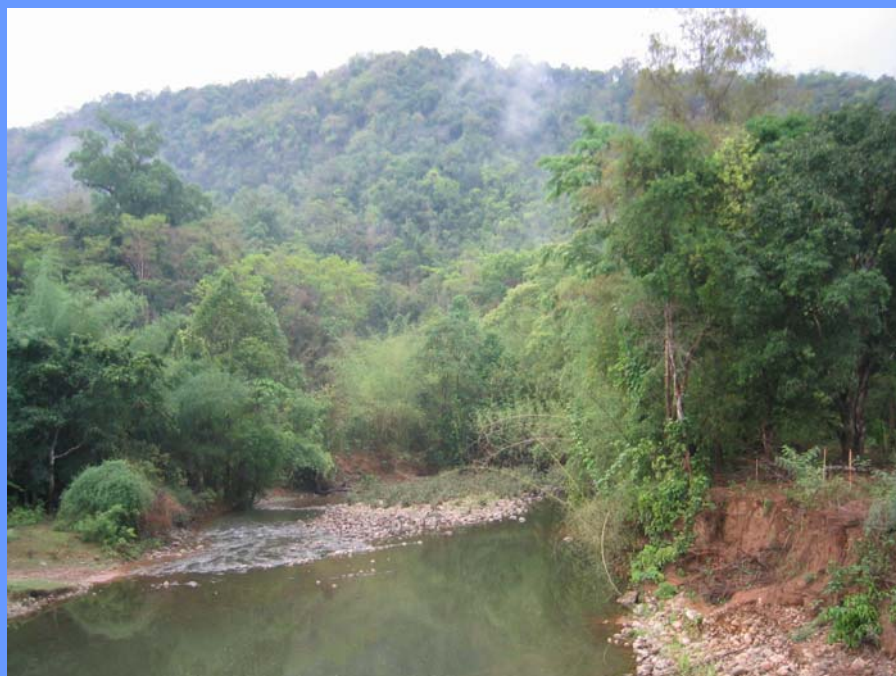# Balancing the Returns to Catchment Management:

The Economic Value of Conserving Natural Forests in Sekong, Lao PDR

Rina Maria P. Rosales, Mikkel F. Kallesoe,
Pauline Gerrard, Phokhin Muangchanh,
Sombounmy Phomtavong & Somphao Khamsomphou

4

Water and Nature Initiative

WWF

IUCN
The World Conservation Union

Citation: R. Rosales, M. Kallesoe, P. Gerrard, P. Muangchanh, S. Phomtavong and S. Khamsomphou, 2005, Balancing the Returns to Catchment Management: The Economic Value of Conserving Natural Forests in Sekong, Lao PDR. IUCN Water, Nature and Economics Technical Paper No. 5, IUCN — The World Conservation Union, Ecosystems and Livelihoods Group Asia.

ISBN: 955-8177-47-4

Cover illustration: Sekong Province forest, Lao PDR (Rina Rosales)

Edited by: Lucy Emerton

Produced by: IUCN — The World Conservation Union, Ecosystems and Livelihoods Group Asia, Colombo.

Available from: IUCN Ecosystems and Livelihoods Group Asia, 53 Horton Place, Colombo, SRI LANKA. Email: iucn@iucnsl.org

IUCN Water & Nature Initiative, Rue Mauverney 28, 1196 Gland, SWITZERLAND. Email: waterandnature@iucn.org

EXECUTIVE SUMMARY

Under the initiative "Communicating the Economic Value of Biodiversity in Lao PDR", IUCN and WWF jointly undertook a valuation study looking at the economic value of maintaining natural regeneration forests.

The valuation assessed the direct and indirect use values derived by various users and beneficiaries of the forest, and included: NTFP harvesting; the financial returns to the provincial government from timber harvesting; watershed protection; biodiversity conservation; and carbon sequestration.

Two methods were used to compute for NTFP values. The first method consisted of the use of market prices of goods, where available, together with estimated quantities of harvest. The second method applied was the Participatory Environmental Valuation (PEV) technique, whereby local villagers expressed the value of NTFPs within the context of their own perceptions, needs and priorities rather than through conventional cash-based techniques. Estimating timber values was based on provincial revenues from exports and timber tax earnings.

The production value of fisheries, agriculture, and hydropower, both existing and potential were used to estimate the value of watershed protection, and the forest's contribution towards reducing floods and erosion was calculated as the damage costs avoided. Biodiversity conservation services of the forest were estimated using the "revealed willingness to pay" of the government as expressed by its expenditures for forest conservation, and the value of carbon sequestration was based on results from other studies.

Judging from the results, where the estimated annual value of NTFPs is well above the provincial annual average income of US$ 120, conserving natural forests in Sekong has significantly positive economic values, and is thus a worthwhile undertaking. Therefore, it becomes imperative that goals, which the provincial government set out to pursue, such as improved livelihoods and sustainable development and utilization of natural resources, should translate into the promotion and conservation of natural forests in order for them to succeed in the long run.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF ACRONYMS

BTM	Benefit-Transfer Method
BV	Bequest Values
DUV	Direct Use Values
FAO	Food and Agriculture Organization
FGD	Focus Group Discussions
GDP	Gross Domestic Product
GOL	Government of Lao PDR
GWh	Gigawatt hours
ha	Hectare
HI	Household Interviews
IUCN	The World Conservation Union
IUV	Indirect Use Values
kg	Kilogram
km^2	Square kilometers
LNMC	Lao National Mekong Committee
LUPLA	Land Use Planning and Land Allocation
MAF	Ministry of Agriculture and Forestry
MW	Megawatt
NERI	National Economic Research Institute
NFR	Natural Forest Regeneration
NTFPs	Non-Timber Forest Products
NUV	Non-Use Values
OV	Option Values
PAFO	Provincial Agriculture and Forestry Office
PEV	Participatory Environmental Valuation
SPC	State Planning Committee
STEA	Science, Technology and Environment Agency
T	Tonnes
TEV	Total Economic Value
UNDP	United Nations Development Programme
US	United States
US$M	Million US Dollars
UV	Use Values
UXOs	Unexploded Ordinance
WTP	Willingness to Pay
WWF	World Wide Fund for Nature
XV	Existence Values

At the time of the study US$1 = 10,600 Lao Kip

The project "Integrating Wetland Economic Values into River Basin Management" has the overall goal of more equitable, efficient and sustainable wetland and river basin management resulting from the practical application of environmental economics techniques and measures. To help to achieve this goal, its immediate objectives are:

- To increase awareness and capacity among planners, policy-makers and managers to identify and use economic measures for wetland conservation.

- To generate and disseminate practical and policy-relevant tools and examples of the use of economic measures for wetland conservation.

- To assess environmental economic aspects of wetland and river basin management at key sites, including the identification of wetland values, economic causes of wetland loss, incentives and financing mechanisms for wetland conservation.

- To work with local communities, government and non-government agencies and the private sector to integrate wetland economic values into development and conservation decision-making and to pilot concrete economic measures for wetland management.

National, regional and global case studies, policy briefs and technical working papers are being carried out as part of this project. These deal with the practical application of environmental economics techniques and measures to ecosystem and river basin management in different regions of the world, including Africa, Asia and Latin America.

This study was carried out jointly by IUCN and WWF between March and April 2003, under the initiative "Communicating the Economic Value of Biodiversity in Lao PDR". The aim of this initiative is to demonstrate the links between biodiversity and current sectoral priorities and development needs in the country, and to eventually influence development and economic sectors to integrate biodiversity concerns into their policies, plans and budgets. For this particular study, the basic objective was to determine the economic value of maintaining natural regeneration forests mainly through numerical estimates of direct and indirect use values derived by various users and beneficiaries of the forest. Institutional partners in Lao PDR included the National Economic Research Institute (NERI), the Lao National Mekong Committee (LNMC) and the Ministry of Agriculture and Forestry (MAF).

Objectives of the study

The socio-economic development plan for Sekong mentions increasing forest cover as one of its major objectives. Two options are possible to achieve this – to either focus on production forestry or to promote natural forest regeneration. A comparison of the two options would therefore have to be carried out to determine which option is best for the province and its people. However, as pointed out earlier, there may be no competition between the two schemes, if there is enough area allowed for both schemes to be undertaken. This study thus limits itself to the focus on natural regeneration (NFR) forests, particularly on what it would cost the country if NFR schemes were not undertaken.

Determining the contribution of natural regeneration forests to overall socio-economic development necessitates information on the benefits and costs of undertaking this management option. For tree plantation forests, benefits would be in the form of economic returns from timber harvest, while the costs would be in the form of lost opportunities for livelihoods, along with the loss of biodiversity and carbon sequestration functions. On the other hand, natural regeneration would have the opposite set of benefits and costs, with the associated costs of plantation as its benefits. In a country where poverty alleviation is of prime importance, estimating the contribution of NTFP harvesting for sustaining livelihoods would demonstrate the importance of NFR schemes in achieving its poverty alleviation goals. Moreover, the Provincial Agriculture and Forestry Office (PAFO) of Sekong has proclaimed a target of 4000 has. for natural forest regeneration for the year 2003 alone[1]. For lack of any scientific basis for saying otherwise, we assume the target extraction rate will be done in a sustainable manner. This study on the economic returns of conserving Sekong forests thus has the main objective of determining the benefits from naturally regenerated forests, through the following sub-objectives:

- Estimate the direct use values of Sekong forests in terms of their contribution to livelihoods
- Estimate the financial returns from sustainable use of forests, mainly in the form of sustainable timber harvesting
- Estimate the indirect use values of Sekong forests in terms of their contribution to watershed protection, biodiversity conservation and carbon sequestration
- Draft recommendations on using the estimated benefits of conserving Sekong forests for policy formulation

Structure of the Report

This report is divided into five parts. The first part provides a brief background of the study and of Sekong province, including its forest resources and relevant portions of its five-year socio-economic development plan. The second part discusses the objectives of the study. The third part presents the economic framework and methodologies used for estimating the various economic values being measured for Sekong forests. The fourth part details the results of the study and provides the actual estimates of the various economic value components, including a short description of the villages in which primary surveys were conducted. Finally, the fifth part draws broad conclusions and recommendations from the study results.

---

[1] Personal Interview with PAFO Officials, April 23, 2003, PAFO Office, Sekong, Lao PDR.

Socio-economic profile of Sekong Province

Sekong province is located southeast of Lao PDR, and has a total land area of 7,665 km^2. It is bordered by Vietnam to the east, Attapeu Province to the south, Saravane Province to the north, and Champassak Province to the west. Sekong is the second smallest province in Lao PDR and has the lowest population density of any province in the country (9.5 persons/km^2) (SPC 2000). However, due to high levels of in-migration, these numbers are expected to increase rapidly[2]. It currently has the highest population growth rate at 3.2%, which presents a potential for population pressures in the future. As of 2001, population in the province reached a total of 71,386 people, 35,987 of which were female. Along with Savannakhet, Salavane, and Attapeu, Sekong is part of the Central Annamites, which has been identified as one of five priority regions of the WWF's Ecoregion Conservation Program in Indochina (see *Figure 1*). The Central Annamites initiative is working towards the integration of development needs with biological assessment to develop a conservation strategy for the Central Annamites Biodiversity Landscape. Of particular importance is the presence of a wide range of rare, endemic and threatened taxa therein, including several large mammals such as the tiger, clouded leopard, Asian elephant, Asiatic black bear and the sambar.

The Annamites are a significant source of livelihoods of its inhabitants, who mostly rely on forest resources for the following:

- Biodiversity-based activities, e.g. agriculture and aquaculture
- Non-timber forest products (NTFPs)
- Timber
- Watershed protection, such as for flood prevention and urban water supply
- Hydropower and associated activities

Government documents classify the province into three major regions: upland, plateau and lowland. It is split administratively into four districts: Thateng on the Bolaven Plateau, Lamam in the lowland plain, and Dakchung and Kaleum in the mountainous areas bordering Vietnam.

