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Policy Options for Cambodia's Ream National Park: A Stakeholder and Economic Analysis

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Cambodia's Ream National Park is under serious threat, mainly from illegal logging and over-fishing. Yet, the Park provides livelihoods to local people and has considerable tourism potential. A team of Cambodian researchers, led by Thankvaro Thyl de Lopez, conducted an extensive empirical study of the park and analyzed three possible scenarios for its future. They found that the economic benefits of the three scenarios did not differ widely, but that the protection option provided by far the greatest benefit to local inhabitants.

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R E S E A R C H R E P O R T

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Policy Options for Cambodia's Ream National Park: A Stakeholder and Economic Analysis

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POLICY OPTIONS FOR CAMBODIA'S REAM NATIONAL PARK: A STAKEHOLDER AND ECONOMIC ANALYSIS

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Sing Thea, Cheiv Sarina, Sim Song, Veoun Chantha, Nget Vandy,
Leng Bunly and Choeun Sinoeun**

EXECUTIVE SUMMARY

Background

Preah Sihanouk "Ream" National Park is located in southwestern Cambodia, in the province of Kompong Som. The Park covers 21,000 hectares of terrestrial and marine habitats. Approximately 26,600 people live within the boundaries of the Park. Important stakeholders include local communities, commercial loggers and fishermen, park authorities, the Cambodian Ministry of Environment and tourists.

Research framework

The objectives of this report are two-fold: (1) to determine how the establishment or the destruction of the Park distributes benefits and costs among different stakeholders; and (2) to formulate strategies for the management of these stakeholders in order to achieve conservation goals. Five surveys were undertaken in the field to provide social, economic and ecological data for cost benefit- and stakeholder analyses. These included: a survey of 15% of households in local communities; three different contingent valuation surveys of tourists in Kompong Som and park visitors; and a forest inventory of the Park's mangroves.

The findings of these surveys, together with accompanying recommendations, are listed below:

Use of natural resources by local communities

- **Sustainable collection of firewood, construction material, medicine and food provide local communities with a net income of approximately US\$ 160,000 per year.** The Park is essential to local villages where the average annual income is less than US\$ 100 per capita.
- **Commercial trawlers and push-nets that operate illegally in the Park threaten the livelihoods of subsistence fishermen.** The annual catch,

estimated at more than 3,000 tons per year, exceeds sustainable yields. While the area has historically supported subsistence activities, commercial fishermen are to blame for over-fishing. Unless existing environmental laws are strictly enforced, the fish stock of Ream will eventually collapse.

Attitudes of villagers towards environmental conservation

- **Villagers perceive illegal fishing and deforestation as major environmental problems in Ream National Park.** More than half of all households interviewed are concerned about illegal fishing; some 34% believe illegal logging is a threat to the Park.
- **Local communities strongly support park authorities and conservation measures.** An overwhelming majority (68%) of villagers are satisfied or very satisfied with park management. More than 95% agree that hunting, illegal fishing and commercial logging must not be allowed in the Park.
- **Local communities demand that environmental laws should be strictly enforced.** Open-ended questions reveal that the highest priority for villagers is that more resources be allocated to protect the park effectively.

State of the Park's mangroves

- **Logging activities have heavily disturbed the Park's mangroves.** Out of roughly 1,800 hectares, less than half can be considered of high stand density. Some areas have average timber volume of less than 15 cubic meters per hectare.
- **The clear cutting of the remaining mangroves would yield a one-time net income of less than US\$ 630,000.** The negative impacts on ecosystem functions and fishing activities are uncertain but are expected to exceed this value.

Visitor satisfaction with Ream National Park

- **Visitor satisfaction with Ream National Park is very high.** 88% of park visitors are either satisfied or very satisfied with their experience of Ream.
- **However, additional investments are required to develop the *jewel of the South* for a broader public.** The Park's nickname is well earned, but its visitor facilities are inadequate. Safer boats, marked hiking trails and English speaking guides are needed to attract more tourists.

Ream National Park's potential for tourism

- **Ream National Park has excellent potential for eco-tourism.** More than 90% of all tourists interviewed in Kompong Som declare themselves interested in visiting Ream National Park. Tourists who come to Kompong Som have higher levels of education and income than the general population. A majority are repeat visitors who travel to the area as often as every weekend. Tourism could therefore provide a steady flow of revenue to the Park.
- **Information about Ream National Park is insufficient.** Few people in Kompong Som are aware that a National Park is located within a few miles of the seaside resort.
- **There is strong demand for better managed scenic areas in Cambodia.** The majority of tourists interviewed believe that the country does not allocate enough money to its National Parks and Protected Areas. A majority of Cambodian tourists have already visited popular parks such as Angkor, Kep and Kirirom. However, visitor facilities remain inadequate, particularly for foreign tourists.
- **Foreign tourists are willing to pay on average US\$ 10.4 per person for a boat ride in Ream National Park. Cambodian tourists' willingness to pay is US\$ 9.2 for the same boat ride.** If Ream National Park managed to attract even 5% of the tourists who visit Kompong Som, the revenues from visitors would exceed US\$ 100,000 per year, compared with US\$ 2,500 at present.

Cost benefit analysis of management scenarios

The costs and benefits of three different management options have been compared.

- The *experimental park* scenario corresponds to the base case where some level of protection is achieved, but fisheries eventually collapse.
- The *ghost park* scenario assumes that all timber and fish are harvested, destroying the area.
- The *dream park* scenario only allows subsistence activities, recreation, education and research.
- **Given the uncertainties surrounding long-term protected area planning and conservation, most Cambodian policy makers are likely to favor the immediately capturable benefits of development. Without international transfers for conservation, Ream National Park is likely to be destroyed. At a 10% discount rate, the dream park**

has the highest net present value (US\$ 11.9 million). This compares with 10.0 million for the ghost park and US\$ 9.8 million for the experimental park. Although the dream park scenario has the highest net present value, it exceeds that of the ghost park by less than US\$ 2 million.

- **Protection scenarios allocate the bulk of the Park's benefits to local communities.** The dream park case confers three times more benefit value to villagers compared to the ghost park case, that is, US\$ 2,729 per household versus US\$ 919 per household. The distributional analysis shows that local communities would stand to lose most if the park were destroyed.

Recommendations for the management of the stakeholders of Ream National Park

- **The community forestry and fishery programs must be extended to additional villages.** Villagers' involvement is essential to the successful control and monitoring of all commercial activities.
- **The Ministry of Environment must take a leadership role in protected areas management.** MoE should promote cooperation with international donors and non-governmental organizations, assert its jurisdiction over protected areas and provide stronger institutional support to field staff.
- **Rangers must continue to develop their skills and should receive a salary raise in order to increase their retention.** Participation in existing training seminars at MoE would improve staff expertise. Rangers should be allowed to cultivate deforested land around their stations to supplement wages.
- **All commercial activities must be stopped.** Existing park regulations must be enforced to their full extent with the cooperation of local authorities and other government agencies.
- **Marketing efforts for the Park must be intensified.** Visitors provide essential revenues for park operations. Entrance fees should be increased and an environmental trust fund set up to collect donations.

1.0 INTRODUCTION

For the past decade, efforts to manage in a sustainable way the natural resources of Cambodia have been confounded by short-term commercial interests. The efforts of the international community to help the country manage its natural resources have had limited success. The Asian Development Bank (ADB) forecasts that at present rates of logging there will be no commercial species left in Cambodia within the next five to ten years (ADB, 2000). Global Witness, an environmental non-governmental organization, has been very critical of the rapid destruction of the country's natural capital (Global Witness, 2000). The overuse of its once bountiful natural resources has been justified on economic ground. The argument is that the protection of the environment is a luxury in a country where the majority lives under the poverty line. The establishment of national parks and other protected areas confers benefits and costs to varying degrees on a variety of stakeholders. Budget constraints, poverty, and pressing social needs work against protected areas. The present study examines the economics and the stakeholders of Ream National Park, a protected area located in southwestern Cambodia. Trade offs are inevitable in situations where a range of individuals have competing interests. The objective of the research is to determine what the costs and benefits of Ream National Park are and to explicitly show the resulting sources of conflicts between stakeholders. The report is organized as follows: (1) background information on Cambodia's environment and Ream National Park; (2) methodological aspects; (3) survey of local communities; (4) inventory of the mangroves of Ream; (5) survey of tourists and visitors of Ream National Park; (6) cost benefit analysis of management scenarios; (7) stakeholder management recommendations.

2.0 BACKGROUND

2.1 Country Information

The kingdom of Cambodia is the cradle of the Khmer, a civilization famed for its architecture and culture. The Khmer ruled part of South East Asia from the 8th to the 14th century. In sharp contrast, the modern history of Cambodia has been a long tragedy punctuated by war and bloodshed. From 1975 to 1979, the murderous Regime of the Khmer Rouge caused traumatic damages to the country. Over two million Cambodians were exterminated on the so-called *Killing Fields*. Three decades of violent conflicts have left Cambodia's society, economy and natural environment deeply scarred. On the Human Development Index, Cambodia is ranked 136th out of 174 countries (World Bank, 2000). With a Gross National Product (GNP) of US\$ 278 per capita, Cambodia remains one of the twenty poorest countries in the world.

Table 1. Key statistics for Cambodia

Area: 181,535 km ²
Population: 10.2 million
Life expectancy at birth: 51.6 years
Infant mortality rate: 115 deaths/1,000 live births
Population growth rate: 2.5%
Ethnic groups: Khmer 90%, Vietnamese 5%, Chinese 1%, other 4%
Literacy rate: 35%
Religions: Theravada Buddhism 95%, other 5%
Official language: Khmer
GDP at current prices (US\$ million): 3,342
GDP per capita (US\$): \$278
Access to safe water: 32% of population
Nutrition: Over 50% of children under five either stunted or underweight

Sources: UNDP (1997). GDP for 2000 estimated by Cambodia Development Research Institute (CDRI).

2.2 Natural Environment

Cambodia is divided into two topographical regions: (1) the central plains which cover three quarters of the country along the Mekong and Tonle Sap Basin, (2) the mountainous regions bordering on three sides. The Mekong River and the Tonle Sap, Southeast Asia's largest body of freshwater, have made the central basin the cradle of the Khmer culture. The plains are surrounded in the east by the Ratanakiri Plateau, in the west by the Cardamome Mountains, and in the southwest by the Elephant Mountains. The Gulf of Siam borders the southern coastline.

2.2.1 Biodiversity

Cambodia belongs to the Indo-Malayan realm, which includes most of Laos and Vietnam, and the eastern part of Thailand. The greatest biological diversity is generally thought to be found in Cambodia. Over 200 mammal species, 700 birds, 400 marine fish and 2300 vascular plants have been described (Ashwell and IUCN, 1992; MoE, 1994; MoE, 1998). Mammals that have become extinct in neighboring countries have been observed in Cambodia. These include bears, elephants, tigers, dugongs and forest bulls. The World Conservation Monitoring Centre (WCMC) estimates that 15,000 species of plants exist in Cambodia, one third of which are thought to be endemic (McKinnon and McKinnon, 1986; WCMC, 1992). Cambodia has a diverse flora featuring numerous endangered tree species such as blackwood, Burmese ebony and Siamese rosewood (Dy Phon, 1970). The Kingdom is in a key position to conserve the biological heritage of Southeast Asia. However the reckless

exploitation of natural resources has dramatically decreased Cambodia's biodiversity over the past two decades.

2.2.2 Forest resources

Forests are the main natural resources of the Kingdom. The export of wood products is a major source of foreign exchange. The World Bank reports US \$185 million of wood products exported in 1995 (World Bank, 1996). The country has become a major exporter of wood to Thailand, Vietnam, Japan, Taiwan and Singapore. Nearly all forest areas with commercial potential have been granted to timber companies. The government has awarded logging concessions through a non-transparent process (World Bank, 1996). In general, concessions were negotiated between senior government officials and prospective concessionaires. Concessionaires in turn contract logging operations to local warlords who can muster political, military and economic resources. The Department of Forestry and the Ministry of Environment (MoE) do not generally have access to the details of the agreements. The Mekong Secretariat has produced a land use map based on 1989 LANDSAT satellite images in cooperation with the Food and Agriculture Organization (FAO) and the Ministry of Agriculture. The total forest cover was reduced from 73% of the country's territory in the early 1960s to 68% in 1989 (Hun Kim Leng, 1965; Mekong Secretariat, 1991; Thung, 1993). Recent estimates put the forest cover at less than 65% (World Bank, 1996).

2.2.3 Marine and freshwater resources

The Tonle Sap, the Great Lake of Cambodia, is the largest freshwater body in Asia. During the monsoon, it is about 250 kilometers long and 100 kilometers wide. The Tonle Sap region has been central to Cambodian society since the Angkor period, when it already supported large human settlements. Fish account for an average 75% of the animal protein intake of the Cambodian population (FAO, 1992). The livelihood of about 30% of the Cambodian population, or over three million people, depends on the Tonle Sap and its surrounding floodplain.

Cambodia has a 435 kilometers of coastline and an Exclusive Economic Zone (EEZ) covering 55,600 square kilometers. The country has a limited fishing fleet. Consequently, most of the fishing boats reported in the EEZ are Thai or Vietnamese (MoE, 1994; MoE, 1998). There is little current information on the status and trends of fish stocks. The Scientific Research Institute for Oceanography and Fisheries of the USSR conducted a research expedition between 1983 and 1986, in cooperation with Cambodian scientists (Tana, 1994). More than 400 fish and crustacean species were reported, including commercial

species such as mackerel, anchovy, sardine, tuna, flat fish, snapper and grouper. The marine fisheries account for 30,000 tons of the annual fish catch. The catch from both marine and inland fisheries was about 95,000 tons in 1994 (DoF, 1995). The actual figure is likely to be much higher than official statistics because the catch of foreign boats is not included. FAO and DoF have projected an increase of annual consumption to 137,000 - 277,000 tons by 2005 (Csavas and others, 1996).

The Cambodian Fisheries Law (1987) addresses the exploitation of freshwater and marine resources. The law regulates access to fishing areas, gear specifications, fishing seasons, and the designation of fish sanctuaries. As such, it provides a framework for management of fish resources. For instance, industrial fisheries may not operate in the Tonle Sap area during the monsoon (June 1 – September 30), when most species migrate to the floodplains to spawn. In practise, enforcement is limited by the weak institutional capacity of DoF.

2.2.4 Environmental degradation

Despite the efforts of both environment and development activists, the battle against deforestation in Cambodia is all but lost. Most commercial hardwood has already been exploited. Logging companies are withdrawing from Cambodia as their operations become less profitable (ADB, 2000). Forest cover has not been completely removed, but most accessible areas have been cut. Large swathes of evergreen forests in the southern and central regions have been destroyed in less than twenty years. The extent of environmental degradation over such a short period of time is unprecedented in the country's history. More than 60% of Cambodia's forests are located in mountain regions. Deforestation is likely to result in serious environmental consequences, including erosion and flooding. Evidence of these impacts is already being seen. Flash floods in areas surrounding Phnom Penh become frequent when in the memory of Cambodians these rarely occurred in the past. Deforestation has caused major changes in the hydrologic system of the Tonle Sap. The inundated forests surrounding the lake are an important spawning, nursery and feeding ground for fish. The inundated forests have been reduced by 1 million hectares (Thung, 1994). There are reports that stocks of some commercial species have collapsed (Department of Fisheries, 1996). The livelihoods of Cambodians depend on forest and fish products. The rural poor stand to lose most from environmental degradation. The majority remains under the poverty line. The exploitation of the country's resources has not resulted in any significant economic development.

2.3 Protected Areas

Cambodia has a long history of protected areas. In 1925, 10,800 hectares of forests surrounding the temples of Angkor were declared a national park, the first in South-east Asia (Le Billon, 1994). By the late 1950s, one third of Cambodia had been classified into 173 forest reserves, and six wildlife protection areas had been set aside. The forest reserves covering 3.9 million hectares were managed for forest production. The wildlife reserves covering 2.2 million hectares were established for the protection of wildlife, in particular large mammals. Thirty years of war have severely disrupted the management of Cambodian protected areas.

A Royal Decree established the present system of protected areas in 1993. The total area under protection covers 3,568,100 hectares or 19.7% of the country's total area (Kingdom of Cambodia, 1993). This makes Cambodia one of the countries with the highest percentage of land under protection. The Cambodian system uses the World Conservation Union's (IUCN) classification for protected areas and comprises ten wildlife reserves, seven national parks, three protected landscapes, and three multiple use areas. Angkor protected landscape and the Tonle Sap multiple use area constitute sites of international significance and are central to the Cambodian economy and culture. Inadequate funding severely constrains the management of the Kingdom's protected areas. Consequently, only four national parks are permanently staffed with Ministry of Environment (MoE) personnel (Bokor, Kirirom, Ream, and Virachey), while Angkor and the Tonle Sap both benefit from direct foreign assistance.

2.4 Characteristics of Ream National Park

Preah Sihanouk "Ream" National Park is located in the province of Kompong Som, 194 kilometres southwest of Phnom Pen. It is the tradition of the Kingdom that the name of illustrious members of the Royal family be bestowed on national parks. Ream bears the name of His Majesty Norodom Sihanoukvarman, the present sovereign of Cambodia. The park covers 15,000 hectares of land and 6,000 hectares of marine habitats. The landscape is generally mountainous. Particular features include mangrove forests, evergreen forests, beaches, rocky shores, coral reefs, and islands. A freshwater river, the *Prek Toek Sap* flows through the estuary of the park into the ocean.

The Park is divided into three zones: (1) core zone in which all resource use is prohibited; (2) general conservation zone in which limited resource use is permitted; and (3) community development zone which includes villages and ricefields. The community development zone, which is located on the park's territory, acts as the buffer zone of the park. Hunting is forbidden in the park.

Subsistence fishing and the gathering of non-timber forest products are allowed in the conservation and community development zones.

Ream National Park was officially inaugurated in March 1995. MoE presence remained minimal until July 1997, when the Environmental Technical Advisory Program (ETAP), a component of the United Nations Development Program in Cambodia (UNDP), started a demonstration project involving training and management. ETAP ended in December 1999, midway through the data collection phase of the present study. The program was not renewed because of lack of funding and interest. At the time of writing, Ream National Park does not benefit from any international assistance and receives only minimal support from MoE. The Parks Society of Cambodia (PSC), a local non-governmental organization, still operates a small-scale water supply and sanitation program in the community development zone.

2.5 Stakeholders of Ream National Park

A wide range of groups and individuals have converging and diverging interests or stakes in the park's resources. Park authorities have to deal daily with all stakeholders. Consensus is not always possible since the resources of the park can only support limited levels of exploitation.

Local communities - 24 villages are located in close proximity to Ream National Park. The park's natural resources are crucial to the subsistence of local communities. The main occupations include farming, fishing, trading, contract laboring, gathering non-timber products, wood cutting and charcoal production. A few people run moto-dups and remorques (moto-taxis). Most villagers have two or three occupations.

