*NAM THEUN 2 WATERSHED MANAGEMENT AND PROTECTION AUTHORITY*

# SOCIAL AND ENVIRONMENT MANAGEMENT FRAMEWORK AND OPERATIONAL PLAN (SEMFOP-1)

**[1st April 2005 to 30th September 2011]**

## PART 4

# BIODIVERSITY MANAGEMENT AND CONSERVATION FRAMEWORK

**(JANUARY 2005)**

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## 4.1: INTRODUCTION

### 4.1.1: Background

The Lao delegation at the 1965 Conference for the Conservation of Nature in Bangkok reported 10 forest reserves in Lao PDR totalling 151,500 ha with plans to upgrade to national park status.[1] Studies of these areas had begun, but the political uncertainty and war during the late 1960's and 1970's curtailed these efforts. In 1975, the newly formed Lao PDR repealed the prior Constitution, all legislation and the established forest reserves. Not until the end of the Cold War in 1989 did an emphasis on conservation and protected areas formally re-emerge in Lao PDR.

### 4.1.2: Conservation and Protected Areas in Lao PDR

#### *4.1.2.1: Development of National Protected Areas*

The first biodiversity management study undertaken in the Lao PDR was in 1986, followed by the first attempt to develop a biodiversity management systems at a national level[2], instituted by the Forest Resources Conservation Project (1988-91), part of the Lao-Swedish Forestry Cooperation program. This project focused on developing and establishing a Protected Areas System, i.e., areas set aside specifically for the management and protection of biodiversity, based on two foundations:

1. Policy arising from GoL's commitment to forest conservation, especially as expressed in the Tropical Forestry Action Plan of 1990. GoL's goal was to achieve 25,000 km2 of forest under conservation protection (10.5% of country).
2. Design philosophy and criteria for site selection were based on the biogeographic analyses of MacKinnon and MacKinnon (1986).

The principles that guided the assessment of suitable sites (Salter and Phanthavong 1989) were:

- "Protection needs to be provided to the full range of ecosystems and species communities occurring within the country,"
- "The total area under protective management needs to be adequate to prevent or minimize species extinctions"
- "Effective protection for 5-20% of the original area of each habitat type within each biogeographic subunit" needs to be provided in the Lao PDR.
- The approach assumed that protection of adequate, representative areas of habitat would also protect the majority of plant and animal species, therefore individual species requirements were not considered.

The search for appropriate protected areas started by assessing 68 sites that had been proposed (by various sources) for protection. Analyses of the sites, individually and as a system, were based on:

- extent of remaining natural vegetation: 50,000 ha. was the minimum for selection;
- completeness of original cover: priority given to more intact areas;
- extent of representation in biogeographic subunit, based on contributions of altitude classes and habitat types;
- regional priority: according to MacKinnon and MacKinnon (1996) by biogeographic subunit, size, regional importance of habitat, and so forth;
- degree of threat: priority given to high threat areas identified by MAF.

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[1] *UN List of National Parks and Equivalent Reserves, 2nd edition, 1971. Prepared by IUCN pursuant to UN Economic Social Council Resolution 810: Brussels.*

[2] *Biodiversity management by villagers has probably taken place for many years, although it was generally overshadowed by non-management type extraction, due to the perceived abundance of biodiversity in relation to the small population of Laos in the recent past.*

The process identified 29 of the 68 sites as potentially suitable for protected areas (and rejected the others). Ground assessments of most of the 29 were completed by 1991, and 17 suitable sites identified. The process culminated in 1993 by PM's Decree 164 establishing the 17 recommended protected areas, plus Phou Phanang near Vientiane, which was added for its historical value. Two more areas were added by Ministerial Decrees in 1995 and 1996, making a system of 20 protected areas, or NPAs (see Map 3). Some additional NPAs have been proposed but not legally gazetted. A brief history of the NPA's establishment and activities in the following decade is presented in Table 4.1 below.

**Table 4.1: A brief history of the development of the NPA system in the Lao PDR**

| Year | Event |
|---|---|
| 1986 | Some priority sites for protection in Laos are suggested by MacKinnon and MacKinnon<br>4th Party Congress reports that regulations are necessary for the protection of forest resources and conservation of the environment and its natural beauty; |
| 1988-1991 | DoF, LSFP and IUCN conducted reconnaissance surveys of potential protected areas; by 1991 eight suitable areas are identified and recommended for management planning; additional areas are identified as priorities for assessment. |
| 1989 | 1st National Forestry Conference, chaired by the PM, affirms need for biodiversity conservation<br>The report, "Needs and Priorities for a Protected Area System in Lao PDR", is issued by LSFP/ IUCN. |
| 1990 | Tropical Forestry Action Plan prepared; it reiterates emphasis on forest conservation. |
| 1992 | Assessment and identification of suitable sites for PAs continues;<br>LSFP/DoF & Cambridge student expedition begin wildlife and habitat surveys in proposed PAs. |
| 1993 | Adoption of Constitution of Lao PDR, including Article 17 stating "all organizations and citizens shall protect the environment and natural resources . . . forests, fauna, water"<br>Prime Minister's Decree 164 establishes the first 18 NPAs;<br>LSFP begins management planning in four NPAs. |
| 1994 | Wildlife Conservation Society begins to assist DoF in wildlife and habitat surveys in each NPA (these will continue through 1999), staff training management assistance in Nam Ha NPA. |
| 1995 | Xe Sap NPA added to the system. |
| 1996 | Dong Phou Vieng NPA added to the system (for a total of 20 NPAs);<br>Forestry Law passed by National Assembly;<br>IUCN Biodiversity Conservation Project (BCP) begins management assistance to two southern NPAs later to be joined by GAA and PDI).<br>GEF/World Bank FOMACOP project begins fieldwork in 4 NPAs through 2000 |
| 1996-1998 | Forestry Law enacted defining and establishing categories for protection and conservation forest;<br>7th Party Congress emphasizes need for increased forest conservation;<br>WWF organizes transboundary conservation meetings between Lao PDR and Vietnam; joint Lao-Vietnam survey of Hin Nam No NPA in 1998 |
| 1999 | Major, donor-supported phases of LSFP, FOMACOP, IUCN, and WCS projects in 11 NPAs come to an end. Some funds and adviser assistance extended for some areas.<br>WWF begins assistance to Hin Nam No NPA.<br>IUCN/DANIDA begin assistance to Nam Et/Phou Loei NPAs.<br>Large extensions approved to Nam Ha NPA, now contiguous with a reserve in Yunnan, China.<br>World Commission on Protected Areas 2nd Southeast Asia Regional Forum, in Lao PDR (Pakse). |
| 2000 | Four-day NPA management workshop convened in Vientiane; attended by representatives of every NPA and chaired by the Director General of DoF;<br>Manager's Guide to Protected Area Management completed;<br>The first fully approved NPA ecotourism venture begins (in Nam Ha NPA). |
| 2001 | MAF issues Regulation 524 on establishment and management of NPA system and wildlife and aquatic species (to be amended in 2003) |

Currently, there are four tiers of conservation and protection forest in Lao PDR:

i. Pursuant to PM Decree 164 and MAF Regulation 524, the central government (Prime Minister's Office) has established NPAs;

ii. Provincial and District Governors and local authorities have established 276 conservation and protection forest reserves (mostly for watersheds and future utilization) within their own jurisdiction, but these have no national legal recognition or management guidelines;

iii. Village conservation and protection zones within village boundaries established under a village forest management agreement with DAFO through the land use planning and allocation program (MAF Instruction 822).

The number and total area of each type are presented in Table 4.2.

**Table 4.2: Levels of Protected Areas in Lao PDR.**

| Level | Legislation | Number | Total ha |
|---|---|---|---|
| National (GOL; MAF) | PM 164 (1993)<br>MAF Reg 524 (2001) | 20 NPAs<br>2 corridor zones | 3.3 million ha<br>77,170 ha |
| Provincial Government | None specific<br>Land Law, Art. 12 | 57 conservation areas<br>23 protection forests | 931,969 ha<br>461,410 ha |
| District Government | None specific<br>Land Law, Art. 12 | 144 conservation areas<br>52 protection forests | 503,733 ha<br>55,713 ha |
| Village Authorities | MAF Instr. 822 (1996)<br>MAF Reg 535, Art. 8 (2001) | Villages where LUPLA has occurred | Conservation / protection forest zones under VFMAs |

*4.1.2.2: Protected Area Staff, Infrastructure and Resources*

Biodiversity protection throughout the Lao PDR is constrained by a general lack of infrastructure and equipment, inadequate-funding, under-staffing, and low capacity levels in protected area management staff. Annual budgets for NPAs, even at best with some external funding, typically only amount to a few thousand dollars. The majority of NPAs have no 4-wheel drive vehicle, insufficient motorcycles and very little basic equipment. Most have in the region of 5 or 6 staff assigned to them and some of these may be seconded to other duties. NPA staff normally come from diverse and often irrelevant backgrounds, they are poorly trained and motivated and tend to be rotated to other un-related positions on a regular basis. One study (Craig, 1998) revealed that the average length of service of staff members in in Phu Xang He NPA was less than 2 years. This makes capacity development very difficult, even in cases where resources are available for training and skills development. Due to lack of capacity very few NPAs have any long-term management plan, and even those that do, normally lack the budget to effectively implement it.

*4.1.2.3: Lao Environment and Conservation Fund*

A Lao Environment and Conservation Fund (LECF) is to be established as a source of funding for priority projects and activities in the fields of research, preservation, mitigation and restoration of the environment, including the protection and conservation of natural resources and biodiversity, and the mitigation of adverse social and environmental impacts associated with development projects. It is expected that LECF resources would be used to support only those priority projects and activities that complement and do not replace activities, functions or tasks that are carried out under the responsibility of the GOL.

A draft Prime Ministerial Decree to establish the LECF has been finalised and will shortly go to a national and international disclosure phase prior to its expected signing in April 2005. The fund is to be capitalised initially through a US $5 million loan from the Asian Development Bank. Under the Fund, specialised financing windows may be established under the framework of the LECF to administer, manage and account for moneys that may be deposited for specific environmental protection purposes.

It is intended to establish one such financing window as the Central Lao Conservation Fund (CLCF) to provide financial support for the central Lao protected areas surrounding NNT including Phou Hin Poun, Hin Nam Nor as well as the NCNP. Consideration will be given to establishing a similar financing window specifically for the Nakai Nam Theun NPA, under which any funds not used during the NT2 concession period will be invested for future use by the WMPA to ensure the long term sustainability funding for the NNT Watershed/NPA.

### 4.1.3: Nakai Nam Theun NPA

*4.1.3.1: Development of Nakai Nam Theun NPA Management*

The Nakai-Nam Theun NPA is not only the largest of Lao PDR's twenty national protected areas3, it is without doubt the most important for biodiversity conservation. It is one of the most important protected areas in Asia.

Initial attempts to develop a management plan for biodiversity conservation in the NT2 Watershed/NPA were undertaken in the mid 1990's by a cooperative program of WCS and DoF's CPAWM. A team from WCS along with some CPAWM staff undertook site visits, interviews with villagers, discussions with decision makers and reviewed all the information on biological surveys and other data collected to date. This led to the development of a "Preliminary Management Plan for the Nakai-Nam Theun NPA" in June 1995. A further study was undertaken, resulting in a report by Finlay in 1996 "Preliminary Analysis for Zonation Decision-Making in Nakai-Nam Theun National Protected Area".

At the same time, CPAWM conducted somewhat more intensive village level investigations of villager use of biodiversity resources and a mapping of village agricultural and forest areas. While the data from these investigations has been lost, a new GIS map has been generated (Annex Map 10). Assuming this map represents some type of reality, the village usage areas could form the basis for zonation of the NPA and thus for biodiversity management.

The first attempt to actually implement NPA and biodiversity management was initiated by a PHRD Grant under the World Bank's Nam Theun Social and Environmental project (NTSEP). IUCN implemented this project in two phases, the first being the 'Pilot Field Activities in Community Development and Biodiversity Conservation', conducted from May 1998 to July 1999, followed a year later by the 2nd Phase called 'Year 2000 Activities'. However, the impact of this project on the management of the NNT NPA was constrained by limited budget and the lack of continuity in project implementation.

Following that, a District Upland Development and Conservation Project was implemented, originally planned from 1/4/99 to 30/9/02, but later extended to 30/9/03. DUDCP, a Learning and Innovation Loan, was secured by GoL to improve the livelihoods of local communities, while simultaneously conserving the biodiversity of the Nakai - Nam Theun NPA. Although, this project was not specifically aimed at developing NPA management capacity per se, it nevertheless developed the capacity of selected NPA staff in participatory field management, and in data collection, analysis and interpretation. DUDCP focused on conservation in three sub-watershed zones (Navang, Thapaiban and Teung) through:

i. the establishment of six village-based conservation and monitoring units,
ii. incorporating conservation values into the project's development activities, and
iii. conducting conservation awareness activities in three focal villages.

Thereby contributing to the overall development of a biodiversity management framework.

*Nam Chat-Nam Pan Provincial Protected Area*

The Nam Chat-Nam Pan Provincial Protected Area (NCNP) was established by a notice issued by the office of the Bolikhamxay provincial governor in December 2000. It compromises roughly 650 km² of Wet Evergreen Forest in the Annamite Chain of eastern Bolikhamxay Province, north of National Route 8, roughly between the Nam Chat river and the Vietnam border. The inclusion/exclusion of the NCNP as part of the NT2 Watershed/NPA has been a contentious issue over the course of the development of the NT2 Project. The area had previously been proposed as a 'Northern Extension' to the Nakai-Nam Theun NPA, but this has now been dropped due to the area's designation as a provincial protected area.

The key issue in respect to the NCNP has been the relatively limited extent of Wet Evergreen Forest in NNT and the apparent importance of this habitat to the rare Saola (*Pseudoryx nghetinhensis*). Based on available evidence, the NCNP with its predominant wet evergreen forest, is thought to be a major

*[3] The area of the NT2 Watershed/NPA, prior to reservoir impoundment is 4,240 km², fractionally larger than the current area of the Nam Et Phou Loei NPA which is 4,230 km², and likely more if boundary revisions are approved.*

stronghold of the Saola. It is the only site in Lao PDR (and only the second in the world) where a wild Saola has been photographed.

There has been concern, that without the funding support that would be available if it were considered part of the NT2 NPA Watershed, effective management of the NCNP would not be possible. However, experience to date and prospects for future funding, as described in the following two paragraphs, tends to indicate that these worries are largely unfounded.

In December 2001 Bolikhamxay Province completed preparation of a five-year management plan for the protected area. The plan is brief, but impressive. It addresses the key issues, but avoids overambition. It includes provision for a modest field headquarters and staff, and plans for patrols (quite detailed), rural conservation education, zone delineation and participatory planning of local resource use and development. The core management staff of five have been appointed in name, but are apparently not yet based in the area. The five-year plan requires a budget of US $108,000, which is currently being sought (Robichaud, 2003).

The Central Lao Conservation Fund, to be established under the umbrella of the Lao Environment and Conservation Fund, intends to provide financial support for the central Lao protected areas surrounding NNT including Phou Hin Poun, Hin Nam Nor as well as the NCNP. A draft version of these arrangements has now been finalised and is expected to be completed at the end of 2004, following national and international disclosure (See Section 4.1.2.3).

#### *4.1.3.2: NNT Faunal Diversity Survey, Research and Management*

Apart from the fisheries work of Dr. Maurice Kottelat in 1989, the first biodiversity field survey in the NNT NPA was conducted in 1994 under the cooperative program of the Department of Forestry's Center for Protected Areas and Watershed Management and the Wildlife Conservation Society, culminating in the report: "A Wildlife and Habitat Survey of Nakai-Nam Theun National Biodiversity Conservation Area" by Timmins, R. J., and T. D. Evans (1996). Additional field studies were carried out by WCS, and included areas such as the previously proposed northern extension and the corridor to Phou Hin Poun NPA, and a study on the Saola and reptiles, as reported in Summary of Saola, herpetological and wildlife trade studies in NNT NPA and proposed NT Extension, by Robichaud and Stuart (1999). Also published in 1999, the Saola Conservation Action Plan for Lao PDR proposed a specific action plan to conserve the rare Saola.

The NTSEP/IUCN project, carried out in two phases, also supported wildlife surveys as part of field training to the NPA monitoring and patrolling staff, police, military and village volunteers. Similarly, Boonratana's work (Boonratana, 2001; 2002a; 2003) with the DUDCP ensured that the NPA monitoring and patrolling staff and the Village Conservation and Monitoring Units also continuously recorded all observations of wildlife, therefore further adding to, or confirming the faunal database. They also provided data sets for monitoring trends in abundance of selected species, hunting pressure and habitat disturbance.

Intensive work on the Asian elephants on the Nakai Plateau was undertaken by Dr. Ramesh Boonratana in 2000 for NTSEP/IUCN Year 2000 Activities, and by an M.Sc. student, Mr. Khamkhoune Khounboline in 2001, supervised Dr. Arlyne J Johnson (WCS) and Dr. Ramesh Boonratana (IUCN consultant)

#### *4.1.3.3: NNT Floral Diversity, Research, and Management*

Very little work has been undertaken on the floral diversity of the NNT NPA, or on its management. Apparently, the early work of Vidal did not include any studies or field trips to the Nakai Plateau or any of the areas within the NT2 Watershed/NPA.

In 1995 WCS engaged Mr. Phengsintham (NUOL) to study the vegetation in the Ban Navang area of the NNT NPA. In 1997, as part of the NTSEP funded project to develop the ESMP for the NNT NPA, James K Jarvie conducted a brief overview of flora and habitats. He described habitats but decided not to survey the occurrence of, or name any tree species, as he considered much more work (in terms of time and detail) was required to be sure that identification was correct, especially as their was likely to be many species new to science in the area.