Figure 1: Central Annamites Priority Landscape

Livelihood activities consist mainly of agriculture, livestock raising, farming in which slash and burn is still a major practice, NTFP harvesting, and other trade-related services. Rice is the major crop grown, covering 7,130 has out of the total 12,000 has agricultural land in the area. Shifting cultivation is practiced in 3,710 has, and the rest is seasonal wetland rice. Most of the lowland rice is rainfed, and only 200 has is irrigated paddy (all of which are found in Lamam
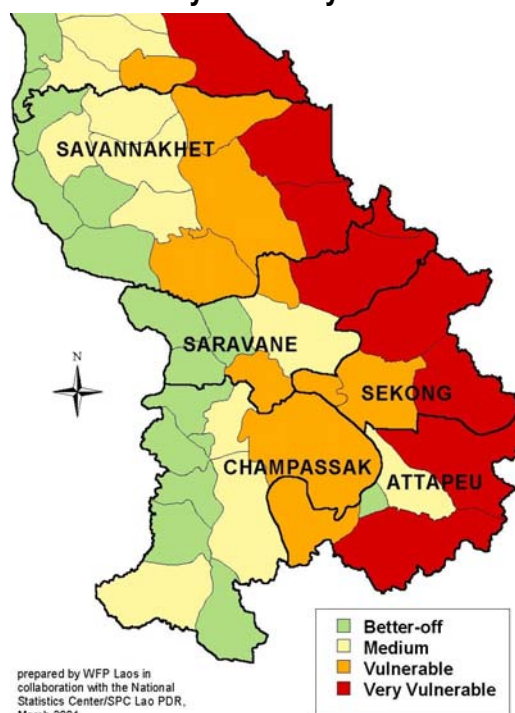
[2] A 1997 UNDP mission to Sekong estimated real population increase in the province at 6.7%

District). Production in 2000 reached 2.43 tons per hectare, or a total of 17,310 tons a year. On a provincial basis, this represents the lowest yield in the whole of Lao PDR.

In terms of the poverty index, most of Sekong is classified as highly vulnerable[3]. *Figure 2* presents a graphical presentation of the poverty index in Southern Lao PDR.

Figure 2: Vulnerability to Poverty in Southern Lao PDR

prepared by WFP Laos in collaboration with the National Statistics Center/SPC Lao PDR, March 2001.

Legend:
- Better-off
- Medium
- Vulnerable
- Very Vulnerable

The provincial government estimates that about 66% of Sekong's households are poor. GDP per capita is estimated to be at US$ 120, way below the national average at US$ 420, and majority of those living in Sekong experience rice shortages every year. Many rural communities have difficulty meeting subsistence needs, especially at the end of the dry season, when NTFPs become an important component of diets. Moreover, the incidence of acute malnutrition and chronically energy deficient children is high in Sekong relative to other provinces in Lao PDR (UNDP 1997).

The proportion of income spent on food is high in Sekong (78%), while rice and animal production is lowest, relative to the rest of the Central Annamite provinces. *Figure 3* illustrates the discrepancies among the four provinces in terms of agricultural production in the area.

Figure 3: Agricultural production by Province, Central Annamites

	Savannakhet	Saravane	Sekong	Attapeu
Area (km^2)	21,678	10,478	7,665	9,520
Population (people)	703,049	279,340	73,309	92,733
Population Density (people/km^2)	32	28	9	10
Villages (no.)	1,543	708	260	209
Households (no.)	106,858	55,142	12,868	15,876
Average household size	6.6	5.1	5.7	5.8
% Rural Population	85%	94%	84%	95%
Upland Rice (ha)	5,484	10	5	5
Lowland Rice (ha)	94,644	114	9	35
Average rice per household (ha)	0.937	0.002	0.001	0.003
Buffalo (no.)	240,450	67,802	17,000	40,000
Average buffalo per household (no)	2.25	1.23	1.32	2.52
Cattle (no.)	304,558	80,943	9,000	9,000
Average buffalo per household (no)	2.85	1.47	0.70	0.57

---

[3] Criteria used are paddy production, number of large animals per household, access to roads, access to forested land, education and health. Source: WFP in collaboration with the National Statistics Center of Lao PDR, March 2001. In WWF Lao Project Office, Benchmark Socioeconomic Data Report for the Central Annamites Priority Ecoregion. October 2001.

Other development issues include the low literacy rates for men and youth in Sekong. An overwhelming majority of the province's households (90%) have yet to be connected to the electrical grid of the country. Unexploded ordinance, or UXOs[4], is still a major issue in Sekong, thus delaying any road and other infrastructure projects that could contribute to the province's growth. Along with Attapeu, Sekong is thus relatively difficult to access, further contributing to low economic development and high poverty incidence in the area.

Forestry and Biodiversity Profile

In Sekong alone, the total forest area is comprised of 505,700 has., representing around 54% of its total land area, and is made up of the following forest types:

Table 1: Forest Types in Sekong

Forest type	Area (ha)	% of total forest in province
Mixed deciduous	383,300	75.6
Semi-evergreen	63,700	12.5
Mixed hardwood-conifer	30,400	6.0
Dry dipterocarp	13,300	2.6
Montane conifer	11,200	2.2
Gallery semi-evergreen	3,800	0.8
TOTAL	505,700	100

Source: Lao National Mekong Committee, and WWF Lao Project Office. 2002. Community-based forest management for conservation and sustainable development in the upper Sekong Watershed, a joint project proposal. pp. 26.

In addition, gallery semi-evergreen forest occurs within areas dominated by dry dipterocarp forest along the Sekong and Senam Noi river banks, accounting for some 3,800 ha. Figure 5 shows the forest density existing in Sekong province.

There are a few biodiversity studies that have been conducted in Sekong which indicate that the province is globally significant for biodiversity conservation (Davidson et al. 1997; Duckworth et al. 1999; Duckworth and Hedges 1999; Steinmetz et al. 1999; Schaller 1995). Evidence of large mammals

Figure 5: Forest Density in Sekong Province

---
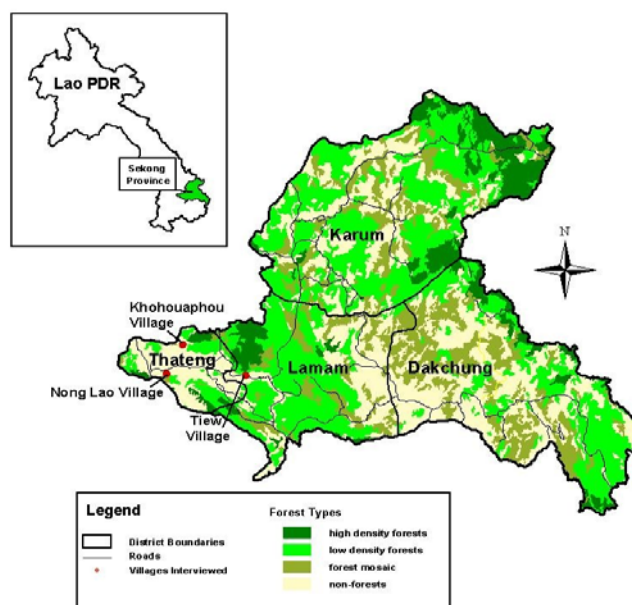
[4] This region was heavily bombed during the war in the early 1970s. Most of the province is still considered high in terms of UXO contamination. Sources: (1) Atlas of Laos, Spatial structures of the economic and social development of the Lao People's Democratic Republic. Bouthavy Sisouphathong, National Statistical Centre, State Planning Committee of Lao PDR and Christian Taillard LASEMA-CNRS, GDR Libergeo-CNRS, France; and (2) UXO Lao. 1997. Living with UXO. Final Report. National Survey on the Socio-Economic Impact of UXO in Lao PDR. 1997. Report by Handicap International. For Ministry of Labor and Social Welfare. Lao national UXO Programme (UXO LAO). In WWF Lao Project Office, Benchmark Socioeconomic Data Report for the Central Annamites Priority Ecoregion. October 2001.

such as Tiger *Panthera tigris*, Clouded Leopard *Pardofelis nebulosa*, Asian Elephant *Elephas maximus*, and Gaur *Bos gaurus* has been reported (Duckworth and Hedges 1999). Douc Langur *Pygathrix nemaeus*, Dhole *Cuon alpinus*, and Asiatic Black Bear *Ursus thibetanus*, and Sambar *Cervus unicolor* have also been recorded in Sekong (Bergmans 1995).

Bird diversity is also high in the area, with a total of 178 species identified in the above survey, including three of international importance – Crested Argus *Rheinardia ocellata*, Green Peafowl *Pavo muticus* and Spot-bellied Eagle Owl *Bubo nipalensis*. The Ractchet-tailed Treepie *Temnurus temnurus* and Great Hornbill *Buceros bicornis* were also observed. Fish, amphibian and reptilian biodiversity are reputed to be most likely very high due to large expanses of undisturbed habitat and abundant watercourses, albeit there is a lack of scientific studies and inventories in this regard.

Socio-Economic Development Plan for Sekong

The current Fifth Five Year Socio-Econoimc Development Plan for 2001-2005 of Lao PDR states its goals to be the following: graduate from least-developed country status by the year 2020, reduce poverty by half by the year 2005, and to eradicate poverty completely by 2010. In support of this, the provincial government of Sekong has come up with a five-year socio-economic development plan for the province. The major objectives of the plan include building a stronger socio-economic structure for the province, putting a stop to slash and burn activities and arresting further forest degradation, improving livelihoods of the people, and promoting sustainable development and harvesting of its natural resources. A major strategy is to increase the income of the province by making use of its natural resources, mostly by harvesting timber and exporting these to bigger cities within the country. To further meet national quotas on timber harvesting and simultaneously increase forest cover, certain portions of degraded forests, the current state of which were mostly due to slash and burn activities, are being allocated for tree plantations.

Production forestry is on the rise in Sekong. In 2001, GOL granted the province a log quota of 10,000 m^3, and in 2002, this rose to 28,000 m^3. State companies and provincial authorities are responsible for management of production forests. Local communities are currently allowed to collect a limited amount of fuelwood for home consumption (5 m^3/household/year) from production forest, but the state manages for timber[5].

Such schemes will necessarily compete with the alternative of letting forests regenerate naturally, or at least using indigenous and mixed timber species to simultaneously increase forest cover and protect livelihood sources. Given the high dependence of local communities on NTFP harvesting for their livelihoods, there is thus the ongoing debate on whether degraded forests should be transformed into plantation forests to increase long-term incomes of the province, or whether they should be allowed to regenerate naturally and protect the livelihoods of the current and future generations. There may be no competition in terms of the physical area devoted to either plantation or to natural forest regeneration. In fact, there may be enough degraded forests to allow for both schemes to be undertaken. Such decisions will depend on how land is allocated within the province.

Land use planning and land allocation (LUPLA) to villages is another major priority for Sekong. Due to lack of funding and manpower, however, the province is behind most others in the country in fulfilling targets under the National Land and Forest Allocation Program. Out of the total land area of 7,665 km^2, about 66,000 ha has been allocated, to a total of122 villages. Most of the progress has been made in Thateng and Lamam; in Dakchung and Kaleum allocation has been completed in only 23 villages covering an area of 5,056 ha.

---

[5]Lao National Mekong Committee, and WWF Lao Project Office. 2002. Community-based forest management for conservation and sustainable development in the upper Sekong Watershed, a joint project proposal. pp. 26.