Commercial loggers - The limited resources of the park are easily accessible and can be exploited quickly. Prior to 1997, commercial loggers were able to harvest trees directly from the park. Timber was processed on site in sawmills or burned in kilns for charcoal. Part of the wood production would be exported to Thailand and Vietnam. Under ETAP's supervision, commercial logging was abruptly put to an end. Rangers systematically confiscated cut trees and destroyed charcoal kilns.

Police - There is a widespread failure to enforce civil and criminal codes in Cambodia. The situation is particularly acute in rural areas. The *Police Nationale* maintains two posts in the *Prek Toek Sap* estuary. Villagers and rangers have reported that off-duty policemen, dressed in civilian clothes, have been acting as bodyguards for push-net boats or have operated push-net boats themselves since the mid 1990s (ETAP monthly report, October 1999).

The Navy - The Cambodian Navy has its largest base in the southeastern corner of Ream National Park. Several thousand men and their families are stationed at Ream. Personnel from the Ream Naval Base have taken part in illegal logging and wildlife hunting (MoE and IUCN, 1996).

Ministry of Environment - With only 0.2% of the budget of the Royal Government of Cambodia, less than \$600,000 in 2000, the management capacity of the Ministry of Environment is severely limited. Cambodia almost entirely relies on foreign assistance for operations and capital expenditures in the environmental sector.

Rangers - The first twelve rangers were recruited in July and August 1997 in the communities adjoining the park. The staff had no prior experience in conservation and were uncertain about their role in protected area management. Their awareness of environmental issues and conservation was low. Under UNDP management, rangers were able to develop core competences and acquire extensive field experience.

United Nations Development Programme - The stated mission of UNDP is "to help countries build national capacity to achieve development through poverty alleviation, environmental conservation, job creation and the advancement of women". UNPD's Country Cooperation Framework (CCF) in Cambodia focuses on four development areas: local socio-economic development, macro-economic management and governance, social sector development, and environmental management and natural resources management. More than 70% of UNDP's annual budget will be devoted to local socio-economic development through the year 2000, comparing with 4% for environmental and natural resources management (UNDP, 1997).

Land Speculators - There has been a great deal of land speculation in the area surrounding the city of Kompong Som. The boom of the tourist industry in the early 1990s provides investment opportunities for commercial developers. Investors include government officials in Kompong Som and Phnom Penh, and foreign nationals (Taiwanese, Thai, Malaysian, Chinese and Vietnamese).

Commercial Fishermen - In recent years, commercial fisheries have adopted the use of 'push-nets'. Push-nets were introduced into the area five or six years ago by Vietnamese fishermen. Push-net poles can be deployed very quickly and turn fishing boats into trawlers. They enable a considerably larger catch than traditional fishing techniques. Push-nets have been documented to cause destruction of fish habitat such as sea grass beds (Guy, 1995). A shrimp farm covering 40 hectares has been illegally operating in the park for the past two years.

Tourists - Ream National Park is located 18 kilometers from the provincial capital of Sihanoukville, also known as Kompong Som. The population of Kompong Som is expected to reach 100,000 by 2000. Kompong Som has been a seaside resort popular with Phnom Penhners and foreigners since the 1960s.

3.0 RESEARCH FRAMEWORK

3.1 Research Problem

The establishment of Ream National Park is one choice among several possible uses for the site. The harvesting of timber and wildlife, the conversion to agriculture, or the building of human dwellings are other alternative uses. The short-term profits of timber harvesting may appear more attractive than the long-term benefits of protecting forests. Every land management choice has economic implications in terms of cost (value losses) and benefits (value gains). Forests are sources of commercial hardwood, non-timber products and wildlife. They also provide environmental functions that are essential to human activities such as watershed protection, climate maintenance and biodiversity. If the forest is clear-cut, both the value of lost natural resources (timber and non-timber products) and the value of environmental functions should be taken into account. On the other hand, the decision to preserve Ream's forests and estuary should incorporate the foregone benefits of development options. The failure to properly evaluate the cost and benefits of each land use option may lead to inappropriate natural resources management. The decision of which option to pursue can only be made if all the gains and losses associated with each land use option are included in an accounting framework. The difficulty stems from the fact that many of the environmental services of tropical forests are not traded in formal markets. The benefits of Ream National Park are hard to identify and to measure in monetary terms, whereas the costs are easier to quantify. The risk is to overlook the benefits of the park in the decision-making process.

3.2 Objectives of the Study

The objective of the research is to perform an economic analysis of Ream National Park. The assumption that the costs of conservation are greater than the benefits precludes the establishment of the park. The study attempts to quantify and assign value to the more significant resources of Ream. The analysis aims to explicitly show trade offs and sources of conflicts over natural resources. More specifically, four questions need to be answered:

1. Is the establishment of Ream National Park justified on economic grounds?

2. What are costs and benefits of different management scenario for Ream National Park?
3. What is the distribution of these costs and benefits over different stakeholders?
4. If the protection of the park is warranted, what stakeholder management options should be implemented?

3.3 Methodology

3.3.1 Typology of benefits and costs of protected areas

Several typologies for the benefits of protected areas have been put forward. Dixon and Sherman (1990) derive their classification from the conservation objectives of protected areas: (1) maintenance of environmental resources, services and ecological processes, (2) production of natural resources, (3) production of recreation and tourism services, (4) protection of cultural and historical sites and objects, (4) provision of educational and research opportunities. de Groot (1992) distinguishes four categories for the functions (goods and services) provided by natural ecosystems: (1) regulation functions; (2) carrier functions; (3) production functions; (4) information functions.

Dixon and Sherman (1990) divide the costs of protected areas between direct costs, indirect costs and opportunity costs. Direct costs are the costs associated with the establishment and management of protected areas: purchase of land, investment in infrastructure and administration expenses. Indirect costs are associated with damages indirectly caused by the existence of the protected area: for example grazing of crops or harming of people by wildlife. Opportunity costs include the forgone benefits from alternative land uses such the exploitation of timber and wildlife, or the output from agriculture.

3.3.2 Cost benefit analysis (CBA)

Cost benefit analysis compares alternative policies and projects according to their monetized valued costs and benefits. When there are several possible choices, the management option with the highest net benefits to society should be undertaken. However this often ignores the economic and social impacts on different stakeholder groups. Standard cost-benefit studies tend to report only the net aggregate economic values of proposed projects. From the point of view of economic efficiency, there is no difference if one stakeholder group is made worse off as long as another group is made better off by at least the same amount. The underlying assumption is that a dollar gain to a stakeholder group is equivalent to a dollar loss to another stakeholder group. However, under

different management scenarios, those who pay the costs and those who receive the benefits will not be the same. The costs and benefits of land use options are distributed unevenly among groups with different social characteristics. The assumption can have a number of important implications: (1) disadvantaged stakeholders such as the poor or minorities may bear a disproportionate share of the costs (2) stakeholders with wealth and influence may oppose the implementation of options that would not maximise their economic benefits. The first shortcoming raises the issue of equity or fairness of the distribution of costs and benefits among stakeholders. If a particular set of individuals bears the costs, and another set reaps the benefits, this may seem unfair not only to those individuals, but also to society at large. The second issue of concern is the practical implementation of a land use option. The establishment of Ream National Park creates conflicts over the management of natural resources. Powerful groups will generally oppose decisions that are detrimental to their interests. This is of particular importance in Cambodia, where institutional capacity is still limited. A distributional analysis attempts to address both concerns by examining who receives the benefits and who pays the costs of a chosen management option.

3.3.3 Techniques for valuing the resources of Ream National Park

3.3.3.1 Direct market prices

Market prices are established through the transaction of goods and services between supply by producers and demand by consumers. The producers' supply curve reflects the quantity of products that producers are willing to supply at different prices. The consumers' demand curve reflects the quantity of products consumers are willing to purchase at different prices. In efficient markets, prices can be used directly to determine the net benefits of traded environmental products and services. In cases where markets are distorted by taxes and subsidies, a shadow price or efficient price needs to be calculated to reflect the true value of the resource use to society. The gross monetary value of marketed forest products is obtained by multiplying market prices by quantities. Net monetary values are calculated by deducting harvesting and transports costs. Nearly all timber is traded on markets. Other traded natural resources of the park include firewood, food, medicine, fish and wildlife.

3.3.3.2 Direct substitute approach

The direct substitute approach derives the value of non-marketed goods or services from the price of substitute goods and services. Forest resources that are not marketed directly may have the same uses as similar products that are traded

on markets. For example, the value of non-marketed construction wood may be approximated by substitute timber sold in markets.

3.3.3.3 *Contingent valuation methodology (CVM)*

The contingent valuation method uses questionnaires to determine the preference of individuals for environmental goods and services. Respondents are asked to formulate their maximum willingness to pay or their minimum willingness to accept compensation for a change in the level of the good or the service. The survey creates a hypothetical market to palliate for the absence of real markets for the studied good or service.

3.3.3.4 *Expected damage*

The method uses the damage that would be incurred if an environmental function were impaired as a proxy for its value. For example, the benefit of protection from storm by a forest might be estimated by the value of damage avoided to houses. The drawbacks of the method have been discussed in the environmental economics literature (Freeman, 1994). Expected damage does not necessarily reflect an individual's willingness to pay to prevent the risk of damages. Risk averse individual might be willing to pay more than the value of the expected damage.

Table 2. Monetised and non-monetised benefits of Ream National Park.

Monetised benefits	Valuation method	Type of value
Non Timber Forest Products	Market prices, direct substitute	Direct use value
Marine and freshwater products	Market prices	Direct use value
Timber from evergreen forests	Market prices	Direct use value
Timber from mangroves	Market prices	Direct use value
Recreation and tourism	Contingent valuation	Direct use value
Protection from storm and erosion	Expected damage	Indirect use value
Non-monetised benefits		
Marine ecosystems		Indirect use value
Medical resources		Direct use value
Carbon storage		Indirect use value
Protection from saline water		Indirect use value
Education and research		Indirect use value
Culture		Indirect use value
Option value		Option value
Existence value		Non use value

3.3.4 Stakeholder management

The concept of stakeholder originates in the field of corporate management in the early 1960s (Freeman, 1984). Stakeholders were originally defined as "those groups without whose support the organisation would cease to exist". These different groups included shareowners, customers, suppliers, lenders and society. Freeman's original work consisted in developing prescriptive action for managers: "The stakeholder approach is about groups and individuals who can affect the organisation, and is about managerial behaviour taken in response to those groups and individuals. The stakeholder theory views the organization as having to deal with a multitude of constituent groups, which include local communities, government agencies, special interest groups etc.

The concept of stakeholder has appeared more recently in the area of economic development. Rather than *stakeholder management*, development agencies traditionally refer to *stakeholder participation*. For instance, the World Bank literature differentiates between *popular participation* (poor and disadvantaged people) and *stakeholder participation* (the government, NGOs, private corporations and the World Bank itself) (World Bank, 1996). The analysis is performed from the standpoint of a development project rather than that of a firm. The difference between the concept of stakeholders in development projects and the stakeholder theory of the firm is the emphasis on *participation*, rather than on the *management* of those stakeholders by an organisation. Participation is one of many strategies available to project managers. A comprehensive stakeholder management approach consists in analysing the objectives and stakes of all those involved and in implementing strategies to effectively deal with them.

3.3.5 Research components

Five surveys provide social, economic and ecological data for the cost benefit analysis and the formulation of stakeholder management strategies. (1) A household survey examines the direct use of park's resources by local villagers and their attitudes towards environmental conservation. (2) (3) (4) Three different CVM surveys provide data on park visitors and assess Ream's potential for recreational activities. (5) A forest inventory determines the current state of the park's mangroves.

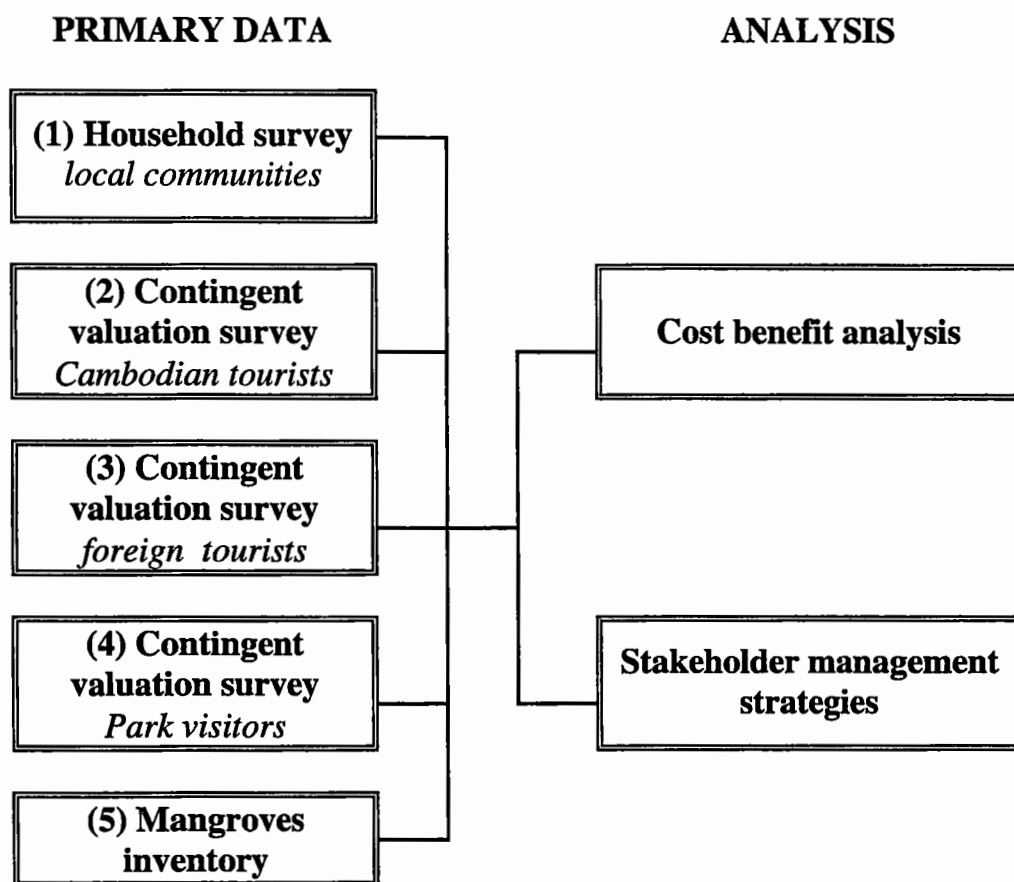


Figure 1. Research components

4.0 SOCIO-ECONOMIC ANALYSIS OF THE VILLAGES OF REAM NATIONAL PARK

4.1 Survey Design

The household questionnaire builds upon the work of Camille Bann in Cambodia (1997a and 1997b) and Jack Ruitenbeek in Indonesia (1992). Questions to assess the attitude of villagers towards Ream National Park, however, are specific to the present study. The questionnaire is divided into five main parts: (1) household socio-economic characteristics; (2) fishing activities; (3) products collected from the park; (4) farming activities; and (5) environmental attitudes.

There are 24 villages within the boundaries of Ream National Park, distributed over the four communes of Boeng Ta Prum, O Chrouv, Oknha Heng, and Ream. This represents a total of 4,640 families and an estimated 26,600 people. The survey aims to gather information at the family level. A random

stratified sample by villages was determined, with a target of 15% of usable surveys to be collected. This represents a total of 696 interviews. The sample size allows accurate 95% confidence intervals for population percentages and population means. For instance, if 50% of respondents answer "yes" to a particular question, then there is a 95% probability that between 48.4% and 51.6% of the population would answer "yes" to the same question. 95% confidence intervals are given in appendix of the report.

4.2 Data Collection

The research group was divided into teams of two interviewers. All answers to the questionnaire were systematically recorded as well as the numerous comments made by respondents and their families. Single comments may be considered as anecdotes, but when taken in the context of a random sample, statistically significant patterns emerge. The questionnaire asked villagers to provide personal information on their families and their livelihoods. History has taught Cambodians to be weary of expressing opinions in public. Successive oppressing regimes have always trodden upon the rights of human beings in Cambodia. In order to gather quality data, researchers must clearly state their objectives and the nature of their work. The household interview began with an explanation that EEPSEA is a politically independent research body. The interviewers introduced themselves as university staff and students, whose principal goal was to understand and learn. Each family was assigned a code that would be used for the database and would ensure that all answers remain confidential. Hence, answers cannot be traced back to a specific respondent.

4.3 Household Social Characteristics

4.3.1 Demographics

The average household has 6.5 people. The largest households have 12 members. These may include elder relatives of the head of household, as well as his or her younger siblings. Each family has on average 3.7 children.

The population's age has a mean of 21.7 years. 50% of the population is under 16 years old. 75% of the population is under 33 years old. Fewer than 7% of people are above 50 years old. There is a marked drop in the proportion of people of 22, 23 and 24 years old. This corresponds to the steep decrease in the birth rate during the Khmer Rouge period and the subsequent Vietnamese occupation of Cambodia.

The level of education of the population is extremely low, with an average 2.5 years of formal schooling per person. 38% of adults are illiterate. 73% of adults have had only primary education or less. 34% of children between 6 and 18 years old have never had any schooling.

83% of the surveyed population is Khmer. 17% is Khmer Islam, the *Cham* ethnic minority. Vietnamese and Chinese represent respectively less than 1% of the sampled population.

4.3.2 Area of origin

58% of the population was born in the four communes of Ream National Park. The peak in the number of immigrants in 1979 corresponds to the end of the Khmer Rouge regime. Among those who were not born in the area, half came after 1990, under the United Nations mandate in Cambodia. Less than 25% of immigrants moved to Ream in the early 1980s after the invasion of Cambodia by Vietnam. In 1993 when a Royal Decree formally established Ream National Park, 89% of the current population had already settled in the area. Unfortunately, demographic data as provided by the present study was not available to policy makers at the time Ream was designated as national park.

4.3.3 Dwellings

Fewer than 8% of houses are made of stone, brick or cement. 35% of houses were built with timber collected in the park before the area came under protection. 44% of household bought their timber from the Prek Toek Sap mill. Houses use an average 4.4 cubic meters of timber. However, it took less than 2 cubic meters to build 32% of houses. Park authorities may grant a household permission to fell a tree to repair a house.

4.4 Household Income

43% of families feel they can barely provide for their own subsistence and survive. Interviewers focused on the self-sufficiency of families in food. They did not ask families whether they had enough money to send children to school or to buy clothes, but simply whether they had enough to survive.

The mean income is US\$ 528 per year per household. However, the median family income is only US\$ 316 per year. 32% of families have an annual income below US\$ 200. This represents an average annual income of US\$ 92 per capita.

Families listed 29 different occupations as their main sources of income. 30% of families rely on fishing, 28% on farming and 16% on trading and shop keeping. Other jobs traditionally found in rural areas are miller, distiller, moto taxi driver, laborer and accumulator charger. 5% of families rely on both farming and fishing as their main source of income, while 2% rely on farming and a second or third source. Hence the majority of people are dependent on the natural resources of the park to subsist. 80% of families believe they could not find any other job than the one they have, or that they could not perform any other job because they do not have the required skills.

