from and discussions with key informants and interviewees during the field study. In this context, two major impacts of the hydropower plant here are discussed include downstream impacts and upstream ones. Both the downstream and the upstream impacts are included: i) During the construction of hydropower plant and ii) After its operation.

4.1 During the construction of this hydropower plant

During the construction of the hydropower plant, people living downstream will have impacts due to the deterioration in water quality. This means that during the dam construction, many chemical compounds will release into the river. Such cases were already experienced in Ratanakiri. During and after several hydropower plants at upstream the Se San located in Vietnam constructed, villagers living along the Se San and the Srepok downstream reported that water quality at the downstream area is poorer than ever and turbid and sediments have been found. As a result, many water borne diseases and skin ones were noticed since then. Not only human but also domestic animals drinking river water are exposed to such diseases. People normally boil river water prior to drinking it. Scientifically, this method just only kills bacteria but does not weaken or completely destroy the effectiveness of chemical composition (toxics) causing poisoning risk (Fisheries Office 2000).

4.1.1 Upstream Impacts

Since there is no any study focused on upstream impacts, it is hard to provide detail picture. Rough aspects here are thus described as follows:

A. Impacts on feeling

Although acceptable compensation for overall property losses will be provided in advance, it is difficult to explain how bad feelings they will encounter. Based on the field study found villagers report that if there is any resettlement due to constructing the hydropower plant, they will have nothing remained, included loss of their villages, lost the residential land that their houses were located on along with their plantations and paddy fields, lost household property, lost income-earning sources etc.

B. Clearing of forest for new plantations

Local people depend on current plantations and paddy fields, river-based resources and other non-timber forest products for their subsistence livelihoods. Thus, forests will have been severely impacted as people move away from nearby river villages to their upland new resettlement area. All of people who move depend on growing rice in their paddy fields to sustain their livelihoods, so as they move they must clear forest to make a new plantation in order to grow rice and vegetables for their families.

4.2 After its operation

After the operation of the proposed hydropower plant, there will have several impacts. The main impacts that should be focused on is only downstream impacts, while the upstream impacts already described during the construction of the hydropower plant.

4.2.1 Downstream Impacts

Although the root cause is water surges, daily fluctuations in water levels, change in seasonal flows, or other factors, the ecosystem along the Se San river has been reported to be altered drastically by Ialy falls and dams located in Vietnam site. As a result, this has brought consecutively to largely reflecting impacts on the communities, many of which are indigenous groups and rely mainly on the river and its surrounding environment for their livelihoods and their cultural way of life. Villagers along the river acknowledged serious harms from the upstream dams, starting from loss of life, livelihood, and property to declines in food supplies, health, and nutrition (NGO Forum on Cambodia, 2005).

A. Loss of Life

It has been reported the dams in Vietnam have led to some deaths in communities in Cambodia. Both officials in Vietnam and Cambodia acknowledged that water releases from such dams have seriously impacted the lives of few numbers of villagers. However, the estimates varied between official sources and villagers to the number of deaths caused by the dams' operation. Based on Vietnamese government report acknowledged that a February 2000 water release, there were several villagers died caused by the dams, but not specifically quantitative data. Specific data was determined to be seven dam-related deaths. Meanwhile, the 2000 study found 32 villagers died due to water release directly. The 2002 study found that three deaths from water releases. Additional studies conducted in Stung Treng province, where locate downstream from Ratanakiri, also found losses of lives, but no quantity was determined. Based on field visits conducted in March and April of 2005 by NGO Forum on Cambodia's an international expert team did confirm that surges and fluctuations of water levels in the river killed many people (NGO Forum on Cambodia 2005). All of the studies as described above may be concluded that if the proposed hydropower dam will be constructed, it is necessary to take more measures in advance in order to completely prevent local people from deaths prior to operation.