CALCULATING FOREST BENEFITS:
Valuation framework and methodologies

Total Economic Value[6]

The total economic value (TEV) approach is probably the most commonly used methodology in economics to measure the economic value of the environment and natural resources. It is defined as the sum total of all use values (UV) and non-use values (NUV) of the good or service being measured. Use values can further be classified into three types: direct use values (DUV), indirect use values (IUV) and option values (OV), although there are some sectors that contend that OV should be included as part of NUV rather than of UV. On the other hand, NUV are made up of existence (XV) and bequest values (BV). The total economic value may be expressed as:

TEV   *= UV + NUV*
           = (DUV + IUV + OV) + (XV + BV)

Direct use values refer to values derived from actual use of the good either for direct consumption or production of other commodities. Market prices are used for goods that are traded but for goods or services with no market prices, i.e., not traded, their values are more difficult to estimate. In the case of forests, direct use values would include the value of NTFPs being extracted for livelihoods, and the value of timber being sold and traded in the market. Benefits are therefore enjoyed by community or village members that depend on NTFP extraction for their livelihoods, and by the provincial government that gets to collect tax revenues from the sale of timber.

Indirect use values are benefits derived from ecosystem functions, such as the forest's functions for watershed protection, sequestering carbon, and biodiversity conservation. These are values derived from resources and services that are not consumed, traded or reflected in national income accounts. They usually accrue to society as a whole, rather than to individuals or corporate entities. In the case of watershed protection, the direct beneficiaries are those who live and/or operate within the whole watershed catchment area. On the other hand, biodiversity conservation and carbon sequestration benefits are global in nature, whereby people who may not live within the boundaries of Sekong or Lao PDR as a whole still attach positive values and derive benefits from such services. Although difficult to measure, there is increasing evidence that IUVs may prove to be larger than DUVs.

Option values are those that approximate an individual's willingness to pay (WTP) in order to ensure that the good can be accessed at a later date. OVs are some sort of insurance values, in which people assign values to risk aversion in the face of uncertainty. Forests provide an option for potential discoveries of microorganisms or genetic resources that may prove beneficial in the future. Bioprospecting activities by pharmaceutical and biotechnology companies are concrete examples of benefits that would have option values. Given this, society as a whole may be willing to pay to retain the option of having future access to a certain species. Again, this type of benefit is global in terms of the beneficiaries covered. A pharmaceutical discovery from a genetic resource in Sekong will in most cases benefit the rest of the world, thus people in general will have a positive value attached to this service.

Existence values are defined as the WTP of people merely to ensure the continued existence of a certain species or ecosystem. It is the benefit accruing to an individual just by knowing that the resource exists. The ethical dimension is important in determining the XV, which reflects sympathy, responsibility and concern that some people may feel toward certain species and

---

[6] Lifted mostly from Padilla, J. and R. Rosales. Economic Valuation of Biodiversity: A Preliminary Survey of Current Thinking and Applications. People, Earth and Culture. Los Baños, Laguna: 1998.

ecosystems or biodiversity in general. Like option values, existence values are global in nature. The existence of the tiger, for instance, would be important not just to the Lao population but also to people in other parts of the world in general.

Bequest values are measures of benefits people attach to resources so that future generations may avail of the same benefits that accrue to the present generation. These values provide a strong economic justification for preserving natural lands, and they seem to dominate all other benefits of wilderness in the minds of some people. It also ensures inter-generational equity.

A graphical representation of the various benefits derived from Sekong forests, as well as the beneficiaries to whom these benefits accrue, is presented below:

Figure 6: Economic Benefits From, and Beneficiaries of Sekong Forests

BENEFITS/ BENEFICIARIES	Village/ Community Level	Provincial Government	Watershed Catchment	Global Community
NTFP Harvests				
Timber Revenues				
Watershed Protection				
Carbon Sequestration Biodiversity Conservation Option Values Existence Values Bequest Values				

Other refinements to the theory involve the measurement of users' non-use values, which is defined as the importance users place on the good to maintain a given quantity and quality, although they may not intend to enjoy the good in the future. The difference of this with the pure non-use value is that the latter is held by a current non-user to maintain a certain quantity or quality above the extinction threshold.[7]

The economic value of Sekong forests being measured refers to direct and indirect use values only. The report does not try to capture option and non-use values, as doing so would require extensive surveys. Hence, the figures reported here are minimum, so to speak, and can easily become larger if more types of economic values could be captured and measured. As can be seen in the graph, the values that will be estimated will pertain to all types of beneficiaries, albeit not all benefits accruing to the global community will be captured.

Approaches in Measuring Direct and Indirect Use Values

In measuring direct use values, market prices are usually used. In this case study, direct use values are composed of the value of NTFP harvesting to people's livelihoods in Sekong, and the financial returns to the provincial government from timber harvesting. For NTFP harvesting, computations are not as straightforward though, as amounts of harvest for each type of product are not easily discernible. Two methods were used to compute for NTFP values. The first method consisted of the use of market prices of goods, where available, together with estimated

---

[7] Freeman, A.M. 1994. The Measurement of Environmental and Resource Values: Theory and Methods. In Dharmaratne, G., F. Sang & L. Walling 2000. Tourism Potentials for Financing Protected Areas.

quantities of harvest. Focus group discussions (FGDs) were conducted in three villages to get specific species and quantities harvested in a year. The second method applied was the Participatory Environmental Valuation (PEV) technique, whereby local villagers express the value of NTFPs within the context of their own perceptions, needs and priorities rather than through conventional cash-based techniques[8]. Cash measurements are of little relevance to subsistence economies, and values are better expressed through a numeraire that is accepted and accorded a high value in the village. It is important to note, though, that the numeraire must have a market value, even if the respondents are not aware of what it actually is. In the case of Sekong, rice was used as the numeraire, given that it is the staple crop planted and eaten. Villagers are then asked to rank all the products extracted from the forest, including rice, by placing counters on each product harvested. The number of counters would signify the importance placed on that particular product. The value of each product is then expressed relative to the value they place on rice. Results of the PEV and the FGDs were then compared and used to validate each other. Ideally, the survey should have been done in a random fashion, covering more respondents. Due to the usual limitations of time and budget, this was not achieved. Nevertheless, the results should be taken to reflect relative amounts, and can be used for providing bases for policy recommendations, but not to calculate and extrapolate values for the whole country.

Figure 7: FGD in Nong Lao Village, Sekong, May 2003

Figure 8: PEV Survey in Ban Kor Houa Phou, Sekong, May 2003

The financial benefits from timber harvesting were mostly in the form of tax revenues for the provincial government. These were significant in the sense that timber is the major export of the province, and there are plans to increase timber production in the years to come.

Estimating the other components of TEV is not as straight-forward, given that most of them are not being traded in the market, hence they do not possess market prices. Economic techniques have been developed to approximate such values. Indirect use values considered in this study are composed of watershed protection, biodiversity conservation and carbon sequestration. Watershed protection refers to the function of the forest in protecting downstream users, such as irrigation facilities, micro-hydro power supplies, lowland agricultural production and fishery resources that fall within the watershed's catchment area, against floods and sedimentation. Potential hydropower likewise contributes to the total watershed protection value of the forests of Sekong. The presence of the forest allows these users and facilities to be protected against damages from floods and erosion. The avoided costs from these damages are thus what would represent the value of watershed protection from Sekong forests.

Biodiversity conservation services of the forest can be estimated using the "revealed willingness to pay" of the government as expressed by its expenditures for forest conservation. To achieve

---

[8] Emerton, L. Participatory Environmental Valuation: Subsistence Forest Use Around the Aberdares, Kenya. African Wildlife Foundation Discussion Papers Series. September 1996.

the current level of biodiversity in a given protected forest, the government is willing to pay as much as it is actually spending for that given area. This amount can be seen as the value of biodiversity conservation from the supply side, i.e. the government, who is "supplying" biodiversity through its protection efforts.

Finally, for carbon sequestration, the benefit-transfer method (BTM) was used. BTM is an approach that involves taking the results from one or more primary economic studies with estimated values for similar impacts, and modifying and transferring them to the area being studied[9]. In this case, the impacts or benefits from conserving Lao forests[10] in the amount of carbon they sequester is used to measure the same type of benefit from conserving Sekong forests. Ideally, a forest resource inventory should be conducted to determine exactly the species and count of trees inside the forest. However, due to the absence of such data, broad assumptions on species and count were made.

---

[9] Philippine Environmental and Natural Resources Accounting Project (ENRAP). Guidebook for Environmental and Natural Resources Accounting: Methods and Procedures. DENR-Philippines/ USAID/ REECS. 2000.
[10] Bouttavong, et. al. Lao PDR Biodiversity: Economic Assessment. 2002.

SEKONG FOREST BENEFITS:
The direct value of forest goods

For purposes of this study, the major direct uses of the forests in Sekong province include Non-timber Forest Product (NTFP) collection and timber extraction. The annual household value of NTFPs will be based on results of the PEV survey as well as calculations based on market prices. The value of harvested timber will be expressed in terms of provincial revenues from exports and timber taxes.

In the following section, socio-economic characteristics of the surveyed villages will be outlined, with particular focus on how these characteristics influence the relationship between NTFPs and local livelihoods. These will include the number of households, the household size, the income category of the individual household, and the village land allocation schemes.

Furthermore, household preferences towards different NTFP categories will be identified and linked to seasonality as well as the level of poverty. Finally, the importance of NTFPs as a source of livelihood will by illustrated both in terms of cash and non-cash income.

Socio-Economic Characteristics of the Sample Villages

Three villages in Sekong province were chosen as primary data gathering locations. The villagers were identified based on recommendations from provincial authorities and accessibility. Within each village, focus group discussions were conducted along with individual household interviews. A total of 8 focus group discussions and 38 household interviews were conducted in the villages of: Ban Tiew in Thateng district, and Ban Nong Lau and Ban Kor Houa Phou in Lamam district. Within each village the households were subdivided into different income categories to test the hypothesis that NTFP collection as a livelihood source becomes less important as people become better off.

The table below shows the distribution of village households into different income categories:

Table 2: Profile of Sample Villages

Village	Number of People	Average Household Size	Number of Households	Income Category		
				Poor	Medium	Rich
Ban Tiew	479	5.9	81	21	60	-
Ban Nong Lau	323	5.2	62	9	49	4
Ban Kor Houa Phou	455	5.5	82	47	35	-

The income categories and the corresponding criteria were defined by the village heads, and therefore directly related to the actual socio-economic characteristics of the households. Despite village differences in terms of location, accessibility, and the number of households, a number of criteria were the same. As reflected in Table 3 below, the level of rice sufficiency, the amount of cash income, and conditions related to housing and livestock were among the common determinants of income level.

Table 3: Factors Determining a Household's Income Category

Village	Income Category		
	Poor	Medium	Rich
Ban Tiew	Rice deficit Bad house Little or no livestock	Rice sufficient Some cash income Good house	Not applicable
Ban Nong Lau	Rice deficit for more than 3 months Often sick Children don't go to school	Rice deficit for up to 3 months	Rice sufficient Paid job Own a tractor or rice mill
Ban Kor Houa Phou	Rice deficit Small house with leaf-roof	Rice sufficient Good house with tin-roof	Not applicable

Land use planning and land allocation are major priorities within Sekong province. In accordance with these priorities, the following land use scheme has been set up for each village.

Table 4: Sample Villages' Land Allocation

Land Type	Ban Kor Houa Phou Area (ha), (1998)	Ban Nong Lao Area (ha), (1997)	Ban Tiew Area (ha)
Conservation Forest	1,758.0	87.0	139.5
Protected Forest	26.0	138.0	649
Restoration Forest	35.0	2.0	483
Production Forest	450.0	213.0	8.06
Sacred Forest	11.0	0.8	-
Village Area	1.5	5.0	2.7
Rice Field (paddy land)	11.2	78.0	72
Coffee	159.1	20.9	45
Cardamom	0.8	-	-
Upland Rice	23.7	18.9	6
Agricultural Land	14.3	-	-
Track, Roads and Ponds	68.5	-	-
Reserve Land	72.2	-	-
Bush Forest	449.1	-	-
Total Area	***3,030.0***	***1,132.0***	***1,712.0***

Source: PAFO, 2003

As Table 4 shows the forest is categorized according to purpose – conservation, biodiversity protection, regeneration, production, and religious. Each forest category is associated with a set of rules and regulations enforced by the provincial government. These rules and regulations addressing forest utilization are the most important ones from a village perspective. In effect these regulations prescribe the villagers to harvest timber in the production forest only, whereas NTFP collection is allowed in all forest categories.