Only a minority of soldiers, teachers and other civil servants state their salaries as their main sources of income. Most of them farm and fish within the park. 24% of families rely on at least two different occupations. Less than 1% of families declare receiving any significant aid from non-governmental organizations or charities.

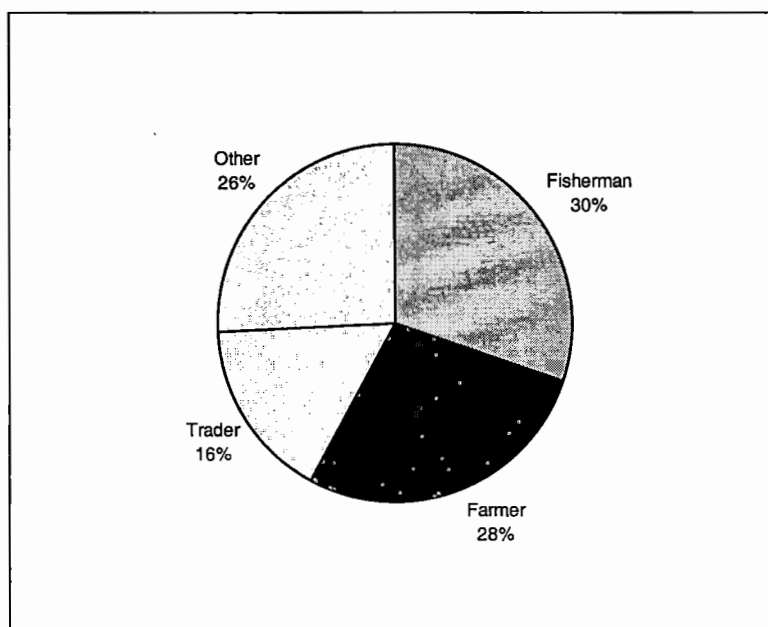


Figure 2. Main sources of income for villagers (percent of population)

4.5 Agricultural Production

4.5.1 Crop production

51% of families own a plot for rice, fruits or vegetables. 71% of plots are less than 1 hectare. The total area in the park under agricultural use is estimated at 2,978 hectares. Half of all families cultivate rice. Even when farming is not their main source of income, families may hold some land for rice and other

crops. The mean annual rice yield is 1.5 ton per hectare. Fewer than 24% of holdings manage to exceed 2 tons per hectare per year.

Using average market prices, the total value for the annual harvest of crops cultivated at Ream may be estimated. An exchange rate of 3,800 Cambodian riels to one US dollar is used. Families who have a plot produce an average US\$ 127 worth of crops. The largest holding produces US\$ 1,053 worth of rice per year. However, 75% of families who cultivate land grow crops of a value less than US\$ 180 each a year. The total value of the annual harvest of crops at Ream National Park is estimated at some US\$ 316,594.

4.5.2 Animal production

It is customary and necessary for most families to raise animals, generally chicken or pigs, pigs, ducks, buffalos and cows. The total annual value of animals raised by villagers of Ream National Park is estimated at some US\$ 182,317. Pigs and chickens represent the largest shares in the total annual market value.

4.6 Products Collected in Ream National Park

4.6.1 Product types

Families collect some 50 different products, including wood, plants and animals. 84% of families gather firewood from the park, 3% gather wood for construction and 3% mine coal. Some 2% gather *Banlay Prey*, a forest thorn used for cooking. Another 1% gathers *Sbov*, a general term for roof-covering reeds and straw. According to park regulations, villagers may only collect dead wood for personal use. Logging and hunting are strictly forbidden. The number of families that hunt or log illegally was insignificant at the time of the survey. The park is a source of firewood, medicine, food, and construction materials for the villagers of Ream. 88% of all products collected are used to make fire, 6% to prepare traditional drugs, 3% to build fences and another 3% to supplement the daily diet of families.

4.6.2 Firewood

Ream does not have any electricity with the exception of a few private generators. Individual homes are rarely connected to power lines. Wood is the main source of energy for cooking meals and for boiling water for consumption. 97% of families use firewood, 17% of households buy firewood at the village markets.

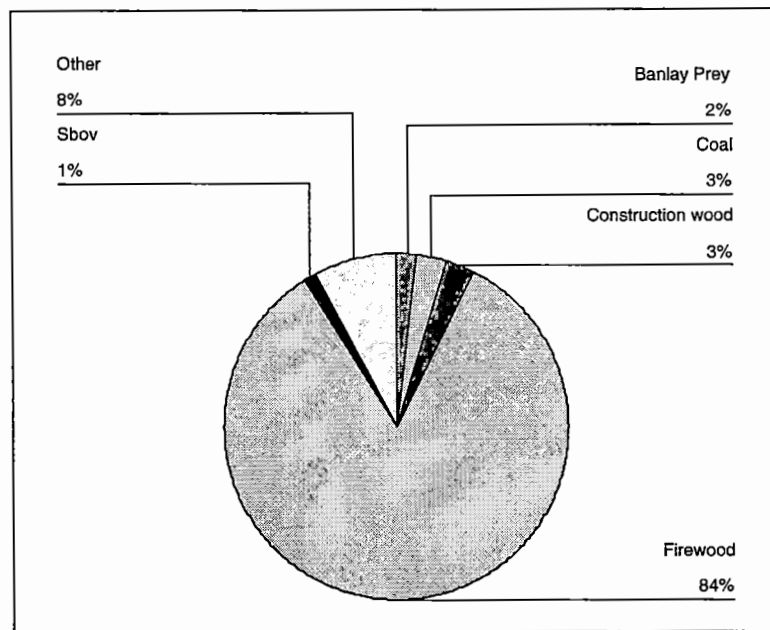


Figure 3. Products collected (percent of all households)

Households that collect firewood gather on average 1.2 cubic meters of firewood per month. 72% of these families use less than 1.0 cubic meter of firewood per month. The population of Ream uses a total of 44,788 cubic meters of firewood every year.

Villagers generally collect firewood around their houses. The area surrounding Ream, Smach Deng and Toek Sap villages represents 14% of the annual quantity collected. Similarly, Okhna Heng, Boeng Ta Prum, O Chrouv and Koh Kchang constitute 25% of the quantity collected. The two areas have relatively little ecological significance since they are densely populated and extensively cultivated. 9% of firewood is collected in the mangroves of Ma Ou. Fishermen transport mangrove firewood to Toek Sap and Bot Koki villages. Koh Thmei Island is the fourth collection area. The mangroves around Koh Krobei also provide fishermen with fuelwood.

Almost 100% of stoves used by families are *standard* earthen stoves, also called *Chinese* stoves. *Standard* stoves are made of baked clay and are sold on local markets. They have the shape and size of a bucket. *Gas* stoves, *rudimentary* stoves and *traditional* ovens represent less than 1% of all stoves used in the park. Rudimentary ovens consist of a few bricks or stones laid together in the shape of a cross or circle. *Traditional* ovens are more firewood efficient than *standard* and *rudimentary* stoves, but are considered bulky and expensive. The adoption of firewood efficient stoves would significantly reduce the consumption of firewood in the park.

4.6.3 Medicine

Villagers collect more than 200 species of medicinal plants in the park. The Ministry of Environment has conducted some preliminary botanic surveys in Ream and Bokor National Park (MoE and IUCN, 1999). To this date, medicinal plants are only identified by their Khmer names. In depth botanic surveys are required to classify these medicinal plants. The plants enter the composition of traditional drugs in different proportions. Villagers use traditional medicine for diarrhea, headache, fever, fatigue, poisoning, malaria, anesthesia, constipation, vertigo, etc. *Kru Khmer* or Khmer healers keep their own recipes. Ream has at least two healers who are known nationwide. They claim to be able to cure certain forms of AIDS. A few healers ship their drugs to Phnom Penh markets. The present study shows that twelve species represent more than 88% of the quantity of medicinal plants collected.

Healers may collect a hundred kilograms of plants every month, whereas villagers collect only a few kilograms for their family needs. The average monthly harvest is 13.7 kilograms per family. 47,240 kilograms of medicinal plants are collected every year in the park.

Phnom Samathik or the Mountain of Meditation is the preferred area for gathering medicinal plants. It is not clear when villagers started honoring the *Nak Ta Phnom*, the Old Genies of the Mountain. Villagers still trek through the forest to the stone boulders where the *Nak Ta* dwell to burn incense and light candles. Against those who would do evil to their natural domain, the *Nak Ta* are said to be ruthless. For these reasons, villagers believe that the medicinal plants are more abundant on Phnom Samathik and that they have high curative powers. 70% of the total harvest of medicinal plants is collected on Phnom Samathik. Families walk an average of 2 kilometers to collect medicinal plants. The walk lasts about 40 minutes.

4.6.4 Value of products collected in the park

Using local market prices, the total annual value of products collected is estimated at US\$ 170,615. Ream National Park provides an average annual US\$38 for each family in terms of firewood, medicine, food and building material. Firewood represents the largest shares in the total annual market value with US\$ 111,970, followed by fencing material with US\$ 21,170 and food with US\$ 15,834.

Market values are adjusted for all collection costs incurred to obtain net income from products obtained in the park. Costs may include petrol if villagers use a motorbike or a boat to travel to the collection area. The opportunity cost of

labor must also be deducted from gross market values. Children and other unpaid members of the family play an important role in the economy of Ream. From a young age, children learn to farm, fish, cook, care for their siblings or collect products in the park. It is difficult to estimate the opportunity cost for children. The time they spend in the forest could be spent at school, if there were schools. As for adults, there are very few employment alternatives. 83% of fishermen and 80% of farmers believe they are unable to change occupation. As a fisherman summarizes: "even if there is no fish left, I can only keep trying, there is nothing else I can do". The villagers of Ream lack the necessary skills that would make a switch in trade possible. For these reasons, the present study assumes the opportunity cost to be zero. Only 5% of households use a vehicle to travel to collection sites and to transport firewood. Petrol cost is therefore deducted from the market value of firewood gathered in the park. These changes marginally modify annual market values.

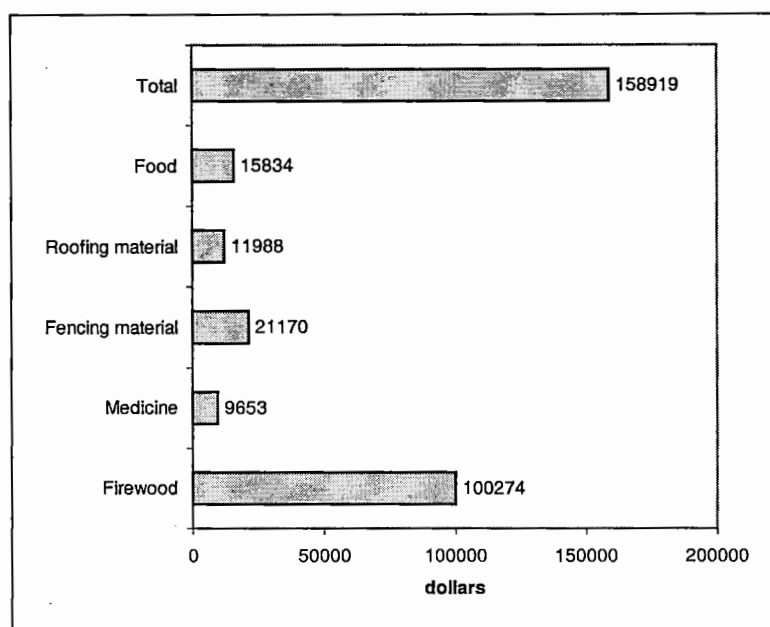


Figure 4. Annual net income from products collected in Ream National Park

4.7 Fish Caught in Ream National Park

4.7.1 Fish species

27 species of marine fishes, crustaceans and shells, and 8 species of freshwater fishes are harvested in the park. This represents a total of 79 actual species, since Cambodian names may cover several different Latin names. 39% of fishermen harvest *Bankea* (shrimps). Shrimps are used to make paste or are sun dried. Two species of crabs are collected: *Kdam Ses* (blue swimming crab) and *Kdam Tmor* (rock crab and mud crab). Both of these species are expensive

by Cambodian standards. Other popular species are *Ptuok* (Striped snakehead murrel), *Kbhok* (Mullet), *Andeng* (catfish), *Kamong* (mackerel), *Ki* (snapper) and *Khok* (large headed hairtail).

4.7.2 Fish catch

Quantities caught range from a few kilograms per month for subsistence fishermen to several tons per month for operators with large boats. Half of fishermen catch less than 25 kilograms per month, whereas 2% fishermen catch more than 1 ton of fish per month.

Kbhok (mullet), *Kamong*, *Bankea*, *Ki* and *Koun* (sardine) constitute the largest annual catches in the park. These five species represent 72% of the overall annual catch. A total of 3,174 tons of fish, crustaceans and shells are caught at Ream National Park every year. The 95% confidence interval for the annual catch lies between 2,522 tons and 3,836 tons per year. Marine species represent 94% of the total quantity. These figures underestimate the actual fish catch since they do not take into account all illegal fishing boats. For instance, park rangers have caught Vietnamese trawlers repetitively. These commercial boats are larger than any Cambodian push-net craft. In a matter of hours, trawlers catch more fish than Ream's subsistence fishermen in months.

4.7.3 Fishing trip

98% of fishermen fish inside Ream National Park. Only a small number fish beyond the boundaries of the park. On average, fishermen sail or row 6 kilometers to fishing areas. The average trip lasts more than 2 hours.

Most of the fishing activities occur at the mouth of the Prek Toek Sap, around Koh Kchang Village. 74% of the total annual quantity of fish is caught in this area of 20 km². The Ma Ou cove is the second most popular fishing area with 6% of the annual catch. The mangroves of Ma Ou are well known to villagers for their crabs and clams. The shallow waters of the channel allow only smaller boats to operate. Fish is caught along the Prek Toek Sap up to the Ranger station. Some fishermen venture as far as Koh Sampoach beach, but the area is much less productive.

4.7.4 Fishing boats

Only 34% of boats are motorized. Most boats are *Touk Chaev*, traditional Cambodian rowboats equipped with two oars and a small sail. These narrow boats are usually less than 10 meters in length and carry two fishermen. They are adapted to the shallow waters of the mangroves and to coastal fishing. Strong

currents make the return trip an arduous task. On windy days few subsistence fishermen venture beyond the protection of the estuary. Smaller boats are often carried out of the water and stored under stilt houses. A minority of fishing boats are equipped with powerful engines and employs crews of up to 5 people. All larger boats are based in the fishing villages of Koh Kchang and Don Loy.

Touk Chaev cost between US\$ 20 and US\$ 50. The boat can be used a maximum of five years before a replacement is required. Traditional boats demand only minimum maintenance. Large motorized craft may cost more than US\$ 2,000. Their owners usually depreciate them over a maximum of six to seven years. These boats may cost up to US\$ 500 to maintain each year.

4.7.5 Market value of fish catch

The market value of the total fish catch is estimated at some US\$ 2.0 million. For 58% of families, fishing is either a main source of income or a complementary source of income. Ream National Park provides an average annual US\$ 901 in fish catch for these families. *Bangkea* represents the largest share in the total annual market value with US\$ 513,371, followed *Kamong* with US\$ 213,190, *Ki* with US\$ 171,834 and *Kdam Tmor* with US\$ 171,224. *Khbok*, *Ptuok* and *Karav* (threadfin) are other economically important species.

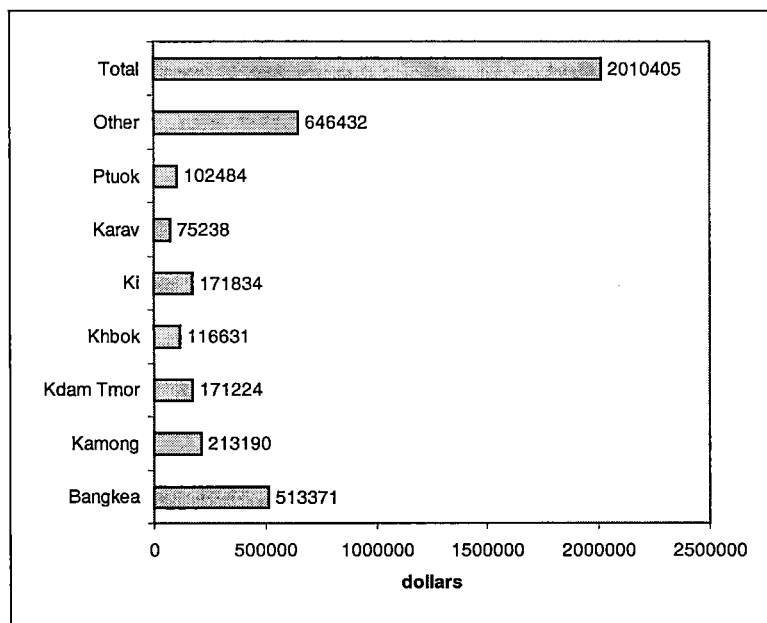


Figure 5. Market value of annual fish catch (US\$)

4.7.6 Net value of fish catch

Market values are adjusted for all fishing costs incurred to obtain net income from fish caught in the park. As in the case of other products, the opportunity cost of labor is assumed to be zero. All costs items are subtracted from gross catch values. Costs include petrol if villagers use a motorized boat. Boat and net maintenance costs are also deducted from gross values. An annual depreciation expense is calculated for boats and nets, using their usage expectancy. Some fishermen use bait, generally shrimp, fish, frog or calamari. A minority of fishermen have to rent their boats and pay a monthly fee. Other costs include bribes to corrupt officials and exactions by pirates. The total net annual income from fish is estimated at US\$ 1.4 million. This represents an average of US\$ 630 per family fishing in the park. There is a large difference between net and gross values for *Bankea*. Although many villagers fish *Bankea*, large boats operating from Koh Kchang village are responsible for the bulk of the annual harvest. These boats incur higher maintenance costs than traditional craft.

4.7.7 Distribution of fish catch over fishing population

There is widespread agreement among villagers that a minority of large boats using illegal equipment are responsible for the destruction of the natural resources of the park. Park authorities have been struggling to curb the activities of push net boats and commercial operators. Economists traditionally measure equality of income distribution with so called Lorenz curves. A similar graph can be used to assess the distribution of the total annual value of the fish catch of the park. The horizontal axis measures the percentage of the population of fishermen while the vertical axis measures the percentage of the total annual value of the fish they catch. The 45-degree line would correspond to a case of perfect equality. The graph of Ream shows a highly unequal distribution of annual fish catch. 50% of fishermen account for less than 10% of the total annual value of the catch. 20% of fishermen receive more than 70% of the total annual value. Subsistence fishing practiced by the majority is threatened by commercial fishing.

4.7.8 Towards extinction of fish species

89% of fishermen have seen their catch decline over the past 5 years, 8% have seen their catch remain stable and 3% have been able to increase their catch. Some 14% of fishermen are able to quantify the decrease in their catch. 50% of them estimate this decrease at more than 60%.