Possibly the most detailed study of the flora has come from various studies of plants or plant parts used by villagers, termed NTFPs. Information on the use of NTFPs in the area can be found in reports of six missions, as follows:

i. Foppes et al, 1997, undertook a short mission for NTEC from 26/2 to 30/3 1997 (reported in The use of Non-Timber Forest Products on the Nakai plateau, Foppes et al, 1997) in which they conducted a rapid survey in five villages on the Nakai Plateau, which has easier access to markets and are more exposed to logging activities than villages in the NPA villages. They found that villagers could identify 306 species of NTFPs: 223 food products and 67 non-food products, with damar resin "khisi", fish/frogs, edible rattan shoots ("san", "boun"), cardamom, and wildlife considered the most important forest products. In addition, village groups estimated income derived from NTFPs at 76% of an average family compared to livestock sales of 16%. While income from NTFPs was higher among the wealthy families than among the poor families, NTFPs were the only source of income for the poor families, therefore essential for them.

ii. The Environmental and Social Management Plan for the Nakai-Nam Theun Catchment and Corridor Areas (IUCN, 1998) noted the earlier CARE study as suggesting that villages outside the NPA (lower Nam Theun area) have a much higher cash income than the villages inside the NPA (upper Nam Theun area), however gathering of NTFPs is relatively much more important for the people inside the NPA.

iii. In 1998 Ingles et al, conducted NTFP investigations in four villages, three type-1 (Ban Makfeuang, Ban Nameo, Ban Vangkhouay) and one type-3 village (Pak Katan) (reported in Rapid survey of the use and Government regulations of non-timber forest products from the Nakai-Nam Theun NPA). Village communities could enumerate 303 types of NTFPs: 279 food products (plant foods 131, animals 148) and 24 non-food products, and on average, local people estimated 54% of family income to be derived from NTFPs, compared to 42% from livestock, 4% from crops. Local people also relied heavily on NTFPs for subsistence needs. They also need a continued trade surplus from selling NTFPs to obtain rice, other external goods and services.

iv. The "Final report, Nam Theun Social Environmental Project, Year 2000 Activities" by IUCN reported that NTFPs in 6 Brou villages provided 53% of the average family cash income of 403,776 kip per family in 2000, against livestock 32% and labor 15%.

v. A diagnostic survey on farming systems, agroforestry and NTFPs by the DUDCP found that villagers could identify 450-470 NTFPs, and suggested that current gathering/hunting systems may provide more economic returns than the swidden and settled farming. The project was of the opinion that depletion is unlikely to occur for some NTFPs, but is a serious threat for some commercial products that include wildlife, rattans and agarwood.

vi. In 2001 the DUDCP engaged Joost Foppes to carry out a brief but detailed review of NTFPs in three NPA villages, who could enumerate up to 510 NTFPs. Results of the review showed that NTFP contributed to only 24 % of the income, and larger percentage of the NTFPs were consumed or used.

*4.1.3.4: Biodiversity Protection (DUDCP Supported)*

The first phase of the NTSEP project (1998/9) encouraged a participatory approach to biodiversity protection by establishing three Village Conservation Monitoring Units (Ban Thamuang, Ban Makfeuang and Ban Maka), with occasional participation from the District and Provincial Police, the NPA staff, and the DAFO staff from Bolikhamsay Province (Boonratana, 1998). However, these units lasted only for the project's duration. Besides establishing the monitoring units, the project attempted the enforcement of rules and regulations regarding wildlife use and trade, and proactively maintained dialogues with enforcement agencies such as the police and army.

In 2000 the NTSEP project indirectly provided biodiversity protection in the Nam Theun Corridor through a six-month study on movements and seasonal migration, which involved the long-term participation of the NPA staff, the District Police and the District Army (Boonratana, 2000). In the process, several hundred snares and traps (for both large and small animals) were destroyed or confiscated, and several poaching, fish bombing, and wildlife trading incidences were reported to the

District governor's Office. This resulted in a temporary reduction in the poaching of fauna and flora until not too long after the project ceased its activities.

Again from end of 2000 until early 2001, four Village Conservation Monitoring Units (Ban Thamuang, Ban Navang, Ban Makfeuang and Ban Teung) from three zones in the Nakai-Nam Theun NPA were again re-established by the DUDCP with each unit comprising six villagers, mostly militiamen and village heads or their deputies (Boonratana, 2001). The units were backstopped by an NPA staff member assigned to each zone, and by a VCMU facilitator covering all three zones. This was later extended to include two additional villages (Ban Xonglek and Ban Nameuy) in 2002 (Boonratana, 2002a). The units and their members were given basic field equipment (tents, sleeping bags, compasses, binoculars, jackets, shoes, etc.) and per diems for their effort. Since, their establishment the units successfully curbed illegal activities such as wildlife poaching and trading, fish harvest using explosives and poisons, and agar wood poaching and trading, and have lead to the arrest of several offenders.

In addition to providing biodiversity protection, the units collect monthly monitoring data for the presence of wildlife, and impacts on wildlife and habitats. Hence, establishing the first set of monitoring data for the NPA, and possibly the first set of monitoring data in the region to be gathered by villagers with little or no formal education. An analysis of the two years monitoring data gathered by the VCMUs have shown that there is a relative increase in species abundance, a relative decrease in hunting pressure, but a relative increase in disturbance on the habitats (Boonratana, 2003). However, VCMU activities are expected to end when the project field activities end in June 2003.

Besides establishing the units, the project through the VCMUs developed simple local rules and regulations with respect to harvesting of certain biodiversity resources, which has lead to an increase in fish supply to some villages. The project further incorporated conservation criteria into village agreements for livelihood improvement assistance, and made all project personnel (short and long term) sign an agreement that they would not partake in any activity that is contradictory to conservation practice.

In 2001/2002 the NPA with some seed funding from NTEC established and trained another unit in Ban Maka along the same lines as the DUDCP's VCMUs, but this unit was active only for a short period due to limited funding.

#### *4.1.3.5: WMPA Sub-Committee Implementing Conservation Activities*

Following the passing of Decree 25 establishing the WMPA, the WMPA's first BoD meeting established two sub-committees, one being "The sub-committee implementing conservation activities in the NT2 Watershed"[4] which, with funds provided by NTPC, has and continues to undertake the following activities;

*Public Outreach and Awareness Raising*

The organization of public meetings for over 70 villages around the NT2 Watershed/NPA (15 meetings in Khamkerd District for 38 villages, and 22 meetings in Nakai, Gnommalath and Boulapha Districts for 39 villages) in order to inform villages of:

- The background and progress of the NT2 project;
- Passing of Decree 193 (establishing the two corridors as part of the NPA and the resettlement area as forest only for resettlers);
- Declaration 03/BKX regarding the establishment of Nam Chat Nam Phan PPA;
- Forestry Law of 1996; and PM's Order 15, especially on the section dealing with the prohibition of logging in the NT2 Project Area.
- The preparation and broadcasting over local TV and radio stations of messages similar to those given in the public meetings (above);
- The participatory placement of signboards around the NPA and its corridors. NPA boundary demarcation has already been completed along the entire length of the PIZ involving some 289

[4] *A second sub-committee was also formed, the 'sub-committee to establish the organization and staffing for the WMPA's Executive Secretariat'. The SEMFOP-1 document is the result of this sub-committee's work.*

kilometers. Actual demarcation on the ground involves the steps described in Table 4.3. The first SEMFOP Annual Workplan includes budget for demarcation of the southern boundary adjacent to the reservoir. This work will be completed by June 2005.

**Table 4.3: Summary of steps used in boundary demarcation.**

| Step | Tasks |
|---|---|
| 1 | The boundary line is surveyed and a path at least a meter wide is cut along it. In some areas this line must first be swept for UXO. This line is further marked with red paint on trees and rocks at least every 10m and on either side of rivers and roads as appropriate. Stakes should be used where grassland areas are crossed. |
| 2 | The length of the boundary path is measured. |
| 3 | Metal signs of standard specification are placed every 50-60 meters along the boundary line. |
| 4 | Numbered concrete bollards of standard specification are placed every 500m. |
| 5 | Detailed 1:25,000 mapsof the boundary are produced and provided to relevant agencies. |

*Patrolling and Enforcement*

The sub-committee is providing support to 6 patrolling and enforcement units as follows:

1. Nam Kata (Khamkerd) - 15 soldiers, 10 days patrolling per month;
2. Ban Maka - 3 Police and 3 Army (at Ban Seuk);
3. Houaphu - Forestry Staff;
4. Ban Thalang - 6 Police/Army staff;
5. Ban Nam Nian - 6 Police/Army staff; and
6. NPA Centers (LiL) - support for extra 5 days per month patrolling.

These units undertake forest patrols - about 10 days per month or as information is obtained relating to possible illegal activities. These units not only patrol but also conduct enforcement such as apprehension of persons trapping or illegally trading in wildlife or NTFPs. They also seize goods and weapons or tools and, if the wildlife seized is still alive, release them back to the forest.

## 4.2: Baseline Data

### 4.2.1: Introduction

This section aims to summarize the state of knowledge of the bio-resources of the Nakai-Nam Theun National Protected Area (the NT2 Watershed/NPA), specifically:

- the area's natural flora;
- the area's natural fauna; and
- human use of these flora and fauna resources

It is intended to cover all taxa for which there is existing information, although fishes are not treated in depth because they are the subject of a separate report.

The first biodiversity field survey of NNT NPA was conducted in 1994 under the cooperative program of the Department of Forestry's Center for Protected Areas and Watershed Management and the Wildlife Conservation Society (Timmins and Evans, 1996). Several major surveys followed over the next few years, led by DoF and STEA, and financed by the NT2 Electricity Consortium and the World Bank

### 4.2.2: National and Global Significance of NT2 NPA Biodiversity

Following are some of the independent assessments that have been made of the importance of NNT:

- An analysis of existing and proposed national protected areas in Laos according to three aspects of their forest cover: extent, quality, and the significance of its representation in its bio-geographic sub-unit, showed NNT to have the country's most important forest cover. (Berkmüller et al., 1995)
- A review of Indo-Malayan protected areas rated NNT as "globally significant" (MacKinnon, 1997).
- Ling (1999) ranked existing and proposed Lao protected areas using a complementarity algorithm based on vertebrate diversity. Complementarity is a step-wise analysis that picks the most diverse site first, and then selects subsequent sites, one at a time, that add the most new diversity to the set of sites picked before it. Ling analyzed sites based on three criteria: i) all bird species, ii) threatened birds, and iii) threatened mammals. NNT ranked first or second for all criteria, and highest overall of all sites analyzed, leading this researcher to comment that the "NNT clearly emerges as the lynch-pin of the Lao protected areas network..."
- A recent participatory review of the Lao national protected areas system included a prioritization of the importance of the NPAs (Robichaud et al., 2001). NPAs were assigned to ranked categories of value according to their importance for biodiversity, watershed protection and ecotourism potential. NNT was the only protected area that ranked in the highest category in all criteria.
- WWF-US compiled a global priority list of the 200 ecoregions of highest significance in the world for biodiversity conservation, "The Global 200" (Olson and Dinerstein, 1998). Nakai-Nam Theun is both the core and the largest protected block, in their "Annamite Range[5] Moist Forests" ecoregion.
- WWF-Indochina recently coordinated a comprehensive analysis of conservation priorities in a complex of ecoregions covering parts of Laos, Vietnam and all of Cambodia, termed the "Forests of the Lower Mekong Ecoregion Complex" (Baltzer et al., 2001). One of the priority landscapes identified in this complex is the "Northern Annamites". Its conservation importance is rated "Critical" (the highest category). NNT is more than twice the size of any other gazetted or decreed protected area in this complex.

In a separate analysis, Conservation International listed the Indo-Burma hotspot, where NNT is geographically located, as one of the world's 25 threatened ecoregions (Mittermeier et al., n.d.). The hotspot concept use plants as the baseline criterion, followed by respectively, and finally, the degree of threat. The Indo-Burma hotspot is both one of the richest and most heavily impacted of all the hotspots. According to the best available information, the Indo-plant and vertebrate endemism and diversity, Burma

*5 Known as the Sai Khao Phou Leung mountain range in the LaoPDR.*

hotspot is home to over 300 mammal species, over 1000 bird species, over 400 reptilians, and over 200 amphibians. It boasts the highest freshwater turtle diversity in the world, and an amazing array of mammals that include the recently discovered Saola and large-antlered muntjac, both of which occur in the NNT. Within the Indo-Burma hotspot, the NNT and adjoining protected areas on both sides of the international border form a large forest complex, which is the focal point of biodiversity for this hotspot (Boonratana, 2002).

#### *4.2.2.1 Diversity of habitats*

NNT is dominated by extensive dense semi-evergreen, evergreen broadleaf, and mixed deciduous forest and significant areas high-quality pine forest on the Plateau. As noted above, the broadleaf forest of NNT has the highest quality and highest conservation importance of all forests in existing or proposed NPAs in Laos. In fact, the NNT NPA may harbor the highest quality semi-evergreen/evergreen forest block in Laos, Vietnam, Yunnan (China) or Thailand. Although there is little detailed knowledge of plant species composition, the NNT forest is known to be extraordinarily rich. In just one village (Ban Navang), the inhabitants can name 466 local non-timber plant products that they use for food, construction material, medicine, trade and other purposes. This is more than twice the amount named by any other village elsewhere in Laos. A study of rattans found 14 species, including *Calamus kingianus* which is known only from riverine habitats on the Nakai Plateau and from a handful of sites in northeastern India.

### 4.2.3: Flora and Forests

#### *4.2.3.1: General Status of the Baseline Data*

The gap between (i) 'the significance of any NNT biological resource', and (ii) 'the information known about that resource' is greatest for flora or vegetation. The well-known work of the French botanist Vidal apparently did not include sampling from the NNT, and since 1995 there have been only six short-term studies that focussed on the flora, of which four focussed on locally-used non-timber forest products. The studies to date are:

i. A short study on natural forest tree species around Ban Navang (western sub-watershed area) in 1995 by P. Phengsintham of the Dong Dok University (supported by WCS).
ii. A description of habitat types and general aspects of forest ecology by Jame Jarvie in 1997, which did not include any plant collections or species identifications (for IUCN's ESMP of the NTSEP).
iii. A study of the use of NTFPs by five villages on the Nakai Plateau in 1997 by Foppes and three Lao colleagues (for NTEC).
iv. A study of NTFPs in the NPAs in 1998 by Ingles a and three Lao collegues (for IUCN/NTSEP).
v. A brief mission to collect rattan specimens from a small area of the NPA in 1999 undertaken by Tom Evans of the Oxford Forestry Institute.
vi. A relatively short but detailed study of the use of NTFPs in three villages in the NPA (Ban Makfeuang, Ban Navang and Ban Teung) undertaken by Foppes in 2001 (for DUDCP).

It should be noted that the reports of Phengsintham and then Foppes gave extensive species lists of plant names using the local Lao language, with many matched to scientific names, although often only to the genus level. However, at least in the case of the NTFP studies, the scientific names were assigned not by examination of the specimens, but by translation (carried out in Vientiane) from the local Lao names. This is an unreliable method, especially for an area that is apparently distinctive, but little known as NNT NPA.

Surveys for commercial timber trees, and possibly rattans, were carried out by the Bolisat Phatthana Khet Phoudoi (BPKP) and/or by the Provincial Forestry Offices, but this information could not be accessed.

In summary, most of the studies to date did not involve the systematic collection and identification of specimens. Thus, in spite of the likelihood that the NNT may contain a number of new species and even genera, there has been little systematic study of the vegetation of NNT. Consequently, with the exception of the rattan study, it is not possible to draw a reliable list of known plants from the studies to date, since the accuracy of the identifications is subject to doubt.
The proposed training and capacity development work to by Edinburgh Botanic Gardens, be funded under the Darwin Initiative, is expected to lay sound foundations for the future work needed to ameliorate

the current situation of poor botanical information. This grant has the objective of providing practical and theoretical training in tropical plant taxonomy to major institutions associated with biodiversity documentation, protection and utilisation in Lao PDR.

This project will focus on the NNT NPA for field work and, in cooperation with NAFRI, will train up to 30 Lao counterparts over 3 years in tropical plant taxonomy, data management and field techniques. It is expected that this initiative will lay the foundation for a National Plant Species Database and the establishment of a Threatened Plant list. It will also produce an up-to-date multilingual botanical dictionary and thus allow previously inaccessible botanical texts to be used throughout the Lao PDR.

#### *4.2.3.2: Scientifically-Designated Forest and Habitat Types*

To date there are three scientifically based classifications of the forest and habitat types of NNT. These are briefly summarized below:

*Classification by The Forest Inventory and Planning Centre (FIPC)*

With support from the Lao Swedish Forestry Program, MAF's Forest Inventory and Planning Centre prepared forest cover maps for the whole country (the first maps produced in 1992), including the NNT NPA and its adjoining areas. The categories the FIPC used include:

| | | |
|---|---|---|
| dry evergreen | coniferous forest | unstocked forest |
| mixed deciduous | mixed broadleaf/coniferous | savannah |
| dry dipterocarp | forest plantation | grassland |
| gallery forest | bamboo | scrub and other (non-forest) categories |

In general, these forest categories have various shortcomings, especially when applied to the forest of the NNT NPA (see analysis by Jarvie, 1997). In addition, the FIPC developed these forest cover maps from satellite photo interpretation with limited ground-truthing and with no reference to aerial photos. These two factors together render this forest type categorization for NNT neither realistic nor practical.

*Classification by WCS Lao PDR*

In 1995 and 1996, scientists supported by WCS differentiated habitats of NNT while carrying out biological surveys. Their classification was based on the structural and wildlife community distinctiveness, rather than botanical associations. The major habitat types they used include: where:

| | |
|---|---|
| Upper montane forest | Plateau pine/semi-evergreen forest mosaic |
| Cypress forest | Evergreen/semi-evergreen |
| Upper dry evergreen | Wet evergreen |
| Lower dry evergreen | Cultivation, scrub and other degraded habitat |

The researchers themselves recognized the limitations of these categories, and that in reality there is a continuum between the different habitat types. Both WCS researchers and FIPC used elevations to assist in their classifications, which apparently is not a good indicator of habitat type. As Jarvie (1997) noted, it was possible to possess a species-rich Dipterocarp forest at one location, whereas another location at the same altitude may be dominant with Fagaceous species.