Each village has some land allocated for cultivation purposes. The major crops grown are upland and lowland rice, coffee and peanut. The average production per hectare is summarized in Table 5.

Table 5: Average Production for Selected Crops in Sample Villages

Rice kg/ha/year		Coffee kg/ha/year	Peanut Kg/ha/year
Lowland	Upland		
2,575	1,238	410	545

NTFP Collection

Based on the household interviews and the focus group discussions, the most important NTFPs are identified. Respondents were asked to rank specific forest products/resources[11] according to importance. The results can be seen in Figure 10, where the forest products have been grouped in broader categories as follows:
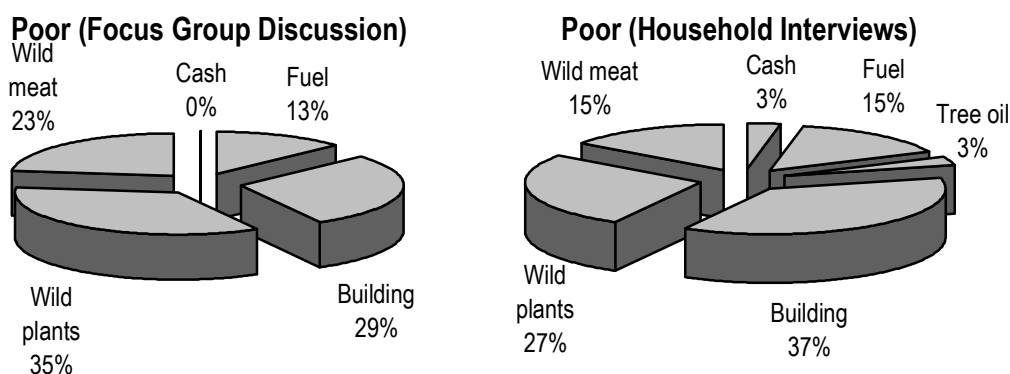
Figure 9: Categories of Forest Products

Building material:	Wild plants:	Wild meat:	Cash products:	Fuelwood	Tree oil
Leaves & grass Timber for building Bamboo Rattan	Fruits Vegetables Mushrooms Bamboo shoots Medicine purposes Flowers	Mammals Fish Reptiles Insects Birds Frogs	Bong bark Cardamom Honey Perfume tree Resin		

Further sub-groupings are made according to income categories. Two graphs are depicted for each income category, one illustrating the ranking results from the household interviews (HI) and the other the outcome of the focus group discussions (FGD).

From the different graphs in Figure 10, it is quite clear that all income categories see building material as the most important forest product category, followed by wild plants. However, cash products are perceived much more important by the rich households as compared to wild meat, which is ranked third by both medium and poor households. One point worth noting is that even though the building material category comes out as the topmost category, fuelwood is still the most appreciated single forest resource/product. Furthermore, since perceived importance is based on individual preferences, the graphs below indicate which NTFPs have the highest value for the households. On the other hand, as will be shown later, the value associated with a specific forest product/resource by the individual household does not necessarily correspond with values according to the market price.

Figure 10: Ranked Importance of Forest Product Categories by Income Category

Poor (Focus Group Discussion)
Wild meat 23%
Cash 0%
Fuel 13%
Wild plants 35%
Building 29%

Poor (Household Interviews)
Wild meat 15%
Cash 3%
Fuel 15%
Tree oil 3%
Wild plants 27%
Building 37%

---

[11] Forest products/resources: bamboo, bong bark, birds, bamboo shoots, cardamom, dye, fish, flowers, frogs, fruits, fuelwood, honey, insects, leaves & grass for housing, mammals, malva nuts, medicine plants & roots, mushrooms, perfume tree, rattan, reptiles, resin, timber for construction, tree oil, vegetables and wild chicken. For an elaborated list of products/resources see Annex 1.

Medium (Focus Group Discussion)

Wild meat 21%
Cash 11%
Fuel 13%
Building 30%
Wild plants 25%
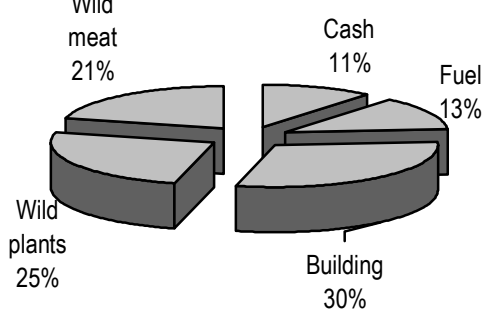
Medium (Household Interviews)

Wild meat 18%
Cash 5%
Fuel 14%
Tree oil 4%
Building 29%
Wild plants 30%

Rich (Focus Group Discussion)

Wild plants 21%
Wild meat 13%
Cash 17%
Fuel 14%
Building 35%

Rich (Household Interviews)

Wild plants 20%
Wild meat 9%
Cash 11%
Fuel 18%
Tree oil 0%
Building 42%
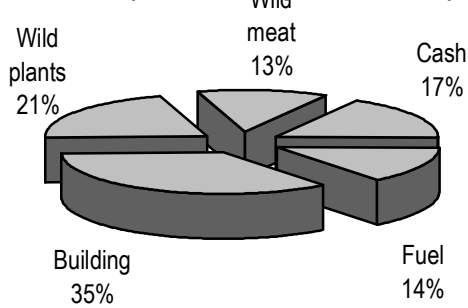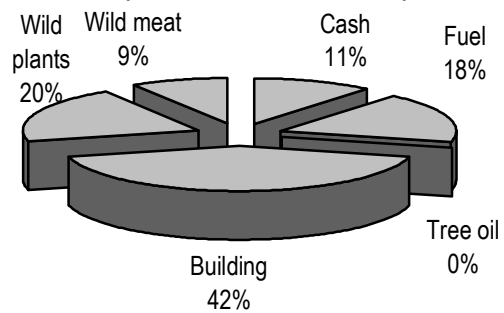
A seasonality chart was likewise derived from the FGD results, showing collection months for the different NTFPs and the relative amounts collected in each month. The chart is depicted in Table 6 and shows that some NTFPs are available all year and hence collected regardless of season. Other NTFPs such as cardamom, honey, and mammals are only collected during certain months.
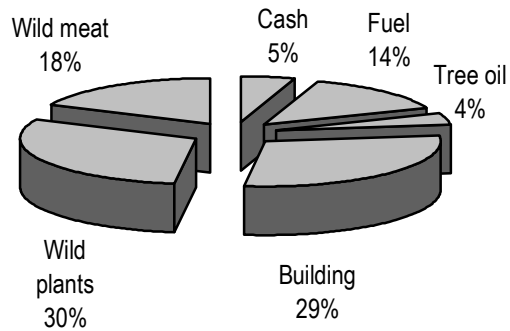
Table 6: Seasonality Chart of NTFP Collection

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Bamboo	10%	10%	8%	10%	7%	7%	7%	8%	8%	8%	8%	8%
Bong bark	13%	13%	13%	38%	25%							
Birds	10%	10%	10%	14%	10%	10%	5%	10%	10%	5%	5%	5%
Bamboo shoots					9%	15%	21%	21%	15%	6%	9%	3%
Cardamom								33%	33%		33%	
Fish	10%	10%	12%	14%	10%	6%	6%	4%	8%	8%	6%	6%
Flowers					100%							
Frogs	3%	3%	12%	9%	12%	21%	9%	6%	6%	3%	6%	12%
Fruits	5%	5%	5%	5%	14%	18%	18%	9%	9%	5%	5%	5%
Fuelwood	10%	12%	14%	12%	8%	6%	6%	4%	4%	6%	8%	12%
Honey	25%	25%	25%									25%
Insects			13%	13%	19%	6%	6%	19%	6%	6%	13%	
Leaves & grass	17%	21%	8%	13%	8%	0%	0%	0%	4%	4%	8%	17%
Mammals				25%	25%				25%	25%		
Medicinal plants	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Mushrooms	3%	6%	3%	12%	12%	15%	6%	9%	12%	6%	6%	9%
Rattan	9%	9%	11%	9%	7%	7%	7%	7%	7%	7%	7%	9%
Reptiles	8%	8%	8%	8%	8%	15%	15%				15%	15%
Timber	12%	12%	10%	10%	9%	5%	5%	7%	7%	7%	7%	9%
Tree-oil	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Vegetables	7%	7%	12%	12%	12%	9%	7%	7%	7%	7%	7%	7%
Wild chicken									33%	67%		

The Value of NTFPs

In this section, the economic value of NTFPs is estimated. As mentioned in section III, this computation is done using two different techniques. The first deals with computing values based on quantities collected and their corresponding market prices, and the other by applying PEV. As the results will show, the estimated values vary according to technique. The most plausible explanation for this is the high degree of uncertainty surrounding the stated quantities collected. The interviewed households found it extremely difficult to express how much they collect in terms of meters, kilos, cubic meters, and liters. The local villagers used different measurements such as bundles, baskets, and pots, which then had to be converted into units associated with a market price.

On the other hand, if one has faith in the revealed quantities, then the actual preferences that the household has towards a certain NTFP and the utility they derive from it must explain the fact that different values were found for the same forest product/resource. In subsistence economies, the existing market price does not necessarily reveal what villagers are willing to pay or accept for their products. They might not be willing to pay the market price or they might be willing to pay more, if they could afford it. The results will also show that very little is actually sold, which in turn could indicate that the market price is too low. In an economy relying on NTFP collection for subsistence, selling off products would mean that close substitutes would have to be bought. Since these substitutes are probably more expensive than what is sold, the current market prices provide little or no incentive to engage in trade.

Information derived from the eight focus group discussions relating to the average NTFP quantity collected is summarized in the table below. By combining this with market prices, it is possible to calculate the market value of the NTFPs collected by an average household.

Table 7: Market Value of NTFPs Collected by Sample Households

NTFPs	Average Quantity Collected per Household	Units	Average Price per Unit (Lao Kip)	NTFP Value per Household Based on Price (Lao Kip)
Bamboo	965.3	Meters	278	268,340
Bong bark	172.5	Kilos	333	57,443
Birds	16.0	Pieces	4,000	64,000
Bamboo shoots	118.6	Kilos	1,250	148,281
Cardamom	6.3	Kilos	14,000	87,500
Fish	40.9	Kilos	13,500	552,656
Frogs	27.4	Kilos	6,750	185,119
Fruits	44.2	kilos	900	39,797
Fuelwood	5.3	cubic meters	90,000	477,000
Honey	18.8	liter	8,500	160,087
Insects	1.56875	kilos	20,000	31,375
Leaves & grass	517.1	kilos	817	422,440
Mammals	0.4	kilos	10,000	3,750
Medicinal plants	12.0	kilos	10,000	120,000
Mushrooms	60.9	kilos	8,700	529,395
Rattan	381.0	meter	425	161,925
Reptiles	2.6	kilos	22,000	57,750
Timber for building	1.2	cubic meters	500,000	600,000
Tree-oil	16.9	liters	4,000	67,500
Vegetables	74.4	kilos	2,375	176,581
Wild chicken	0.4	pieces	15,000	6,000
Total NTFP value per household/year (Kip)				4,216,938
Total NTFP value per household/year (USD)				$398

Table 7 reveals that every household on average collects NTFPs with a combined market value of $398. If an average household in one of the surveyed villages therefore were to sell

everything they collect from the forest within a year, they would earn $398. As indicated, $398 is seen as the minimum value of a household's yearly NTFP collection.

We now turn to the results from the participatory environmental valuation conducted at the household level. The same thirty-eight households that ranked the different NTFPs were now asked to place counters on each card including the numeraire (household rice sufficiency). The idea is to obtain a proxy value for the different NTFPs by using the market value of household rice sufficiency as the base. Specifically, this is done by comparing the number of counters attached to each forest product/resource card to the number of counters allocated to the numeraire.