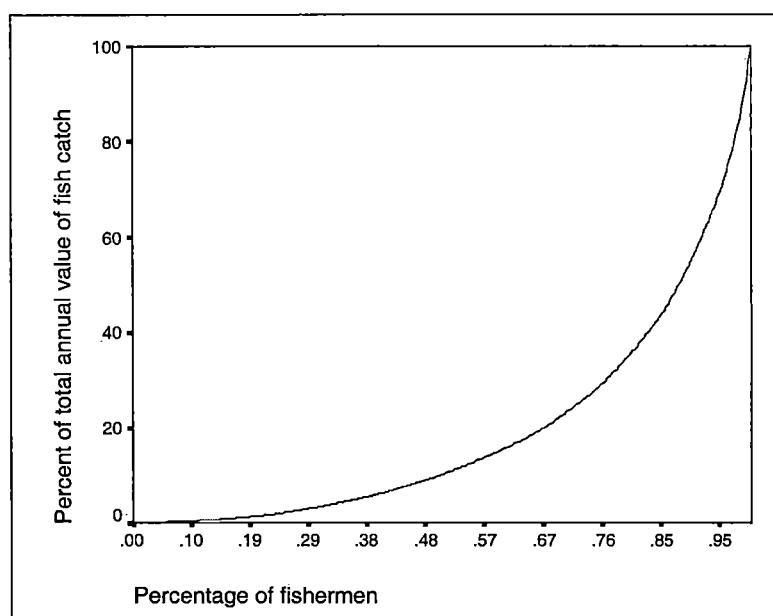


Figure 6. Unequal distribution of annual value of fish catch

43% of fishermen believe illegal fishing, i.e. electric fishing, fishing with explosives and other illegal equipment, is one of the reasons explaining the decline in their catch. 27% of fishermen explicitly blame push-nets, while 37% state overfishing as a reason. The logging of mangrove forests, lack of enforcement by rangers and the pollution of shrimp farms are other factors cited for the decline in catch.

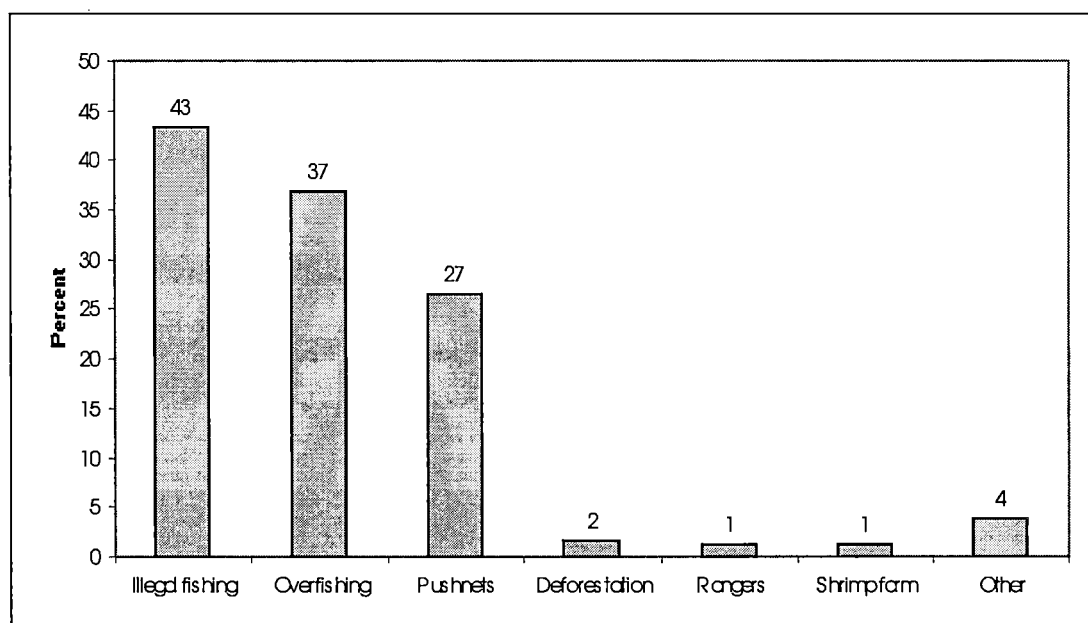


Figure 7. Specific reasons cited by fishermen for the decline in fish catch (percent of fishing households)

Subsistence fishing as practiced today is probably very similar to when it was first chiseled on the bas-relief of Angkor Wat eight centuries ago. The fisheries of Ream are an open access natural resource. Any individual is free to harvest as many fish as possible provided he uses regulated equipment. Unfortunately, illegal fishing is widespread in the park and will eventually destroy the livelihood of almost thirty thousand villagers. As long as total revenues from fishing exceed total costs, new fishermen will enter the fishery. Economic theory predicts that extinction would occur in an open-access fishery if the following conditions were met: (1) the population of fish falls below a critical biomass level where natural death of fish is higher than new birth; (2) fish prices increase significantly and the costs of harvesting are independent of fish stock. For the villagers of Ream, the opportunity cost of fishing is very low. Few other trades are available. There is little doubt for most fishermen that they will sail as long as there is one fish left in the estuary. The 1994 Ream management plan questioned the sustainability of fishing in the park and reported an unspecified decline in catch (MoE and IUCN, 1996). A limited survey of 60 fishermen had then estimated the total annual catch at 5,303 tons, compared with 3,174 tons for the present study. As reported earlier, 89% of fishermen report a decline in catches over the 1995-2000 period. Half of fishermen quantify the decline at some 60%. The body of evidence suggests that maximum sustainable yields have been exceeded for some species of fish over the past decade. At present rates the fisheries of Ream will collapse. However, it is difficult to predict when the fish stock will become exhausted.

4.8 Environmental Attitude of Households

4.8.1 Villagers' evaluation of the current condition of the park

Villagers are concerned about the condition of the park's forest. 40% of respondents believe the forest is in poor condition. An insignificant number of people regard the forest in very good condition. The areas around Ream have been totally destroyed by logging and are almost barren. The park itself has suffered from deforestation. A core zone of less than 1,000 hectares might be considered primary forest. Yet Ream national park remains the last vestige of a tropical forest that covered most of Cambodia a mere fifteen years ago.

Villagers are concerned about the condition of the park's estuary as well. Villagers' assessment of the estuary's condition parallels their assessment of the forest. Fewer than 20% of respondents believe the estuary is in good condition. 55% think that the estuary is in fair or poor condition. Families who fish tend to rate the estuary as in worse condition than other families.

4.8.2 Most important environmental problems as rated by villagers

Illegal fishing is the main source of concern for local communities. Illegal fishing is a significant environmental problem for 52% of households, followed by deforestation with 34%. Water pollution, waste disposal, forest fire, hunting, soil erosion and sedimentation are other environmental problems cited by villagers. 96% of those who mention illegal fishing as an environmental problem believe that push-nets are the main culprits.

4.8.3 Villagers' perception of rangers' duties

Villagers associate rangers with the protection of the forest of Ream. When asked to list the different tasks of rangers, 44% of villagers answer that the protection of the forest is one of their duties. The destruction of charcoal kilns and the confiscation of logs have had a high profile impact in the Ream area. In comparison, only 11% of villagers believe that park authorities have played any role in the protection of the estuary. Villagers do not perceive marine patrol as an actual ranger task. Illegal fishing still plagues the park. Authorities have had limited success in controlling push-nets and commercial fishermen.

4.8.4 Villagers' assessment of park authorities

A large majority of villagers regard favorably the work of park authorities. The successful conservation of a heavily populated national park like Ream depends on community support. As law enforcement officers, rangers have to confront poachers, loggers, land speculators and powerful stakeholders with political connections. It is not uncommon for rangers to believe that "villagers hate us". Some MoE officials have expressed concern about the hostility of villagers. An official once declared to the research team: "There is nothing we can do. The people want to cut down trees and to use push-nets. They are against us". The present results shed some light on the actual situation. The minority of villagers who oppose the park resort to violence and corruption. The impoverished majority watch helplessly as the very foundation of their livelihood is destroyed. Statistics give an equal voice to all respondents regardless of their political power or wealth. It will come as a surprise to many that 48% of villagers are very satisfied with the work of rangers, 20% are generally satisfied, 10% somewhat dissatisfied, 8% very dissatisfied. Thus, an overwhelming majority of 68% of villagers are satisfied or very satisfied with park management.

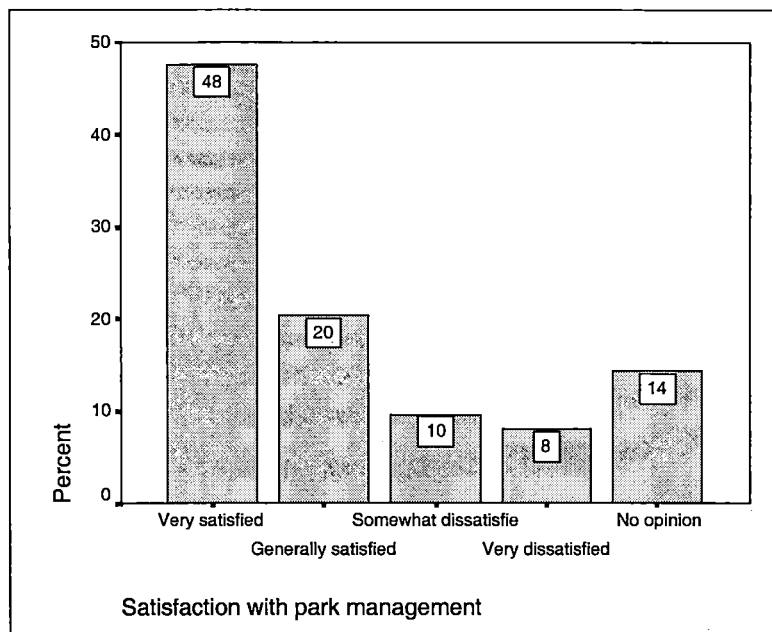


Figure 8. Villagers' satisfaction with park management
(percent of all households)

4.8.5 Villagers' attitude towards conservation measures

The majority of villagers agree with park conservation measures. Interviewers read five statements to villagers and asked them whether they agreed or did not agree. 94% of villagers agree that commercial logging should be banned from the park, 96% agree that all forms of illegal fishing should be stopped, 95% agree that there should be no hunting in the park.

4.8.6 Villagers' demands with respect to the management of Ream National Park

The final open-ended question of the survey asks villagers what would improve park management. Nowhere in the questionnaire do interviewers mention corruption nor do they provide any clues as to what could be improved. Villagers are asked to freely express their ideas and make recommendations. Local communities demand the strict enforcement of environmental regulations. Villagers' advice and suggestions range from a plea for the strict rule of law, an end to corruption, and to ingenious advice about patrol routes to catch push-nets. 36% of households ask for the rigorous application of existing environmental laws. These believe that the resources of the park are not sufficiently protected. Fewer than 5% of interviewers mention ranger corruption. Rather there is an understanding that rangers are poorly equipped to deal with "the rich and powerful". Villagers summarize the situation in the following words: "People are sitting on the law!", "Rich people can do what they want!" or "Stop the

anarchy!'. These findings confirm the support of local villagers for rangers, but also villagers' discontent about the lack of commitment from the Cambodian government. 19% of households demand that push-nets be stopped, and that existing fishing laws be strictly enforced. A ban on logging, community development, and access to wood to build houses, and the closure of existing shrimp farms are other measures requested by villagers.

5.0 ASSESSMENT OF THE MANGROVES OF REAM NATIONAL PARK

5.1 Inventory Design

The mangroves of Ream cover some 1812 hectares. This figure is based on 1989 aerial photographs taken by the Mekong River Commission (MRC) and computer mapping by MoE. Mangroves are located in five main areas within the park:

1. Toek Sap village, the main ranger station on the estuary
2. Ma Ou village, a secondary ranger outpost on the estuary
3. Koh Kchang village, the largest fishing village on the estuary
4. Koh Thmei, an island located at the mouth of the estuary
5. Koh Sampoach, a beach facing directly the ocean

The mangroves of Koh Kchang and Ma Ou are the largest with 660 hectares and 597 hectares respectively. The inventory surveys 37 plots of one hectare. This represents a 2% random stratified sample by mangrove zone. All trees with a diameter exceeding 10 centimeters are measured. The forest inventory was undertaken over a four-month period, from mid January 2000 to mid May 2000. Access to mangroves is often slow and difficult due to mud, tides, currents, snakes and landmines. Plots were randomly determined using MoE maps and 1989 aerial photographs. The researchers delineated each plot with ropes and wooden poles. Moving towards the general direction of the rear mangrove area, all trees were counted. More than 900 trees have been identified and measured.

5.2 Mangrove Species

Rhizophoraceae and *Avicennicaceae* represent respectively 51% and 35% of the trees of Ream's mangroves. All other families represent 5% or less of all trees. Local tree names may differ from one province to another. *Kravagn* and *Korgnkagn Chmol* are common Khmer words. Most villagers are able to differentiate easily between these dominant mangrove trees. *Basac* trees include four different Latin species (*Bruguiera cylindrica*, *Bruguiera gymnorhiza*, *Bruguiera parviflora*, *Bruguiera sexangula*).

Avicennia officinalis and *Rhizophora apiculata* species are the most abundant species of Ream's mangroves, accounting for 36% and 34% respectively of all trees. *Rhizophora apiculata* (Korngkagn Chhmol) and *Avicennia officinalis* (Kravagn) are associated with mud habitats under the influence of tides and rivers. *Bruguiera cylindrica* and *Xylocarpus granatum* are the only other species representing more than 5% of all trees.

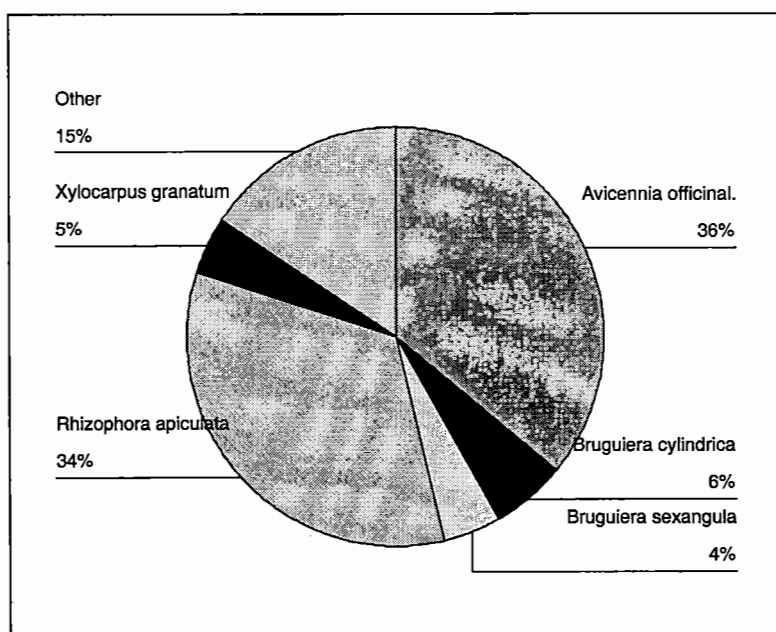


Figure 9. Distribution of trees by scientific name
(percent of all mangrove trees)

5.3 Standing Volume

Toek Sap has the highest mean diameter at breast height with 22.5 centimeters, followed by Koh Sampoach with 21.2 centimeters and Ma Ou with 17.4 centimeters. The mean diameter for the mangroves of Ream is 16.9 centimeters.

Toek Sap and Ma Ou have on average the tallest trees with respectively 9.9 and 9.4 meters. Koh Kchang and Koh Sampoach have significantly shorter stands with respectively 6.6 and 5.6 meters. The mean height for the mangroves of Ream is 8.7 meters. Ma Ou has the highest average volume per hectare with 112.5 cubic meters. Koh Kchang has a significantly lower average volume than any other zone with only 13.0 cubic meters per hectare. The mean volume per hectare for the mangroves of Ream is 62.1 cubic meters.

The total timber volume of the mangroves of Ream is estimated at 111,645 cubic meters. With 67,138 cubic meters, Ma Ou represents 60% of the timber stand of Ream's mangroves. The island of Koh Thmei has 22,154 cubic meters of timber or 20% of the total stand. All other zones have significantly lower timber volumes.

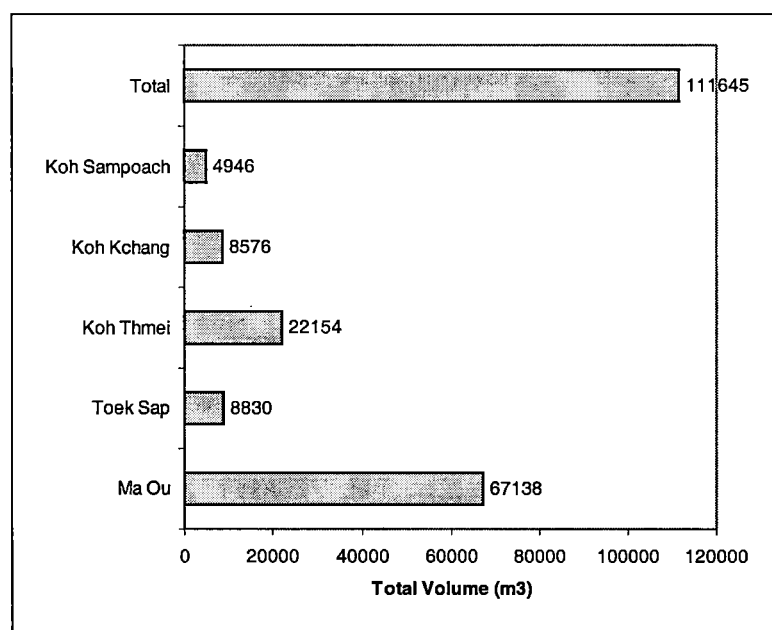


Figure 10. Distribution of total volume per zone (m3)

5.4 Quality of Mangroves

Koh Kchang is a heavily degraded zone. Remaining trees are predominantly short saplings with low diameters. Because of the proximity of the fishing village, the zone has been heavily logged for firewood and construction wood, leaving few mature trees. In addition, businessmen have established an illegal shrimp farm, clearing an area of forty hectares of mangroves. Koh Kchang has been a source of contention for several years. Most push-nets operate from the village, with, according to anonymous fishermen, the complicity of the local police post. The village is *de facto* beyond the control of park authorities.

Ma Ou and Toek Sap have relatively undisturbed mangroves. Two ranger stations effectively monitored the area up to May 2000. Push-nets and large boats do not venture in the vicinities of ranger stations. This zone is very popular with subsistence fishermen. Crabs and shells are abundant in the malodorous mud of mangroves. Harvesting of shells with bare hands and little equipment still occurs at the shade of undisturbed *Korkagn* trees. However, the Ma Ou ranger outpost, which played a crucial part in the estuary patrol system, was

burnt to the ground by push-net owners in May 2000. The arsonists were clearly identified but have not been prosecuted by local authorities. There is a high probability that illegal logging and fishing have resumed in the area. Ma Ou represents the last primary stand of mangroves at Ream. The destruction of these mangroves could have devastating effects on fishing activities along the Prek Toek Sap.