*Classification by James Jarvie*

As mentioned above (Section 4.2.3.2.), until the flora of the area is much better understood, it is impossible to make an accurate ecological map of the area. Nonetheless, Jarvie (1997), supported by IUCN Lao PDR, probably presented the best organization of habitats and their probable occurrence based on the following hierarchy:

- Major habitat (or forest types)
- Sub-habitat (or forest type)
- Dominant vegetation forms or genus/species
- Occurrence
- Current known distribution
- Description

A tabular analysis of habitat based on this hierarchy is presented as Table 4.8.

**Table 4.8: Forest habitats of NNT ( Jarvie, 1997).**

| Major habitat | Sub-habitat | Vegetative form | Occurrence | Known distribution | Description |
|---|---|---|---|---|---|
| Lowland semi-evergreen | Mixed species | | Very common | Dominates the core NPA. | Many areas are species rich, with a canopy dominated by a variety of species, often Dipterocarpus: and Shorea of the Dipterocarpaceae, various members of the Fabaceae, and the species Pinus merkusii and Keteleeria evelyniana of the Pinaceae. |
| | Dominant | Lagerstroemia | Common | Riverbanks of the Nam Xot, around villages of PhonKeo & Ban Nameo. | Lagerstroemia: Lythraceae dominates the canopy. |
| | Dominant | Bamboo | Common | Mainly in disturbed forest around current villages, and old village sites. | Bamboo dominating either the sub-canopy. It results from past disturbance |
| | Dominant | Palm | Common (?) | Based on helicopter observation, common in southern parts NPA. | Palms dominate either the canopy or sub-canopy. |
| Lower montane | Fagaceous | | Common | Dominates higher elevations | The family Fagaceae (oaks) dominate. The habitat is montane. In terms of tree species, it is less rich than lowland evergreen forest, yet nonetheless shows a high degree of diversity. |
| | Fagaceous - Cypress | Fokienia | Rare | Occurs in the Upper Nam Xot (and Nam Phan Nam Chat PPA) | Fokienia hodginsii (Cupressaceae) is the sole species of its genus, and known only from Lao PDR, Vietnam and China. It occurs in montane forest on, and marginally below, ridge tops at 1000m ASL and above. There are possibly other important species of cypress present such as Calocedrus macrolepi, |
| Upper montane | Cloud | | Rare | Seen on Phou Laoko, a mountain > 2000 m that harbored the largest endemic vertebrate fauna for a cloud forest in the NPA as a whole. | Cloud forest is a wet habitat found principally on high ridges and mountaintops. The family Ericaceae generally dominates trees species. They are relatively short, often appear stunted, and are generally covered in moss. Ferns and lichens are common. |

| Major habitat | Sub-habitat | Vegetative form | Occurrence | Known distribution | Description |
|---|---|---|---|---|---|
| Pine | Pine dominant | | Locally common | In the plateau area. | Pinus merkusii is the dominant species where it appears to represent the pinnacle of a fire climax succession, in which large evergreen species are few, and usually absent. |
| | Dominant, with dry dipterocarp | | Rare | In the plateau area. | Characterized by a mixture of pine and dry Dipterocarp forest, dominated b the pine. |
| | Dominant with evergreen | | Locally common | In the plateau area. | Characterized by a mixture of pine and mixed evergreen forest, dominated by the pine. |
| Riverine | | | Frequent | By the slower watercourses in all parts of the NPA. | Riverine habitat occurs by permanent streams. Trees are normally relatively small, and herbs are common. Banks may be seasonally flooded. |
| Deciduous | Dry Dipterocarp | | Rare | Only in the plateau area | A lowland deciduous habitat, generally on shallow soils and often scrubby in aspect. Dipterocarpus is the dominant tree genus. |
| Scrub | Low scrub | | Occasional | Near all villages that have had continual agriculture. | Highly disturbed habitat covered by small woody and weedy species. Not a regenerating forest. |
| | Bamboo | | Occasional | Near all villages that have had continual agriculture. | Highly disturbed habitat covered in bamboo and with attempts to define the area few, if any trees. |
| | grass | Imperata | Rare | Hmong encroached area of Phou Pang | Highly disturbed habitat dominated by the grass, Imperata cylindricans: Poaceae. Fires common. |
| Secondary | Early regenerating | | Common | Near all villages that have had continual agriculture. | A regenerating area with trees providing good ground cover, about 5-20 years old. |
| | Late regenerating | | Common | Near all villages that have had continual agriculture. | A regenerating area with trees providing good ground cover, > 20 years old. |

*4.2.3.3: General Forest Types – Amalgamated Classification*

Thus based on a combination of WCS and Jarvie's classifications and descriptions, the following general forest types could be described.

*i) Pine Forest and Pine/Semi-Evergreen Mosaic Forest*

Common on the Plateau at 490-623 m elevation, where pine may be the pinnacle of a fire climax succession. It occurs in a range of stands with Pinus merkusii (Pinaceae) clearly dominant, to areas of mixed pine and semi-evergreen forest. In unlogged areas dominated by P. merkusii, the species comprises 27.5% of all stems and more than 50% of tree basal area, with Schima (Theaceae) comprising about 15% of stems and 12% of basal area. Characteristic of the unlogged pine forests of the Plateau is low tree density, but large tree size. In one study, the average diameter of all trees larger than 10 cm dbh was 57 cm.

*ii) Semi-Evergreen Forest*

This is the dominant forest type of the NPA, and common from 500 m to higher than 1000 m. It represents a continuum of forest types, in some areas grading into more strictly evergreen forest, and in others to mixed deciduous forest. Many areas are species rich, with a canopy formed by a variety of species including Dipterocarpus and Shorea of the Dipterocarpaceae and various species of Fabaceae, and sometimes the genus Keteleeria. In other more deciduous areas, Lagerstroemia (Lythraceae) dominates, such as along the banks of the Nam Xot river and some areas of the Nam Pheo watershed. In the southern portions of the NPA, large palms dominate.

*iii) Wet Evergreen Forest*

Occurs at mid-elevation (roughly 500 - 900 m) near the Vietnam border, and has evolved due to winter monsoon rains from Vietnam that penetrate the border in areas of moderate elevation, rather than falling on the Vietnamese side of the Annamite ridge. Although most of the NPA receives only occasional rain in January-March, the wet forests sit under extended periods of dense, low cloud and frequent, light rain. Annual precipitation can exceed 2,500 mm, with only 1-3 months of dry season, and the air temperature is markedly lower than elsewhere in the protected area. This may be the preferred habitat of rare species such as the Saola. Plant endemism is expected to be high, and wet evergreen forest is one of the most globally significant habitats in the NPA.

*iv) Cypress Forest*

The cypress Fokienia hodginsii (Cupressaceae) occurs uncommonly, on dry ridges above 1000 m. Trees can grow very large, probably to 40 m tall and 2 m diameter. The species has been assessed as Near Threatened by IUCN. Where the tree occurs it usually makes up 5-30% of the canopy cover, and may occur in mixed associations with oaks (Fagaceae). Found in, at least, the upper Nam Xot and Nam Theun watersheds.

*v) Fagaceous Forest*

Oaks dominate in high, dry areas, probably above 800 m. The NNT Fagaceous forest has high tree diversity, but not as rich as semi-evergreen forest.

*vi) Ericaceous Cloud Forest*

Rare in NNT, at high elevation. Cloud forest, a wet habitat, is often dominated by shrubs and small trees, such as rhododendron. Ferns, mosses and lichens are common. Found on a few high summits that are kept wet with frequent mists and fogs (such as the summit of Phou Vang in the south)

*vii) Dry Dipterocarp Forest:*

Rare, found only on parts of the Plateau.

*viii) Secondary Forest:*

Regenerating forest is a dense formation common near most villages with continual agriculture. It is characterized by trees providing good ground cover, about 5-20+ years old. Just when a forest ceases to be 'secondary' and becomes one of the other forest types has no easy answer. In any case, some areas that are now 'good' forest in NNT may have previously been cleared for cultivation.

*4.2.3.4: Natural Habitats Accounting*

A Natural Habitats Accounting conducted in 2003 by Malaysian Environmental Consultants (MEC, 2003) estimated that approximately 12,500 ha[6] or 3.55% of the original NNT NPA had been lost due to the boundary changes created by PM Decree 193. Of this, the combined total of lower value habitats (permanaent agriculture, unstocked forest and swidden) account for over one third of all the land lost. The mixed broadleaf/coniferous habitat suffers the largest total loss, but on a percentage basis this only accounts for a little over 10% that habitat type. The other higher value habitats (evergreen and mixed deciduous) together account for only about 5% of the area lost.

*4.2.3.5 Indigenous Habitats and Forest Types*

The forest and habitat types described in 4.2.3.2 are those developed by science based researchers, usually with little reference to local understanding or villager concepts of forest type. This, with the exception of the NOFIP/FIPC categories, some of which (in their Lao language version) are similar to commonly used village expressions of the forest type. However, no detailed study has been undertaken to identify the categorization of these various forest types identified by villagers, if indeed there are any. It may be that indigenous villagers categorize their forests more by their location ('along a stream', 'on a hill' or 'ridge'), or with regard to the main species they extract, or an event that occurred therein, rather than any system of forest typology.

*Spirit forest*

Nonetheless, some studies have noted that a significant portion of the forest of NNT NPA is divided into spiritual territories by the residents (Chamberlain, 1997; Culas, 2001). These territories and the spirits residing in them play a fundamental role in people's day-to-day lives, determining where, when and how they can travel through the area, where new fields should be cleared, which animals can/cannot be hunted, and so forth. The extent to which the location and disposition of these spirit forests are dependent on the morphology and quality of the forests, however, is poorly known.

*4.2.3.6: Tree and Plant Species*

The only list of tree and plant species comes from a short survey in forests around the Ban Navang area, conducted by Phengsintham (1996). The list of 141 species found (Table 4.9) is compiled from eight transects and general observations, and the researcher was confident enough to give names at the genus or species level to 129 species. These included 5 species, which he gave scientific names but for which no local name could be associated.

*4.2.3.7: Rattans*

Table 4.10 lists the 14 rattan species scientifically identified to date in NNT and on the Nakai Plateau by the one study of T.D. Evans and Lao colleagues in 1997. A species of special concern is Calamus kingianus which is known only from the banks of rivers on the Nakai Plateau, and a handful of northeastern Indian sites. The relationship of the two populations is in question, and the Plateau specimens may prove to be an endemic species. While they may be heavily impacted by the NT2 project, there are likely to be undiscovered populations both upstream from the inundation area and at other sites across northern Indochina.

**Table 4.10: Rattans recorded from the Nakai-Nam Theun NPA and the Nakai Plateau.**

| | | |
|---|---|---|
| 1. Calamus viminalis | 6. Calamus kingianus | 11.Calamus wailong |
| 2. Calamus poilanei | 7. Calamus bimaniferus | 12.Daemonorops jenkinsiana |
| 3. Calamus gracilis | 8. Calamus rhabdocladus | 13.Korthalsia sp. |
| 4. Calamus henryanus | 9.Calamus nambariensis] | 14. Plectocomia pierreana |
| 5. Calamus solitarius | 10.Calamus platyacanthoides | |

Source: Evans, T.D., K. Sengdala, O.V. Viengkham and B. Thammavong. 2001. A Field Guide to the Rattans of Lao PDR. Royal Botanic Gardens, Kew. Kew, U.K.

*4.2.3.8: NTFP Species*

6 *This does not include habitat conversion or degradation in the corridor zones caused by road and dam construction.*

Local communities of the NPA know and use an unusually high amount of NTFPs. Local people can enumerate more than 500 different products collected from the forest, almost three times more than in other parts of Lao PDR. However, many of these species have not yet been scientifically identified, as there is a gap between local ethno-botanical knowledge and botanical records kept by the GOL.

Nonetheless, some understanding of the occurrence and diversity of plant species can be gleaned from those NTFPs collected and used by villages in the NPA. A list of those species enumerated as used by three NPA villages in 2001 is given later in Table 4.11. While this list requires scientific verification, it does provide some indication of the diversity of the NTFPs in the surrounding areas.

### 4.2.4: Use of Flora

#### *4.2.4.1: Timber*

*Commercial logging*

Commercial logging has previously occurred in three area of NT2 Watershed/NPA:

i. Logging of indeterminate legal status in the upper watershed in the early and mid-1990's, targeting mainly Fokienia spp[7]. Helicopter removal of logs required clearing an area about 30 metres in diameter around each felled tree, which when combined with tree felling resulted in significant habitat damage. In addition, the loggers reportedly hunted extensively. At the same time, construction began on a road through the core of the protected area to reach the timber, but its construction was eventually halted, again following a WB mission

ii. Transborder timber poaching along the international border in which high value trees, including Fokienia spp are cut and removed overland with teams of men or water buffaloes.

iii. Sanctioned logging of the NT2 inundation zone on the Nakai Plateau and some encroachment logging in areas outside the inundation zone. Encroachment logging has included some areas north of the edge of the proposed reservoir, which was halted following the GOL/WB logging mission in the year 2000. The main species taken on or around the plateau were pine and Dalberghia.

A history of logging has been ongoing on the plateau for the past 20 years. This has been primarily under a concession by GoL to the state enterprise BPKP. From the early 1980's, BPKP has developed and expanded its timber operations. Intensive and systematic logging was conducted to the north and east of the plateau throughout the 1980's, and then later on the plateau itself. In 1984 Decree 188 gave BPKP the mandate to develop Lak Sao from a small community to a significant township using locally felled timber.

After the start of the NT2 Project, BPKP was directed to focus its logging operations on the reservoir inundation zone. The volume of timber extracted from this area rose from earlier levels of 20,000-40,000 $m^3$ per year to nearly 300,000 $m^3$ per year in 1977 (Prosser, 1997). The rate of extraction fell between 1997 to 1999 and no recorded logging has occurred since 2000. It is estimated that a total of 1,556,000 $m^3$ of unfelled timber still remain in the inundation zone as of the end of 1999.

*Customary logging and wood use*

Villagers fell and saw wood for two main purposes, to build houses and to build boats. House construction requires different types of timber for different purposes, ranging from support beams, walls, roof beams and even roof tiles. The ability to make such houses depends on money or assets. A family must have money or barter goods to hire people to saw logs, make planks and transport the wood. A poor family only has enough spare time to make a rough pole and bamboo house as compared to a square support pole and sawn plank house of a better off family. A village with timber constructed house is therefore considered wealthy.

Data on the number of houses constructed from timber in the NT2 Watershed/NPA is unavailable. Similarly, there is no data on the number of boats, but this is expected to be small. As a rule, such customary use of timber is not seen as a problem or threat in NPA villages. Firewood is another category of wood use, although some may regard it as a non-timber forest product.

[7] Fokienia *is the most valuable timber tree species in Laos, with logs valued at around a US$1000 per $m^3$. Its distribution in NNT is patchy and restricted to areas near the Vietnam border. The species is considered globally Near Threatened by IUCN.*

*4.2.4.2: NTFPs Non-timber(and non-wildlife) Forest Products*

There are four distinguishable classes of human use of NTFPs in the NT2 Watershed/NPA:

i. subsistence use (local consumption) by residents;
ii. subsistence use (local consumption) by non-residents (villagers from outside NNT NPA);
iii. commercial harvest by residents; and
iv. commercial harvest by non-residents.

However, it is only practically possible to obtain relatively clear data on NTFPs from residents of NPA villagers (class i and iii) as all their harvests would definitely be from the NPA. Various studies have confirmed the local understanding of plant NTFPs by NT2 Watershed/NPA residents is extraordinarily rich. These studies include:

- A study of four villages in which 303 NTFPs were enumerated, of which 279 are food products (131 plants and 148 animals), and 24 are non-food products (Ingles et al., 1998).
- A 1997 study of three villages on or near the plateau enumerated 306 species, of which 223 are food products (including 59 wildlife species) and 67 are non-food products (Foppes et al., 1997).
- A 2000 study in the three main villages of the DUDCP which identified between 450-470 NTFPs.
- A 2001 study in which three villages enumerated about 510 plant products used. Of these, 297 are used for food and 169 for construction materials, medicine, and for other uses, as summarized in Table 4.11 (Foppes/DUDCP, 2001).

Of the total number NTFPs or plants enumerated in these three villages, a NUOL botanist was confident enough to put a scientific name to 353 species (Table 4.12), although this identification was not verified by reference to the actual plants, or plant parts.

These combined lists of NTFPs, identified by the villagers, are far more than those listed by villagers in any other area yet studied in Lao PDR. This could be attributed to some combination of:

- the exceptional richness of the forests in NT2 watershed/NPA;
- the high reliance of the local population on forest products; and
- the very intimate knowledge of local people on the biodiversity and ecology of the forest.

*Abundance*

NT2 Watershed/NPA villagers report that plant NTFPs used for subsistence purposes are still abundant. This is unusual in the Lao PDR, therefore indicating high forest quality. Those harvested for commercial sale, however, have declined, as shown in a comparative analysis (Table 4.13).