In the actual calculations, it is assumed that in a world without rice shortage, each household member on average would consume 200 kilos[12] of rice a year and that the market price of rice is 800 Kip/kilo[13]. For a household with the size of 6, the value of rice sufficiency would therefore be 960,000 Kip/year (200*6*800). If the numeraire in this case were given 10 counters and, for example fuelwood 5 counters, then the annual household value of fuelwood collected from the forest would be 480,000 Kip ((960,000/10)*5). However, if the household were smaller but had still allocated the same number of counters to both the numeraire and fuelwood, then evidently the value of fuelwood would be smaller.

The results of the PEV are shown below and are all based on actual household sizes.

Table 8: NTFP Value Per Household Based on PEV Technique

NTFPs	NTFP Value per Household Based on PEV (Lao Kip)
Bamboo	470,262
Bong bark	107,821
Birds	87,655
Bamboo shoots	434,441
Cardamom	72,695
Fish	369,460
Flowers	22,035
Frogs	257,533
Fruits	235,640
Fuelwood	777,222
Honey	21,754
Insects	128,270
Leaves & grass	505,988
Mammals	17,225
Medicinal plants	170,946
Mushrooms	278,597
Perfume tree	37,953
Rattan	181,372
Reptiles	55,314
Resin	54,698
Timber for building	604,395
Tree-oil	170,640
Vegetables	498,329
Total NTFP value per household/year (Kip)	5,560,248
Total NTFP value per household/year (USD)	$525

---

[12] Based on an average household size of 6 – 2 adults and 4 children – and a consumption of 300 kg/adult and 150 kg/child (25 year agricultural statistics)
[13] Average market price 2003

Based on results from the PEV, the collected NTFPs represent a total value of $ 525 per household a year. This is slightly higher compared to the market value derived in Table 7, but, as mentioned earlier, the fact that we are dealing with a subsistence economy implies that utility derived from consuming a specific NTFP may not be entirely reflected in the market price. Fuelwood is a good example. This is a product that is valued highly by the villagers and is believed to be almost as important as rice. However, based on market prices, its value is far below that of rice, wherein a one-year average of fuelwood supply costs 477,000 Kip, and the cost of having sufficient rice is 896,000 Kip[14].

The PEV results further show that the top six NTFPs in terms of value are fuelwood, timber for building houses, leaves and grass for roofing and walls, vegetables, bamboo and bamboo shoots. Alternatively, the top six NTFPs based on market prices are timber for building houses, fish, mushrooms, fuelwood, leaves and grass for roofing and walls, and bamboo. The above rankings are average observations that fit the majority of the sample households, and therefore do not clearly show any divergence between the income groups. The rankings are summarized in the table below.

Table 9: Average Ranking of NTFPs According to Value

Average Ranking	Valuation Technique	
	Market Value	PEV
1	Timber	Fuelwood
2	Fish	Timber
3	Mushrooms	Leaves & grass
4	Fuelwood	Vegetables
5	Leaves & grass	Bamboo
6	Bamboo	Bamboo shoots

However, since the PEV was done on a household level, it is possible to further distinguish the value according to income group. This will allow for further analysis of NTFP preferences according to different income groups. In the graph below, the relative value that the different NTFPs represent for each income category can be observed:

Figure 11: Relative NTFP Values According to Income Group
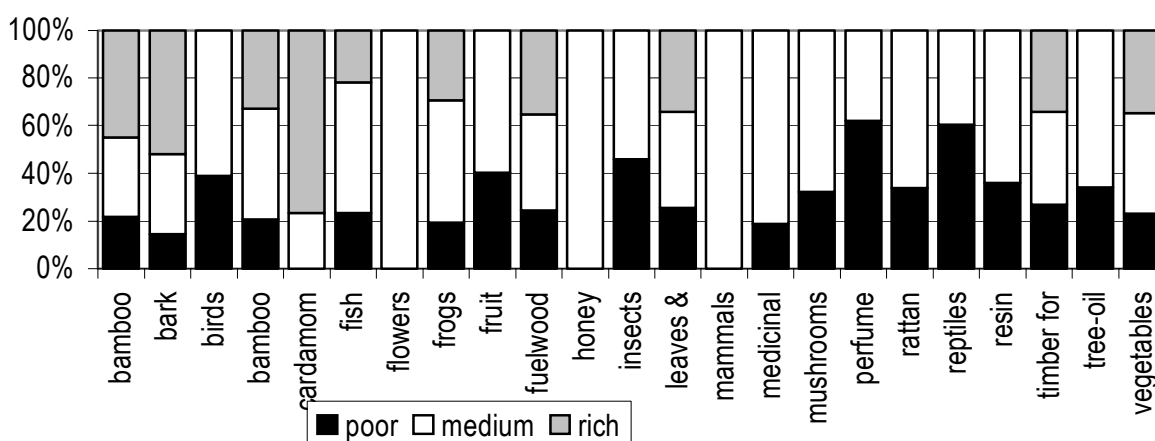
Whereas Table 7 and Table 8 summarize the NTFP values in absolute terms, it should be noted that the above graph only demonstrates the relative distribution of NTFP value between the different income categories.

---

[14] Based on actual average household size equal to 5.6

Figure 11 shows that only the medium income category collects and therefore values flowers, honey, and mammals. On the other hand, poor households value reptiles and perfume tree more than the medium group. The rich households don't even collect these products. Bamboo, bamboo shoots, fish, frogs, fuelwood, leaves and grass, and timber for building are valued more or less equally among the three income groups. Another interesting point that is that the rich households collect and value relatively fewer NTFPs, which supports the hypothesis that as households become better off, their reliance on NTFPs decline.

NTFP Collection as a Source of Livelihood

To fully understand the role of NTFPs in a subsistence economy, the following paragraph will focus on clarifying how much NTFPs contribute to local livelihoods in terms of both cash and non-cash income. Information regarding the sample households' cash income was easily obtained through interviews, whereas estimating the non-cash income involved valuing a series of products that were not sold but were consumed.

Figure 12 Sources of cash and non-cash income, per year

Non-cash Income - Poor US$ 413

Cash Income - Poor US$ 90

Non-cash Income - Medium US$

Cash Income - Medium US$ 315

Non-cash Income - Rich US$ 953

Cash Income - Rich US$ 202
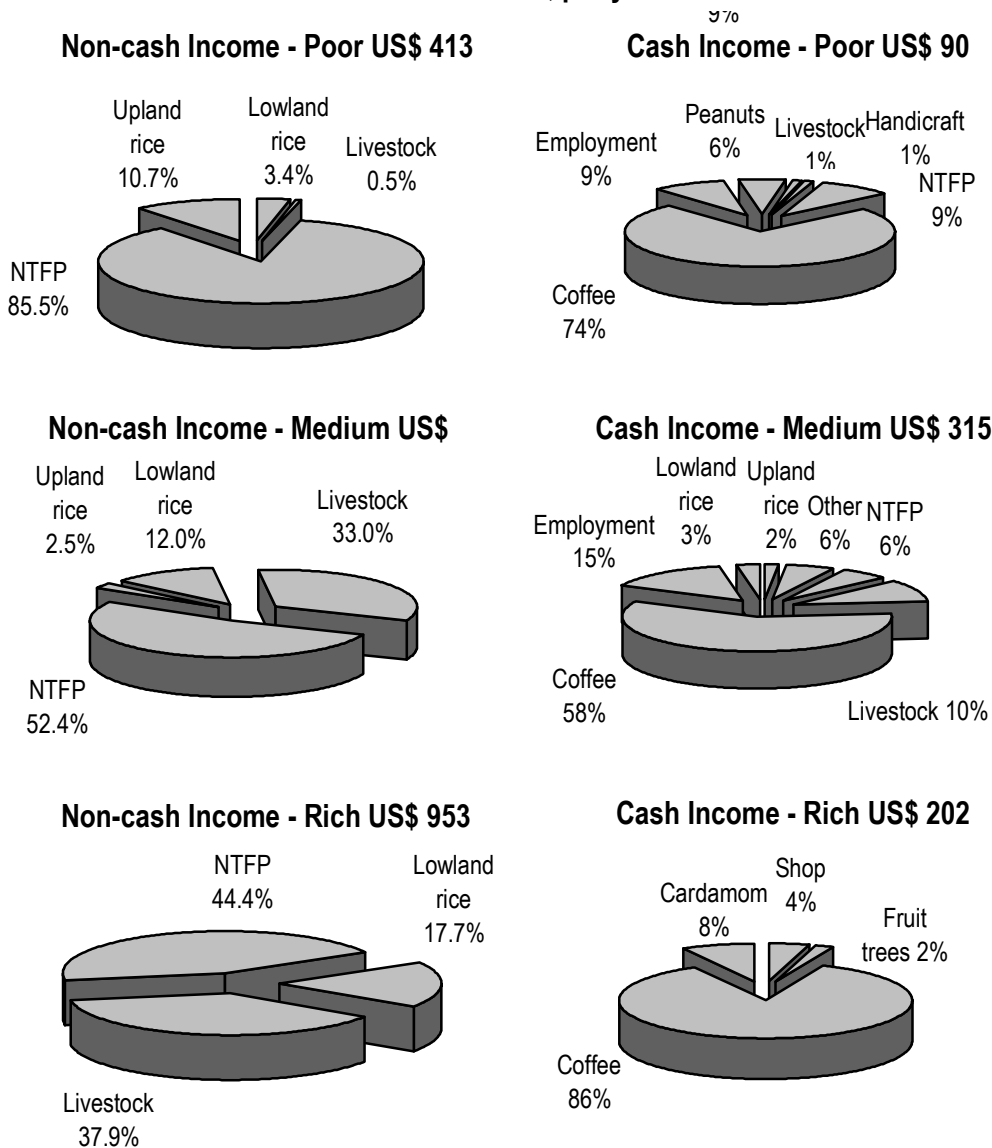
Non-cash income covers rice production, livestock and NTFPs. Information about rice production is known (Table 5), as is the livestock distribution in the villages and the value of each species[15]. In Figure 12 above the total NTFP value revealed in Table 8 is compared to other sources of income and reveals average household monetary values.

Across all income categories, the main source of non-cash income is NTFP collection. Very few NTFPs are actually sold. For poor households, NTFPs account for as high as 71% of overall income. This figure declines as people become better off, i.e. 43% for the medium households and 36% for the rich. In absolute terms, it is interesting to note that the aggregated value of NTFPs is highest for the medium group (US$ 663). According to the villagers, this is based on the fact that the medium and rich households have a better knowledge of where and when to find NTFPs in the forest. They simply collect more NTFPs both in terms of quantity and species (see Figure 11).

Another surprising result is that the rich households seem to have lower incomes than the medium group. One explanation is that the categorization of the households is not solemnly based on income, but also on the quality of the house and on rice sufficiency. Furthermore, only one out of the three surveyed villages had a "rich" income category.

The relative percentages of cash and non-cash income sources for each income category are summarized in the table below along with the percentage of total income made up by the value of NTFP collection.

Table 10: Relative Shares of Cash and Non-Cash Income Sources

Income Source	Income Category			
	Poor	Medium	Rich	All Households
Cash income	18%	20%	18%	16%
Non-cash income	82%	80%	82%	84%
Total income	100%	100%	100%	100%
NTFP as part of total income	71%	44%	36%	41%

Across income categories, ratios of local livelihood dependence on cash and non-cash income seem to be uniform. However, as households become better off their reliance on NTFPs decreases.

Timber Values

In this paper the assumption is made that timber values are expressed in terms of provincial benefits rather than national ones. The assumption is made since the actual survey was restricted to Sekong province and therefore applying the results to other provinces is considered not be viable.

Whereas the total value of NTFPs, which is based on household preferences, shall be viewed as an economic value in the sense that no transfer payments occur, the estimated timber value is financial in character. The method chosen to estimate the timber value involves assessing the provincial revenues from exports and timber tax earnings. Taxes are transfer payments and therefore in effect financial values. However, the earnings from timber taxes do contribute towards indicating how much timber extraction is worth for the province.