5.5 Monetary Value of Mangroves

Mangrove timber harvested outside of the park is sold in local markets at prices ranging between US\$ 40 and US\$ 50 per cubic meter. Small trees are mainly used to make poles that can be purchased for US\$ 5 per cubic meter. With the exception of their rear area, mangroves are accessible only by boat. Large trees are particularly difficult to transport because of shallow waters and mud. The study assumes a net income for trees above 45 centimeters at US\$ 30 per cubic meter to take into account petrol and boat maintenance costs. Subsistence fishermen can easily transport small poles. The net income from poles is therefore assumed to be the same as their market price. If the mangroves of Ream were totally logged, they would yield a net income of US\$ 629,988.

6.0 SURVEY OF TOURISTS AND VISITORS

6.1 Survey Design

The interview, which consists of 20 questions, is divided into four main parts: (1) environmental issues; (2) recreational activities; (3) entrance fees; and (4) background information. The first part determines respondents' attitudes towards environmental issues. Question 2 requires tourists to rank in order of importance seven general problems in Cambodia. An answer card was provided to facilitate the ranking of crime, corruption, employment, healthcare, environment, education and human rights. The second part concerns recreational activities in Kompong Som, Keng Kong or Ream and in Cambodian protected areas. If the interviewee has never been to Ream, he is asked whether he would be interested in visiting the park. The third part of the survey elicits willingness to pay (WTP) bids from respondents. Researchers read a short text about Ream and hand out the park's leaflet. The interviewee is given as much time as necessary to go through the leaflet. The two services offered are a ranger guided boat tour to the beaches of Koh Sampoach and a ranger guided walk to O Toul Creek and Meditation Mountain. For each tour, respondents are asked to state their maximum willingness to pay in dollars or in riels. Two additional services are offered for visitors of the park: a day long guided walk through the forest to the beaches; a night in the park's guesthouse. The final part of the survey

collects background information on respondents, including age, gender, education, income, country of origin and country of residence.

Researchers conducted the interviews in pairs. Interviewers systematically approached all visitors on Orchid and O Chentil Beaches in Kompong Som and at Keng Kong Bay. A total of 638 Cambodian tourists and 305 foreign tourists in Kompong Som, 312 Cambodian tourists at Keng Kong Bay participated in the survey. An additional 106 foreign visitors of the park were interviewed, out of an estimated 200 visitors per year.

6.2 Socio-economic Characteristics

80% of Cambodian respondents in Kompong Som have at least a *baccalaureat double* or high school diploma, with 33% at least a bachelor degree. Tourists at Kompong Som beaches are significantly more educated than the average Cambodia population, where the illiteracy rate is estimated at some 67% (UNDP, 1999). They are also significantly wealthier, with 39% of people having an annual income of at least US\$ 2000. The highest declared incomes are in the range of US\$ 20,000. 48% of Kompong Som tourists are from Phnom Penh. 37% reside in Kompong Som, either in Sihanoukville itself or other parts of the province.

In contrast, 50% of tourists at Keng Kong Bay have had only secondary education or less. Only 4% have been to university. 43% of respondents declare an annual income below US\$ 500. 89% of Keng Kong respondents reside in the province of Kompong Som. Keng Kong is a local beach known only around Ream and as far as the city of Kompong Som. Keng Kong is not indicated on tourists maps nor is there any sign directing to the bay from National Road 4.

Three fourths of foreign tourists in Kompong Som have a university degree. 31% of them have annual income over US\$ 40,000. Park visitors are relatively less educated and have lower income. 43% of them have a university degree. 22% of all visitors have an annual income over US\$ 40,000. Foreign visitors are a generally highly educated and wealthy group.

In Kompong Som, tourists from the United Kingdom (15%) and Germany (14%) represent the larger proportions. French, Australians and Americans follow with 10%, 10% and 8% respectively. Only 66% of foreigners interviewed are visiting from outside of Cambodia. A large proportion of foreign respondents reside in Cambodia. Most of them work for NGOs, development agencies and private businesses.

Park visitors from the United Kingdom and Germany represent the larger proportions with respectively 19% and 15%. Australians, French and Americans total 9% and 8%. In contrast to foreign tourists in Kompong Som, only 18% of foreign park visitors reside or work in Cambodia.

6.3 Environmental Attitudes

6.3.1 Membership with environmental organizations

95% of Cambodians surveyed in Kompong Som do not belong to any environmental organization. Most international conservation organizations have representations in Cambodia, but operate only limited educational programs. In rural areas, the Cambodian population is familiar only with development agencies. A few local NGOs have been created in the past few years, among them Mlop Baitorg and the Parks Society of Cambodia, but these remain exceptions. Fewer than 4% of Keng Kong respondents belong to an environmental organization. At Ream, park authorities have developed community fishery and forestry programs, where villagers participate in environmental protection and natural resources management. These are however isolated initiatives.

Only 7% of foreign visitors interviewed in Kompong Som belong to any environmental association. In contrast, a quarter of visitors of Ream National Park belong to an environmental group. Some 7% are members of the World Fund for Nature (WWF), and 5% are members of Greenpeace.

6.3.2 Most important problems in Cambodia as ranked by respondents

Almost 60% of Cambodian tourists in Kompong Som rank corruption as the most important problem in Cambodia. The absence of rule of law and the resulting high criminality is perceived as the second most important issue. Some respondents may give different issues the same ranking. For instance, the same respondent may rank crime and corruption as the most important issues. Similarly, for most respondents interviewed at Keng Kong, corruption, crime and the lack of respect for human rights are the most important problems in Cambodia. 54% of respondents rank corruption as the most important problem while 55% rank crime as the most important problem. Despite the fact that Cambodia is one of the poorest countries in the world, education and healthcare are ranked as secondary issues. Respondents believe that peace and order, the respects of existing laws and human rights are more important than economic issues.

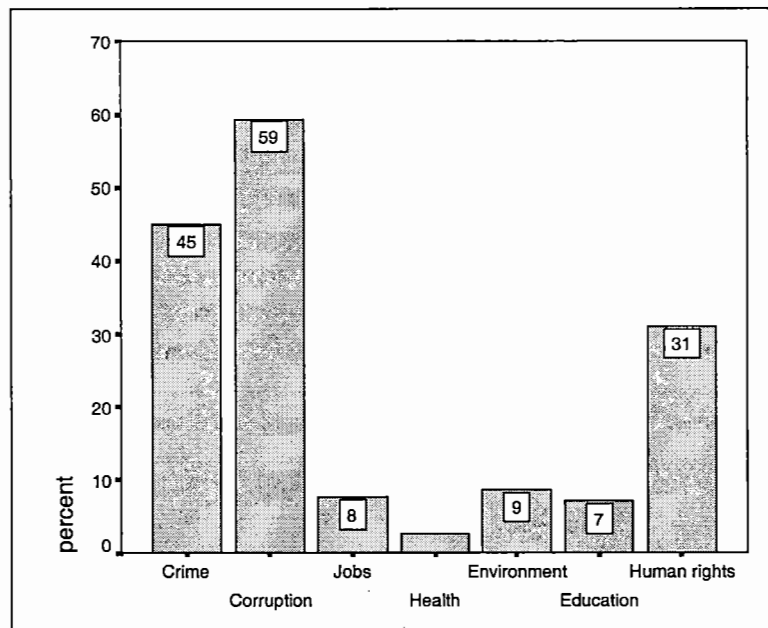


Figure 11. Most important problems in Cambodia as ranked by respondents (percent of all Cambodian tourists in Kompong Som)

Similarly, foreign tourists in Kompong Som and park visitors rank healthcare, education, the lack of respect for human rights and corruption as the most pressing issues in Cambodia. Crime and the environment are on average considered less important. 36% of Kompong Som foreign tourists rank corruption as the most important problem, 30% rank the lack of respect for human rights as the most important. Only 3% of park visitors rank environmental problems at the top of their list.

6.3.3 Evaluation of Cambodia's parks budget by respondents

Some 65% of Cambodian tourists in Kompong Som believe that not enough money is being allocated to protect the parks of Cambodia. Only 1% of Keng Kong tourists state that parks receive too much money. Similarly, a majority of foreign tourists (54%) and park visitors (51%) believe that too little money is allocated to the management of national parks. If asked how much the annual budget of national parks is, few people would be able to give an answer. However the answers express the general feeling of the population that parks are poorly funded and that the government is not doing enough to protect Cambodia's environment.

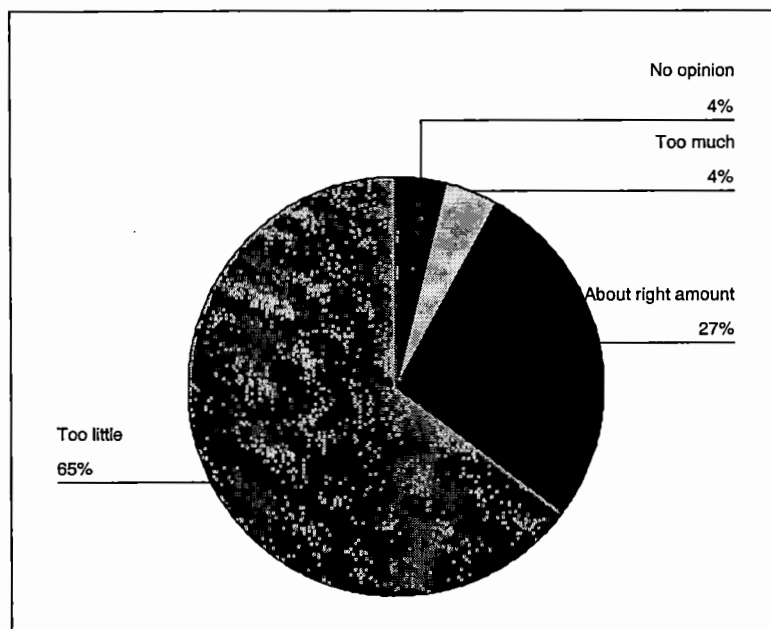


Figure 12. Evaluation of Cambodia's parks budget by respondents (percent of all Cambodian tourists in Kompong Som)

6.4 Recreational Activities

6.4.1 Frequency of visits

Some 32% of Cambodian respondents come to Kompong Som once a week, most of them to spend Saturday or Sunday by the sea. Kompong Som is within easy reach of the capital city and has always been a popular seaside resort. Fewer than 23% of respondents come to Kompong Som once a year or less. Keng Kong respondents are regular visitors of the bay as well. 38% of them come on average once a week. The area attracts many local people during weekends and public holidays.

The majority of foreigners in Kompong Som appear to be one-time visitors. Tourists usually spend most of their stay in Angkor Wat, with a few days on the beach at Kompong Som. 57% of respondents come to Kompong Som once a year or less. Only 8% come to the town every week. Similarly, there are few repeat visitors of the park. 86% of respondents are one-time visitors. Some 6% of visitors, most of whom reside in Kompong Som, visit the park about once a week. These are all individuals living in Kompong Som.

6.4.2 Recreation

Hiking or strolling, swimming and picknicking are the main activities undertaken at the beaches of Kompong Som and Keng Kong. With few

swimming pools available, the ocean is the only place where people can enjoy a swim. Walking along the seaside has been popular with generations of Cambodians. Vendors offer a variety of fresh seafood and drinks. Although there are few restaurants on the beach, most people have their meals on the sand between strolls and swims. Keng Kong is a secluded beach surrounded by the forests of Ream and offers opportunities to watch dolphins, monkeys, birds and other wildlife.

Foreign tourists in Kompong Som engage in a broader variety of activities than Cambodian tourists. 94% swim, 41% picnic, 32% snorkel. 21% declare watching wildlife. This last figure is surprising since there is little biodiversity on the sandy beaches of Kompong Som. 10% of foreigners sunbathe, an activity totally illogical for most Cambodians who would rather stay in the shade. Another cultural difference resides in the fact that most foreigners seem to stay in one place on the beach, while Cambodians prefer to stroll along the sea.

Some 68% of park respondents took the boat tour, while 31% hiked with rangers. 70% of visitors came to view the scenery and 53% the wildlife of Ream. Snorkeling equipment (mask and fins) was rented to 12% of visitors. 8% of visitors hired the park's canoe to paddle around the mangroves and the estuary. Only 5% of people have stayed in the park's guesthouse, a self-contained house with two bedrooms located on Keng Kong bay. 10% of visitors reached the park with a thirty-minute motorbike ride from Kompong Som. There is also a taxi service between Ream and the town. Public transportation remains inadequate and most visitors have to rent motorbikes or cars to drive to the park.

6.4.3 Protected areas visited by respondents

Cambodians do not make a clear distinction between *national park* or *protected area*. Respondents refer to a broader definition more akin to *scenic areas* or *environmental areas*. Strictly speaking, Kirirom, Bokor, Kep, Phnom Kulen and Ratanakiri are national parks; Angkor is a protected landscape. MoE also oversees Ta Mao Zoo, a small park in the suburbs of Phnom Penh, and Kbhay Chay Water Falls located a few kilometers from Kompong Som. Phnom Chisor and Tonle Bati are renowned Khmer archeological sites a few hours south of Phnom Penh, but are under the jurisdiction of the Ministry of Tourism. A majority of Kompong Som Cambodian respondents (58%) have already visited a scenic or environmental area. Kirirom National Park, Kep National Park and Angkor Protected Landscape are the most popular destinations. Like Ream, Kep and Kirirom are easily accessible from Phnom Penh via national roads. Although Bokor is closer to Phnom Penh than either parks, the winding mountainous dirt road discourages visitors. By contrast, only 21% of Keng Kong respondents have been to any other environmental or scenic area.

Angkor, Kirirom and Bokor national parks are the main destinations for foreigners. The proportion of foreign visitors in these parks is very low. Phnom Kulen, the founding site of the first Angkor is traditionally packaged in the same tour as Angkor Wat. Ratanakiri can be reached only by traveling several days by car and plane. A quarter of Ream visitors have been to other national parks, compared with 30% for foreign tourists in Kompong Som. Cambodian parks appear to be underutilized by foreigners. Inadequate facilities, lack of information and security are the main reasons for the situation.

6.4.4 Respondents' interest in visiting Ream National Park

Among Cambodian respondents in Kompong Som, only 9% have been to Ream National Park. All visitors of the parks, with a few exceptions, have been foreigners. Few Cambodians are even aware of the existence of a national park at Ream. An overwhelming 97% of respondents declare that they are interested in visiting Ream. By contrast, 87% of Keng Kong visitors have been to Ream National Park. The park is freely open to the public. Only guided walks and boat tours are charged. Visitors may hence hike in the park providing they know the area. Among the respondents who have never visited the park, only 2% would be interested in visiting it.

Most foreign tourists interviewed, like most Cambodian tourists, have never heard of Ream National Park. Only 12% of them have visited the park. Among foreign tourists who have never been to Ream, 90% declare that they would be interested in visiting the park.

6.4.5 Sources of information about Ream National Park

Guesthouses in Kompong Som are the main source of information about the park. Several of them have park leaflets and posters. 26% of park visitors discovered Ream through their guesthouse. The park is also mentioned in the locally printed tourist brochure of Kompong Som (11% of visitors). The popular Lonely Planet guidebook also favorably mentions Ream National Park (10% of visitors). Other guidebooks provide information to 20% of visitors. Finally 16% of visitors have heard about the park through friends.

6.4.6 Visitors' satisfaction

A mere 4% of visitors were somewhat dissatisfied by their experience at Ream National Park. No visitor declares himself or herself to be very dissatisfied. 31% of people are very satisfied with the park, while 57% are generally satisfied with their visit. These promising figures are the results of park authorities efforts to set up a visitor infrastructure over the past two years.

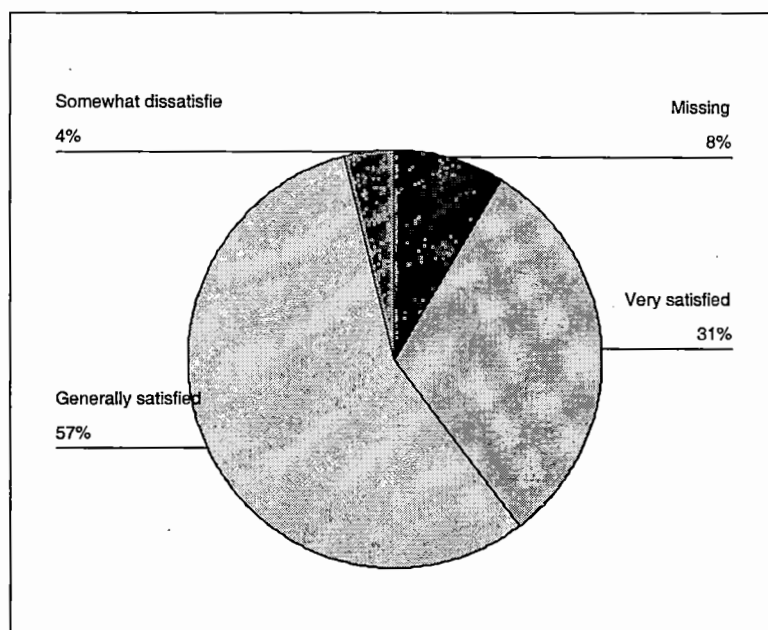


Figure 13. Visitors' satisfaction (percent of all foreign park visitors)

6.4.7 Improvement to the park suggested by visitors

Among the recommendations and suggestions made by visitors, 18% request more information about the parks ecosystems and wildlife. A few rangers still have difficulties with environmental interpretation skills. Additional training is required to improve their knowledge of the park and their English proficiency. Another concern for visitors is the poor condition of boats. These are used both by patrol units and tourist units. The larger and more powerful boats are often unavailable for visitors, leaving guides with small traditional craft. Strong currents and waves may make the ride to the beaches of Koh Sampoach very uncomfortable.

6.5 Willingness to Pay

6.5.1 Response rates and zero bids

It is common to find high non-response rates in contingent valuation surveys. The present study records a 57% rate of response for willingness to pay questions (WTP) for Cambodian tourists in Kompong Som, 87% for foreign tourists in Kompong Som and 84% for park visitors. These are very high figures. Most respondents are able to formulate bids because they are already familiar with national parks and other tourist attractions in Cambodia. According to economic theory, the more familiar with the good and its consumption the respondents are, the more accurate will be their valuation (Cummings and

others, 1986). Despite the fact that few Cambodian tourists interviewed have been to Ream, many are repeat visitors familiar with the area surrounding Kompong Som. Additionally, a majority have visited other parks or scenic areas. Similarly, a high proportion of foreign tourists reside in Cambodia. These individuals are already familiar with popular national parks like Bokor and Kirirom. In contrast, the survey records only a 23% rate of response for WTP questions for Keng Kong Bay. Cambodian tourists at Keng Kong are generally from poor local communities. Few can afford an entrance fee, even if it is only symbolic.

The proportion of zero bids is extremely small. The number of respondents who state US\$ 0 as a value is below 5% for the Keng Kong sample and close to 1% for the Kompong Som Cambodian sample. No zero bid was recorded for the foreign samples.