B. Loss of Property and Livelihood

Communities along the Se San River reported that the river has ruined much of property due to water surges from upstream since earlier operation. On the other hand, villagers mentioned that since the operations such kinds of dams, Vietnam has not compensated any property lost. Thus, it has seriously affected to their subsistence livelihoods of local communities along the river (NGO Forum on Cambodia 2005). Regarding to loss of livelihood, experiences from the Ialy Hydropower plant on parts of Cambodia revealed that the overall impacts have deeply reduced human livelihoods system along the Se San River, resulting to the lack of river bank use and reduction in fisheries resources. Local people increased wildlife hunting, non-timber forest products collection, exploitation from forest products and encroachment since those had encountered problems with rice and other crops cultivation which are close to the river due to flooding and rapid water level changes (Fisheries Office 2000). Based on recent study found villagers living along the Se San have adversely affected their daily livelihoods for income-earning sources either in the rainy season or in the dry season. An economic valuation report comparing data from 1999 with the information provided on pre-dam conditions clearly found an average decline in household income of 57%, from US$ 109 to $ 46 per month. The overall economic loss in Ratanakiri in 1999 was over US$ 2.5 million (McKenney B. 2001). This is just only one year in one province, and how about Stung Treng? How much villagers living along the Se San should be compensated since 1999 and from now onwards? Prior to river changes, fishing, animal trading and other income-generating activities were all means of earning surplus wealth. Such activities have subsequently been reduced based on current river condition and its surrounding environment.

C. Health Deterioration

The dam's construction and deterioration in water quality are associated. It is reported that the deteriorating water increases in illnesses, resulting numbers of deaths in recent years. These cases

have been found in Ratanakiri province. However, the relationship between dam, water quality and health remains undetermined. Up to now, there were no any baseline studies of such relevant sickness to water quality; it is thus difficult to make assumption of causality to the dam's operation (NGO Forum on Cambodia 2005). Since many hydropower dams at upstream constructed, water quality in the Se San and the Srepok have seriously deteriorated. This means that these rivers have become more turbid and sediments than ever, and also bad smell in some parts of the rivers. Based on the field study found all of the villagers in the project area, however, lack of fresh water wells or other sources of potable water, thus they mainly rely on the Se San and the Srepok rivers to provide water for drinking, cooking, and bathing. As a result, local villagers have suffered from water-quality associated ailments including itchiness, eye irritation after bathing in the water, as well as stomach problems, respiratory problems, throat and nostril irritation, dizziness and vomiting after drinking the water. Furthermore, a great number of domestic animals have also died since the water quality first deteriorated, but it is hard to quantify to animal deaths have resulted from deteriorating in water quality. Of this, villagers suggested that most domestic animal deaths are completely involved in bad water quality in the river. In addition, wild animals have also been found dead near the Se San River (Fisheries Office 2000).

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បញ្ជីសំនួរលេខ: .....

Socio-economic Characteristics Survey

1- General Information

Village ភូមិ: ..... Commune ឃុំ: .....

District ស្រុក: ..... Province ខេត្ត: .....

1.1 Distance from house to school for children ចំងាយពីផ្ទះទៅសាលារៀនសំរាប់កូន: .....ម៉ែត្រ

1.2 Distance from house to commune health center for family ចំងាយពីផ្ទះទៅមណ្ឌលសុខភាពឃុំរបស់គ្រួសារអ្នក: .....ម៉ែត្រ

1.3 Household type ប្រភេទផ្ទះ

- ☐1- Concrete/wooden wall with tile roof ផ្ទះថ្ម/ឈើប្រក់ក្បឿង
- ☐2- Wooden wall with zinc roof ផ្ទះឈើប្រក់សង្កសី
- ☐3- Wooden wall with thatch roof ផ្ទះឈើប្រក់ស្លឹក
- ☐4- Thatch/wooden leave wall with thatch roof ខ្ទមស្លឹក