The forest allocation scheme for Sekong province is shown in Table 1. Forests allocated for timber extraction cover 58,479 hectares, which is equivalent to approximately 12% of the total forest cover.

---

[15] Livestock prices: Chicken US$ 1.1, Duck US$ 2.1, Pig US$ 4.7, Cattle US$ 66, Buffalo US$ 165

Timber Revenues and Taxes

According to PAFO, the government budget allocated for forest management in Sekong province is approximately 20 million Kip/year (US$ 1,887/year). Half this money is earmarked for conservation and fire prevention/protection activities. The other half is spent on raising awareness among the local communities as to which rules and regulations apply when utilizing forest resources.

Obviously the budget is very small, but additional income is generated from timber taxes. Once the timber is logged a tax in the order of US$ 2-3 per cubic meter[16] is paid to the province, which then transfers the money back to the government. However, some of the tax earnings stay with the province and cover expenditures towards replanting degraded forests and establishing small plantations.

In 2002, the province logged 23,000 cubic meters – 20,000 m^3 of softwood and 3,000 m^3 of hardwood. As noted in Section I.C, the GOL had granted Sekong a log quota of 28,000 m^3 in that same year. The implication of this is that the province did not make full use of its log quota. In 2003, PAFO plans to expand logging massively and intends to log 40,000 m^3 of timber – 35,000 m^3 of softwood and 5,000 m^3 of hardwood, thereby creating tax earnings in the order of US$ 85,000.

Based on provincial export revenues from 1996 to 2000, an average timber price of US$ 13 per m^3 is derived. By using this price and multiplying it with the projected log quota of 40,000 m^3 of timber, timber export revenues in 2003 are estimated to be US$ 520,000. Adding the tax earnings of US$ 85,000 results in a direst use value from timber extraction in the order of US$ 605,000/year. The results are summarized in the table below:

Table 11: Timber Values for 2003

	Tax Earnings	Export Revenues	Total Timber Value
Timber values for 2003	US$ 85,000	US$ 520,000	US$ 605,000

---

[16] US$ 2 for 1 m^3 of softwood, and US$ 3 for 1m^3 of hardwood

SEKONG FOREST BENEFITS:
The indirect value of forest services

Indirect use values refer to ecosystem services that indirectly contribute to the improvement of economic production and productivity, and quality of life in general. Forest services such as watershed protection and biodiversity conservation contribute to maintenance of water supply and quality and protection against floods and erosion, while carbon sequestration helps mitigate global warming. This section discusses the estimated contribution of Sekong forests in providing such services to the relevant beneficiaries.

Watershed Protection

Forests provide natural catchment areas for water supply. They further serve as natural filters for maintaining water quality at levels that support human and other aquatic life. Continuous logging and forest degradation have resulted in flooding and soil erosion that in turn has had tremendous negative impacts all the way down to coastal areas where watersheds eventually end. Other downstream users who usually experience negative impacts from erosion and flooding are lowland agricultural farmers and downstream fisher folk. Likewise, forest denudation would negatively impact water supply, including energy sources dependent thereon.

The presence of forests can result in the avoidance of such costs. To estimate the total value of Sekong's watershed protection services will necessitate the estimation of each of these individual costs avoided through the forests' presence. For this particular section, analysis will be conducted using the Sekong watershed as the basic unit, which is composed of 28,815 km^2 broken down into the following:

Table 12: Sekong Watershed Area, by Slope

Slope Class	Area (km²)	Percent to Total
0-2%	82,580	28.7%
2-5%	26,350	9.1%
5-8%	17,380	6.0%
8-15%	30,440	10.6%
15-30%	53,510	18.6%
30-60%	61,370	21.3%
>60%	16,520	5.7%
no data	0	0.0%
TOTAL	**28,815**	**100.0%**

Fisheries and Aquatic Resources

The existence of forests ensures protection against erosion, which if not mitigated could cause sedimentation problems, and would negatively impact on fisheries and aquatic resources downstream.

The average annual per capita consumption of fish and aquatic resources in Lao PDR is 28 kg./year, making up an average of 43% of total animal products consumed, and 55-59% of animal protein equivalents. Practically all aquatic resources in Sekong are caught and sold locally. Unfortunately, there is no disaggregation of fish consumption on a provincial level. We further assume that total consumption has a one-to-one correspondence with fish catch. To get estimated fish catch for Sekong, the average national consumption figures are thus used. Multiplying the average consumption per capita with Sekong's total population in 2001 gives us an estimate of annual fish caught and consumed in the province at 1,998,808 or approximately

2 million kilos a year. Combining this figure with the average price of US$ 0.68/ kg. gives us an approximate value of US$ 1,359,189 for fisheries and aquatic resources in Sekong.

Table 13: Estimated Fish Catch at Sekong

Sekong population, 2001	Estimated Fish Catch (kg.)	Estimated Value of Fish Catch (US$)
71,386	1,998,808	1,359,189

Interviews with the Science, Technology and Environment Agency (STEA) representative in Sekong[17] revealed that droughts experienced during the past ten years are being attributed to the decrease in forest cover in Lamam and Tateng districts due to slash and burn. Also experienced during this period was a rise in temperature, which they believe affected cropping seasons and periods. One noticeable cause of the decline in forest cover though, is the increase in land used for agriculture purposes. During the same period, sedimentation and erosion were observed, and there was a decline in fish catch at about the same time, estimated to be in the range of a 10% decline. However, there were also other possible reasons for this, including the use of destructive fishing methods and overharvesting. There have been no scientific studies conducted to determine the exact relationships of these events. Nevertheless, most reviews conclude that the major threat to sustaining biodiversity, and river fisheries, is environmental degradation (Arthington and Welcomme, 1995, Coates 1995a, FAO 2000, Welcomme 1995b, 1997, Kottelat and Whitten 1996)[18]. Suffice to say that the existing forests do protect downstream fishery resources, which are estimated to be in the value of US$ 1.4 million. If we apply 10% as the total impact of the loss of forest cover on fishery resources downstream, then the estimated watershed protection function of the forest for fishery resources would amount to US$ 135,919 per year.

Agricultural Production

Aside from fisheries and aquatic resources, agricultural farmers likewise benefit from forest protection against erosion and floods, which can cause heavy damage on crops during the rainy season and when typhoons occur.

Rice is the major crop grown in Sekong. Agricultural data from 1999 to 2001 reveals that on the average, 55% of total agricultural area is planted with rice. Agricultural productivity is expectedly low for upland rice, relative to lowland and irrigated production.

Table 14: Rice Production, Sekong, 1999-2001

Indicator/ Rice Paddy Type	Upland Rice	Lowland Rice	Irrigated Rice	Total
Production (tons)				
1999	4,810	8,641	1,640	15,091
2000	6,264	9,350	1,696	17,310
2001	6,670	10,840	1,900	19,410
Area harvested (has)				
1999	3,142	2,788	430	6,360
2000	3,713	2,960	424	7,097
2001	4,415	3,285	468	8,168
Production per ha (tons/ha)				
1999	1.53	3.1	3.8	2.8
2000	1.69	3.16	4.0	2.4
2001	1.51	3.3	4.06	2.4
% Area Harvested with Rice to Total Area Harvested (in %)				
1999	29	26	4	59
2000	17	31	6	51
2001	30	22	3	55

---

[17] Personal interview with Mr. Phetdavong Bounmysavath, Head, STEA-Sekong. April 23, 2003.
[18] In Coates, D. Biodiversity and Fisheries Management Opportunities in the Mekong River Basin. IUCN.

Primary Source of Data: Agricultural Statistics Yearbook, 2001. Department of Planning, Vientiane, May 2002.

Table 15: Production and Area Harvested, Non-Rice Crops, Sekong Province 1999-2001

Indicator/ Crop	Starchy Root	Coffee	Others	Total
Production (tons)				
1999	7,350	1,213	4,146	12,709
2000	10,629	2,624	18,342	31,595
2001	11,137	1,880	13,897	26,914
Area harvested (has)				
1999	1330	2020	1102	4452
2000	1912	2030	2908	6850
2001	2003	2350	2357	6710
% Area Harvested with Non-Rice to Total Area Harvested (in %)				
1999	12	19	10	41
2000	14	15	21	49
2001	13	16	16	45

Prices received by farmers vary among glutinous and non-glutinous rice. However, there is no data on production and area harvested using the same classification. In computing for total production value, the average price for all rice paddies in 1999 was used along with total rice production figures. Unfortunately, data for 2000 and 2001 prices were not available during the time of the survey, hence all prices are expressed in 1999 prices. The following table summarizes the total production values and values per hectare for rice:

Table 16: Rice Production Value, Sekong, 1999-2001

Indicator/ Rice Paddy Type	Upland Rice	Lowland Rice	Irrigated Rice	Total
Total Production (tons)				
1999	4,810	8,641	1,640	15,091
2000	6,264	9,350	1,696	17,310
2001	6,670	10,840	1,900	19,410
Production Value (in 1999 US$)				
1999	302,667	543,731	103,196	949,594
2000	394,159	588,344	106,720	1,089,224
2001	419,707	682,102	119,557	1,221,365
Value per ha. (in 1999 US$)				
1999	96	195	240	149
2000	106	199	252	153
2001	95	208	255	150

In considering watershed protection functions, only lowland and irrigated rice production values are used. Current practices for upland rice harvesting, i.e. slash and burn activities, cause erosion, hence are assumed to negate the erosion control functions accorded by Sekong forests towards agricultural production. In effect, the value of erosion control is estimated to be the following:

Table 17: Erosion Control Value Estimates, for Rice Production, Sekong

	3–yr. Average Production Value (in 1999 US$)	Value per ha. (in 1999 US$)
Lowland Rice	604,726	200
Irrigated Rice	109,824	249
TOTAL	**714,550**	**207**

Micro-Hydropower Facilities

Micro-hydropower facilities are commonly used to supply electricity to rural households in Sekong. The Ministry of Industry, Handicraft, and Electricity estimates that an average micro-hydro generator runs between 6-10 months a year, depending on the extent of floods and droughts. Such facilities source water from the existing watersheds in Sekong. Each generator initially costs between US$ 16-20, with regular maintenance amounting to US$ 5-10 per year, and lasts between 5-10 years[19]. There are around 300 micro-hydro facilities in Sekong, according to the Ministry of Industry, Handicraft and Electricity. The total annual value of the facilities thus amounts to US$ 2,970 per year.

Each generator runs for approximately 1,333 hours a year, producing between 200 to 300 watts. For all 300 facilities, approximately 99,975 kw of hydropower are produced using water provided by Sekong forests.

Consumer costs for electricity fall in the range of Kip 84 to 569, depending on the actual usage in a month. This translates to the value of hydropower from micro-hydro facilities to be in the range of Kip 8,397,900 to 56,885,775, or US$ 792-5,367[20] a year.

Table 18: Micro-Hydropower Value, Sekong Watershed

Total kw Generated	No. of Facilities	Value per kw	Value of Total kw
99,975 per year	300	Kip 84-569	US$ 792-5,367

Potential hydropower supply

Aside from micro-hydro facilities, there are a number of planned hydropower dams in the Sekong watershed that will utilize water being protected by the forests:

Table 19: Planned Hydropower Dams, Sekong Watershed

Planned Dams	Installed Capacity (MW)	Total Energy (GWh)	Plant Factor	Reservoir Area (km^2)
Xe Kong 5	248	1183	0.54	70
Xe Kong 4	451	1746	0.44	160.4
Houay Lamphang Gnai	60	354	0.67	3.5
Xe Katam	119	709	0.68	
Xe Kaman 3	308	1349	0.5	12
Xe Kaman 1	468	1925	0.47	222
Xe Xou	59	277	0.54	112.9
Nam Kong 3	25	142	0.65	37
Nam Kong 1	238	802	0.38	12.1
TOTAL	**1,976**	**8,487**		**629.9**

Total maximum energy that is estimated from the planned dams is 8,487 GWh per year, which if valued (at consumer prices of electricity for micro-hydro dams) falls in the range of Kip 712,908,000,000 to 4,829,103,000,000, or US$ 67,255,472 – 455,575,755[21]. This represents a huge value in terms of potential hydropower supply being provided by the watershed protection services of the Sekong watershed.