6.5.2 Distribution of values

The highest fee that Cambodian tourists in Kompong Som are willing to pay is US\$ 100 per person for the boat ride and US\$ 70 per person for the walk to the creek. Only two respondents are willing to pay the first figure and one respondent for the second figure. These numbers are not unreasonable in the Cambodian context, where the income distribution is very unequal. A quarter of Cambodian tourists are willing to pay more than US\$ 11.4 per person for the boat ride and more than US\$ 9.6 for the walk to the creek. In contrast, 75% of the bids of Keng Kong respondents are below US\$ 5.1 for the boat ride and US\$ 3.6 for the walk to the creek.

The highest fee that foreign tourists in Kompong Som are willing to pay is US\$ 50 per person for the boat ride and US\$ 30 per person for the ranger guide walk to O Toul creek. The survey does not record any extreme values or outliers. A quarter of foreign tourists are willing to pay more than US\$ 13.2 per person for the boat ride and more than US\$ 10.2 for the walk to the creek. Similarly, for park visitors, the maximum fee recorded is US\$ 50 for the boat ride, US\$ 35 for the guided walk to O Toul creek, US\$ 40 for the guided walk to the beaches and US\$ 45 per night at the park's guest house. A quarter of visitors are willing to pay more than US\$ 14.9 per person for the boat ride and US\$ 9.8 for the walk to the creek. The maximum amount that park visitors are willing to contribute towards a trust fund is US\$ 1,000. Some 8% of visitors state contributions in excess of US\$ 100.

6.5.3 Mean values

The sample of Kompong Som Cambodian tourists yields a mean of US\$ 9.2 per person for the boat ride and US\$ 6.6 per person for the walk to the creek. The 95% confidence interval for each excursion is respectively [US\$ 8.2 to US\$ 10.3] and [US\$ 5.9 to US\$ 6.6]. The 5% trimmed mean is US\$ 8.0 for the boat ride and US\$ 5.7 for the creek walk. A 5% trimmed mean does not take into account the lowest 5% and highest 5% of the distribution. The mean values for Keng Kong Cambodian tourists are significantly lower: US\$ 4.2 per person for the boat ride and US\$ 2.4 per person for the walk to the creek.

For Kompong Som foreign tourists, the boat ride mean value is US\$ 10.4 per person and the creek walk mean value is US\$ 7.6 per person. Park visitors formulate higher average bids for the boat ride with US\$ 12.6. Their mean values are US\$ 7.9 for the guided walk to O Toul creek, US\$ 9.1 for the guided walk to the beaches and US\$ 8.3 per night at the park's guesthouse and US \$48.7 for the trust fund.

6.5.4 Regression of bids against characteristics of respondents

The object of estimating a valuation function is to test whether respondents' characteristics (age, income, education etc.) may predict their willingness to pay. Using ordinary least square regression, it is possible to determine for each willingness to pay (WTP) variable an equation in the form:

$$\begin{aligned} \text{WTP} &= \text{function (Variable1, Variable 2 ... Variable I)} \\ &= \text{constant} + \text{coefficient 1 (Variable 1)} + \text{Coefficient 2 (Variable 2)} \\ &\quad + \dots + \text{Coefficient I (variable I)} \end{aligned}$$

The proposed models include different combinations of variables for each willingness to pay value. These variables are selected because of their relevance in predicting the willingness to pay of respondents. The regression parameters are presented in the appendices to the present report. The multiple coefficient of determination R^2 indicates the goodness of fit of the model. R^2 is the proportion of the variation in the dependent variable explained by the linear equation. Mitchell and Carson (1989) suggest a minimum coefficient of determination of 12% for the validation of contingent valuation exercises. It is not unusual to obtain models with low predictive power in contingent surveys.

The assumption of equality of variance or homoskedasticity is correct for all the multiple regression models described hereafter. No significant pattern can be observed on the plots of standardized residuals against standardized predicted values. A common problem with multiple regression models resides in

multicollinearity between the different dependent variables of the equation. The highest value obtained for the variance inflation factor of independent variables is 1.7. The independent variables used in the different models have high tolerance. Therefore the non-collinearity assumption of regression analysis also holds.

For the Kompong Som Cambodian sample, the ranking for corruption is significant at the 1% level. Respondents who rank corruption as an important problem in Cambodia (rank 1 being the most important) are willing to pay lower values than respondents who rank corruption as a secondary problem. This may be explained by the fact that respondents believe that corrupt government officials might embezzle entrance fees. Respondents who belong to conservation societies tend to give high values for the boat ride as well. Values for the boat ride increase with age, education and income. The linear equation model explains 11.7% of the variation of the boat ride fee. Boat tours are available in Kompong Som, Phnom Penh, Angkor and other popular recreational sites. Respondents are thus quite familiar with the goods evaluated. For the guided walk to the creek, the model explains only 3.6% of the fees given by respondents. Hiking is not usually considered a leisure activity in Cambodia. Guided walks often target foreign visitors. Cambodian visitors would generally prefer using a means of transportation to go directly to a scenic point. Hence a larger proportion of Cambodian respondents may be unable to formulate meaningful dollar values.

For the Keng Kong Cambodian sample, the proposed linear equation model explains 29.5% of the variation for the boat fee and 29.6 % of the variation of the creek fee. The model has thus good predictive power for both fees. Cambodian visitors at Keng Kong are able to formulate more meaningful dollar values than tourists in Kompong Som. Most of them know Ream National Park as well as rangers.

A large proportion of foreigners are one-time visitors of Cambodia on short holidays. This may explain the relatively low predictive power of regression models for foreign tourists in Kompong Som. The linear equation model explains 9.3% of the variation for the boat fee and 5.1% of the variation of the creek fee.

In contrast, for the sample of foreign park visitors, the proposed linear equation models explain between 21.2% and 26.2% of the variation of the different fees and 28.4% of the variation of trust fund donations. The models have good predictive power for all five variables. Visitors are able to formulate meaningful dollar bids for different environmental goods and services of the park, because they are more familiar with its characteristics.

6.5.5 Adjustment of WTP values for cost-benefit analysis

The non-response rates are substantial only for the Cambodian sample of Keng Kong Bay. This represents the poorest group of respondents. It is difficult to estimate the proportion of non-responses that are in fact zero bids. This proportion may be very low. Most of the non-response answers could correspond to "I don't know" or "no idea" types of answers, rather than actual protests bids. A conservative approach is to reduce mean willingness to pay values by the non-response ratio. This assumes that all non-responses are zero bids.

Table 3. Adjustment of WTP values for cost benefit analysis

Survey	Response rate %	WTP Boat	Adjusted Boat	WTP Creek	Adjusted Creek
Kompong Som Cambodians	57	9.2	5.2	6.6	3.8
Kompong Som Foreigners	87	10.4	9.0	7.6	6.6
Keng Kong	23	4.2	1.0	2.4	0.6
Toek Sap	82	12.6	10.3	7.9	6.5

7.0 ECONOMIC ANALYSIS OF ALTERNATIVE SCENARIOS

7.1 Management Scenarios

It is customary for cost benefit analysis, to assess a broad range of alternatives, including those with remote feasibility. Although it is possible to consider different logging cycles for the forests of Ream, such an exercise would be inappropriate to the current Cambodian situation. With increasing environmental degradation, there are fewer choices and management options available. The present study attempts to integrate scenario planning into the traditional cost benefit framework. The modern form of scenario planning was developed in the field of management in the 1970s. A portfolio of alternative projects for Ream should include only those that are practically feasible in Cambodia. Scenario planning may be defined as "the art of long view about decisions to be made" (Schwartz, 1991). It allows the government of Cambodia and the international community to assess the implications of their decisions and to be informed of future developments. Three different scenarios cover the future of Ream National Park. Reality will likely be a combination of the three plots. *Experimental Park* is a continuation of the present situation but with better management as experience grows. *Ghost Park* is a degradation of the present situation with the total destruction of the natural resources of Ream. *Dream Park* requires fundamental changes to develop Ream into a national tourist attraction

while preserving local livelihoods. The three plots are described hereafter with fictitious characters to provide an illustration of the future as it unfolds.

7.1.1 Experimental Park

Ranger Gna and Sim have just attended another round of lectures on "community participation in protected areas of Cambodia". The International Committee for Parks (ICP), a western multilateral environmental institute, has organized the "strategic capacity building" seminars. Even Park Director Thol who usually grasps concepts quickly seems perplexed. ICP is the latest organization to operate at Ream National Park. Rangers have worked through three different management plans and six foreign consultants over the past years. Old Krum, the Sre Khnong village chief, still grumbles that the livelihoods of his people have not improved much. Fishing is not as good as it used to be. ICP keeps on insisting on participatory approaches. Old Krum assesses the situation bluntly: "You need more boats and people on patrol, you must enforce the law more strictly". Gna and Sim know that illegal fishing is to blame for the villagers' plight. The aged fisherman may be right...

The original UNDP demonstration project at Ream was to assess the feasibility of protected area management in Cambodia. Despite its successes in training staff, providing equipment and setting up management structures, the project was short lived. Wetlands International followed on the tracks of UNDP in September 1999 for a six month zoning project of Ream. Other international organizations have expressed interest in helping MoE manage the park. The lack of long term planning on the part of donors is aggravated by the weak institutional capacity of Cambodia. Demonstration projects do not confront critical management issues. Ream National Park is often touted as a showcase. Indeed, it hints to what could be achieved if there were stronger, longer-term commitment on the part of donors and the government of Cambodia. In this scenario, the park manages to survive on an annual budget of US\$ 30,000, which is estimated to be the minimum required for ranger patrols. The current level of conservation is maintained. About 200 foreign tourists visit the park every year, but this remains insufficient to cover operations. Park budget fluctuates widely from one year to another. During extended periods without funding, there is a surge in illegal logging. Fishing remains above the maximum sustainable level. By 2005, the fish stock of Ream has been depleted.

7.1.2 Ghost Park

Ranger Gna and her colleagues have not been paid for the past three months. There has not been any news from the Ministry. Park director Thol will take the afternoon bus to Phnom Penh to sort things out. Gna hopes that the

dynamic little man will not come back empty-handed. Yesterday Sim left the park to take up a position in the city. Sim used to work in the tourist section. He speaks English well and always wears a welcoming smile. The Grand Hotel of Kompong Som has offered him \$90 a month to work as a receptionist. This is twice as much as UNDP used to pay. \$90 is ten times as much as his MoE salary, when he is paid. Rangers have not been on patrol for the past five months. There is no cash for petrol or spare parts. This morning, a group of villagers came to complain again about illegal trawlers and push-nets. Old Krum was carrying a rusty machine gun. He threatened to take matters into his own hands. Tempers are rising. Gna is worried. She does not see any future for the park...

This is the worst-case scenario. Ream gradually becomes a ghost or paper park that exists only on the maps of the Royal Decree on protected areas. Commercial loggers and commercial fishermen get the lion's share. An increase of the net value of the catch by 50% would lead to a collapse of the stock. There is hence a transfer of the net income from subsistence fishermen to push-nets. Underpaid and poorly equipped rangers watch helplessly the destruction of the park. The natural resources of Ream are totally depleted in two years. Environmental degradation, in particular soil erosion and flooding, further impoverish local communities. The area spirals down into absolute poverty. In a model described by Homer-Dixon (1999), environmental degradation leads to social instability. Frustrated fishermen and farmers of Ream vent their anger against local corrupt officials. Armed confrontation between villagers and commercial operators occur sporadically. Rangers move to jobs in the cities, where their English and computing skills are properly rewarded.

7.1.3 Dream Park

Thol is the happy director of a park truly for the people. A group of friendly Swedish tourists have made a generous donation to the park's trust fund. They have complimented young Sim for his guided tour. Visitors seem to like the new trail to the mountain streams. Things have been going well lately. The park is almost self-sufficient and boasts a staff of 50 rangers and community workers. Natural resources are strictly monitored, with only subsistence activities allowed. The new hovercrafts are perfectly adapted to the shallow waters of the bay. Old Krum has been complaining to Gna about the noise, but villagers are happy that it frightens off push-nets. The park headquarters have been connected to the electric grid. Rangers can watch television at night or play chess. And best of all, Director Thol sleeps on a mattress now, a luxury...

This scenario requires an internationally funded five-year development program. Most of the necessary infrastructures already exist at Ream. Additional

funding would allow the further development of patrol, tourist and community activities. In this scenario the park employs 50 rangers, versus 25 at present. Three additional ranger outposts equipped with fast crafts are built to monitor the whole of the estuary. Only subsistence activities are allowed in the park. Community outreach includes environmental education, participatory resources management, as well as water supply and sanitation. Visitors enjoy a variety of activities and marked trails. Small commerce and restaurants flourish around the visitor's center. A bus shuttle is offered between Kompong Som and Ream.

7.1.4 Leading indicators

As the course of history gradually unfolds, leading indicators may point to which scenario is closest to reality. The budget allocated to the park is an indicator of its health. Basic activities such as patrols and maintenance of equipment cannot be sustained without funds. Below US\$ 30,000, the park would suffer considerable degradation to its habitats. High staff turnover is a sign that rangers do not see their future in conservation work at Ream. This would be a tremendous loss to the park, since the training of these men and women required a considerable amount of time and funds. A third indicator is the simple observation of push-nets operating on the estuary. Even to an outside observer, the systematic cruising patterns of push-net are unmistakable. Another leading indicator is the gradual deforestation of the park. Any logs transported on the highway that borders Ream would have their origin in the park. As the EEPSEA research team left Ream at the end of June 2000, park staff morale was low. Recent reports from members of the Parks Society of Cambodia (PSC) are pessimistic. Few visitors tour the park during the monsoon, which reduces a primary source of revenues. Rangers are unable to purchase petrol for park motorbikes and boats, let alone repair them. At this stage, there is no clear commitment from the government or international donors to manage Ream National Park efficiently.

Table 4. Summary of management scenarios

Scenario	Plot	Annual park budget
<i>Experimental Park</i>	Protection of forests, but collapse of fish stock within 5 years.	US\$ 30,000
<i>Ghost Park</i>	Clear cutting of all forests and harvesting of all fish over two years. Impoverishment of local communities and social instability.	No budget.
<i>Dream Park</i>	Sustainable exploitation of all natural resources. Subsistence activities allowed. Ban of all commercial activities.	US\$ 100,000

7.2 Summary of Valuation Components

7.2.1 Non-timber forest products

Non-timber forest products include firewood, fencing and roofing material, food and medicine. The current levels of collection are assumed to be sustainable. In the experimental park and dream park scenarios, subsistence collection of these products provides a constant stream of benefits over twenty years. The net income from non-timber products is projected at US\$ 158,919 per year. The 95% confidence interval estimates net income from these products between US\$ 108,767 and US\$ 201,764. In a ghost park scenario, the total destruction of the forests of Ream would result in the complete loss of these benefits.

7.2.2 Marine and freshwater fish

Under UNDP and MoE management, there has been a decrease in illegal fishing with the extension of ranger patrols. However, present fishing levels are still unsustainable. Ream has historically known large settlements. Subsistence fishing predates the park and had been sustainable in the decades preceding the war with an equivalent level of population. The introduction of commercial fishing and push-nets in the late 1980s dramatically distorted the situation. The absence of fish stock assessment makes assumptions problematic. To determine sustainable levels that correspond to subsistence fishing, all commercial boats have to be removed from the household survey. The assumption is that commercial operators own boats that are above ten meters in length and that are valued at more than US\$ 700. These boats generally have an annual fish catch exceeding 3 tons per year and represent 8% of all households at Ream. This leaves in the sample mainly subsistence fishermen and a corresponding annual subsistence catch. Additionally, fishermen estimate the average decrease in fish catch at some 50% over the past five years. If commercial fishing were banned from the park, subsistence fishermen might be able to increase their catch to historical sustainable levels. A conservative estimate puts this increase at 40%. These calculations yield an annual catch of 1,593 tons per year, which is 48% lower than the present harvest. The dream park scenario is the only case where Ream is specifically managed for subsistence activities. Sustainable net income from fishing would be US\$ 924,093 per year. In a ghost park scenario, the stock would collapse within 2 years under maximum levels of harvest. The net income from fishing would be 50% higher than at present, which corresponds to annual landings in excess of 4500 tons per year. In the experimental park scenario, fishing continues at present levels and exhausts the stock within 5 years.

7.2.3 Timber from mangroves and evergreen forests

Commercial timber extraction would occur only under the ghost park scenario. The mangroves of Ream could be entirely cut within a year, yielding a one-time net income of US\$ 629,988. The evergreen forest of the park covers approximately 7000 hectares. This data is based on 1989 aerial pictures of the park. A workshop was organized with park staff in order to assess the present condition of the forest. The forest may be broadly classified into three categories. Primary or untouched forest covers some 1,000 hectares in the core zone. About 2,000 hectares of secondary forest have already been logged, leaving only a small proportion of commercial species. An additional 4,000 hectares of forest were heavily degraded prior to the establishment of the park. All commercial trees with diameter exceeding 45 centimeters have been removed from degraded forest. The park's management plan reports a 1971 FAO study that provides stocking rates for forests around the Bay of Kompong Som (FAO, 1971). Primary forests have an average 74 cubic meters of timber per hectare, of which 14 cubic meters of commercial trees with diameters exceeding 45 centimeters, 17 cubic meters of non-commercial trees with diameters exceeding 45 centimeters and 43 cubic meters of other trees. The present study assumes that the park's secondary forest has retained half of its commercial stock and all its non-commercial stock. The degraded forest is assumed to have all of its non-commercial stock. These conservative hypotheses provide an upper bound for the standing stock of the park's forests. The Prek Toek Sap sawmill markets Dipterocarp timber at US\$ 130 per cubic meters and hopea timber at US\$ 90 per cubic meter. The price of other commercial species averages US\$ 100 per cubic meter. However the sawmill purchases its trees at much lower prices. Villagers estimate the value of dipterocarp trees at less than US\$ 80 per cubic meters. Non-commercial timber and poles are found on local markets at respective prices of US\$ 50 per cubic meters and US\$ 5 per cubic meter. Because of the mountainous landscape, commercial loggers would incur high operating costs in the park. Reasonable estimates of net income are US\$ 60 per cubic meter for commercial trees and US\$ 30 per cubic meter for non-commercial trees. Local villagers with low opportunity costs would harvest only small trees. In the ghost park scenario, the evergreen forest would be clear-cut in two years, yielding a one-time net income of US\$ 6.7 million, or US\$ 3.4 million per year. Under the other park management scenarios, logging is only exceptionally allowed for the repair of local houses.

7.2.4 Recreation and tourism

Benefits from recreation and tourism have been estimated at US\$ 2,060 per year under the experimental park scenario. This is based on the assumption some 200 foreign tourists per year and corresponds to present levels of visits. In

the dream park scenario, the number of visitors would increase gradually to 3,000 foreigners and 7,000 Cambodians over five years. These very conservative figures represent less than 5% of the annual number of tourists in Kompong Som. Approximately 179,000 foreign tourists visited Cambodia in 1999 (Ministry of Economy and Finance, 2000). Annual income from visitors would total US\$ 67,612. With increased marketing efforts and the provision of additional services and amenities, there is little doubt that Ream National Park could attract at least 10,000 visitors a year from among the tourists of Kompong Som.