**Table 4.11: Classes of NTFPs listed by 3 communities, upper Nam Theun, May 2001.**

| Use category | Ban Teung | MakFeuang | Navang | 5 villages lower Nam Theun-'97 | 28 other village in Lao – '97 |
|---|---|---|---|---|---|
| Food Products | 120 | 96 | 297 | 124 | 237 |
| Fruits | 40 | 19 | 63 | 51 | 87 |
| Seeds | 7 | 4 | 38 | - | - |
| Flowers | 4 | 6 | 45 | - | 4 |
| Leaves | 28 | 26 | 54 | 40 | 86 |
| Stems/shoots | 20 | 19 | 35 | 17 | 22 |
| Roots/tubers | 11 | 9 | 31 | 7 | 22 |
| Mushrooms | 10 | 13 | 31 | 9 | 16 |
| Non-food products | 120 | 79 | 169 | 70 | 204 |
| Fiber products | 66 | 35 | 116 | 24 | 48 |
| Medicines | 25 | 27 | 36 | 43 | 52 |
| Exudates | 15 | 4 | 6 | 3 | 10 |
| Ornamentals | 14 | 13 | 11 | - | 92 |

**Table 4.13: current abundance and availability of selected important NTFPs.**

| Typical products | Past Situation | Present Situation | Trend | Typical causes of change | Solutions |
|---|---|---|---|---|---|
| Almost depleted | | | | | |
| 1 Agarwood "Po heuang" | could cut 30-500 threes in 1 hour (NV) | cannot find more than 1 tree in 2 days | Totally Reduced) | Villagers cut agarwood for selling | -Protect remaining trees<br>- plant new trees |
| 2 Gibbons "Thani" | See gibbons within 3-5 minutes walk | Cannot see gibbons within 2 days walk | Reduction 480:1 | -People eat them<br>-Slash-and-burn reduces tall gibbon forests | -Protect remaining animals<br>-Designate no-hunting, no-slash-and-burn zones |
| 3 Big rattans "Thoun" | One man could get 60 kg in 1 hour or 10 stems in 2 hours | -A man needs 3 hours to find 20 kg or 12 hrs for 5 stems ) | Reduced 90% | Villagers cut and sell - in 1994 Navang sold 100,000 stems | - Protect remaining stands (villages must agree, join in protection scheme)<br>- Planting trials |
| Declining, but still easy to find | | | | | |
| 'Boun' rattan shoots | One man can get 10 shoots in 1 hour | Same (MF)<br>Same reduction as 'toey' (BT) | 1:1<br>6:1 | This plant often regrows in fallow | No problem perceived, no action needed |
| 'Nor mai' bamboo-shoots | Can collect 1 basket (12 kg) in 1 hour(BT) | Now get only 1 kg in 1hour (BT) | 12:1 | More people in the village, Some bamboo died | No problem perceived, no action needed |
| 'Kho' leaves | > cut 50 leaves in 3 hours (NV)<br>> 30 leaves in 2 hours (BT)<br>> 50 leaves in 6 hours (MF) | > 5 leaves in 4 hrs (women)<br>> 50 leaves in 1 day (men)<br>> 30 leaves in 1 day (BT)<br>> no change (MF) | 13:1 women<br>4:1 men<br>4:1<br>1:1 | Trees suffer from slash-and-burn, eating of young shoots, more use of leaves for houses | Many families already protect the remaining "kho" trees in their fields. Some have started to plant "kho" trees near houses. |

| Typical products | Past Situation | Present Situation | Trend | Typical causes of change | Solutions |
|---|---|---|---|---|---|
| 'Toey' pandan leaves | > Find within 10 min. village(BT) > 1 bag in 6 hours (MF) | need to walk 1 hour to find (BT)<br>No change (MF) | 6:1<br>1:1 | Village grows, more people need mats | No problem perceived |
| 'Pa' fish | One man can get 1 kg in 1 hr | It takes 4 hours to get 1 kg | 4:1 | 1: Less water(deep area fill up with sand)<br>2: outsider buy, fish<br>3: used explosives,<br>4: population increase | > make fish ponds ?<br>> don't cut trees near the river<br>>designate special no-fishing zones |
| ' Farn' muntjak deer | You could see one in 30 minutes | It takes 1-2 day to see one | 50-25:1 | hunting by villagers | protected areas, hunting rules |
| No decline, or stable | | | | | |
| forest vegetables | Plenty | Plenty | No change | | Not needed |
| mushrooms | Plenty | Plenty | No change | | Not needed |
| palm shoots | Plenty | Plenty | No change | It grows in fallows | Not needed |
| 'wan chod' medicine | Plenty | Plenty | No change | | Not needed |
| 'ki si' resin | Plenty | Plenty | No change | Lack of market | Not needed |
| banana flowers | Plenty | Plenty | No change | | Not needed |

*Relative importance*

Table 4.11 lists in order the most important plant NTFPs ranked by men and women combined in three villages in as studied in 2001 (Foppes et al.,) and their status, as assessed by the respondents. Again, the trend in the NT2 Watershed/NPA villages - where non-food NTFPs, and mainly housing and handicrafts NTFPS are ranked high - is dissimilar to most other Lao villages where food NTFPs are seen as the most important. Table 4.14 also confirms anecdotal evidence that most subsistence products are still widely available, but some of the products sold for cash are becoming rare. There is no other area in Lao PDR where NTFPs are still considered to be so abundant as in the upper Nam Theun area.

**Table 4.14: Rank order of important plant NTFPs in 3 villages in NPAs (after Foppes 2001).**

| NTFP | Women | Men | combined | Use | Status |
|---|---|---|---|---|---|
| Palm leaves "Kho" | 32% | 40% | 72% | Roofing, walls | MD |
| Small rattans "Vai" | 26% | 25% | 51% | Handicraft, food | - |
| Pandan leaves "Toey" | 38% | 11% | 49% | Handicraft | MD |
| Rattan shoots "Boun, San" | 8% | 36% | 45% | Handicraft, Food | Boun: MD; San: NC - I |
| Cardamom "Mak neng" | 18% | 26% | 44% | Sale | I |
| Bamboo-shoots "Nor mai" | 25% | 16% | 41% | Food | MD - I |
| Bamboo canes "Mai pong" | 1% | 36% | 37% | Handicraft, food, housing | - |
| Parashorea resin "Khi si" | 7% | 24% | 31% | Sale | NC |
| Big rattans "Thoun" | 4% | 14% | 18% | Sale | SD |
| Agarwood "Po heuang" | 4% | 11% | 15% | Sale | SD |
| Forest vegetables "Phak" | 7% | 3% | 10% | Food | NC |
| Medicinal herb "Wanchod" | 5% | 0% | 5% | Medicine | NC |
| Wild galangal “Houa kha” | 0% | 3% | 3% | Condiment | - |
| Palm shoots “Keuang” | 3% | 0% | 3% | unknown | - |
| Edible tubers “Man” | 3% | 0% | 3% | Food | - |
| Forest fruits “makfai, mak ngen” | 1% | 0% | 1% | Food | - |
| Incense bark “Yang bong” | 1% | 0% | 1% | Sale | - |

SD: severe decline, MD: moderate decline, NC: no change, I: increase

*Relative income from commercial NTFPs*

Estimating income from NTFPs is difficult, and information presented must be used with caution as sale/income often varies widely from year to year, depending on:

i. a purchaser or a market for the product,
ii. the availability of the product in the forest,
iii. an assessment by villagers of the value of effort expended compared to potential income.

A summary of income estimated from NTFP studies in the NPA and on the plateau is given in Table 4.15.

**Table 4.15: The contribution of NTFPs to family cash income of communities in the Nam Theun area, estimates from various sources, 1997.**

| Source | Date | Area | Method | Total (kip) | % NTFP | % Livestock | %Others |
|---|---|---|---|---|---|---|---|
| Foppes et al.,. | 1997 | Lower NT | Ranking | - | 76% | 14% | 10% |
| Foppes et al., | 1997 | Lower NT | Interviews | 204,038 | 41% | 32% | 27% |
| IUCN | 1998 | Lower NT | interviews | 514,307 | 64% | ? | 36% |
| IUCN | 1998 | Upper NT | interviews | 174,307 | 65% | ? | 35% |
| Ingles et al., | 1998 | Upper NT | ranking | - | 54% | 42% | 4% |
| IUCN | 2000 | Upper NT | interviews | 403,776 | 53% | 32% | 15% |
| Uncited | 2001 | Upper NT | ranking | - | 24% | 26% | 50% |
| Average | | Plateau | | | 60% | 15% | 25% |
| Average | | Upper NT | | - | 49% | 25% | 26% |

In comparing NTFP income with income from other activities, the most recent study of 2001 reported that men and women ranked Livestock and NTFPs as the most important sources of cash family income, providing each about a quarter (26%) of all family cash income (see Table: 4.16).

**Table 4.16: Villager's ranking of cash income sources, 3 villages, upper Nam Theun, May 2001**

| No | Income source | Ban Navang | | B. Mak Feuang | | Ban Teung | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | W | M | W | M | W | M | W | M | All |
| 1 | Livestock sales | 10 | 9 | 9 | 8 | n.a. | 10 | 25% | 26% | 26% |
| 2 | NTFPs | 9 | 25 | 6 | 5 | n.a. | 5 | 19% | 28% | 24% |
| 3 | Selling crop products | 7 | | 8 | 7 | n.a. | 2 | 20% | 10% | 14% |
| 4 | Selling alcohol/tobacco | 8 | 5 | 3 | 2 | n.a. | 8 | 13% | 14% | 14% |
| 5 | Labour | 6 | 5 | 4 | 8 | n.a. | 2 | 13% | 14% | 14% |
| 6 | Selling fish* | 5 | | | | n.a. | 3 | 5% | 3% | 4% |
| 7 | Selling wildlife* | | 6 | | | n.a. | | 0% | 4% | 2% |
| 8 | Handicrafts* | 6 | | | | n.a. | | 6% | 0% | 2% |
| | Total no Scores | 51 | 50 | 30 | 30 | | 30 | | | |

W: Women; M: Men

If fish, wildlife and handicrafts are also considered as NTFPs, then NTFPs are the most important source of income (34%). Men and women agree on the importance of products such as livestock, selling alcohol/tobacco and labor. However, selling NTFPs and wildlife gets more points from the men's group, and handicrafts from the women's group. This may indicate a gender division, but this is uncertain, as the survey team observed more men working on handicrafts than women.

In the rest of Lao PDR, the average share of family income derived from NTFPs is around 50%, but villages close to rich forests received up to 90%. One would expect a similar high percentage for the upper Nam Theun area, where villagers know and use such unusually high numbers of NTFPs. It may well be that the reasons that villagers in the upper Nam Theun derive comparatively lower income from NTFPs is due to: (I) the high level of available NTFPs for subsistence consumption reduces the need to buy food, and thus the need to commercialize NTFPs; and (II) the difficult access to markets reduces their ability to sell NTFP products.

*Aquilaria (Thymelaeaceae):*

The fragrant wood of this evergreen tree is the most valuable forest product by weight in the Lao PDR. It

has been virtually eliminated from the NNT NPA, as in most other areas of the Country. This probably explains why NT2 Watershed/NPA villagers didn't rate it as important during recent assessments of their most important NTFPs. The following account of the trade in Aquilaria is taken from the Saola Conservation Action Plan for Lao PDR - Revision (Robichaud, 1999):

> *"In recent years two forest products have drawn an intense concentration of poachers into the Saola's mountainous habitat in eastern Laos. One is the heartwood of a broadleaf tree of the genus Aquilaria. Young Aquilaria trees are occasionally attacked by a particular fungus, or insect, and infected trees respond by producing a resinous compound into the heartwood of the growing tree. This special wood is very fragrant, and is valued as a luxury incense in Muslim countries. In Laos it is known variously as may dam ("black wood"), my ketsana, or may heuang (royal wood). The local price reported in 1999 for I kg. of good quality may dam was US$2500 (the average annual per capita income of Laos is US$350 [Lao PDR State Planning Committee 1998]), and consequently nearly every corner of the most remote Lao forest has been scoured for may dam, and almost none is left. Poachers now dig for poor quality, low-value may dam 'crumbs' in the root structures of trees destroyed previously."*

Intense searches for the wood over the years have probably had knock-on effects on wildlife in the NPA, as it stimulated large groups of men (mostly from neighbouring countries) to probe the most remote areas of the NNT NPA in search of the last Aquilaria. While camped for weeks in the NPA, they sustained themselves by hunting and snaring, and harvested other commercial products such as turtles.

*Rattans:*

Table 4.17 lists the uses by humans of each rattan species identified in NNT and on the Nakai Plateau. Rattan has been so intensively harvested for trade that it is now nearly depleted. Residents of Ban Navang reportedly cut and sold 100,000 canes in 1994 alone. Much of the problem lies with large quotas issued to Lao traders or directly to foreign merchants. Khammouane Province has ceased issuing rattan quotas, but villagers in the Khammouane portion of NNT still harvest rattan to fill quotas issued by Bolikhamxai Province. Particularly hard hit has been the most commercially valuable rattan species, *Calamus poilanei.* While it may already, or soon be commercially extinct, biological extinction is a more distant threat for this and other rattans, since rattans have a long seedling stage that can buffer the population against short-term over harvesting, and most species are multi-stemmed.

**Table 4.17: Rattans and rattan use in the Nakai-Nam Theun NPA and the Nakai Plateau.**

| Species | Current Or Potential Uses |
|---|---|
| Calamus viminalis | handicrafts, trade, food |
| Calamus poilanei | handicrafts, trade (most valuable in Laos), food |
| Calamus gracilis | handicrafts, trade, food |
| Calamus henryanus | handicrafts, food |
| Calamus solitarius | handicrafts, trade, food |
| Calamus kingianus | handicrafts; other uses unknown |
| Calamus bimaniferus | handicrafts; trade unknown |
| Calamus rhabdocladus | handicrafts, trade, food |
| [Calamus nambariensis] | handicrafts, trade; food unknown |
| Calamus platyacanthoides | handicrafts, trade, food |
| Calamus wailong | handicrafts, trade, food |
| Daemonorops jenkinsiana | handicrafts, trade, food |
| Korthalsia sp. | uses unknown |
| Plectocomia pierreana | handicrafts, food |

Source: Evans, T.D., K. Sengdala, O.V. Viengkham and B. Thammavong. 2001. A Field Guide to the Rattans of Lao PDR. Royal Botanic Gardens, Kew. Kew, U.K.

*4.2.4.3: Other Human Use of the Forest*

*Crop agriculture*

The predominant (or at least, most obvious) human use of the forest in NT2 Watershed/NPA is swidden agriculture. The forest - either primary or regenerating - provides essential nutrients for the cultivation of rice, cassava and vegetables. It undoubtedly also plays a role in local climate moderation, and may act as a source of either crop pests (e.g., wild pigs) or crop pest controls (e.g., small carnivores that consume rodents).

Paddy cultivation is less widespread in the area (being practiced in the protected area most extensively by the Sek people), and is less directly dependent on the forest than swidden. However, it probably also benefits from the forest services of climate moderation, maintenance of stream quality (for irrigation) and pest control (alternatively, the forest may contribute pest problems, such as crop-raiding wildlife).

*Grazing*

The undergrowth of forest in some areas of the NPA is apparently burned by residents to promote grazing forage for large livestock. Its extent and impact are little understood, however. Buffaloes and cows are also allowed to graze in the forest and along stream edges. Again, the extent and impact of this are poorly known.

### 4.2.5: Rivers and Streams

*4.2.5.1: General Status of the Baseline Data*

Waterways and their associated flora are among the most important habitat features of the NNT NPA for humans, wildlife and aquatic biodiversity itself. The watercourses of NNT vary from wide slow-moving rivers, to steep, rushing, perennial or annual streams. Water quality is generally very high.

The significance of the Nam Theun River is well known. In addition, small streams in Indochina, particularly on the western slope of the Sai Phou Leung range, have distinctive and diverse faunal communities (including high endemism), and are therefore of high conservation priority. Given the dependence of rural Lao on fish as a source of protein, these are also of high importance to food security. One study attempted to characterize the importance of the watercourses of NT2 Watershed/NPA by taking threatened species of birds as an indicator, as presented in Table 4.18. Data on the flora and other fauna of this important habitat is lacking, or non-existent.

**Table 4.18: types of stream in the NPA, and key bird species ( Timmins and Evans, 1996):**

| Altitude | Description | Key waterbird species |
|---|---|---|
| < 600m | Lowland sluggish rivers and streams with still, deep pools; few rapids; high banks; still backwaters, many sand banks. | White-winged Duck<br>Blyth's Kingfisher<br>River Lapwing, Fish-eagles |
| < 600m | Faster rivers and streams with many rapids; few pools; very few backwaters; in steep terrain. | Crested Kingfisher<br>Blyth's Kingfisher, fish-eagles |
| < 600m | Faster rivers and streams with long deep pools; fewer backwaters and sand banks; in hillier terrain. | White-winged Duck, Blyth's Kingfisher,<br>Crested Kingfisher, River Lapwing. Fish-eagles |
| 600-800m | Fast rivers and streams with many rapids; rocky beds; steeper terrain; fast tributaries. | Blyth's Kingfisher, Crested Kingfisher<br>fish-eagles |
| > 800 m | Steeply descending streams; shallow with few pools | Crested Kingfisher |

*4.2.5.2: Human use of Riverine habitats*

The most widely used habitats other than forest are rivers and streams (although this distinction is a somewhat artificial, since streams are an integral component of the forest). They are a critical source of food for local people (fish, frogs, invertebrates and some edible algae and other plants), and are important sources of water for drinking, cooking, bathing, laundry, mainting large cattle, and in some areas, paddy irrigation. Watercourses are also important for travel for most villagers, either by boat or by foot along their banks. Streams also figure prominently as boundaries of spiritual territories and as the home of some spirits important in local cosmologies.

### 4.2.6: Other Non-Agricultural Habitats

*4.2.6.1: Status of the Baseline Data*

Other habitats have never or rarely been studied by biologists. However, with the exception of scrub habitats, they are minor in extent.

**Savanna:** There are at least three areas of apparently natural savanna (thong) in the protected area. These are large (tens of hectares), nearly treeless grasslands, sharply delineated from surrounding forest. They are apparently natural formations due to very shallow soil on rock, and have not been created or maintained by tree cutting, grazing or burning.

**Marsh:** These are permanently wet areas covered by herbs. There are at least two areas of marsh of about 3 ha each that occur in the NPA (but there may be more), in the vicinity of Ban Nameo. The habitat is more extensive on the Plateau, and these areas may include permanent small pools.

**Scrub:** Occurs occasionally near villages. Characterized by a coverage of small woody and weedy species that shows no evidence of regenerating into forest. Scrub is possibly perpetuated by livestock grazing (such as seen near villages along the banks of the Nam Pheo).

**Imperata Grassland:** Uncommon in the area, and confined mainly to areas of repeatedly burned and cultivated hillsides in the northern reaches of the protected area where Imperata cylindrica (Poaceae) has taken over. There is evidence from Thailand that Imperata grass areas can be regenerated to forest,but the process is slow (personal communication, G. Zwack, CARE).

*4.2.6.2: Human Use of other Habitats*

On the plateau, pools and wetlands are probably an important source of food for local people, and less so where such features occur in the uplands. Savanna areas visited during surveys showed no evidence of grazing or other use by local people, probably due to their remoteness from any village.