---

[19] Personal interview with Mr. Adam Harvey from the Ministry of Industry and Handicraft, Electricity Department.
[20] Exchange rate used: US$1 to Kip 10,600
[21] At Kp 10,600 to US$ 1

Flood Control

The flood control functions of the forest can be estimated by computing how much it would take if actual dams were built to prevent floods. The planned hydropower dams have an estimated cost of US$ 2,418 million for all nine projects. The figures, however, included transmission costs which are not relevant to the watershed protection function under consideration. Applying a conservative estimate, i.e. 50% of actual construction costs[22], and assuming fifty years lifetime for the dams, and 10% maintenance costs per year, annual costs result to approximately US$ 26.6 million per year. This figure represents the avoided costs of having to actually build the dams, to serve as flood control measures for downstream users of the watershed. Dividing this by the number of hectares of the forests of Sekong results in flood control functions at US$ 92.3 per hectare per year.

Table 20: Construction Costs of Planned Hydropower Dams, Sekong Watershed

Planned Dams	Construction Cost/yr, US$M (50% of total, for 50 years)	Maintenance Costs per year, US$M	Total Annual Costs, US$M/yr
Xe Kong 5	3.98	0.398	4.378
Xe Kong 4	5.9	0.59	6.49
Houay Lamphang Gnai	1.06	0.106	1.166
Xe Katam	0.822	0.0822	0.9042
Xe Kaman 3	3.43	0.343	3.773
Xe Kaman 1	4.38	0.438	4.818
Xe Xou	1.25	0.125	1.375
Nam Kong 3	0.86	0.086	0.946
Nam Kong 1	2.497	0.2497	2.7467
TOTAL	**24.179**	**2.418**	**26.597**

In sum, total watershed protection functions of Sekong forests are made up of the following values:

Table 21: Watershed Protection Value Estimates, Sekong Watershed

Watershed Protection Component	Total Annual Value (US$)	Annual Value per hectare[23] (US$/ha/yr)
Fisheries & aquatic resources	135,919[24]	0.47
Agricultural Production	714,550[25]	2.5
Micro-hydropower facilities	792-5,367	.003 - .02
Potential hydropower supply	67,255,472–455,575,755	233 - 1,581[26]
Flood Control	26,597,000	92.3

Biodiversity Conservation

Ideally, the value of biodiversity conservation would be measured in terms of the actual quantity and quality of biodiversity that Sekong forests provide, and how much beneficiaries of biodiversity would be willing to pay for the environmental service. Unfortunately, there has been no resource inventory conducted to date. Alternatively, supply-side valuation can be used, wherein the amounts spent by governments in protecting forests, thereby ensuring the continuing existence of biodiversity, can proxy for its value. By spending for protection,

---

[22] No estimates for actual dam construction costs without transmission were available
[23] refers to total area of Sekong watershed
[24] 10% of total fishery and aquatic resources value
[25] average production of lowland and irrigated rice between 1999 to 2001
[26] total annual value divided by total watershed area

management bodies ensure the existence of biodiversity, and the amounts they spend "reveal" what they are "willing to pay" to conserve biodiversity.

Over the years, foreign donor agencies have invested quite substantial amounts of money and effort in conserving Lao PDR forests. This is in recognition of the global benefits derived from keeping the country's forests and resulting biodiversity intact. Likewise, the national government of Lao PDR has spent a noteworthy amount in protected areas considered of national importance, two of which are located partly in Sekong. Unfortunately, due to the mere size of these protected areas and the usual priority given to economic development and infrastructure concerns, budgets are inadequate to fully guard these forests against human threats such as illegal logging and poaching of wildlife.

In Sekong province, the provincial government spends an average of Kip 20 million, or US$1,887 for forest protection a year. This covers all types of expenditures, such as forest guards, supplies, transportation, etc. The budget is obviously very small and is not enough to protect the forests adequately. More importantly, if this is used to proxy for the economic value of biodiversity conservation, it reflects a very low value and does not really approximate the value from the demand side (i.e. how much beneficiaries of biodiversity would be willing to pay to conserve it). In this case, the biodiversity conservation value that is derived from this exercise is considered to be the minimum value of biodiversity conservation.

There are five types of forest in Sekong according to the classification of the Provincial Agriculture and Forestry Office (PAFO):

Table 22: Forest Types According to PAFO, Sekong

Forest Type	Area (ha.)
Mixed Forest	49,095
Primary Rainforest	65,413
Upland Forest	50,779
Bamboo Forest	61,764
Pine Forest	278,650
TOTAL FOREST AREA	**505,700**

Further to this classification, the PAFO has a separate category for protection and conservation forests, which are essentially part of the total forest area of Sekong. Protection and conservation forests make up for around 25% of total forest area, and are broken down accordingly:

Table 23: Conservation and Watershed Protection Forests, Sekong

Forest Type	Area (ha.)
Total Conservation Forests	9,349
National Conservation Forests	95,212
Watershed Protection Forests	19,600
Total Conservation and Watershed Protection Forests	**124,161**

Conservation forests refer to forests that are preserved and protected primarily for biodiversity conservation. National conservation forests are areas that fall under national government jurisdiction, and have separate management bodies and national budgets allocated therefor. Watershed protection forests are designated as protected areas by the province primarily to safeguard water supply sources.

Only the total hectarage of protection and conservation forests is used to compute for the value of biodiversity conservation on a per hectare basis. It is assumed that biodiversity is conserved only for these types of forests, since resource extraction is allowed in other forest classifications. The total area of protection and conservation forests in Sekong is 124,161 has. Out of this, 28,949 has are being protected using provincial government budgets. The total biodiversity

conservation figure, as approximated by the provincial government budget, is US$1,887. Dividing the latter figure with the total area conserved gives us a biodiversity conservation value per hectare of US$ 0.07 for Sekong forests being protected at the provincial level.

One of the most commonly talked about uses of biodiversity is for bioprospecting, where genetic resources offer enormous potential value in agricultural, industrial and pharmaceutical applications. One can therefore value an aspect of biodiversity conservation by looking at the willingness of these companies to pay for preservation in the hope of potential discoveries in the future. A survey was conducted among eighteen biodiversity "hotspots" in the world, and results are presented below[27]:

Figure 13: Willingness to Pay of Pharmaceutical Companies to Preserve a Hectare of Land in 18 Biodiversity Hotspots

Pharmaceutical company willingness to pay to preserve a hectare of land in eighteen biodiversity "hotspots"	
Hot spot	*Value in dollars per hectare*
Western Ecuador	$2.29
Southwestern Sri Lanka	1.87
New Caledonia	1.38
Madagascar	.76
Western Ghats of India	.53
Philippines	.52
Atlantic Coast Brazil	.49
Uplands of western Amazonia	.29
Tanzania	.20
Cape Floristic Province of South Africa	.18
Peninsular Malaysia	.16
Southwestern Australia	.14
Ivory Coast	.13
Northern Borneo	.11
Eastern Himalayas	.11
Colombian Choco	.08
Central Chile	.08
California Floristic Province	.02

Sources:
R. David Simpson and Roger A. Sedjo, 1996, "Valuation of Biodiversity for Use in New Product Research in a Model of Sequential Search," RFF Discussion Paper 96–27.
R. David Simpson, Roger A. Sedjo, and John W. Reid, 1996, "Valuing Biodiversity for Use in Pharmaceutical Research," *Journal of Political Economy* 104, 163–185.
Norman Myers, 1990, "The Biodiversity Challenge: Expanded Hot-Spots Analysis." *The Environmentalist* 10, 243–256.
Norman Myers, 1988, "Threatened Biotas: 'Hot Spots' in Tropical Forests." *The Environmentalist* 8, 187–208.

Six of these hotspots are found in Asia, and if we assume that Lao PDR would have similar characteristics in terms of biodiversity (given that it was identified as an important ecoregion by WWF), we can use the minimum and average figures derived for these areas to approximate for bioprospecting values in Sekong:

---

[27] Simpson, R. D. 1997. Biodiversity Prospecting: Shopping the Wilds is Not the Key to Conservation. Resources for the Future, Washington, D.C., USA.

Table 24: Estimated Bioprospecting Value, Sekong

Minimum WTP per ha (US$)	Average WTP per ha (US$)	Conservation Area (has)	Estimated Bioprospecting Value (US$)
0.11	0.55	124,161	13,658 – 68,289

Table 25 summarizes the biodiversity conservation values estimated for Sekong forests:

Table 25: Minimum Biodiversity Conservation Value of Sekong Forests

Indicator	Total
Total Provincial Conservation Area (has)	28,949
Total Conservation Area (has)	124,161
Biodiversity Conservation Value (US$)	1,887
Biodiversity Conservation Value per ha (US$ per ha)	0.07
Bioprospecting Value (US$)	13,658 - 68,289
Bioprospecting Value per ha (US$ per ha)	0.11 – 0.55

Carbon Sequestration

Carbon sequestration refers to the atmospheric regulation services that forests provide. Growing natural vegetation stores carbon and locks it up, thereby helping to mitigate or avoid global warming[28]. Ideally, to measure carbon sequestration functions, a forest inventory is conducted to determine the actual timber stand in the area. However, this exercise requires huge investments, and in the larger scheme of things, such amounts would usually be used for more immediate purposes, e.g. infrastructure development, in developing countries like Lao PDR. Needless to say, there are no existing forest inventories in Lao PDR, much less Sekong province, and it would be very difficult to come up with carbon sequestration values based on primary data. The benefit-transfer method (BTM) is thus applied to estimate the carbon sequestration value for Sekong forests (see Section III.B).

The Lao PDR Biodiversity Assessment Report contains estimates of carbon sequestration services of Lao's forests on a national scale. The BTM is likewise used, due to the absence of any primary research on carbon sequestration in the country. Nevertheless, there have been a number of estimates made for carbon sequestration by tropical forest vegetation. These range from an average of 100 to 150 tonnes of carbon per hectare of closed secondary forests, to 200-250 tonnes of carbon per hectare of closed primary forest (Myers 1997)[29]. For the whole Asia-Pacific, Sedjo and Sohngen (2000) estimate total carbon density to be at 166 tonnes per hectare. In the same report abovementioned, assumptions were made regarding tonnes of carbon sequestered in Lao forests based on forest type:

Table 26: Carbon Sequestration Value, Lao PDR

Forest Type	Area (has.)	Tonnes of Carbon Sequestered per ha.
Evergreen/ mixed dense	1,589,653	150
Evergreen/ mixed disturbed	4,033,725	75
Evergreen/ mixed mosaic	2,113,086	50
Deciduous	733,141	125
Deciduous mosaic	600,227	50
Regrowth Forest	317,999	75

Source: Lao PDR Biodiversity Assessment Report

---

[28] Emerton, L. et. Al. Nam Et-Phou Loei National Biodiversity Conservation Area, Lao PDR: A Case Study of Economic and Development Linkages. IUCN, 2002.
[29] In Bouttavong, et. al. Lao PDR Biodiversity: Economic Assessment. 2002.