7.2.5 Protection from storm and erosion

As the household survey shows, it is common knowledge among villagers that the trees of the park provide protection from flooding and soil erosion. Yearly monsoon rains and storms have so far spared Ream. The regional climate is very humid because of the proximity of the sea (MoE and IUCN, 1996 based on Kompong Som meteorological office). Most of the rainfall occurs between May and October when humidity averages 82%. Strong winds occasionally exceed 230 kilometers per hour. The Prek Toek Sap swells from a 50 to a 200-meter wide river during the rainy season. These factors combined with a tide that has an amplitude of 1.5 meters would make the area extremely vulnerable without the protection of the park's forests. Mangroves are natural barriers against wave and current, while the evergreen forest shield villages and cultivated fields. In exceptionally bad climatic conditions, extensive damage to houses and crops would occur in the ghost park scenario. Logging would lead to exposure to natural forces. Over the past ten years, Cambodia has suffered from three occurrences of particularly harsh climatic conditions including year 2000. On each occasion, the country had to resort to emergency international food aid. The paucity of data makes the expected damage method the only applicable valuation tool. Expected damage underestimates the value of protection of the park. As the risk of losses from storm or soil erosion increases, villagers might be willing to pay more to prevent the risk than the cost of the expected damage. For catastrophic losses, the difference can be very large. The total value of houses at Ream is estimated at US\$ 1.5 million. Crops and animals total some US\$ 492,417. In the ghost park scenario, all properties and agricultural production would be destroyed every five years by flooding and storms. This is a reasonable assumption that probably underestimates the benefits of protection from the park. In the experimental and dream park scenarios, protection from storm and erosion are thus estimated at an equivalent of US\$ 404,470 per year.

7.2.6 Park management costs

UNDP remunerated rangers US\$ 60 a month. US\$ 30,000 would cover the annual salaries of 25 rangers, as well as operation costs for one pick-up truck, four motorbikes and three boats. Community development activities would be limited to environmental education and participatory resources management. Under the experimental park scenario, the current level of conservation is maintained. Under the dream park scenario, the annual budget of the park would be increased to US\$ 100,000. An investment program of US\$ 500,000 over five years would provide three additional ranger outposts, tourists facilities, and equipment, including hovercrafts or speedboats. These figures would make any western protected area manager perplexed. Protected area budgets average US\$ 3,181 per square kilometer in the United States and US\$ 1,017 per square kilometer in Canada. Malaysia and Thailand spend annually US\$ 500 and US\$ 667 per square kilometer. Under the dream park scenario, the budget of Ream would be equivalent to US\$ 476 per square kilometer per year. Cambodia remains an inexpensive country to undertake conservation work (James and others, 1999). Both budgets were projected in June 2000, during a general meeting of Ream park staff and members of the Parks Society of Cambodia, a not for profit organization. Budgets do not include salaries of western consultants, which average US\$ 250 per day in Cambodia. Management processes are already in place at Ream and rangers have acquired considerable field experience. Thus, international expertise would only be required on a periodic basis.

7.3 Cost Benefit Results

7.3.1 Cost benefit assumptions

The cost benefit analysis uses real dollar terms and assumes that there will be no variation in costs and prices over the time period. Benefits and costs are discounted over a twenty-year period. Longer time horizons would increase the uncertainty surrounding the different valuation components. Shorter time horizons would understate the benefits of conservation scenarios and the sustainable use of natural resources. A 10% discount rate converts all benefits and costs of different years into their present value. The discount rate should reflect the opportunity cost of risk free investment or the cost of borrowing for the government of Cambodia. The Asian Development Bank has used a rate of 10 to 12% to calculate the net present value of its projects (ADB, 1987).

7.3.2 Comparison of net present values

The dream park scenario has the highest net present value with US\$ 11.9 million, followed by the ghost park scenario with US\$ 10.0 million and the experimental park scenario with US\$ 9.8 million. In the experimental park case, illegal fishing eventually leads to the collapse of the stock and other benefits do not make up for the loss of income from timber. Although the dream park scenario has the highest net present value, it exceeds that of the ghost park by less than US\$ 2 million. Given the uncertainties surrounding long-term protected area planning and conservation, most Cambodian policy makers are likely to favor the immediately capturable benefits of development. Ream's biodiversity would be lost not only to local communities but also to the international community. Cambodia cannot be expected to shoulder all the costs of conservation on its own. International conservation financing is needed to help the country manage the resources of Ream in a sustainable way.

7.3.3 Sensitivity analysis

7.3.3.1 Confidence intervals for net present values

The net present value of each scenario varies when the lower bound or the upper bound of the 95% confidence interval for the valued benefits are used. The lower bound yields a net present value of US\$ 9.5 million for the dream park, US\$ 9.2 million for the ghost park and US\$ 7.5 million for the experimental park. Using the higher bound, the net present values are estimated at US\$ 14.1 million for the dream park, US\$ 10.8 million for the ghost park and US\$ 12.0 million for the experimental park. The lower bound shows almost equivalent values for the dream park and the ghost park. Hence if the ghost scenario were chosen, and actual values are in the lower bound case, the mistake would cost US\$ 371,000. If the ghost park scenario were preferred, and actual values are in the upper bound case, the mistake could cost up to US\$ 3.2 million. Within a 95% confidence interval, the dream park should always be favored over the ghost park and the experimental park scenarios.

Table 5. Summary of net present values for park management scenarios (US\$)

Net Present Value		95% confidence interval		Base case
		<i>Lower bound</i>	<i>Upper bound</i>	
10% discount rate	Experimental park	7,515,199	11,976,441	9,765,845
	Ghost park	9,153,819	10,846,416	9,991,544
	Dream park	9,525,645	1,412,6518	11,896,705

7.3.3.2 Variation of discount rate

A 5% discount rate would favor both conservation scenarios over the exploitation of the natural resources of the park. The net present value of the dream park (US\$ 17.6 million) is substantially larger than that of the ghost park (US\$ 10.7 million). A 15% discount rate would bring down the net present value of the dream park to US\$ 8.7 million, compared with US\$ 9.8 million for the ghost park and US\$ 8.0 million for the experimental park. A 13.4% discount rate equates the net present value of the dream park and the ghost park at US\$ 9.5 million. A 9.3% discount rate equates the net present value of the experimental park and the ghost park at US\$ 10.0 million.

7.3.3.3 Variation of recreation values

If the number of visitors to the park remained at its present level of 200 individuals per year, the net present value of the dream park would still be superior to that of the ghost park.

7.3.3.4 Variation of management costs

It would take an investment program of US\$ 3.1 million or US\$ 620,000 per year over five years to equate the net present value of the dream park and the ghost park scenarios. Alternatively an increase in the dream park's budget from US\$ 100,000 per year to US\$ 330,000 per year would equate its net present value with that of the ghost park scenario.

7.3.3.5 Variation in net income from non-mangrove timber

For a net income from non-commercial timber of US\$ 42 per cubic meter, the dream park scenario and the ghost park scenario have equivalent net present values. This is equivalent to a forty percent increase over current estimated income per cubic meter. An increase of net income from pole from US\$ 5 per cubic meter to US\$ 8 per cubic meter would equate the net present values of the dream park and the ghost park. The ranking of the three scenarios has low sensitivity to variations in the income from commercial timber.

7.3.4 Distribution of net present value by stakeholders

Although the aggregate net present values of the different scenarios are approximately equivalent, the distribution of benefits among stakeholders shows considerable variation. The dream park scenario confers a net present value of US\$ 12.6 million to local communities, compared with US\$ 7.3 million for the experimental park and US\$ 4.3 million for the ghost park. If local communities

were to be favored over commercial operators, both the experimental park and the dream park would be the chosen options. In the dream park scenario, local communities receive 96% of the present value before costs of the dream park project and 73% in the experimental park scenario. Commercial operators would be excluded from the distribution of benefits of the dream park. The ghost park awards 57% of the net present value to commercial loggers and commercial fishermen. The assumption is that if logging were allowed local communities would collect all trees below 45 centimeter in diameter. This overestimates the benefits to villagers, since only a small proportion of farmers and fishermen might be tempted to harvest poles. In the experimental park and dream park cases, subsistence fishermen are assumed to be able to maintain their current level of catch. On a household level, the dream park confers three times the benefit to villagers as compared to the ghost park, that is, US\$ 2,729 per household versus US\$ 919 per household. Visitors have most to gain from the dream park scenario, where Ream would have improved recreational facilities. In the ghost park, all recreational benefits would be foregone.

Table 6. Distribution of net present value by stakeholder group (US\$)

		Experimental Park	Ghost Park	Dream Park
Net Present Value	Local communities	7,298,621	4,262,848	12,663,776
10% discount rate	Local communities (per household)	1,573	919	2,729
	Visitors	17,538	0	463,364
	Commercial fishermen	2,705,094	2,430,496	0
	Commercial loggers	0	3,298,200	0

7.4 Benefits Not Valued

7.4.1 Marine ecosystems

The value of the marine ecosystems of Ream is not limited to its fish stock. The unspoiled beaches and creeks of Koh Sampoach, Koh Ses and Koh Thmei have earned the park the nickname of *jewel of the south*. Sea grass beds and coral reefs support a variety of marine life from clams to turtles. Villagers always treat with respect dolphins and *sea pigs*, as they affectionately call dugongs. It is even considered an even greater omen to fish in the company of whales. Unfortunately, their sightings have been much more sporadic with the gradual decrease in shrimp catch.

7.4.2 Medical resources

The present study only values the main local and direct uses of biodiversity, including traditional medicines. There are many opportunities to explore in greater detail the diverse ecosystems of Ream. For instance, a plant inventory is required to assess the medical resources of the park. However, the benefits of species and genetic diversity remain hypothetical for local users. With its weak institutions and inadequate infrastructures, Cambodia cannot fully take advantage of its natural heritage.

7.4.3 Carbon storage

As increased concentrations of greenhouse gases contribute to the warming up of the earth's atmosphere, the role of forest areas such as Ream in sequestering carbon will grow in importance. A preliminary greenhouse gases inventory is under way at MoE. Cambodia has very few industries and associated atmospheric pollution. Phnom Penh with its million inhabitants uses less electricity than generated by a 10-megawatt plant as commonly constructed in western countries. The Conference of Parties on Climate Change describes joint implementation mechanisms by which the emissions of a country could be offset by the sinks of another. Such a mechanism would enable Cambodia to earn revenues for its forests to offset the emissions of America, Australia or Europe. Using secondary studies, the monetary value of the park as a carbon sink could be roughly estimated. Unfortunately, under the Kyoto protocol, only developed countries are eligible for joint-implementation. In effect, there is no incentive for Cambodia to keep Ream National Park for its carbon sink value.

7.4.4 Prevention of saline water intrusion

The Groupement de Recherche et d'Echanges Technologiques (GRET), a French NGO, has recently completed a dyke in the neighboring district of Prey Nup. The intrusion of salt water in Prey Nup is a result of mangrove clear felling. As saline water moves inland, agricultural productivity declines. The limited mangroves of Ream play a crucial role in protecting freshwater resources for domestic and agricultural uses.

7.4.5 Education and research

The author and the other members of the research team would place a high monetary value of the educational and scientific aspects of the park. Although a relatively small park, Ream has a wide variety of ecosystems and stakeholders to examine. Several organizations, including Birdlife International, the World Conservation Union and Wetlands International, have all conducted

surveys at Ream. The Royal Institute of Agriculture regularly sends students from its colleges of fishery and forestry for field activities. Under the UNDP mandate, Ream was the training ground for rangers before their posting in other protected areas of Cambodia. The park shows future generations of Cambodian environmentalists and students the frustrations and the rewards of a career in protected area management. Here, visitors appreciate the fragility of rural traditional life and the country's nature.

7.4.6 Culture

As discussed earlier, Phnom Samathik, the Mountain of Meditation, is associated with local religious practices. Phnom Samathik would lose its spiritual significance if instead of the lush forests of Ream, it was surrounded by scrubland. It would be difficult to measure the willingness of local villagers to accept monetary compensation for the destruction of Phnom Samathik. The aesthetic value of Ream is obvious to farmers as the first rays of sun touch the misty mountain tops, and to fishermen as the last rays of sun dawn on bobbing skiffs. Ream is a piece of Cambodian culture. To threaten Ream is to unweave the fabric of Cambodian rural society.

7.4.7 Option value

Individuals may value the opportunity or the possibility to be able to use the park in the future. Some individuals may wish to preserve natural resources for their own future uses or for future generations. Subsistence fishermen at Ream carefully abide by traditional environmental rules such as avoiding spawning grounds or not harvesting small clams. Previous generations of Cambodians have generously left to the present generation a country well endowed with forests, wildlife and fish. As the natural resources of Cambodia are being rapidly depleted, it would be a reasonable option to set forests and wetlands aside to be used at a later period.

7.4.8 Existence value

Non-use values are also referred to as existence values. Existence value derives from the mere existence of the park, its ecosystems and wildlife. People may not have current or future use for environmental goods, but may wish to preserve them in their own right. These are values that individuals place on environmental goods and services that they do not personally use.

7.5 Comparing the Economics of Ream and Virachey National Park

With the completion of the UNDP demonstration project at Ream in December 1999 and the withdrawal of Wetlands International in May 2000, Ream will have to rely solely on meager tourists revenues and MoE salaries. Virachey, a 332,500 hectare national park located in the northeastern province of Ratanakiri, remains the only Cambodian protected area under international assistance. Virachey will benefit from a US\$ 2.75 million grant from the Global Environment Facility and a US\$ 1.91 million learning and innovation loan from the World Bank. A total US\$ 4.91 million will be spent over four years, US\$ 1.8 million of which on consultant fees. The loan has a ten-year grace period, forty years to maturity and a 0.75% service charge. (World Bank - Report 20040 KN – Project Appraisal Document on a Proposed Learning and Innovation Credit to the Kingdom of Cambodia for a Biodiversity and Protected Areas Management Project January 10, 2000). Economic analysis of the project was not undertaken “because this is largely a capacity building project whose benefits are difficult to measure in monetary terms”. Virachey’s example clearly shows that economic analysis does not always play a significant role in environmental policy making. Provided there is political will on the part of international donors and the government of Cambodia, natural resources may be managed for future generations. However when costs and benefits are not explicitly accounted for, there may always be the rightful assumption that the costs of establishing and managing protected areas outweigh their benefits. In this respect, by reporting the economics of Ream National Park, the present study ensures that policy makers, as well as all other stakeholders, are fully aware of the magnitude of the costs and benefits, and hence the economic implications of their actions.

8.0 RECOMMENDATIONS FOR STAKEHOLDER MANAGEMENT

8.1 Stakeholder Management Framework

The protection of Ream National Park is justified on economic grounds. The next step is to manage the conflicting interests of different stakeholders while achieving conservation objectives. In a separate work, the author has developed a stakeholder management framework for conservation projects. The framework is outlined hereafter. A stakeholder may be defined as any group or individual who can affect the achievement or is affected by the achievement of a development project's objectives. Stakeholder management is above all concerned with the achievement of a development project's objectives. In the case of Ream, the sustainable use of natural resources, the preservation of subsistence livelihoods and the development of recreational activities are the overarching goals. Participatory or consensual approaches as traditionally

prescribed by environmentalists dangerously limit the management alternatives of policy makers. As the economics of the Park show, conflict is inevitable between local communities and commercial operators. The natural resources and the environmental benefits of Ream are limited. There is no win-win utopia where houses and crops are spared by storms and erosion after the park has been logged. There is not enough fish for both subsistence and commercial fishermen to coexist peacefully. The role of policy makers is to ensure that the objectives of primary stakeholders are achieved. Hence local communities' interests ought to prevail over those of other stakeholders. Stakeholder management consists in devising strategies to effectively deal with all the actors of Ream National Park.

8.2 Classification of Stakeholders of Ream National Park

A simple typology of stakeholders has been successfully used at Ream to generate strategic guidelines for the Park (De Lopez, 2001). This pragmatic approach is adapted from an original model first described in the management literature (Freeman 1984, Savage and others 1991). Stakeholders can be mapped in a two dimensional matrix. The first dimension assesses the potential of stakeholders for the conservation of natural resources. The second dimension measures the influence or power of stakeholders on the park. Four broad categories emerge. (1) *Conservationists* have high potential for conservation and high influence on the park. (2) *Developers* have low potential for conservation (or high potential for exploitation of resources) and high influence on the park. (3) *Marginal conservationists* have high potential for conservation and low influence on the project. (4) *Marginal developers* have low potential for conservation and low influence on the project. Alternatively, stakeholders may also be viewed as supporting or opposing the park. Four similar categories arise: (1) Supporters, (2) Opponents, (3) Marginal supporters, (4) Marginal opponents.

8.3 Generic Stakeholder Management Strategies

Generic strategies consist in manipulating stakeholders around the matrix in order to decrease their threat and to increase their support for park management. Stakeholders have to be actively managed to ensure the success of the park. The matrix changes as stakeholders shift from one quadrant to another. Five generic strategies emerge:

1. *Coalition* between conservationists - no shift
2. *Marginalisation* - shift from developer to marginal developer
3. *Involvement* - shift from developer to conservationist
4. *Conversion* - shift from marginal developer to marginal conservationist

5. *Empowerment* - shift from marginal conservationist to conservationist.

Marginalisation decreases the influence of non-supportive stakeholders, *involvement* increases the potential for conservation by non-supportive stakeholders, *conversion* increases the potential for conservation of marginal opponents, and *empowerment* increases the influence of marginal supporters. Generic strategies provide general directions for the development of an operational work plan. The framework allows managers to systematically examine all available strategies. Because of budgetary constraints, only primary stakeholders can be dealt with efficiently. The economic analysis of the park shows groups with the highest influence and stakes in Ream. Strong resistance from different stakeholder groups will be encountered in relation to any management change towards the ghost park or the dream park scenarios. Commercial fishermen and local communities ought to be the main targets of specific stakeholder management programs. Direct threats to the integrity of the park and the formation of a stronger coalition between conservationists are the main priorities. The following section discusses specific strategies for the Ministry of Environment and a potential international donor agency.

8.4 Operational Suggestions

8.4.1 Local communities

There is overwhelming popular support for park authorities. However, local communities have been disappointed by the failure to enforce existing park regulations. Subsistence farmers and fishermen are aware of the consequences of environmental degradation. The people of Ream believe that the destruction of the park is not in their interest, nor that of their children. The economic analysis confirms that they would lose significant benefits if commercial fishermen and loggers were allowed to operate without restriction. The involvement of local communities plays a fundamental role in the conservation of the park's resources. Logging remains controlled by rangers. Park authorities have successfully developed community forestry programs in which villagers manage reforested areas. The natural regeneration of *smach* (*Melaleuca leucodendron*) provides small poles and firewood. At the same time, members participate in the monitoring of the forest and inform park rangers of illegal activities. The community fishery program has so far had mitigated successes. Push-nets and trawlers still threaten the livelihood of the majority of villagers. Subsistence fishermen participate in marine patrols but their boats represent a mere inconvenience for armed trawlers. Without additional funding, marine patrols cannot be extended. The destruction of the Ma Ou outpost further compounds the problem since all ranger boats are now based in Toek Sap station.