### 4.2.7: Fauna - Invertebrates

*4.2.7.1: Status of the Baseline Data*

Given the diversity of terrestrial and aquatic habitats in NNT, high diversity can be expected of invertebrates (insects, crustaceans, spiders and other arthropods; worms, and). However, this taxonomic group in the NT2 Watershed/NPA is virtually unknown to science.

The only published survey of any invertebrate group is a one-week study of aquatic snails in the general area of the NT2 project site, with a focus on their potential for disease transmission (Lohachit, 1997). Although this report has imprecise collection-site information, and it is not possible to verify if specimens were collected inside the boundaries of the NPA, the list does include a "*Nam Nian*" collecting station, which might be just inside the boundary of the NPA. Table 4.19 gives a list of the snails collected during the survey in the Nakai Plateau.

**Table 4.19: Snails recorded from the Nakai Plateau.**

| | |
|---|---|
| Clea helena | Melanoides tuberculata |
| Pila pesmei | Helicorbis umbilicalis |
| Sinotaia mandahlbarthi | Corbicula spp. |
| Idiopoma umbilicata | Pseudodon mouhoti |

Source: Lohachit, C. 1997. Freshwater Snails in the Nam Theun 2 Project Area of Khammoune and Bolikhamxai Provinces, Lao PDR. TEAM Consulting Engineers Co., Ltd., Bangkok.

*4.2.7.2: Human Use of Invertebrates*

One study found that the village of Ban Navang uses at least 62 varieties of terrestrial insects for food, and 21 varieties of aquatic invertebrates ("other water animals" besides fish, amphibians or reptiles). While these may be an important supplementary protein source, no invertebrates or their products (such as honey) were listed by either men or women among the 20 most important NTFPs in three villages surveyed. Nor were any named amongst the most important NTFPs in villages on the Nakai Plateau.

Nonetheless, the frequency with which wild honey, snails, crickets and various insect larvae are sold in the markets in Lak Xao and Nakai suggest that invertebrates play a role in local economies and livelihoods. As fish resources decline from overexploitation, increased pressure on aquatic invertebrates such as snails and crustaceans can be expected. There is increasing commercial harvest in the forests of Vietnam for showy beetles for sale to collectors, and this extraction has probably reached the NT2 Watershed/NPA.

### 4.2.8: Fauna – Fish

*4.2.8.1: Status of the Baseline Data*

A general fish survey of Nam Theun (NT) and Xe Bang Fai (XBF) drainages was conducted in 1996 (Kottelat, 1996, 1998). In 1997, several surveys were conducted in other drainages to clarify the endemic or non-endemic status of the fish species inhabiting NT and XBF drainages (Kottelat, 1997). In 1997 and 1999 additional surveys were conducted in other drainages (unrelated to the NT2 project but with support from World Bank; Kottelat, 2000a-b, 2001). In 2002 and 2003, surveys were conducted in the Nam Gnouang (NG), NT and XBF, targetting distribution and ecological data of two species believed to occur only in the area impacted by NT2 project (Kottelat, 2002, 2004a).

The creation of an adequate fisheries baseline will be necessary for monitoring and evaluation purposes (See Table 6.7 in Section 6.5.1) and will be an urgent priority under SEMFOP (Section 6.5.1.1) because the aquatic fauna will be severely impacted immediately with the beginning of the construction phase.

*4.2.8.2: Occurrence*

There is a great diversity of freshwater habitats in Lao PDR and much of the Indochina fish diversity is concentrated in the country. Fish diversity is known to be much higher in the streams and basins on the west (or Lao) side of the Annamite drainage than on the east (Vietnam) side (Kottelat, 1989). Furthermore, fish distribution in Laos is patchy and localized, with high endemism (sometimes to a single stream).

69 species are known from the NT drainage; on the basis of available data, 11 are endemic to the NT+NG drainage. Out of the endemic species, 3 are known only from the NT. All the endemics have been found outside the area which will be impacted by the project (that is, above the reservoir level or in the Nam Gnouang), but the habitat of one of them (Scaphognathops theunensis) is almost totally within the area impacted by NT2 and Theun-Hinboun.

The 2002 and 2003 surveys yielded 6 species not previously recorded from the NT+NG drainages and 8 new records for the NT. This indicates that the fish fauna of the drainage is not yet fully known. 165 species are known from the XBF drainage, 4 of them presently known only from that drainage; all the endemic species have been recorded in the upstream areas which will not be impacted by NT2 project. An estimated 50 additional species should be expected to await discovery in the XBF drainage.

Several species undertake small distance migrations along the NT. These migrations have not yet been studied, but at least for the endemic species, it seems that habitat suitable for all stages of the life cycle is present in the non-impacted areas. The impact on the migratory species in the XBF will be significant due to the number of species migrating between the Mekong mainriver and the XBF.

*4.2.8.3: Human Use of Fish*

Human use of fish in the NNT is high. Villagers in Ban Navang listed 35 varieties of fish they consume (it should be noted that this might include a few species labelled 'fish' in local taxonomies but not in western scientific ones, such as softshell turtles). Men often rank fish as their most important NTFP. Five villages on the Plateau named 28 species they use, and they ranked fish and frogs together as their most important NTFP (equally with "khisi" resin) (Foppes et al., 1997). In addition to being consumed locally, some fish is sold to outsiders, but the extent of this is unstudied. Fish are also extracted in bulk by outsiders, including trans-boundary traders crossing into the upper watersheds of the NT2 Watershed/NPA. Explosives are often used, although again, the relative severity of this is unstudied and its extent unknown.

In three villages in the NNT, fish were included in a category of NTFPs that have declined significantly, but were still reasonably easy to find. Villagers report that formerly it took one hour to catch 1 kg. of fish, and now it takes four hours. Foppes (2001) attributes the decline to:

- changes in stream morphology (cause unspecified);
- fishing and purchase of fish by outsiders; and
- former use of explosives by villagers.

The likely impact of the NT2 dam on fish of the Nam Theun tributaries in the NT2 Watershed/NPA has been little discussed or studied. Migratory species (moving seasonally between streams in the NPA and the Nam Theun river) could be seriously affected, with an impact on local livelihoods. There is also a potential threat to natural fish resources in the NPA by the development of aquaculture systems and the introduction of species which are not native to the area. For this reason, the WMPA will not support any aquaculture development activities which use non-native fish species. It is considered that existing native species still provide adequate potential for aquaculture.

### 4.2.9: Fauna - Amphibians and Reptiles

#### *4.2.9.1: Status of the Baseline Data*

Amphibians and reptiles have been moderately covered by surveys. There have been focused surveys in selected areas in some seasons, but there is undoubtedly much that remains to be discovered. Only very limited work has been done on the Nakai Plateau. The herpetofauna in NNT is roughly as well-known as in other NPA's surveyed in Lao PDR, but much less than some other protected areas in Southeast Asia.

#### *4.2.9.2: Occurrence*

Table 4.20 lists the 25 species of amphibians and Table 4.21 the 29 reptiles identified in the NNT NPA and the Nakai Plateau to-date. Six reptiles are Globally Threatened or Near Threatened and a further six are of national conservation concern. No amphibian species are known to be of conservation concern.

**Table 4.20: Frogs recorded in the NNT National Protected Area and on the Nakai Plateau.**

| Family | Species | | Family | Species |
|---|---|---|---|---|
| ICHTHYOPHIIDAE (caecilians) | Ichthyophis sp. | | BUFONIDAE (true toads) | Bufo galeatus |
| MEGOPHRYIDAE | Leptolalax pelodytoides | | RANIDAE | Amolops cremnobatus |
| (Asian horned frogs) | Leptobrachium pullum | | (typical frogs ) | Huia nasica |
| | Megaphrys lateralis | | | Limnonectes kuhlii |
| | Ophryophryne poilani | | | Rana microlineata |
| RHACOPHORIDAE | Polypedates feae | | | Rana andersonii |
| Tree frogs: | Polypedates leucomystax | | | Rana archotaphus |
| | Rhacophorus bisacculus | | | Rana johnsi |
| | Rhacophorus calcaneus | | | Rana limnocharis |
| MICROHYLIDAE | Kalophrynus pleurostigma | | | Rana livida |
| Narrow-mouthed frog | Microhyla annamensis | | | Rana maosonensis |

| | | | |
|---|---|---|---|
| | Microhyla berdmorei | | Rana nigrovittata |
| | | | Rana taipehensis |

**Table 4.21: Turtles and reptiles recorded in the NNT NPA and on the Nakai Plateau.**

| Family (and common names) | Species | Global/national status |
|---|---|---|
| PLATYSTERNIDAE | | |
| Asian leaf turtle | Cyclemys dentata | |
| Big-headed Turtle | Platysternon megacephalum | EN |
| EMYDIDAE | | |
| Indochinese Box Turtle | Cuora galbinifrons | CR |
| Chinese Three-striped Box Turtle | Cuora trifasciata | CR |
| Keeled box turtle | Pyxidea mouhotii | |
| Four-eyed Turtle | Sacalia quadriocellata | EN |
| TESTUDINIDAE | | |
| Elongated Tortoise | Indotestudo elongata | VU |
| Impressed Tortoise | Manouria impressa | VU |
| TRIONYCHIDAE | | |
| Asiatic Softshell Turtle | Amyda cartilaginea | VU |
| GEKKONIDAE (geckos) | | |
| | Cyrtodactylus interdigitalis | |
| AGAMIDAE | | |
| | Acanothosaura lepidogaster | |
| | Calotes emma | |
| | Calotes versicolor | |
| Water Dragon | Physignathus cocincinus | PARL |
| ANGUIDAE (legless lizards) | | |
| | Ophisaurus sp. | |
| VARANIDAE | | |
| Bengal Monitor | Varanus bengalensis | PARL |
| Water Monitor | Varanus salvator | PARL |
| SCINCIDAE (skinks) | | |
| | Lipinia sp. | |
| | Mabuya multifasciata | |
| | Scincella reevesi | |
| BOIDAE | | |
| Reticulated Python | Python reticulatus | PARL |
| COLUBRIDAE | | |
| Wall's Bronzeback | Dendrelaphis cyanochloris | |
| Hampton's Slug Snake | Pareas hamptoni | |
| Chinese Mountain Keelback | Pseudoxenodon bambusicola | |
| Indochinese Ratsnake | Ptyas korros | PARL |
| Common ratsnake | Pytas mucosus | PARL |
| Red-necked Keelback | Rhabdophis subminiatus | |
| Mountain Keelback | Sinonatrix aequifasciata | |
| Checkered Keelback | Xenochrophis piscator | |
| Oriental whip snake | Ahaetulla prasina | |
| Green cat snake | Boiga cyanea | |
| ELAPIDAE | | |
| King Cobra | Ophiophagus hannah | PARL |
| VIPERIDAE | | |
| White-lipped Pit Viper | Trimeresurus albolabris | |
| Checker-backed Pit Viper | Trimeresurus mucrosquamatus | |

| Family (and common names) | Species | Global/national status |
|---|---|---|
| Pope's Pit Viper | Trimeresurus popeiorum | |

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; PARL = Potentially at Risk in Lao PDR

*4.2.9.3: Human use of Amphibians and Reptiles*

The village of Ban Navang can name at least 20 types of amphibians and 32 reptiles they collect from the forest, mainly for food and trade. This is far more than other villages surveyed elsewhere in Lao PDR (Foppes, 2001). Frogs are harvested for consumption or local sale and, based on experience elsewhere, this may have resulted in population declines in some areas. The principal threat to the herpetofauna of the NPA is the collection of reptiles for the international trade, and this threat is severe. Snakes and turtles are intensively sought and, to a somewhat lesser degree, monitors, agamids and geckos. In 1997, prices realized by villagers were reportedly the equivalent (at 1997 exchange rates) of US$50/kg for some species of snakes, $15/kg. for softshell turtles, $2 each for Indochinese Box Turtles, and $1 for geckos.

Very high prices resulting in intense trade has decimated a Critically Endangered species, Chinese Three-striped Box Turtle (or tao kham, 'golden turtle'). The following account of the of the trade in golden turtles is taken from the Saola Conservation Action Plan for Lao PDR - Revision (Robichaud, 1999):

> *"...The other highly sought product is Tao kham, or "golden turtle", probably Chinese Three-striped Box Turtle Cuora trifasciata. The species is valued in Chinese medicine as a cancer cure (Yoon 1999). Virtually all "golden turtles" collected in Lao PDR (usually with the aid of trained dogs) go to neighbouring countries. From the mid-1990s, as over harvesting made the species rarer and rarer, the local price for a I kg animal climbed from $100 to nearly $700, and can reach $1200 from dealers in China. Like Aquilaria, "golden turtles" were once fairly common in the Sai Phou Leung mountain range but have been nearly wiped out in the past ten years. As a result, poaching pressure has turned to other commercially valuable wildlife, principally pangolins (now $100 for a 3-4 kg. animal), other turtles, snakes, primates, and large mammals such as cats, bears and wild cattle. Because the large mammals are usually taken by snares, this shift in pressure poses a great threat to Saola."*

To give an indication of the catastrophic nature of the decline, in 1998 an official (and resident) of the Nameo sub-district estimated that 5 years ago, two villages in the area found between them about 300 'golden turtles' annually, but now [in 1998] they have found only about five per year.

The intense turtle trade in NNT is a recent phenomenon, with the market reportedly developing only since the late 1980s. In 1998 the deputy village chief of Ban Mak Feuang reported that ten years previously villagers often left Indochinese Box Turtles unmolested, and only occasionally collected them for food. In the previous 2-3 years, however, trans-boundary traders and Lao middlemen began buying them, and in response, villagers started to actively search for them with dogs. Trans-boundary traders also search for turtles directly, probably with at least the same intensity as local residents.

**4.2.10: Fauna – Birds**

*4.2.10.1: Status of the Baseline Data*

Birds are the best surveyed and best known bio-resource of NNT. There are few resident species in the NPA or on the plateau that have not been recorded (although precise identification of some difficult to identify species still awaits), the only biological group for which this can be said.

*4.2.10.2: Occurrence*

The 403 species of birds that have been recorded in recent times in NNT and on the plateau are listed in Table 4.22. NNT has the highest bird diversity of any protected area in the Lao PDR and, with the plateau, is probably surpassed by few if any protected areas in Southeast Asia. Fifteen of the species are Globally Threatened or Near Threatened according to IUCN Red List of Threatened Animals, and an additional 22 species are of national conservation concern (as listed in the Wildlife of Lao PDR). Clearly, NNT is highly significant for bird conservation.

*4.2.10.3: Human Use of Birds*

Hunting of birds by residents and outside poachers is done, for the most part, opportunistically. The species seen with hunters, as remains in villagers, or for sale in local markets are usually those most easily targeted – e.g., green pigeons (Treron) shot or netted as they gather at fruiting trees and mineral licks, or pheasants and partridges caught in ground snares. Residents of Ban Navang named 73 varieties of birds that they kill or capture, mainly for food. None of these, however, are likely to be important components of their diet. Trade in dead birds to markets in Lak Xao and Nakai, while fairly common, is done in small quantities at low prices and probably makes only a minor contribution to local incomes.

Some taxa are captured for the cage bird trade: pheasants, parakeets, doves, mynas, starlings, laughingthrushes and, occasionally, hornbills. By far the most worrisome trade is the live snaring of the globally threatened Crested Argus. This large, rare pheasant is snared on its habitual courtship display grounds (usually a small opening in the undergrowth of a forested ridgetop). The main market seems to be to in neighbouring countries (probably sold to amateur aviculturists). Trans-boundary poachers snare arguses themselves, or resident villagers sometimes catch and sell the birds to them for US$20 - $100 each (1997 prices).

### 4.2.11: Fauna – Mammals

#### *4.2.11.1: Status of the Baseline Data*

The larger mammal fauna has been reasonably well surveyed, although there are probably some species whose presence remains to be confirmed. There has been some focused survey work on bats. One of the largest gaps in the knowledge base is murid rodents and insectivores.

#### *4.2.11.2: Occurrence*

The 92 species of mammals known from NNT are listed in Table 4. 24. Of these, 33-35 are of global conservation concern according to IUCN guidelines, and an additional 24-25 are of national conservation concern. In short, nearly two-thirds of the mammals known from the NNT area merit conservation attention. Among these is a suite of species endemic or near-endemic to central Indochina (and several only to the Sai Phou Leung mountain range and its foothills). Examples are Douc Langur, White-cheeked and Yellow-cheeked Crested Gibbons, Back-striped Weasel, Spotted Linsang, Heude's Pig, Large-antlered Muntjac, Annamite Muntjac, Saola and Annamite Striped Rabbit. For many of these, NNT is the largest and most pristine protected area in which they occur.

NNT's diversity of mammals, and the abundance of near-endemics and threatened species, is a major reason that the area is of the high national and global importance for mammal conservation.

#### *4.2.11.3: Significance of Wild Mammals to the NNT residents*

Mammals play a significant role in the spiritual lives of NNT residents, varying with the residents' ethnicity. One component of this spiritual relationship is the taboo on killing some species. The animal most commonly protected by taboo is Gaur. The most comprehensive set of taboos is probably held by the Kri people of Ban Maka. Their spiritual beliefs bar them from killing most large mammals (and all snakes), specifically all wild cats (with the possible exception of Leopard Cat), bears, dhole, wild cattle, elephants and rhinoceroses. They may kill, apparently, all birds and all other mammals, including primates, civets, pigs, deer and Saola (whether or not this also includes southern serow is not clear). It is little understood (by outside researchers, at least) what impact the decline in populations of animals with which villagers have a spiritual relationship might have on villagers' psychological well-being.

Wild mammals are probably a more important protein source for residents than wild birds, but not at as important as fish. Certain species are hunted because villagers find they taste particularly good, e.g., gibbons, muntjacs, wild pigs and bats. Others are sometimes left unmolested because they taste particularly bad (e.g., hog badger).

Residents of Ban Navang reported 45 varieties of mammals they kill or capture. Villagers in central and western portions of the NT2 Watershed/NPA report drastic declines in gibbons and muntjacs from local hunting. Some species, such as macaques, tiger, pigs, rats and porcupines, are shot, snared or trapped near the village to protect crops or livestock.