1.4 Other major assets and utilities ទ្រព្យសម្បត្តិសំខាន់ៗដែលមានដ៏ទៃទៀត

- ☐1- Motorbike ម៉ូតូ
- ☐2- TV ទូរទស្សន៏
- ☐3- Power tiller គោយន្ត
- ☐4- Water pump ម៉ាស៊ីនបូមទឹក
- ☐5- Engine boat កាណូត
- ☐6- Tractor ត្រាក់ទ័រ
- ☐7- Rice mill ម៉ាស៊ីនកិនស្រូវ
- ☐8- Other (please specify) របស់ប្រើប្រាស់ដ៏ទៃទៀត (សូមបញ្ជាក់): _____

2- Information of Respondent and Family ពត៌មានពីគ្រួសារ និងអ្នកផ្តល់ចំលើយ

2.1 Name ឈ្មោះ .....

2.2 Position in Family ជាន:ក្នុងគ្រួសារ: ☐1- Household head មេគ្រួសារ ☐2- Spouse of household head ប្តីឬប្រពន្ធមេគ្រួសារ

☐3- Son/Daughter of household head កូនប្រុស/ស្រីមេគ្រួសារ ☐4- Parents of household head ឪពុកម្តាយមេគ្រួសារ

☐5- Other (please specify) ផ្សេងទៀត (សូមបញ្ជាក់): .....

2.3 Sex: ភេទ ☐1- Male ប្រុស ☐2- Female ស្រី

2.4 Age: អាយុ .....ឆ្នាំ

2.5 Ethnicity: ☐1- Khmer ខ្មែរ ☐2- Chinese ចិន ☐3- Vietnamese វៀតណាម

☐4- Lao ឡាវ ☐5- Other ដទៃទៀត: .....

2.6 Religion សាសនា: ☐1- Buddhism ព្រះពុទ្ធ ☐2- Islam ចាម ☐3- Christian គ្រីស្ត

2.7 Education of the respondent ការសិក្សាអ្នកផ្តល់ចំលើយ

❒1- Non Education មិនបានរៀន

❒2- Primary School បឋមសិក្សា (ថ្នាក់ទី១ - ថ្នាក់ទី៦ថ្មី) / (ថ្នាក់ទី១២ - ទី៧ជំនាន់ដើម)

❒3- Secondary School អនុវិទ្យាល័យ (ថ្នាក់ទី៧ - ទី៩ថ្មី) / (ថ្នាក់ទី៦ - ទី៣ជំនាន់ដើម)

❒4- High School វិទ្យាល័យ (ថ្នាក់ទី១០ - ទី១២ថ្មី) / (ថ្នាក់ទី២ - ទី១ជំនាន់ដើម)

❒5- Bachelor Degree and Above បរិញ្ញាបត្រឡើងទៅ

2.8 Occupation មុខរបរ: Main ចំបង: ..... Secondary បន្ទាប់បន្សំ: .....

❒1- Worker at Private Companies / Factories កម្មករក្រុមហ៊ុនឯកជន/កម្មកររោងចក្រ

❒2- Government Employee បុគ្គលិករដ្ឋ

❒3- Shop Owner ម្ចាស់ហាង

❒4- Farmer កសិករ

❒5- Fishermen អ្នកនេសាទ

❒6- Motor taxi រត់ម៉ូតូឌុប

❒7- Construction worker កម្មកសំណង់

❒8- Transportation service provider អ្នកស៊ីឈ្នួលដឹកទំនិញ

❒9- Non timber product អនុផលព្រៃឈើ

❒10- Hunter អ្នកចាប់.ដាក់អន្ទាក់ ឬបរបាញ់សត្វលក់

❒11- Other (Please specify) ផ្សេងៗ (សូមបញ្ជាក់) .....

2.9 How many members are there in your family? ចំនួនមនុស្សក្នុងបន្ទុកគ្រួសារ: .....នាក់

2.10 Have you had any member do migration for seeking a job ?

តើអ្នកមានសមាជិកក្នុងគ្រួសារធ្វើចំណាកស្រុកដើម្បីស្វែងរកការងារធ្វើដែឬទេ ? ❒1- Yes មាន ❒2- No ទេ

2.10.1 If Yes, how many members? ប្រសិនបើមាន តើមានសមាជិកប៉ុន្មាននាក់? ..... នាក់

2.10.2 If yes, where did they go? ប្រសិនបើមាន តើពួកគាត់ទៅធ្វើការនៅឯណា?

❒1- In the current living province នៅតែក្នុងខេត្តដែលកំពុងរស់នៅសព្វថ្ងៃ

❒2- Other province/town ទៅខេត្ត/ក្រុងដទៃ

❒3- Outside country (specify) ទៅធ្វើការនៅក្រៅប្រទេស (សូមបញ្ជាក់): .....