Balancing the Returns to Catchment Management:
The Economic Value of Conserving Natural Forests in Sekong, Lao PDR

Attempts were made to match the forest types in the Lao Biodiversity Assessment Report, and the available information on forest types in Sekong. Through consultations with appropriate specialists, and due to lack of any other available data on forest density and composition, the following matches were assumed for this study:

Table 27: Forest Type Matching, Sekong

Lao Biodiversity Assessment Report	Sekong Forest Types
Evergreen/ mixed dense	Mixed deciduous
Evergreen/ mixed mosaic	Semi-evergreen
Evergreen/ mixed disturbed	Mixed hardwood/ conifer
Deciduous mosaic	Dry dipterocarp
Regrowth forest	Montane conifer
Deciduous	Semi-evergreen/ dry dipterocarp

The release of carbon dioxide creates global warming effects. These translate into economic costs and losses in the form of health damages or damage to infrastructure, agriculture, fisheries and other production due to sea-level rise. Such economic losses have been estimated roughly to be in the range of US$20 per tonne of carbon released (Frankhauser and Pearce 1994)[30]. Because of lack of primary data on Sekong forests, conservative figures are used to compute for carbon sequestration benefits. It is assumed that the value of economic losses would be in the range of US$10, in recognition of slash and burn activities in the area. Applying these figures to Sekong forests results in estimated benefits from carbon sequestration to be in the following range:

Table 28: Carbon Sequestration Benefits, Sekong

Forest Type	Area (has.)	Total Carbon Sequestered (T)	Economic Value/ Benefit (US$)
Mixed deciduous	383,300	57,495,000	574,950,000
Semi-evergreen	63,700	3,185,000	31,850,000
Mixed hardwood-conifer	30,400	2,280,000	22,800,000
Dry dipterocarp	13,300	665,000	6,650,000
Montane conifer	11,200	840,000	8,400,000
Semi-evergreen/ dry dipterocarp	3,800	475,000	4,750,000
TOTAL	**505,700**	**64,940,000**	**649,400,000**

In sum, total carbon sequestration benefits of Sekong forests amount to approximately US$649.4 million, or an average of US$1,284 per hectare.

---

[30] In Bouttavong, et. al. Lao PDR Biodiversity: Economic Assessment. 2002.

CONCLUSIONS:
The economic rationale to natural forest regeneration in Sekong Province

The forests of Sekong province offer a wide range of economic and financial values that prove to be substantial and numerous. Estimates of direct use values show that the estimated annual value of NTFPs is between US$ 398 to 525 per household, figures which are way above the provincial average income of US$ 120. Figure 12 attests that they are far more valuable than agricultural sources in subsistence economies, particularly for the poor. NTFPs thus prove to be a very important source of non-cash income for Sekong households, particularly for those that fall in the poorest category. Moreover, its absolute value seems to be positively correlated with knowledge about the forest and its resources. As households veer away from poverty though, the relative contribution of NTFPs towards their livelihoods decline. Nevertheless, they still form a considerable portion of total income.

As far as timber revenues are concerned, Sekong forests provide huge earnings for the provincial government. In 2003, the projected revenues could amount to US$520,000 and tax earnings could reach $85,000, bringing in a total value of $605,000 for the province. Caution should be applied, though, in relying too heavily on timber revenues, as history has proven that unsustainable logging will only lead to huge economic and environmental costs. Whatever short-term gains brought about by continuous logging can easily be wiped out by the long-term negative impacts it causes.

Approximations of indirect use values only further emphasize the importance of natural forests to people's lives. Watershed protection functions, in the form of erosion and flood control, allow for enormous economic costs to be avoided. Hydropower generation is made possible, and allows for renewable energy production. Biodiversity, which is intricately interlinked with human existence and quality of life, is conserved because of the presence of forests. Finally, natural forests regulate the atmosphere through the sequestration of carbon, preventing global warming damages from occurring. Rough estimates of the figures are summarized below:

Table 29: Summary of Economic Values, Sekong Forests

Type of Use/ Benefit	Annual Value/Benefit (US$)	Annual Value/ Benefit (US$/ha)[31]
1. Direct Uses		
a. NTFP[32]	4,906,942 – 6,472,725[33]	398–525[34]
b. Timber Revenues	605,000	10.35
2. Indirect Uses		
a. Watershed Protection		
a.1 Fisheries & aquatic resources	135,919	0.47
a.2 Agricultural Production	714,550	2.5
a.3 Micro-hydropower facilities	792-5,367	.003 - .02
a.4 Potential hydropower supply	67,255,472–455,575,755	233 - 1,581
a.5 Flood Control	26,597,000	92.3
b. Biodiversity Conservation		
Conservation Expenditures	1,887	0.07
Bioprospecting	13,658 - 68,289	0.11 – 0.55
c. Carbon Sequestration	649,400,000	1,284

---

[31] All figures in this column refer to values per hectare, except for NTFP
[32] Total annual value computed for total number of households; annual value computed on a per household basis
[33] Total annual value for all Sekong households, i.e. 12,329 households
[34] Annual value per household

This study has attempted to demonstrate that such values can be approximated, albeit with rough estimates and methodologies. It was conducted to determine if there were indeed any economic benefits in pursuing NFR strategies. Judging from the results, conserving natural forests in Sekong has significantly positive economic values, and is thus a worthwhile undertaking. Alternatively, Sekong stands to lose if NFR strategies are not pursued. It thus becomes imperative that goals which the provincial government set out to pursue, such as improved livelihoods and sustainable development and utilization of natural resources, should translate into the promotion and conservation of natural forests in order for them to succeed in the long run.

BIBLIOGRAPHY

Atlas of Laos, Spatial structures of the economic and social development of the Lao People's Democratic Republic. Bouthavy Sisouphathong, National Statistical Centre, State Planning Committee of Lao PDR and Christian Taillard LASEMA-CNRS, GDR Libergeo-CNRS, France.

Bouttavong, Somvang, Lucy Emerton, Lamphoukeo Kettavong, Sounh Manivong and Sawathvong Sivannavong. October 2002. Lao PDR Biodiversity: Economic Assessment. IUCN, The World Conservation Union, Gland, Switzerland.

Central Planning Committee, Sekong Provincial Government, 2000. Five-Year Socio-Economic Development Plan for Sekong Province. Sekong, Lao PDR.

Coates, D. (undated). Biodiversity and Fisheries Management Opportunities in the Mekong River Basin. IUCN, The World Conservation Union, Gland, Switzerland.

Emerton, Lucy, Oudamsack Philavong, and Kaisorn Thanthatep. July 2002. Nam Et-Phou Loei National Biodiversity Conservation Area, Lao PDR: A Case Study of Economic and Development Linkages. IUCN, The World Conservation Union-Asia, Colombo, Sri Lanka.

Emerton, L. Participatory Environmental Valuation: Subsistence Forest Use Around the Aberdares, Kenya. September 1996. African Wildlife Foundation Discussion Papers Series.

Freeman, A.M. 1994. The Measurement of Environmental and Resource Values: Theory and Methods. In: Dharmaratne, G., F. Sang & L. Walling 2000. Tourism Potentials for Financing Protected Areas.

Lao National Mekong Committee, and WWF Lao Project Office. 2002. Community-based forest management for conservation and sustainable development in the upper Sekong Watershed, a joint project proposal. Vientiane, Lao PDR. pp. 26.

Ministry of Agriculture and Forestry, Lao PDR. 2001. Agricultural Statistics, 25 years, 1975-2000. Department of Planning, Vientiane, Lao PDR.

Ministry of Agriculture and Forestry, Lao PDR. May 2002. Agricultural Statistics Yearbook, 2001. Department of Planning, Vientiane, Lao PDR.

Padilla, Jose and Rina Maria P. Rosales. 1998. Economic Valuation of Biodiversity: A Preliminary Survey of Current Thinking and Applications. People, Earth and Culture. Los Baños, Laguna, Philippines.

Philippine Environmental and Natural Resources Accounting Project (ENRAP). 2000. Guidebook for Environmental and Natural Resources Accounting: Methods and Procedures. DENR-Philippines/ USAID/ REECS, Manila Philippines.

Simpson, R. D. 1997. Biodiversity Prospecting: Shopping the Wilds is Not the Key to Conservation. Resources for the Future, Washington, D.C., USA.

UXO Lao. 1997. Living with UXO, Final Report. National Survey on the Socio-Economic Impact of UXO. In Lao PDR. 1997. Report by Handicap International. For Ministry of Labor and Social Welfare. Lao national UXO Programme (UXO LAO).

World Wide Fund for Nature (WWF) Lao Project Office. October 2001. Benchmark Socioeconomic Data Report for the Central Annamites Priority Ecoregion. Vientiane, Lao PDR.

NTFP category	Species	NTFP category	Species
Bamboo	*Bambusa arundinaria*	Mushrooms	*Auricularia polytricha*
	Bambusa blumeana		*Lentinum spp.*
	Bambusa nana		*Lentinus praerigidus*
	Bambusa sp.		*Lentinus spp.*
	Bambusa tulda		*Termitocytes sp.*
	Cephalostachyum virgatum	Rattan	*Calamus javanensis*
	Dendrocalamus latifollus		*Calamus palustris*
	Oxythenanthera porvifolia		*Calamus sp.*
Bamboo shoots	*Bambusa arundinaria*	Reptiles	*Dragon Lizard*
	Bambusa blumeana		*Snakes*
	Bambusa nana		*Varanus bengalensis*
	Bambusa sp.	Vegetables	*Azadirachta indica*
	Bambusa tulda		*Barringtonia sp.*
	Gigantochloa albociliata		*Centella asiatica*
Bark	*Nothaphoebe umbelliflora (Bong Bark)*		*Eugenia zeylanica*
Birds	*Ducula badia*		*Ferns*
	Treron curvirostra		*Gleichenia linearis*
Fish	*Channa striata*		*Gleichenia spp.*
	Cirrhinus molitorella		*Lasia spinosa*
	Clarius batrachus		*Piper albospicum*
	Danoinae spp.		
	Hampala macrolepidota		
	Hypsibarus spp.		
	Osteochilus spp.		
	Poropuntius deauratus		
Frogs	*Kaloula pulchra*		
	Rana limnocharis		
	Rana spp.		
Fruit	*Baccaurea spida*		
	Bousigonia angustifolia		
	Ficus sp.		
	Mangifera sp.		
	Xerospermum spp.		
Grasses	*Imperata cylindrica*		
Insects	*Cicidas*		
	Crickets		
Insects	*Red ant eggs*		
	Termites		
Mammals	*Muntiacus muntjac*		
	Rats & mice		
	Wild pig		

About IUCN

IUCN -The World Conservation Union brings together States, government agencies, and a diverse range of non-governmental organizations in a unique partnership. As a Union of members, IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

http: //www.iucn.org

About the IUCN Water & Nature Initiative

The IUCN Water and Nature Initiative is a 5-year action programme to demonstrate that ecosystem-based management and stakeholder participation will help to solve the water dilemma of today - bringing rivers back to life and maintaining the resource base for many.

http: //www.waterandnature.org

This document was produced under the project **"Integrating Wetland Economic Values into River Basin Management"**, carried out with financial support from DFID, the UK Department for International Development, as part of the Water and Nature Initiative of IUCN - The World Conservation Union.

This project aims to develop, apply and demonstrate environmental economics techniques and measures for wetland, water resources and river basin management which will contribute to a more equitable, efficient and sustainable distribution of their economic benefits at the global level and in Africa, Asia and Latin America, especially for poorer and more vulnerable groups.

For more information about IUCN's economics activities under the Water and Nature Initiative, please contact:

Africa:
IUCN Eastern Africa Regional Office
PO Box 68200, Nairobi, KENYA
Email: mail@iucnearo.org

Asia:
IUCN Ecosystems and Livelihoods Group Asia
53 Horton Place, Colombo 7, SRI LANKA
Email: iucn@iucnsl.org

Meso America:
UICN Oficina Regional para Mesoamérica
Moravia, Apartado Postal 0146-2150, San José, COSTA RICA
Email: correo@orma.iucn.org

South America:
Av. De Los Shyris 2680 y Gáspar de Villarroel, Edificio Mita-Cobadelsa, Penthouse, PH, Casilla 17-17-626, Quito, ECUADOR
Email: samerica@sur.iucn.org

Global:
Water & Nature Initiative
IUCN - The World Conservation Union
Rue Mauverney 28, 1196 Gland, SWITZERLAND
Email: waterandnature@iucn.org