The trade value of mammals in general is much higher than for birds. Pangolins, primates, bears, otters, civets, tigers and other large cats, elephants, pigs, sambar deer, muntjacs, flying squirrels, wild cattle and southern serow are captured or killed and sold for either meat, traditional medicines, pets and/or trophies. (Ironically, one of the few large mammals that has little intrinsic trade value is one of the rarest, Saola. This is largely because the species is unknown in the traditional Chinese pharmacopoeia). There is a general trend to send wild meat to nearby Lao towns, and medicinal species to neighbouring countries. The animals are killed or caught by villagers and sold to Lao middlemen or to trans-boundary traders, or they are harvested directly by transborder poachers, the local military, the border police and, to a lesser extent, residents of nearby towns such as Lak Xao and Nakai.

A variety of killing and capture methods are used: guns, snares, crossbows, snap-traps, capturing animals in tree or ground burrows and, for otters, baited hooks set in streams. Although the local provincial and district governments have collected home-made or unathorized guns in the area, village militia retain, and hunt with, large caliber rifles. Snaring is widespread and a major threat.

The most intensely traded mammal is by far pangolins. Indeed, it is unlikely the species can long survive the pressure it is under throughout Lao PDR. Almost all are captured alive (usually by digging them from their burrows) and sold into neighbouring countries. In mid-2002 provincial authorities made a single confiscation of 636 pangolins not far from NNT in Khammouane Province. The animals were being transported by one group of traders in five boats in the direction of the eastern international border.

For reasons of local preference for the taste of wild meat, cultural affinity for hunting, and the trade value of many mammals, it is unlikely that the expansion of livestock raising in the protected area will eliminate the 'need' for people to hunt wild mammals.

*4.2.11.4: Comparative use of fauna*

In surveys undertaken in villages, villager participants often refer to all of the animal and plant products they collect and utilize, and a generalized comparison of fauna and flora use is thus possible – with the exception of those wildlife products that villagers use, consume or sell but will not inform about, as they are illegal.

The ESMP (1998) noted that villages outside the NPA (lower Nam Theun area) have a much higher cash income than the villages inside the NPA (upper Nam Theun area) (see Table 4.24). On the other hand, gathering of NTFPs is relatively much more important for the people inside the NPA.

**Table 4.24: Sources of cash income of 12 villages in and outside Nakai-Nam Theun NPA (from: Environmental and Social Management Plan, IUCN, 1998, part II, p. 36)**

| Location | Ethnic | Unit | Agriculture | Gathering | Hunting | Fishing | Total |
|---|---|---|---|---|---|---|---|
| upper NT | Brou | Kip | 3,383 | 2,310 | 3,012 | 2,675 | 11,380 |
| upper NT | Tai Kadai | Kip | 114,292 | 95,470 | 3,977 | - | 213,739 |
| lower NT | Tai Kadai | Kip | 183,333 | 166,848 | 32,914 | 131,212 | 514,307 |
| lower NT | Hmong | kip | 1,320,096 | 65,092 | 53,185 | 28,251 | 1,466,624 |
| | | | | | | | |
| upper NT | Brou | % | 25% | 70% | 3% | 2% | 100% |
| upper NT | Tai Kadai | % | 53% | 45% | 2% | 0% | 100% |
| lower NT | Tai Kadai | % | 36% | 32% | 6% | 26% | 100% |
| lower NT | Hmong | % | 90% | 4% | 4% | 2% | 100% |

In the 1997 study of 5 plateau villages (Foppes et a.,l) 31 mammals, 24 birds, 13 reptiles and amphibians, 31 fishes and 3 molluscs where noted as foods, and in terms of relative importance, the villages ranked fish as number one and wildlife as number five in importance. In terms of income however, fish were said to be 2nd and livestock 1st, with wildlife, ranked 4th (although all plant NTFPs together received 60.5 % of the counts, and thus together most important).

Chazee found that villagers reported that only a few of the forest products were commercialized such as cardamom, damar resin, rattan, markkaen, dry meat of deer, antlers of deer, muntjac and wild boar. He proposed that there were many other traded products for which information was not given by villagers, including the sale of forest turtle, monitor lizard, pangolin, loris, by-products of cats, gaur, goral, banteng.

The findings of the 2001 study of 3 NPA villages (Foppes et al.) is presented in Table 4.25.

**Table 4.25: Numbers of wildlife used by 3 NPA villages (Foppes et al. 2001)**

| | Ban Teung | Makfeuang | Navang | Total 3 villages | 5 villages on plateau (1997) | 28 other villages in Lao PDR -97 |
|---|---|---|---|---|---|---|
| Animal food products | 145 | 150 | 288 | | 99 | 215 |
| Mammals | 32 | 32 | 45 | | 31 | 54 |
| Fish | 30 | 33 | 35 | | 28 | 50 |
| Other water animals | 30 | 27 | 21 | | 16 | 7 |
| Reptiles | na | na | 32 | | | 38 |
| Amphibians | na | na | 20 | | | 8 |
| Birds | 41 | 33 | 73 | | 24 | 63 |
| Insects | 12 | 25 | 62 | | - | - |

## 4.3: MAJOR THREATS AND INTENDED MANAGEMENT RESPONSES

The strategies for biodiversity management and conservation that address the major threats to be adopted by the WMPA can be described in two ways;

i. Strategies which deal with biodiversity management and conservation as part of the overall and general management of the NT2 Watershed/NPA.
ii. Strategies that attempt to address issues related to specific taxonomic groups.

The general biodiversity management and conservation strategies (Section 4.3.1) which will form the basis of the NT2 Watershed/NPA management plans are considerably more important for the conservation of NNT's biodiversity than the specific priorities listed for each taxon (Section 4.3.2). If they are undertaken effectively, they will address most issues raised in taxon-focused strategies. Nonetheless, taxon-focused strategies enable managers to more clearly identify those issues and responses required to deal with priority issues for threatened taxa. In addition, taxon-focused strategies frequently create public awareness and additional funding. Furthermore, taxon-focused strategies for wide-ranging umbrella species (e.g., tiger and elephant) indirectly provide protection to both habitats and their associated fauna.

The management strategies presented in Sections 4.3.1 and 4.3.2 below are critical for conservation of NT2 Watershed/NPA. While some implementation details are suggested below, and the Operational Plans presented in Part 7 provide activity plans, the appropriate form of the strategy and its implementation will be further developed by consultation between the WMPA and the NPA residents.

### 4.3.1: Biodiversity Conservation Threats and Management Strategies

#### *4.3.1.1: Threats from Ineffective Protected Area Management Capacity*

As is the case in all protected areas across the country (See Section 4.1.2.2), implementation of biodiversity protection in the NT2 Watershed/NPA to date is ineffective due to under-funding, lack of resources and an insufficient complement of capable staff. It is also hampered by insufficient institutional capacity and ability at both the district and provincial level, resulting in low motivation, poor facilities and communication, and unclear lines of authority between the district and province. Ineffective management is one of the major current threats to biodiversity conservation in the NNT Protected Area and the cause of much of the degradation that has already occurred is also largely due to poor management.

Under the NT2 Concession Agreement, the NTPC will provide $US 1 million per year for the entire project operating period of 25 years to fund this current and later SEMFOP phases. These funds will be administered by the Watershed Management and Protection Authority to finance all its operations. The sums involved are considered entirely adequate to develop an effective and well-resourced management plan implemented by well trained and competent staff. The WMPA will be supported in this respect by a technical assistance team comprising long and short term specialists of both national and international extraction, who will assist in developing and implementing the management plans.

Effective and meaningful local participation is considered central to the success of biodiversity management and steps have been taken to mainstream participation under SEMFOP. A Participatory Protected Area Management (PPAM) approach has been adopted for biodiversity management under SEMFOP, and will play a key role in developing and promoting the following important SEMFOP initiatives:

- As an entry point for initiating community rapport and developing participatory processes with villagers.
- Conducting participatory needs assessment and planning of resource use, conservation and livelihood development activities and other interventions to be implemented by the WMPA.
- Fostering community organization and cooperation for community conservation initiatives and the formation of locally-based patrolling and biodiversity conservation teams.
- Defining forest zones, based on traditional uses, which can later be integrated into a more macro NPA zonation system.

- As a first step in developing community networks for stronger and more effective NPA protection and conservation, particularly from trans-boundary and other external threats.

Effective protected area management requires a well designed and workable system of zonation. The NPA zonation process will use FLUPAM to define village boundaries and customary land use zones in a participatory manner. During FLUPAM, these village customary use areas will be overlaid with priority conservation zones or 'hot spots', such as salt-licks, and agreements will be sought to protect these areas. Initially all village customary use areas will be designated as CUZ. This will produce fairly extensive CUZ areas which DUDCP lessons have shown are beneficial for instilling custodianshipand improved protection with villagers (See review of ICDPs in the Appendices of this Volume). CUZ and TPZ boundaries will not be finalized until FLUPAM has been completed and tested in all 31 villages and adequate conservation monitoring information is available from the PPAM program. This will ensure that the final zonation system integrates both traditional land use patterns and needs, and biodiversity conservation priorities.

Effective control of poaching and illegal resource extraction from the NPA will require a strong enforcement and patrolling capacity. Current patrolling efforts are not adequate to address problems over the whole area. Patrols by village militia are limited because they are usually not paid and have other responsibilities; they are also reluctant to patrol far from the village as they are often outnumbered by poachers. The DUDCP 'Village Conservation Monitoring Units' were valuable, but their effectiveness was limited by insufficient manpower – six villagers per village from six villages. SEMFOP strategies to improve patrolling and enforcement will include:

- The establishment of a permanent army and police unit to work with the WMPA, recruited from provincial and district soldiers and district police. These units would be free of any other responsibilities beyond the security of the NPA, and their main responsibility would be to reinforce the village militias, village conservation monitoring units, and the border police, and with them patrol against poaching.
- The adoption of non-confrontational approaches. Professionals are needed to provide support and confidence to the village militias, and to ensure that those patrolling would be free of any compromising relationship with poachers in the area. Activities will initially focus on the problem of crossborder snaring and hunting, and only after confidence and trust has been developed will attention turn to the infractions of local people. Local people's cooperation, rather than fear and resentment, will be critical to success in this regard.
- SEMFOP plans to link and coordinate villages along mini-watershed lines into Watershed Conservation and Development Networks for both conservation and development purposes. A key objective of these WCDNs is to give villages a greater combined strength in patrolling and enforcement which, individually, they currently lack. The areas of responsibility of existing VCMUs, will be expanded to cover the entire sub-watershed, and the patrol and enforcement units will also be re-organised along these same watershed lines and linked more closely with the VCMUs through the network.
- At the start of SEMFOP WCS will conduct training for rangers following 'Wildaid' principles as part of their contract for the biodiversity baseline. A ToR for this has been drafted (see General Annex 2, Folio of Annexures, Volume 2), and a contract is currently being negotiated, and is expected to be signed in May 2005. The intention is to provide the WMPA and its enforcement partners, such as the police and military, with the capacity to field a substantial and effective ground presence throughout the NPA. The training will develop the rangers' capacity in regard to knowledge of the PA and its wildlife, the rules and regulations related to it, the means and purposes of patrolling, proper reporting protocols, and a willingness to use the authority vested in them to enforce laws and regulations, especially relating to hunting and trade in wildlife. The training will cover skills such as organizing field patrols, law enforcement, the national legal framework, first aid, field data gathering, reporting, map reading, GPS skills, and wildlife recognition. Standard training curriculum and materials will be developed and translated into Lao. The aim is to establish 2-3 ranger patrol teams using training of trainer (TOT) techniques. These teams would then be responsible for training other rangers and all VCMUs in the skills and techniques learned. Other tasks of the training consultancy would include:
    - developing a rational system of patrolling for the NNT NPA including patrol routes,

communications systems, reporting

- initially, leading and providing direction and hands-on training to TOT patrol teams
- developing a system of local information gathering on wildlife trade and designing appropriate interdiction strategies
- strengthening collaboration between the WMPA, local police and military officials on control of wildlife trade
- helping to design a system of community wildlife monitoring and enforcement teams
- initiating a program of public education and outreach on wildlife trade issues and
- contributing to the development of an appropriate management information system to integrate ranger patrol data with other forms of relevant NPA management information.

*4.3.1.2: Threats from NPA Communities.*

All NPA communities practice some swidden agriculture, which if allowed to become unsustainable, will lead to the general degradation of natural habitats in the NPA. The current livelihood systems of these communities are also highly reliant on forest resource extraction as sources of protein, vegetables and herbs and as a means of offsetting the chronic annual rice shortages faced by most households. The high rates of population increase occurring in all communities are further exacerbating local livelihood problems and placing ever increasing pressure on the natural resource base.

Local practices are not necessarily detrimental to biodiversity; in many cases are sustainable and in some instances can positively contribute to maintaining biodiversity. It is only when practices become unsustainable (or when they are likely to become so in the near future) that they lead to environmental degradation and change is required.

Under SEMFOP, a Participatory Integrated Conservation and Development (PICAD) approach is proposed, under which livelihood development activities will be designed to promote biodiversity conservation by increasing food production, diversifying livelihood options and developing sustaininable land use systems, thereby reducing reliance on hunting, resource extraction and uncontrolled swiddening. Participatory methods and tools will be used to ensure positive outcomes for both conservation and livelihood development.

As part of the land use planning process 'Village Forest and Land-use Management Agreements' (VFLMAs) will be drawn up with villagers. These will be based on existing land use and customary rules and tenure systems which, through discussion with villagers, are modified, strengthened and improved upon. Emphasis here focuses on drafting agreements that are practical and workable, even if initially they are not entirely optimal from a conservation standpoint. These draft agreements undergo a period of trial, testing and modification before they are finally ratified by the WMPA and district authorities. The VFLMA is an exchange of commitments. Villagers receive formal recognition of their tenure rights and continued legal access to specified areas and resources. Likewise, they make commitments to respect the rules that they helped to create. These rules are recognized to be in villagers' own long-term interests, even though they may limit use of resources in the short-term. In recompense for the restrictions imposed by these regulations, the WMPA will undertake to provide livelihood development activities and support. Through this two-way exchange of commitments embodied in the VFLMA, the protected area management team acquires a dependable partner. The FLUPAM process is described in detail in Section 2.2 and a description of and draft template for VFLMAs is presented in Section 5.4.4.

*4.3.1.3: Threats from Peripheral Impact Zone Communities.*

The NT2 Watershed/NPA has a moderately small NPA population, yet it is surrounded by a large and expanding population undergoing rapid, and in places unsustainable, development. Villagers from areas immediately outside the watershed are having significant impacts on it, and may have an increasingly large influence on the sustainability of the NPA if not managed effectively. Furthermore, as increasing population in this Peripheral Impact Zone (PIZ) places further pressure on existing land resources, some in-migration into the NPA might be expected. Livelihood development support for NPA villagers may

well act as a further stimulus in this respect. Thus the area surrounding the NT2 Watershed/NPA will be included as an integral part of the Operational Plan of the SEMFOP.

The WMPA will undertake education, awareness and appropriate livelihood development activities in the PIZ to ensure that development is compatible with and conducive to management of the NT2 Watershed/NPA. These activities will be targeted according to the level of threat posed by PIZ communities, and where appropriate, NGO's or other donors will be invited to work in these communities so that WMPA resources can be targeted within the NPA itself.

To combat the threat of in-migration into the NPA by the PIZ population, safeguard have been put in place under SEMFOP. Any in-migration is likely to be for two reasons: (i) due to marriage, family re-organization of existing inhabitants, or other compassionate reasons. This type of in-migration will normally be into existing villages and, under the law requires prior approval from the Village Chief and then ratification by the district authorities, and (ii) due to land pressure or perceived benefits accruing to NPA villagers through the WMPA's livelihood development program. This type of in-migration could be into existing villages, but may also involve the establishment of new villages which requires approval from the district authorities. An in-migration control strategy has been developed under SEMFOP which deals with the first type in a fair and sensitive manner, while at the same time imposes adequate checks and controls on the second type.

*4.3.1.4: Threats from Transboundary Incursions.*

Although some depletion of wildlife and NTFPs is due to over-extraction by its residents, of much greater concern, is the intensive and extensive depletion of biodiversity is by transboundary traders and poachers. Several reports strongly suggest that intense transboundary poaching and trading in forest products is the principal threat to the ecological integrity of the NT2 Watershed-NPA.

There is no single, simple and quick solution to these cross-border threats. Rather, a longer term strategy is required, involving a package of measures which together will lead to improvements. The strategy developed under SEMFOP includes: international, national and inter-provincial dialogue, re-orienting access and trade via Nakai, re-organized patrolling, stronger enforcement, better border-post management, community involvement and strengthening, and possible international development assistance in local communities on the Vietnamese side of the border.

The fact that the GOL has now signed CITES (membership will become effective on May 31, 2004) will provide Lao PDR with a powerful alliance of of global allies in its growing determination (evidenced by recent wildlife trade crackdowns in Vientiane) to stop international trade in wildlife. The draft decree establishing the Lao Environment and Conservation Trust Fund (See Section 4.1.2.3) will pave the way for establishing Central Lao Conservation Fund to provide support to the interconnected group of NPAs surrounding NNT.

A proactive dialogue has been established with Government and related agencies and authorities in Vietnam in order to share information and experience and develop appropriate control measures to control trans-border trade in wildlife. This employs a number of mechanisms including province-to-province dialogue, and GOL in collaboration with international agencies working on transboundary issues with the Vietnamese authorities. A number of cross visits between GoL/WMPA and Vietnamese officials have taken place, and these have resulted in regular and frank exchanges of ideas with officials from relevant Vietnamese agencies at both the national and provincial levels. In 2004, cross visits of both Vietnamese and GoL led to the joint development of a Cooperative Action Plan for the control of illegal crossborder hunting, trade and transport of fauna and flora, which was signed in late 2004 (see Section 2.3.7.1). These initiatives will be maintained and intensified under the SEMFOP.

The NPA access strategy aims to re-orient trade through Nakai town rather than across the extremely porous border as exists currently. Under the proposals, the current border crossing in the NPA may be closed and used for patrol and enforcement instead. The plan is to route all access via a well controlled and policed ferry system to Nakai (See Section 4.3.1.5).