2.10.3 If yes, what kind of job do they do? ប្រសិនបើមាន តើពួកគាត់ទៅធ្វើអ្វី ?

❒1- Fishing worker កម្មកររនេសាទ

❒2- Motor taxi អ្នករត់ម៉ូតូឌុប

❒3- Construction worker កម្មកសំណង់

❒4- Worker at Private Companies / Factories កម្មករក្រុមហ៊ុនឯកជន/កម្មកររោងចក្រ

❒5- Other (Please specify) ផ្សេងៗ (សូមបញ្ជាក់) .....

2.10.4 If yes, how much money in Riel do they get per month?

ប្រសិនបើមាន តើពួកគាត់ទទួលបានប្រាក់ចំនួលប៉ុន្មាន ជាមធ្យមក្នុងមួយខែ ? ..... រៀល

2.11 AVR Household Income & Expenditures in year 2007: ចំណូល-ចំណាយគ្រួសារប្រចាំឆ្នាំជាមធ្យម

2.11.1	Average Total household incomes per year ប្រាក់ចំណូលជាមធ្យមប្រចាំឆ្នាំក្នុងគ្រួសារ - Salary or wage ប្រាក់ខែ រឺប្រាក់ថ្ងៃ: ..... រៀល/ Riel - Operate rice mill ចំណូលពីម៉ាស៊ីនកិនស្រូវ: ..... រៀល/ Riel - Transportation services ចំណូលពីសេវាដឹកជញ្ជូន: ..... រៀល/ Riel - Manual labor ចំណូលពីការលើកដាក់លីសែង: ..... រៀល/ Riel - Income from selling livestock ចំណូលពីលក់សត្វស្រុក: ..... រៀល/ Riel - Income from Fishing ចំណូលពីផលនេសាទ: ..... រៀល/ Riel - Income from selling rice yield ចំណូលពីការលក់ផលស្រូវ: ..... រៀល/ Riel - Income from selling rice ចំណូលពីការលក់ធញ្ញជាតិផ្សេងៗ: ..... រៀល/ Riel - Income from fruits ចំណូលពីការលក់ផលិតផលដើមឈើគ្រប់ប្រភេទ: ..... រៀល/ Riel - Miscellaneous income ចំណូលផ្សេងៗទៀតក្នុងរយៈពេល១ឆ្នាំ: ..... រៀល/ Riel Total Income for the Whole Year of 2007 **ចំណូលសរុបក្នុងឆ្នាំ២០០៧**: ..... រៀល/ Riel
2.11.2	Average Expenses of household per year ប្រាក់ចំណាយជាមធ្យមប្រចាំឆ្នាំក្នុងគ្រួសារ Food/ Beverage/ Tobacco អ្នបអាហារ-ភេសជ្ជៈ-ថ្នាំជក់: ..... រៀល/ Riel Medical care/ Health expenses ថ្នាំពេទ្យ: ..... រៀល/ Riel Education សិក្សាអប់រំ: ..... រៀល/ Riel Kerosene/Battery (ប្រេងកាត/អាគុយ): ..... រៀល/ Riel Clothes សំលៀកបំពាក់: ..... រៀល/ Riel Telephone ទូរស័ព្ទ: ..... រៀល/ Riel Transport ដឹកជញ្ជូន: ..... រៀល/ Riel Wedding ceremonies and Festivals ចំណាយទៅលើបុណ្យទាន និងមង្គលការ: ..... រៀល/ Riel Others ផ្សេងៗ: ..... រៀល/ Riel Total Expenses for the Whole Year of 2007 **ចំណាយសរុបក្នុងឆ្នាំ២០០៧**: ..... រៀល/ Riel