The strategy to re-orient trade through Nakai may be further strengthened by supporting womens groups

or appropriate individuals in the establishment of small village stores, where essential household items would be sold at Nakai market prices. The required subsidy from the WMPA would be in the form of transport support or costs rather than in cash. This would enable the required subsidy to be slowly reduced as access and transportation systems within the NPA are developed and improved. The transport of the goods could be linked to VCMUs by establishing and supplying collection points for pick up by VCMUs during their patrols.

Watershed Conservation and Development Networks (WCDN,) will be established to link villages in each of the Nam Theun sub-watersheds for both conservation and development purposes (Table 4.26). By this means, villages will be given a combined strength in enforcement which individually they currently lack By re-organizing patrol and enforcement units along the same mini-watershed lines and linking them more closely with the network's VCMUs, it is hoped to strengthen control over cross-border poaching. Under this proposal, clearly bounded and common monitoring and patrolling/enforcement sectors with improved links and communications with the police/military will be established covering the entire NPA. Another option might be the closure of the present border crossing in the NPA to all travellers. Obviously staff would be maintained but would provide patrolling and enforcement functions rather than issuing border passes. This option will only be considered after due consideration and consultation, and only after essential household supplies for villagers can be guaranteed via the Nakai market.

**Table 4.26: Watershed Conservation and Development Networks and VCMU monitoring sectors**

| Mini-watershed Conservation and Development Network | Existing VCMU Incorporated into the network |
|---|---|
| Nam Nian | New - Phupiang and Namnian VCMU |
| Nam Xot | Navang VCMU |
| Nam Mon | Navang VCMU |
| Nam Theun | Taphaiban VCMU |
| Nam Noy | Teung VCMU |
| Nam Pheo | Teung VCMU |
| Nam Yang | New peripheral impact zone VCMU |

Another facet of the to the SEMFOP transboundary strategy is more effective patrolling systems and patrol teams supported by rangers with relevant and adequate skill levels.This will be achieved through the ranger TOT training described in Section 4.3.1.1. This training will provide the VCMUs and and WMPA patrol teams with a knowledge of and the means to use the authority vested in them to enforce laws and regulations, especially in relation to hunting and the trade in wildlife.

*4.3.1.5: Threats from Uncontrolled Access.*

Experience throughout the world has shown that improved access to protected areas can result in more poaching, increased extraction of natural resources, in-migration of shifting cultivators with inherent problems for PA management and biodiversity conservation. At the same time, improved access is required in the NNT NPA to:

- provide access to markets for household supplies from Nakai District as an alternative to the current trans-boundary supply route because the current transboundary traders also hunt wildlife and/or exchange goods for wildlife (in this respect, the plan does not support border markets as proposed in the 1998 ESMP);
- facilitate the transport (export) of produce to the Nakai plateau and beyond in support of livelihood development initiatives;
- facilitate easy and relatively quick travel by NPA villagers to the District centre of Nakai;
- facilitate the provision of rice and government services from Nakai;
- improve access for development, management and patrolling personnel and goods.

In order to address this dilemma of conflicting needs and threats to biodiversity conservation related to the issue of access, an access strategy has been developed as the basis for detailed planning and design of communications infra-structure development under the SEMFOP. This strategy (described in detail in

Section 2.1.6) aims to reduce the porous nature of the NPA boundary by re-orienting the access for both people and commodities through Nakai. The strategy focuses on establishing a single, dominant entry and exit point linked to a well-controlled water borne transport system on the reservoir. By providing a cheap and efficient service, coupled with stringent control and regulation over passengers, their personal possessions and cargo, it is anticipated that current problems of poaching, illegal resource extraction and transborder trade (with the inherent problems associated with it) will be reduced, and at the same time market access, public service availability and the general quality of life of NPA communities will be improved.

The planned, reservoir-based transportation system offers a number of opportunities for improved control and regulation, including:

- A single access point (boat dock) into and out of the NT2 Watershed/NPA which is easy to monitor and regulate.
- Through close cooperation with the reservoir management authorities from the outset, the WMPA will be able to ensure that the system is designed and implemented in line with SEMFOP's primary goal of biodiversity conservation.
- The highly visible nature of water-transport on the reservoir facilitates the identification and detection of illegal activities.
- The public nature of the transport system makes illegal activities more difficult to conceal.
- Trained boat operators and personnel will be able to assist in control and enforcement.

Under the strategy, it will be possible to improve ground-based access routes within the NPA to the benefit of both NPA communities and NPA management, without the concomitant increase in risks from external threats that this normally creates. Improved communications within the NPA, all linking with a single access point via the boat transport system will provide a number of benefits to NPA management and biodiversity conservation:

- Reduced reliance on the currently dominant transborder supply route for household supplies with its inherent opportunities for the extraction of NPA resources by the cross border traders.
- Improved access for rangers and enforcement teams for the rapid response to reported impacts, poaching, wildlife trade and other incidents.
- The potential to move larger items of conservation and protection equipment (for fire-fighting, survey, research, development, etc.) within the NPA.
- Easier access for the VCMUs and better cooperation and coordination within the Watershed Conservation and Development Networks due to improved inter-village communications.
- Improved market access to Nakai for NPA communities, thus providing alternative economic opportunities in place of their current reliance on forest resources.
- Enhanced access for ecotourism, thereby providing alternative sustainable livelihoods for NPA communities (guide-work, sale of handicrafts, cultural-tourism, etc.).

Improvements to internal NPA tracks will all channel movement towards and link with the reservoir transport system and prior participatory planning will be undertaken with villagers to identify:

- their specific, unmet livelihood needs with respect to access
- which unmet needs could be provided by existing routes
- which, if any, can be provided only by a new track
- the anticipated social, economic and environmental costs that track construction would incur, to be weighed against the potential benefits.

*4.3.1.6: Threats from Unsustainable Extraction of Wildlife and NTFPs.*

By their own assessments, residents of the protected area have overharvested and drastically reduced populations of several quarry species, such and muntjacs and gibbons, and several NTFPs. Part of it is a 'commons' problem whereby villagers do not have control over or exclusive access to local forest resources, but instead must compete with outsiders. Consequently, they have little incentive to harvest them sustainably. Another problem is the insatiable outside markets. Rattans are a good example. For their

own use, villagers will collect only as many rattans as they can eat or use for construction material. But there is effectively no upper limit on the number they can sell, other than their labor to cut them.

In order to develop successful sustainable management, agreements will be developed in a participatory manner between villagers and the WMPA. These agreements will address: sustainable harvest limits, harvest seasons, protected species, protected zones and enforcement. Village gun collections, and the establishment and enforcement of rules on the types of snaring allowed, will be an integral part of participatory resource management. For example, it may be appropriate to allow villagers to snare small mammals (crop pests) around agricultural fields, but not elsewhere. Continual and intensive patrolling to destroy snare lines, apprehend poachers and apprehend their equipment and vehicles will also be a focus.

*4.3.1.7: Threats from the Uncontrolled Increase of the NPA Population.*

The populations of NPA villages are increasing at high rates - 17 % from 1996 until 2002. Such a growth rate threatens to exacerbate the current unsustainable and declining livelihoods of most of the NPA and some of the surrounding communities. Sustainable agriculture, and sustainable harvests of wildlife, fish and NTFPs are impossible under unchecked population growth. Without family planning initiatives, improvements in agricultural efficiency and conservation will be compromised by larger populations, instead of relieving pressure on the forest. It has been estimated that tropical forests can sustain hunting and gathering humans at a density of about 1 person/km2. NNT's density is already in excess of that, with much added pressure on its resources from non-residents.

To safeguard against the threats posed by uncontrolled population increases, a strategy for population management in NPA communities has been developed under SEMFOP. This is described in detail in Section 2.1.7, and embodies 3 components:

1. Safeguards to ensure adequate agricultural land for current and future population in NPA villages.

FLUPAM provides for the development of land use agreements with communities that mitigate against future encroachment into undisturbed forest areas, while at the same time, taking account of current and future populations by defining village agriculture and reserve agricultural land areas. FLUPAM proceeds simultaneously with clusters of neighboring villages and thus allows for the possible rationalization of agricultural (and reserve agricultural) land areas between villages according to the population needs of each.

2. Awareness raising and capacity development to enable communities to better make their own decisions on family size, and to provide the capability to be able to act on these decisions.

The assessment of population trends conducted during FLUPAM will be undertaken in a participatory manner with villagers in order to increase community awareness of population issues and to table the problems (and the potential benefits of family planning to them) for consideration when designing livelihood development activities. Wherever appropriate, assistance with family planning will be provided as a key livelihood development activity under the SEMFOP. Other initiatives in the SEMFOP in regard to helping communities generally, and women in particular, make their own decisions in regard to the sustainable management of population include: improved maternal and child health care; capacity development and empowerment programs for women in conjunction with the LWU; and support for female economic activities.

3. Improved education and vocational training opportunities to facilitate the out-migration of capable youth and adults to take up new occupations outside the NPA.

Support activities here will include: the promotion of literacy and numeracy through non-formal education; education of youth, especially girls through improved formal education opportunities; support for vocational development; and professional training to enhance career opportunities and allow NPA villagers to find employment outside the NPA.

Thus, one objective of social development will be to reduce the rate of population increase, a suite of specific and culturally sensitive activities will be adopted, including:

- developing the policy of tightly controlled in-migration into the NPA;
- improve maternal and child health care;

- promote family planning services;
- educate youth especially girls through non-formal education;
- promote literacy and numeracy through non-formal education; and
- support female economic activities.

*4.3.1.9: Threats from the Lack of a Zonation System with Clear Rules and Regulations*

The lack of commonly understood zones, with rules and regulations pertaining to each, means that PIZ and NPA villagers have no clear understanding of what and where they are allowed to follow their various customary livelihood practices. This has created essentially a situation of uncontrolled common property resource extraction, where each individual will extract the maximum possible from the most easily accessible areas, regardless of their conservation value and status.

Zonation should build on a combination of scientifically-derived biodiversity values and traditional zonation systems already in use by resident villagers. Existing scientific reports and results from the biodiversity monitoring to be conducted under SEMFOP will be used to identify key or critical habitats,[8] and agreements with villagers will be sought for improved control of these areas, possibly even their excision as "Totally Protected Zones" (TPZ) if they are unused or rarely used by the local communities. All other land in the village customary use areas would be proposed as "Controlled Use Zones".

This intial process of zoning will be carried out simultaneously with a comprehensive participatory assessment with each village of their forest use during FLUPAM. However, TPZ zonation will only be finalized, following a period of trial and testing of the CUZs and their associated village rules and regulations, after FLUPAM has been completed in all NPA villages.

This zonation strategy will result in 3 major zones, each with unique requirements in regard to both conservation and development, to be used under the SEMFOP.

**Totally Protected Zones:** critical habitats within the NPA, with strictly limited access, where only conservation activities will be permitted.

**Controlled Use Zones:** areas within the NPA, still of critical conservation importance, where appropriate villager activities will be allowed, but controlled according to the participatory agreements established through FLUPAM.

**Peripheral Impact Zones:** areas outside the NPA boundary, but which impact on biodiversity values within it, and thus require varying degrees of support for both conservation and development activities aimed at reducing their level of impact on natural resources in the NPA.

*4.3.1.10: Threats Posed During NT2 Project Construction*

Some NT2 project construction works have already begun, and at its peak construction will employ 2,000 - 3,000 people on-site, with maybe four times as many followers (family, traders, restauranteurs, bar-owners, shop keepers, etc.). This will put tremendous pressure on the NT2 Watershed-NPA to supply wildlife and plant-based NTFPs to this new cash income community. Anticipated threats are diverse and from a number of different sources, including:

- Hunting, accidental and deliberate fire-setting, timber extraction for shanties, trade in wildlife, encroachment for vegetable gardens, etc. by the construction workers and camp followers.
- Encroachment into the NPA for roads, power-lines, borrow-sites, land-fill sites, quarrying, etc. by the construction companies and sub-contractors.
- Encroachment and degradation along the NPA southern border by salvage logging and vegetation clearance operations.

[8] *These include important watershed areas, important water sources for wildlife, mineral licks, unique habitats, and areas with high diversity and density of fauna and/or flora.*

- Additional illegal practices detrimental to the NPA by other outsiders, particularly criminal elements, attracted by the high profile nature of the project and the large number of camp workers and followers.

The WMPA is actively preparing for this in a number of ways including demarcation, patrolling, border posts, gates, VCMUs, etc.. Although it is anticipated that the regular NPA protection measures already instigated will go some way to providing protection during the construction period, other special measures will have to be put in force.

It is intended to establish a construction-risks working group or task force under the WMPA for the period of dam and associated construction works. This working group, comprising WMPA staff from all relevant divisions and district authority partner organisations, will be charged with a variety of actions to ensure that potential threats are minimised. These actions will include:

- Liaison with provincial and district authorities responsible for managing the incoming workforce such as police, interior, health, departments, etc.
- Liaison with other NT2 project agencies such as NTPC, RMU, RMA, EMO, etc. in regard to construction impacts.
- Liaison with NTPC to develop contract-penalty-causes for main and sub-contractors in respect to: (i) construction impacts, and (ii) their employees infringing NPA regulations. .
- Liaison with main contractors and sub-contractors regarding impacts in respect to the NPA.
- Drawing up rules and regulations for NPA protection to be communicated to and signed by all construction employees.
- Establishing complaint procedures for NPA and PIZ villages, along with conflict resolution mechanisms.
- Agreeing on penalties, job-dismissal clauses, actions to be taken by the contractor, etc.for any infringements.

The most immediate threat is posed by the proposed salvage logging that will begin on the Nakai plateau in areas adjacent to the NPA well before reservoir inundation. The salvage logging plan is currently being prepared by GoL and will include provisions on inventory, harvest volume estimates, specific logging locations, timing, sequencing of operations, etc. As part of the planning process local people, WMPA, NTPC and local authorities will be consulted and their views documented and incorporated into the plan. These consultations will result in an environmental and social management plan to address issues of traffic management, biomass waste and vegetation clearance, management of work sites, wildlife and habitat protection, demarcation and monitoring of the areas to be logged, etc.

The WMPA will be fully involved in the development of these safeguards to ensure that all potential threats to the NPA/Watershed are adequately addressed. In addition, starting in April 2005, demarcation of the NPA boundary adjacent to the entire salvage logging area will begin. The first SEMFOP Annual Workplan includes budget for this activity which will be completed by June 2005, prior to any salvage logging.

NPA boundary demarcation has already been completed along the entire length of the PIZ involving some 289 kilometers and the capacity of two well-trained and experienced WMPA teams is entirely adequate for the task of demarcation on the plateau. Two key principles governing demarcation are that (i) the boundary will lie as close as possible to the boundary mapped in Decree 193, (ii) the boundary will be agreed upon by all levels of government and by local people. Actual demarcation on the ground will involve the following steps:

- The boundary line is surveyed and a path at least a meter wide is cut along it. In some areas this line must first be swept for UXO. This line is further marked with red paint on trees and rocks at least every 10m and on either side of rivers and roads as appropriate. Stakes should be used where grassland areas are crossed.
- The length of the boundary path is measured.
- Metal signs of standard specification are placed every 50-60 meters along the boundary line.

- Numbered concrete bollards of standard specification are placed every 500m.
- Detailed 1:25,000 mapsof the boundary are produced and provided to relevant agencies.

### 4.3.2: Scientific Research Strategy

*4.3.2.1: Research Strategy*

The research needs of Nakai Nam Theun NPA are both immense and extremely diverse. Although some survey and research priorities are put forward in the next Section (4.3.3), it would be impossible to develop a detailed research plan at this stage. Indeed, in the early years of SEMFOP-1 the major priority is management and protection, and this is reflected in the allocation of funding during this period. This is not to say that research is not important, and it is recognised that a major national or international research presence adds status and recognition, and thus also helps with protection. However, time resources and funding will be extremely limited for this purpose in the early years and will have to rely on outside sources for research during this period. The WMPA intends to be proactive in attempting to attract interested research organisations, individuals and funding, particularly once biodiversity monitoring begins to identify clearer needs and priorities.

*4.3.2.2: Research Advisory Group*

In order to help in identifying research needs and priorities, and assist in attracting donor interest and funding, the WMPA intends to establish a 'Nakai Nam Theun Research Advisory Group'. The role of this group will include the following:

- Providing the WMPA with advice on all aspects of scientific biodiversity research management, implementation and use of research findings.
- Assisting in identifying research needs, setting priorities and identifying the appropriate expertise (both in-country and internationally) to conduct the research.
- Helping to establish recognition for scientific research in the NPA and assisting in attracting support and funding from interested research organisations and individuals.

The research advisory group will be chaired by the Director of WMPA's Executive Secretariat and will include members from governmenr agencies such as STEA, NGOs involved in conservation, academic institutes, both national and international, (including social institutes and NGOs involved with ethnic minorities to ensure adequate coverage of human/wildlife interations) and others as appropriate. The group will meet twice yearly, but may set up working groups to address specific research topics as they are identified. The Research Adviory Group will not be paid, but will have their expenses covered and will be purely an advisory body. Final decisions on research in the NPA will rest with the WMPA.

### 4.3.3: Taxon Focussed Management Strategies

One of the first tasks of the Biodiversity Conservation Division, with assistance from the TA advisor will be to prioritize the need for surveys and management strategies according to immediate, medium term and longer needs. This will include an assessment of the potential for attracting additional donors and/or specialist expertise for certain surveys or management plans.

As implementation of the SEMFOP proceeds and additional information is gained, priorities will undoubtedly change and new needs will be identified. As a consequence, it would be unwise to set firm priorities at this stage. However, a number of clear needs for survey and management are already apparent and include the following which are outlined in bullet format in the remainder of this section.