2.12 Amount of Debt បំណុលសរុប

- Total Amount of Debt as of December 2007 បំណុលសរុបគិតត្រឹមខែធ្នូ ២០០៧: ..... រៀល/ Riel

3- Land Owned by the Family ដីកម្មសិទ្ធ/ដីប្រើប្រាស់ដោយគ្រួសារ

No.	Land Use ដីប្រើប្រាស់	Size (ha) ទំហំ	Ownership Document ឯកសារបញ្ជាក់កម្មសិទ្ធ	Present Value (US$) តំលៃបច្ចុប្បន្ន (ដុល្លា)
1	ដីភូមិ		☐1-Yes មាន ☐2-No ទេ	
2	ដីស្រែ		☐1-Yes មាន ☐2-No ទេ	
3	ដីចំការ		☐1-Yes មាន ☐2-No ទេ	

4- Crops Grown ការដាំដំណាំ

Crops ឈ្មោះដំណាំ	រដូវវស្សា			
	Cultivated Area (ha) ផ្ទៃដីដាំដុះ (ហ.ត)	Production (ton) បរិមាណផល (ត)	Price per kg (Riel) តំលៃក្នុង១ គ.ក(រៀល)	Total Price in 2007 (Riel) តំលៃសរុបក្នុងឆ្នាំ ២០០៧(រៀល)
1-				
2-				
3-				

Crops ឈ្មោះដំណាំ	រដូវប្រាំង			
	Cultivated Area (ha) ផ្ទៃដីដាំដុះ (ហ.ត)	Production (ton) បរិមាណផល (ត)	Price per kg (Riel) តំលៃក្នុង១ គ.ក(រៀល)	Total Price in 2007 (Riel) តំលៃសរុបក្នុងឆ្នាំ ២០០៧(រៀល)
1-				
2-				
3-				

5- Total cost for growing crops ចំណាយសំរាប់ការដាំដុះ

Expenses for crop grown	Unit ឯកតា	# of Unit ចំនួនឯកតា	Price in Riel/Unit តំលៃក្នុង១ឯកតា	Total Price in Riel តំលៃសរុប
1. Seed គ្រាប់ពូជ				
	kg			
-				
-				
-				
- Total seed cost សរុបចំណាយទៅលើគ្រាប់ពូជ				
2. Fertilizer ជី				
- Urea ជី អ៊ុយរ៉ែ	kg			
- DAP ជី ដេ អា ប៉ែ	kg			
- 16.20.0 ជី ១៦.២០.០	kg			
- 15.15.15 ជី ១៥.១៥.១៥	kg			
- Manure ជីធម្មជាតិ/ជីអាចម៍សត្វ/ជីកំប៉ុស្ត	Ox-cart			
- Others ជីផ្សេងៗទៀត	kg			
Total cost of fertilizer use សរុបចំណាយទៅលើការប្រើប្រាស់ជី				
3. Pesticide ថ្នាំសំលាប់សត្វល្អិត				
- Folidol ថ្នាំ ហ្វូលីដុល				
- 2,4-D ថ្នាំ ២,៤-ដេ				
- Other ផ្សេងៗ				
Total cost of pesticide use សរុបថ្នាំសំលាប់សត្វល្អិត				
4. Pumping & Water Costs ការបូម និង ថ្លៃប្រើប្រាស់ទឹក				
- Total Pumping & Water Costs ការបូម និងថ្លៃប្រើប្រាស់ប្រភពទឹក				
5. Labor កំលាំងពលកម្ម				
- Land preparation ការងាររៀបចំដីថ្ងាលសំណាប				
- Sowing rice seed ការងារសាបព្រោះ				

- Seedling ការងារដកសំណាប/ដកទៅដាំ	
- Plowing field by animals ភ្ជួរលុប/ភ្ជួរស្នងដោយគោក្របី	
- Transplanting ស្ទូង	
- Weeding ប្រោចស្មៅ	
- Fertilizer broadcasting បាច/ដាក់ជី	
- Pesticide application បាញ់ថ្នាំសំលាប់សត្វល្អិត	
- Harvesting ច្រូតកាត់	
- Threshing ប្រោកបែន	
- Transportation ដឹកជញ្ជូន	
- Other ផ្សេងៗ.....	
Total labor cost **សរុបចំនាយលើកំលាំងពលកម្ម**	
6. Lunch provided for hiring/ Sharing labor ចំណាយទទួលបាយទឹក	
7. Rent tractor/ Hand tractor ចំណាយជួលត្រាក់ទ័រ/គោយន្ត/ជួលម៉ៅការភ្ជួរ	
8. Rent threshing machine ចំណាយជួលម៉ាស៊ីនបោក	

Total expenses for growing crops in the year 2007 សរុបចំណាយការដាំដុះក្នុងឆ្នាំ ២០០៧ _____ Riel

6- Livestock Raised ការចិញ្ចឹមសត្វ

No.	Name ឈ្មោះសត្វ	Number (heads) ចំនួន (ក្បាល)
1	គោ	
2	ក្របី	
3	ជ្រូក	
4	មាន់ទា	
5	ផ្សេងៗទៀត:	

7- Resettlement Issues បញ្ហាចំពោះការតាំងលំនៅដ្ឋានឡើងវិញ

7.1 How many time have your family moved the house in the past 10 years?

តើគ្រួសារអ្នកផ្លាស់លំនៅដ្ឋានប៉ុន្មានដងក្នុងរយៈពេលដប់ឆ្នាំកន្លងទៅនេះ ?

☐1- Yes បាទ, ធ្លាប់ផ្លាស់ទីលំនៅ ☐2- Never Move មិនដែលសោះ

7.1.1 If yes, how many times? ប្រសិនបើ បាទ, ឬធ្លាប់ផ្លាស់ទីលំនៅ តើមានចំនួនប៉ុន្មានដង? ..... times ដង

7.2 Have you been aware of there will be a project to construct a hydropower plant in this vicinity?

តើអ្នកបានដឹងមានគំរោងសាងសង់គំរោងវារីអគ្គិសនីនៅក្បែរនេះដែរទេ ?

☐1- Yes បាទដឹង, ☐2- No មិនដឹងទេ

7.2.1 If Yes. From whom ប្រសិនបើដឹង, តើដឹងពីអ្នកណា?

☐1- Relatives សាច់ញាតិ ☐2- Neighbor អ្នកជិតខាង ☐3- Local authority អាជ្ញាធរដែនដី ☐4- Other ផ្សេងៗ: .....

7.2.2 If Yes, when did you hear about this ប្រសិនបើដឹង, តើដឹងពីពេលណា?

☐1- Less than one month តិចជាងមួយខែ ☐2- From one to three months ពីមួយខែទៅបីខែ

☐3- More than 3 – 6 months ច្រើនជាងបីខែទៅ៦ខែ ☐4- From one to three months ច្រើនជាង៦ខែ ទៅ១ឆ្នាំ

7.3 What is your opinion on those project development? តើអ្នកមានមតិយ៉ាងណាលើគំរោងអភិវឌ្ឍន៍នេះ?

☐1- Agree យល់ព្រម ☐2- No Opinion គ្មានយោបល់ ☐3- Disagree មិនយល់ព្រម ☐4- Other ផ្សេងៗ

Reasons មូលហេតុ: .....

.....

.....

7.4 If such project development will necessitate relocation of your house to somewhere else, are you willing to relocate?
ប្រសិនបើគំរោងអភិវឌ្ឍន៍នេះ តំរូវអោយអ្នកធ្វើការផ្លាស់ប្តូរទីលំនៅទៅកាន់កន្លែងផ្សេងទៀត តើអ្នកមាន
បំណងផ្លាស់ប្តូរទីលំនៅដែរទេ ?