*4.3.3.1: Flora Management Strategies*

*Survey and research priorities*

- A general botanical survey of NNT to be undertaken, by a cooperative program between the WMPA, Lao Institutions such as the NUOL, regional institutions in Thailand and Vietnam and international institutions such as the Royal Botanic Gardens in Kew. The international institutions should be able to fund themselves, with counterpart training and participation of the Lao botanists. Focus would initially be on participatory surveys and identification of significant NTFPs.
- Establishment of permanent botanical plots (in triplicate) for all or the main forest types in NNT, with the purpose of systematically studying species abundance, density, composition, structure, and monitoring growth rate and phenology. The establishment and collection of the initial data of these plots would be the task of the WMPA's botanist. Monthly monitoring of phenology would be the tasks of the relevant WMPA division. These plots could be used by interested parties to conduct studies on invertebrate or small vertebrate communities, etc.
- A long-term study of the effects of fragmentation on the Nakai Plateau, i.e., quantitatively study biodiversity and the variety of processes before and after inundation. This will provide data for:
  (a) the design and management recommendations for protected areas in Lao PDR and elsewhere in the region;
  (b) testing the island biogeographic theory (MacArthur and Wilson, 1967);
  (c) providing information on community ecology, as to whether there are critical species-specific interactions, and on the degree of structure of species composition in natural communities.
- A survey to determine all cypress species, and their distribution and (approximate) density.
- A comprehensive rattan survey, with a priority for reconnaissance surveys of the main catchments, combining interviews with specimen collection. The objective of the interviews is to develop an understanding of species distributions, abundance, trends and socio-economic issues.

*Protection/Conservation priorities*

- A total ban on the possession of chainsaws by NNT residents, to be instituted as the presence and use of chainsaws in the NPA will most likely result in a sharp increase in the rate of forest loss.
- A detailed study of the current agricultural systems among the various ethnic groups, and the impact these systems have on forest cover. The urgency of reducing swidden in NNT is poorly known. There have been many suggested solutions to the 'swidden problem' in NNT, but little attempt to understand its nature and impact. A better understanding of swidden agricultural systems in NNT is needed before attempting to alter or dismantle them. This needs to include improved understanding not only of the relationship of swidden to biodiversity, but to the cultures and livelihoods of swidden farmers (See also Sections 3.5.3 and specifically 3.5.3.3 and 3.5.3.6).
- A forest cover monitoring system to be instituted via effective interpretation of satellite data.
- The introduction and institution of improved livestock management, to mitigate or reduce the impacts of livestock on the forest and wildlife.
- A management plan for rattan. It should be noted, however, that potential is poor for sustainable and economically profitable management of rattan. Growth rates are not high, and populations are spread out and therefore hard to manage and police. Cultivation may be difficult as well, but should be investigated. Work will be undertaken with residents – both basic and action research - to improve management of existing wild stocks of NTFPs to ensure that reliance on wild NTFPs maintains villagers' interest and stake in conserving the forest. A major focus of this will be to:
  i. determine the best or optimal harvesting systems;
  ii. determine sustainable off take quantities; and
  iii. determine if zonation is required.
- NTFP domestication to be encouraged when appropriate.

- A monitoring/patrolling program and checkpoint operation, whcih includes inspection for flora. This will require training for staff and implementing partners and adequate dissemination of rules and regulations relating to use of flora.

*4.3.3.2: Invertebrate Management Strategies*

- A strategy to gain, via participatory and scientific studies, a better understanding of:
    i. the status and trend of species important to local livelihoods, either as food, agricultural pests or vectors of disease transmission (e.g., mosquitoes); and
    ii. an investigation of the intensity of transborder beetle collection along the Vietnam border.

*4.3.3.3: Management Priorities and Strategies for Fish*

*Survey priorities and management responsibilities*

- A baseline fish survey of the Nam Theun tributaries within the NPA needs to be carried out as a high priority. This, along with the design of a fisheries monitoring system, will be needed for SEMFOP M&E purposes. The baseline survey and species identification will be conducted jointly by an international expert, LARREC and the Fisheries Department. It will include participatory mapping of areas important to local fishes, and the identification of species that are important for local subsistence, so that mitigation measures can be undertaken in the event that populations decline after inundation of the NT2 Reservoir.
- Under the Concession Agreement, NTPC will be responsible for assessing the project impacts on fish in the reservoir and upstream rivers pre and post impoundment. This includes species and habitat inventories, migrations and fish productivity. The WMPA will take over this responsibility in the NPA and Corridors one year after COD. They will also be a member of the committee advising the adaptive management program in the downstream Nam Theun area. In addition, WMPA will also be responsible for incorporation of patrolling, fishing restrictions and other related measures as part of their planned activities under SEMFOP. Aquatic Life Protection/Conservation strategies

*Fisheries conservation strategies*

- A program to establish sustainable management of stream fisheries in conjunction with villagers. Villagers in NT2 Watershed/NPA repeatedly report declining stocks, due either to over-harvest and unsustainable harvesting methods by themselves, and/or by outsiders. The methodology to promote community-managed fisheries has been practiced for years in southern Lao PDR, and could be replicated in the NT2 Watershed/NPA . Similarly, simple local rules and regulations, with regard to fishing techniques (do's and don'ts and season), developed by the Navang VCMU and the DUDCP biologist, with the participation of local communities, have shown significant increases in fish harvested (Boonratana, 2000). Such a program has a number of attractions for SEMFOP:
    - It will benefit biodiversity conservation in general, as increased fish stocks benefit other key species such as otters, kingfishers, etc.
    - It will reduce villagers reliance on other protein sources including key wildlife species
    - It is a good example of a 'win-win' situation which benefits both conservation and local livelihoods through clear and positive linkages.
    - The potentially very rapid recovery rates of aquatic ecosystems make them excellent examples for villagers of what can be achieved with good conservation practices. This might lead to a greater likelihood of them being applied to terrestrial habitats which generally take longer to recover.
    - It would provide a good example of an integrated conservation and development activity for the Watershed Conservation and Development Networks to demonstrate the need for inter-community cooperation along the entire mini-watershed for them to succeed.
    - It will be cheap and fairly straightforward to implement and would not be a great burden on limited SEMFOP resources.

*4.3.3.4: Management Priorities and Strategies for Amphibians and Reptiles*

*Survey priorities*

- Surveys during warm months of the year (when animals are more active), and at higher elevations, including detailed surveys of the species known to be of conservation concern, especially turtles.
- Studies of the status of frogs collected by villagers.

*Amphibian and Reptile Protection/Conservation strategies*

- A Turtle Conservation Plan to address the intense exploitation for trade suffered by turtles, and the global rarity of some species. Harvest management systems and commercial captive breeding will be investigated, and if feasible will be developed and instituted. .
- A Reptile Management and Protection Plan covering heavily-traded reptiles, such as monitor lizards and some snakes. If the local harvest of frogs is found to be unsustainable, the participatory establishment of a frog conservation and management program will be undertaken. This will likely include the establishment of local frog conservation zones, possibly modelled on the successful frog conservation project implemented in Xe Bang Nouan National Protected Area.

*4.3.3.5: Management Strategies and Priorities for Birds*

*Survey priorities*

- A re-assessment of the current abundance of key species relative to their abundance observed on earlier surveys from the period 1994 – 1997. This will give an indication of the intensity of human impact on the various key species.
- A survey to identify areas important to Crested Argus, especially the breeding display grounds. Areas identified will be high priorities for core protected zones.

*Specific bird conservation priorities*

- Anti-poaching patrols of Crested Argus habitat with emphasis on the mating period, when they are most vulnerable to snaring on their display grounds.
- The feasibility of protecting fig trees from hunting (when in fruit, they are favored sites for hunters because they attract hornbills, green pigeons and other frugivores).
- Village gun collection, registration and regulations on use.

*White Winged Duck*

It has been estimated that there are only about 5 to 10 breeding pairs of white-winged ducks remaining in the Nakai Nam Theun NPA. Their preferred locale of plateau riverine habitat below 600 metres amsl will be reduced by about two thirds by reservoir inundation. However, given the low numbers remaining, habitat availability may not be the most important constraint to their continued viability. In terms of resource needs, the reduced area may be sufficient to support the current population.

A survey to identify potential habitats and locations of unknown populations of WWD will be conducted between the Nakai plateau and the Cambodian border to establish threats and potential release and captive breeding sites. During construction and the first 5 years of the NT2 operating phase a management program for the WWD will be developed and implemented under the EAMP. The management plan will include:

- A study of the genetic character, behaviour and outbreeding potential to other populations.
- Capture of remaining birds or the collection and incubation of eggs.
- Testing the ability of nest boxes as a means of accelerating egg collections.
- Consideration of transferring the population to other suitable breeding grounds.

Under the Concession Agrement, NTPC is responsible for assessing project impacts on the WWD pre and post impoundment. This includes species and habitat inventories and monitoring populations and

movements. They are also responsible for developing and implementing a strategy for the mitigation of any impacts during impoundment and operation. NTPC will train WMPA staff in this to prepare them for taking over the program one year after COD.

*4.3.3.6: Strategic Management Priorities for Mammals*

*Survey and research priorities*

Prioritization here will depend on what is already known, and what is not known, about a particular taxon and its perceived conservation value, either economically, culturally or biologically. Hypothetically, a high priority taxon would be one that meets some of the following criteria:

- it is globally threatened
- little is known about the animal's status in Lao PDR and in NNT
- it has a significant positive or negative role in local and national economies
- it has significance in Lao or human culture (e.g., elephants)
- it is known or suspected to be biologically highly distinctive
- it is known to be a 'keystone species', with an influential impact on its ecosystem

Following these criteria, the following are anticipate to be of high priority for mammal surveys.

- Surveys of abundance of key mammals of conservation concern, to compare their abundance to those observed on earlier surveys in the period 1994 - 1998. This will give an indication of the intensity of human use of the resource.
- Pangolin surveys. Pangolins are probably the most heavily exploited animals in the wildlife trade and the animal is a significant (if irregular) source of income for local people. However, little is known about its ecology, status and management requirements for its protection and conservation. The WMPA is in the process of developing an MoU with WCS for a cooperative, cost-sharing program for biodiversity management, monitoring and staff capacity development in the NPA (See Section 4.3.4). It is intended that the pangolin conservation management plan will be developed with WCS assistance under this MoU.
- The Asian Elephant has been identified as a key species due to: (i) significant reduction of their natural habitat by reservoir inundation, (ii) loss of mineral licks, and (iii) disruption of movement patterns. There is also a high potential for increased human/elephant conflict after the plateau habitat is reduced by the NT2 reservoir. Initial studies will be aimed towards drawing up mitigation measures (for reduced habitats, access to mineral sources and human/elephant conflict), and long-term studies will include a study on their ecology and behavior, and on monitoring patterns of movement and distribution pre- and post-inundation.
- A survey to determined the status (distribution, group and population size, threats, and conservation requirements) of the globally threatened Douc langur . Following this, graduate students (national and/or international) would be encouraged to conduct Ph.D and M.Sc thesis research.
- Gibbons require more long term survey and research, as identification of the resident species is not clear. They would also serve as a good indicator species for long-term monitoring due to (i) their conspicuous territorial calling, and (ii) there susceptibility to hunting.
- Identification of the loris species present in the NT2 Watershed/NPA.
- Small carnivores (e.g., otters, badgers, civets) are little known, while they are perhaps important to rodent pest control and forest ecology (through seed dispersal).
- Flying squirrels are highly sought in the wildlife trade, but are poorly known in terms of taxonomy, status and distribution.
- Muntjac distribution, status and habitat use of the various species, including little-known new ones, requires survey and research, especially as they are an important food item for both humans and carnivores.
- A survey on wild pig, including distribution and status of the various forms that occur (likely to

include the rare and virtually unknown Heude's Pig).

- A survey on bear distribution, identification and status of the forms that occur.
- Rhinoceros are still occasionally reported from the NPA; and if they occur, they would be the most globally threatened animal in the NPA.

*Saola Conservation Action Plan:*

The main components of the Saola Conservation Action Plan will be implemented, including Saola ecology, population and seasonal movements, and their status in the central and northern parts of the NT2 Watershed/NPA.

The NT2 Watershed/NPA is the only protected area in Lao PDR that harbors this rare animal, and researchers in Vietnam have recently suggested that the Saola's IUCN status should be changed from 'Endangered' to 'Critically Endangered'. If so, it would be the only Critically Endangered mammal known to occur in NNT. A Saola monitoring and conservation project that benefited both Saola conservation and village economies was successfully piloted in the then Northern Extension in 1998 and 1999, and this will be introduced and continued in the NT2 Watershed/NPA.

*Elephant conservation and management plan*

An elephant conservation and management plan will be prepared and implemented. This plan will initially rely on the work and recommendations of Boonratana, Khounboline and WCS. It will be initiated along with the elephant conservation and management plan for the Nakai plateau as financed under the EAMP. During the NT2 construction phase the EMO will be responsible for conducting a survey to determine the population of elephants on the plateau and their seasonal movements, using a mark-recapture type program. The information obtained will be used to develop and implement (prior to reservoir inundation) an elephant management program with a special focus on restricting interactions with the resettled human population.

Human-elephant conflict already occurs on the Nakai Plateau, and recently led to the death of a villager. When the NT2 reservoir fills and squeezes the human and elephant residents of the Nakai Plateau into a much smaller area, the incidence and severity of these conflicts will probably rise. It could be a major threat to the welfare of both elephants and resettled villagers. This will probably be the most obvious wildlife mitigation problem from inundation, and the problems will start as elephants react to disturbances from construction of the dam. Elephants will not benignly use the corridor toward Phou Hin Poun NPA. Problems and conflicts should be anticipated, and contingency plans prepared and rehearsed as part of mitigation for the dam. This plan will include the measures taken to ensure that trans-border poaching in the upper watershed is halted. Villagers report that it has driven elephants down toward the Plateau, and with inundation, the elephants will find themselves squeezed between the reservoir and the poaching pressure inside the NPA.

*Pangolin conservation and management plan.*

A conservation management plan specific to pangolin is required.

*Mineral lick management*

Mineral licks in the NPA will be mapped and their usage by both wildlife and humans assessed, and then a conservation plan for critical mineral licks, in participation with villagers, will be developed and implemented, and where appropriate, included in the village level forest use management plans.

### 4.3.4: Biodiversity Baseline Survey

In order to establish a foundation for future monitoring of conservation outcomes for the NT2 Watershed/NPA, it will be important to initiate a program of biodiversity baseline analysis through ground-based biological survey and inventory. This will form a basis for identifying and planning management zones within the NPA, and will provide a project baseline for monitoring changes in land use and wildlife abundance in the protected area.

This work will be conducted in partnership with WCS under a conultancy agreement. A ToR for this has been drafted along with a detailed budget, and it is anticipated that this agreement will be signed prior to

the appraisal of SEMFOP by the International Finace Institutions (IFI). The work will begin at the start of SEMFOP, and involve WCS consultants and relevant staff from WMPA's PPAM Division. The WMPA staff will receive hands-on, on-the-job training from WCS during the survey work and, by this means, their capacity for further work of this kind will be upgraded. The initial input will be for 2 years, with intensive inputs early and regular follow-up visits over the entire period.

The survey work will concentrate on 'major' wildlife species, understood as those listed as "key species" for the Nakai Nam Theun NPA and the Nakai Plateau (See Sections 4.2.7 to 4.2.11 and Appendix 4 of this Volume of the SEMFOP). The major threat to these species is from extraction for internal trade, unregulated export and domestic consumption. If management of the NPA is effective, one would expect to see a constant or increasing trend in the abundance and distribution of major wildlife species in the NPA. The following methods will be employed to estimate presence, abundance and distribution of major wildlife species and threats to these species.

*Camera trapping*

The initial groundwork would involve the establishment of a network of wildlife camera traps throughout the NPA. Camera-trapping methods have proven to be a reliable means of estimating the presence, relative abundance and distribution of rare or cryptic species that are difficult to detect through direct observation (large and small carnivores, ungulates, ground-frequenting primates, porcupines, and other carnivore prey species). Two field teams will be used to place paired camera traps in sampling blocks spaced at regular intervals from east to west across the NPA over a period of 18 months, with each camera trap set left out for 1 month. This method is being employed by WCS now in the Nam Et-Phou Loey NPAs in northern Lao PDR to gather baseline data on presence, abundance, and distribution of carnivore and prey communities and used at other WCS sites in the region to successfully estimate densities of selected large carnivores (tigers and leopards; individuals per km2) and relative abundance (camera trap hours/photo) of other terrestrial mammals and birds.

*Systematic ground transects*

Combined with the network of camera traps, ground surveys will be initiated for key wildlife species as well as threat indicators (snares, gunshots, camps, etc). This would involve basic wildlife and threat data gathering and reporting protocols for park rangers and other NPA staff involved in wildlife management.

Several kilometers of permanent transects will be established across the NPA, with two teams surveying separate lines once every 4-6 weeks over period of 18 months to estimate densities of key species (pheasants, hornbills, pigeons, herons, and primates) as well threats including snares, hunting camps, and forest cutting. Direct sightings and calls will be recorded onto standardized datasheets including species name, number of individuals, and type of threat, bearing distance along line, time, and weather details.

Track and sign of key wildlife and threats (snares, gunshots, hunting camps, forest cutting, etc) will also be recorded along recce transects in several sampling locations across the NPA to estimate encounter rates (observations for kilometers walked) as an index of relative abundance.

Systematic diurnal and nocturnal ground transects will also be established to estimate the presence, abundance and distribution of key reptiles in the NPA.

*Semi-structured interviews*

Data from ground transects and camera trapping would be combined with systematic semi-structured interviews with key informants in villages in and around the NPA to evaluate trends in abundance of major wildlife species and as well as wildlife use. The interview format would include questions related to hunting, trade and use of wildlife by the household and the village in general, with additional questions asked in reference to a limited set of key wildlife species (including mammals, reptiles, and birds). Data from interviews will be recorded on standardized data forms with results used interpret seasonal hunting effort per species, hunting methods, frequency of hunting, frequency of species used for subsistence and trade, location of hunting areas, hunting by and trade with outsiders, and perceptions of wildlife abundance and trends.

The outputs of the biodiversity monitoring will include:

- An inception report provided for Bank review and comment by December, 2004 showing how the work will be carried out.
- Quarterly cumulative reports on quantitative and qualitative observations, including maps of sightings of main species.
- A summary report at the end of year 1 and again at the end of the program.
- A final report providing to WMPA recommendations and guidance on the continuation of the work to be conducted by the trained staff, including important lessons-learned for any necessary modifications to the program.