☐1- Yes បាទ ☐2- No ទេ ☐3- Other ផ្សេងៗ: .....

Reasons មូលហេតុ: .....

.....

.....

7.5 Description of the place that you prefer to move to រៀបរាប់ពីទីកន្លែងដែលអ្នកចង់ប្តូរទៅ

Location ទីតាំង: _____

Approximate Area ទំហំប៉ុន្មាន: _____

8- Water Uses ការប្រើប្រាស់ទឹក

8.1 What source of water you are normally using for various purpose at present ?
តើសព្វថ្ងៃអ្នកប្រើប្រាស់ប្រភពទឹកអ្វីខ្លះសំរាប់គោលបំណងផ្សេងៗ ?

A- Type of Water Use ប្រភេទទឹកប្រើប្រាស់	B-Source (name) ប្រភព (ឈ្មោះ)	C-Disinfection ការសំអាត	Distance from Home (km) ចំងាយពីផ្ទះ	Quality គុណភាព	Availability ប្រើបានប៉ុន្មានខែ	Quantity Use (l/capita) បរិមាណ ប្រើប្រាស់

A: 1 = Drinking/cooking ផឹក/ដាំស្ងួ 2 = Washing clothes/cleaning ជុំសលាង/បោកគក់ 3 = Others ផ្សេងៗ

B: 1 = House connection ទឹកតង់ផ្ទះ 2 = Public stand post កន្លែងត្រែងទឹកសាធារណៈ 3 = Yard connection តង់ក់ពាង

4 = Shallow well អណ្តូងរាក់/ជីក 5 = Deep well អណ្តូងជ្រៅ 6 = Rain water tank អាងទឹកភ្លៀង

7 = Surface water ទឹកលើដី 8 = Other (specify) ផ្សេងៗ (បញ្ជាក់) _____

C: 1 = No 2 = Boiling ដាំ 3 = Alum សាច់ជូរ 4 = Chlorinating ក្លរ

5 = Other (specify) ផ្សេងៗ (បញ្ជាក់) _____

8.2 What is the present utilization of other water source in the vicinity?

តើមានការប្រើប្រាស់បច្ចុប្បន្ននៃប្រភពទឹកដទៃទៀត នៅជិតខាងដែរទេ ?

Present Utilization ការប្រើប្រាស់បច្ចុប្បន្ន	Name of Water Source **ឈ្មោះប្រភពទឹក** (rivers / irrigation / drainage channels / lake / swamps) ទន្លេ/ប្រឡាយ/បឹង	Daily consumption L/day ការប្រើប្រាស់ទឹកប្រចាំថ្ងៃ លីត្រ/ថ្ងៃ
- Irrigating rice field/crop ស្រោចស្រពដំណាំ/ស្រូវ		
- Feeding animal ចិញ្ចឹមសត្វ		
- Handicraft/industrial ឧស្សាហកម្ម/សិប្បកម្ម		

8.3 Problem related to other water uses បញ្ហាទាក់ទិននឹងការប្រើប្រាស់ទឹកក្នុងវិស័យដទៃទៀត

8.3.1 Quality គុណភាព: .....

.....

8.4 Water borne disease happened in your family in the year 2007 ជំងឺឆ្លងដោយសារទឹកនៅក្នុងគ្រួសារអ្នកក្នុងឆ្នាំ ២០០៧

☐1- Cholera អាសន្នរោគ ☐2- Typhoid គ្រុនពោះវៀន ☐3- Dysentery រាគមួល

☐4- Malaria គ្រុនចាញ់ ☐5- Skin infection ជំងឺស្បែក ☐6- Other ផ្សេងៗ

Surveyed by ធ្វើអង្កេតដោយ: _____ Date កាលបរិច្ឆេទ: _____

Starting Time ពេលចាប់ផ្តើម: _____ Completion Time ពេលបញ្ចប់: _____

Checked by ត្រួតពិនិត្យដោយ: _____ Date កាលបរិច្ឆេទ: _____

សូមអរគុណ!