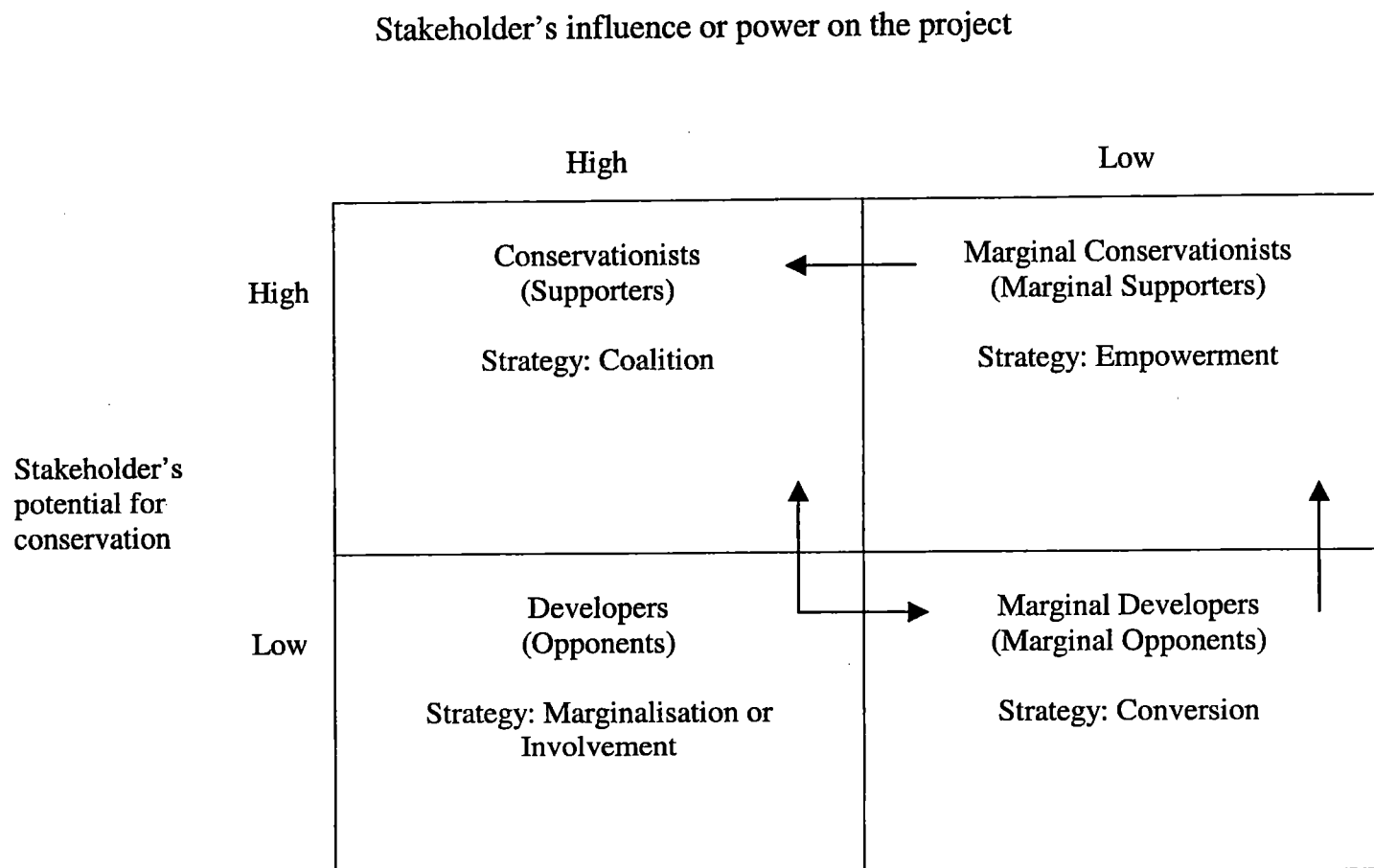


Figure 14. Mapping of the stakeholders of a conservation project

Stakeholder's influence or power on the project

		High	Low
Stakeholder's potential for conservation	High	Rangers Local communities	MOE Visitors
	Low	Commercial loggers Commercial fishermen Navy	Police Department of Fisheries Shrimp farmers

Figure 15. Mapping of the stakeholders of Ream National Park (May 2000)

- (1) The community forestry program should be extended to the degraded areas along Route National 4. This would provide an effective buffer against further intrusion by commercial loggers. Several villages in and around Ream have expressed their interest in setting up similar forestry programs. Under present budget constraints, villages that can participate in forest monitoring should be favored.
- (2) The community fishery program should be enlarged to include all subsistence fishermen of the park. More than 92% of Ream's fishermen practice only subsistence activities. By giving stewardship of marine resources to local communities, this measure would increase the power of the conservationist coalition. Community fishery members already help monitor illegal activities. A large number of them might deter isolated commercial boats. However, law enforcement must remain the responsibility of rangers.
- (3) Park authorities should re-deploy some of their boats to Koh Kchang, Ma Ou and Andong Toeuk. These villages form a triangle where 74% of the annual fish quantity is caught. Additionally, Toek Sap, Ma Ou and Koh Kchang are the main exit points for wood harvested from mangroves. With the support of community fishery members, the bulk of illegal activities may be brought under control.

8.4.2 Ministry of Environment and International donors

By May 2000, UNDP and Wetlands International had moved out of the stakeholder matrix. Without international support, MoE is left to lead a weak coalition of stakeholders made up of rangers, provincial authorities and local communities. MoE is at present unable to provide any form of support to the park. The Department of Nature Conservation, which oversees protected areas, has not been allocated enough funds to even be able to send support staff to Ream. In emergency cases, in order to travel to the park as quickly as possible, staff members often have to pay cost themselves to avoid lengthy procurement delays. The lack of senior Ministry representative at Ream leaves the park in a weak position to negotiate with stakeholders such as the Navy and the Department of Fisheries. Several conservation organizations work in Cambodian protected areas, but they have bypassed national channels to deal directly with local authorities. The weak presence of MoE both on the field and in the organs of power is detrimental to Cambodian protected areas. Despite its legal mandate, MoE has failed to provide clear leadership in protected area management. The weaknesses of the Ministry have not been met with strong international commitment. Protected areas in Cambodia are not on the priority list of donors. The involvement of the international community at Ream is at present uncertain.

Donors traditionally favor social issues over environmental protection. This attitude fails to recognize the critical role of protected areas in rural livelihoods. The economic analysis of Ream shows the high level of dependency of poor communities on environmental resources.

- (1) MoE should promote cooperation with donors and NGOs. MoE must assign staff and allocate resources to actively seek donor support. MoE personnel are in the best position to provide development agencies with field knowledge of protected areas. The conservationist camp would gain strength from shared human resources, technical knowledge, experience and funds.
- (2) MoE must clearly exercise its management rights and assert its role more actively towards all stakeholders. The Royal Decree on protected areas gives the Ministry full jurisdiction over national parks. MoE must request additional funds from the national budget and lobby for the support of the Navy, the Police and the Ministry of Agriculture in and around Ream National Park.

8.4.3 Rangers

Rangers' morale has been low since the withdrawal of UNDP. This is not only due to budgetary constraints, but also to the lack of institutional support. With a few notable exceptions, senior civil servants are rarely seen in the park. This leaves field staff to deal with powerful stakeholders and high-ranking provincial officials. The general feeling of rangers is that there is no clear sense of direction, leadership or long term planning. Ream appears like an isolated island, far removed from the capital city. Under UNDP, rangers acquired considerable field experience and knowledge. Unfortunately the influence of rangers on the park is decreasing at an alarming rate. From *conservationists*, rangers are moving towards the marginal *conservationists quadrant*. There seems to be few career prospects in park ranging at Ream in the near future. Not only are wages low, but also they are rarely paid on time. The city of Kompong Som offers more attractive opportunities in the tourism industry. It is unlikely that the better rangers will wait for the next internationally funded project to start at Ream.

- (1) MoE senior officials have to take an active role in the management of stakeholders at the park level. Support from senior figures would increase the park's standing with local authorities, villagers and other stakeholders.

- (2) Rangers should be allowed to participate in training workshops organized in Phnom Penh. Park staff have acquired core competences but need to improve their expertise in areas such as community development, law enforcement, environmental education, and planning.
- (3) Rangers must be allowed to cultivate deforested land around their outposts. This would supplement staff income and allow them to perform duties on largely symbolic wages.

8.4.4 Commercial loggers and commercial fishermen

Existing park regulations have to be applied to their full extent against commercial loggers and commercial fishermen. The use of trawlers in shallow waters contravenes fishery and environmental laws. The combined forces of the Navy, the Police, the Ministry of Agriculture (Departments of Forestry and Fishery) and the Ministry of Environment would prove insurmountable for most violators. Competition between governmental agencies proves to be a boon for commercial operators. Additionally, some corrupt local officials turn a blind eye on trawlers and loggers as they move in and out of Ream. In other cases, local officials engaged in illegal activities were apprehended and fined by rangers. Off duty sailors and policemen were arrested on several occasions (ETAP, 1999-2000).

- (1) MoE must report all cases where civil servants are engaged in illegal logging and fishing. When arrests are clearly documented, MoE must push the relevant government agency to reprimand the individuals. Without official support, loggers and push-nets would lose a considerable amount of political influence on the park.

8.4.5 Visitors

Visitors provide much needed cash for park operations. Several guidebooks mention Ream. Kompong Som guesthouses and hotels have played a crucial part in directing tourists as well. However, visitors have suggested that information about Ream and recreational activities are insufficient. The survey also shows that boat rides and guided walks are currently under-priced. Cambodian tourists in Kompong Som have also been left out of any marketing efforts, when the study reveals that a majority would be interested in visiting the park. Finally an independent park trust fund would be able to collect additional funds for operations.

- (1) Marketing efforts should be increased. This need not cost a great deal of money. Leaflets about the park and its services can be distributed on the beaches of Kompong Som, in guesthouses and travel agencies.
- (2) Foreign visitors ought to be charged up to US\$ 12 for the boat ride and US\$ 7 for the guided walk. Cambodian visitors may be expected to pay US\$ 9 for the boat ride and US\$ 6 for the walk.
- (3) An environmental trust fund managed by park authorities, MoE and non-governmental organizations must be set up. The study suggests that visitors donate an average US\$ 49 to the fund if they are confident that it is strictly monitored and managed.

8.4.6 Shrimp farmers

The only shrimp farm at Ream is located in the vicinity of Koh Kchang village. At present its small size does not constitute any major threat. However it gives violators the signal that blatantly illegal activities can proceed unpunished in the park. The shrimp farm has frustrated rangers and local communities for the past two years. ETAP had recommended the closure of the farm on environmental grounds (ETAP, 1998). MoE has adopted a no action stance toward the case despite complaints from local fishermen and rangers. 40 hectares of mangroves were illegally cleared to establish the farm. Using the mangrove inventory of the present study, the net income from wood alone is estimated at US\$ 14,907. With market prices of land at an average US\$ 200 per hectare along National Road 4, the owner has saved an additional US\$ 8,000 in investments.

The shrimp farm must be closed. The owners must be fined for the area of forest cleared. This fine should not be of an amount inferior to the estimated income from clearing mangroves. This preemptive measure essentially puts an end to shrimp farming at Ream before other entrepreneurs move into the park.

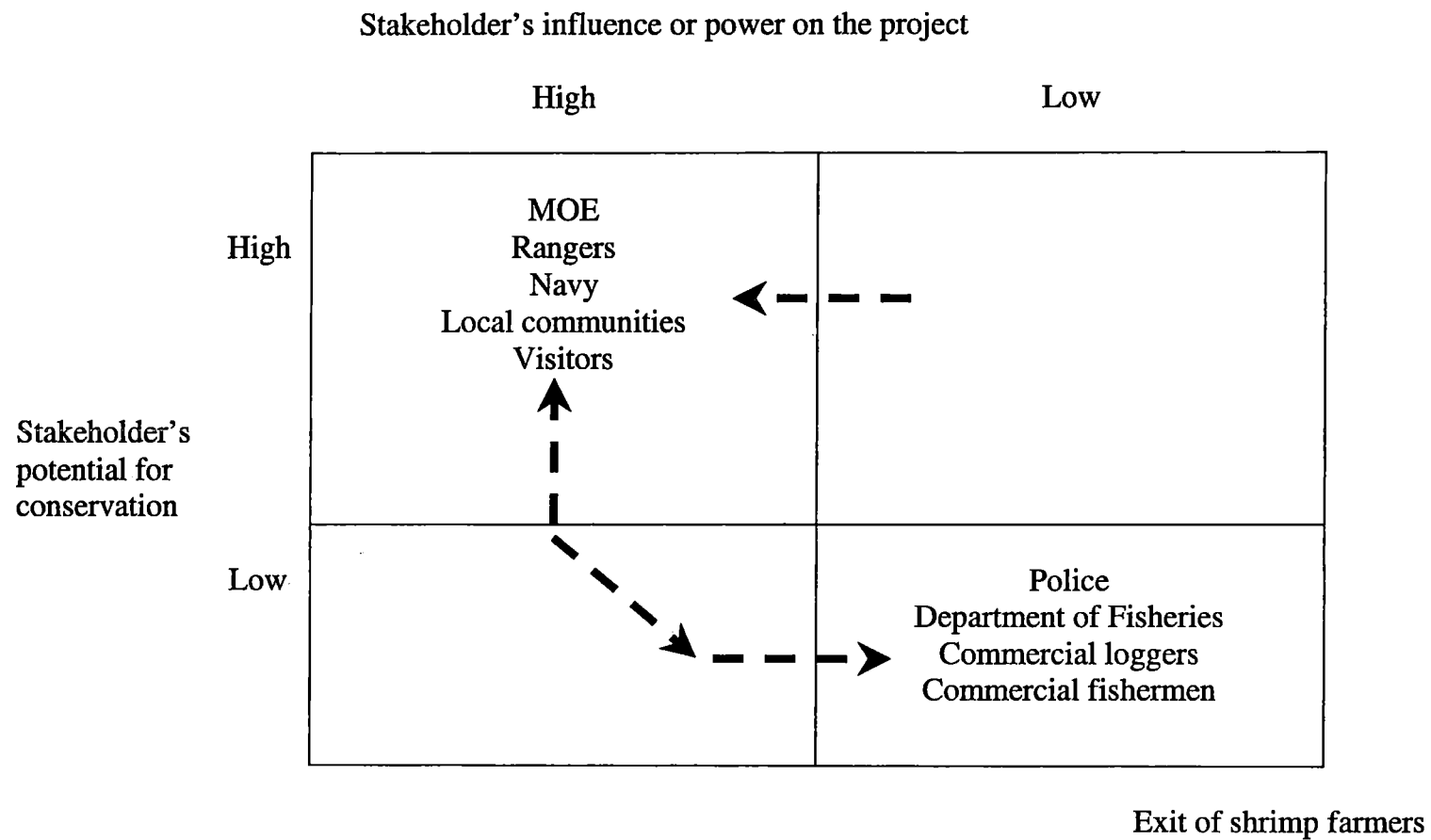


Figure 16. Mapping of the stakeholders of Ream National Park (operational objectives)

9.0 CONCLUSION

The Ream area has historically been the home of large human settlements. Subsistence farming and fishing constitute the most important sources of income. Nature provides fish, firewood, medicine, fruits, building material, meditation mountains, beaches of white sand and aesthetically pleasing sunsets. Commercial entrepreneurs and human greed threaten all these benefits.

Since its creation in 1997, Ream National Park has been managed in the interests of subsistence farmers and fishermen, visitors and future generations. With the assistance of the international community, the park has struggled to curtail the activities of loggers and trawlers. The achievements of the short-lived park demonstration project at Ream are noteworthy. Ranger work is praised by an overwhelming majority of villagers. There is strong popular demand for the stricter control of all commercial operations in the park. As long as subsistence activities are allowed, the poor and the disadvantaged will support park authorities. The study shows that the people of Ream do not expect alms from development agencies or the government. They simply demand that the environmental laws passed by the National Assembly, approved by the Council of Ministers and signed by His Majesty the King be implemented strictly. All must abide by these laws, not just the poor of Ream, but also commercial loggers, commercial fishermen and shrimp farmers.

The withdrawal of international assistance comes as a disappointment to park staff and local communities. The Ministry of Environment is left to lead a seriously weakened coalition of environmentalists. The monetary benefits of the park largely outweigh its costs. However, without hard cash, basic management operations cannot be funded. These are trying times for the communities of Ream National Park. The fragile ecosystems of Ream are at present under considerable stress. A collapse of the fishery is probable unless measures to ban all trawlers are enforced. The park's mangroves and forests have already been partially logged. The battle will be lost unless there is commitment from the government of Cambodia and the international community to protect Ream. Local communities, visitors to the park and tourists in Kompong Som all agree that too little has been done for Cambodia's brave new parks.

The potential to turn the park into a major tourist destination is real. There is strong interest among Cambodian and foreign visitors for the recreational services of Ream. This would provide funding to help manage the park. Inadequate facilities and insecurity are serious obstacles to making Ream a popular tourist destination. However, there is popular demand for better-managed and accessible scenic areas. Without long-term commitment and additional investments, the landscapes of Koh Sampoach and Phnom Samathik will remain undiscovered by the general public.

The net monetary benefits of strengthening park management are higher than the benefits of clear-cutting the area. Many unvalued benefits of the park favor conservation over unsustainable exploitation. The three scenarios assessed by the cost benefit exercise have approximately equivalent net present values. However, the distributional analysis shows that local communities would stand to lose most if the park were destroyed. The question is not only to preserve or to destroy Ream, but also whether to favor poor local communities over commercial stakeholders. The protection of the park is hence justified on social grounds. The risk is real that Cambodian policy makers will favor development over conservation. Protected area management requires long-term commitment in financial and human resources. Cambodia currently lacks the expertise, the funds and the political will to manage its natural environment. Without international transfers from wealthier countries, conservation will remain an exorbitant goal.

Like the majority of villagers and rangers, the research team can only express pessimism with regards to the park's future. To the parents and the grandparents of the current generation, Ream has historical and sentimental values that are not captured by the present study. The protected area bears the name of a sovereign who presided over a more prosperous and radiant period of Cambodia's history. The park reminds them that the country used to be verdant from Phnom Penh to Kompong Som. Ream is a small and fragile park under siege. With progressive environmental degradation, the range of management options narrows. It is imperative that the leaders of Cambodia and international donors be confronted with the harsh reality of the situation; a reality that Ream's fishermen and farmers face every day as they struggle to subsist.

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List of Acronyms

Technical terms

CBA	Cost Benefit Analysis
cm	centimeter
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GNP	Gross National Product
ha	hectare
kg	kilogram
km	kilometer
km ²	square kilometer
kwh	kilowatt-hour
m ³	cubic meter
NEAP	National Environmental Action Plan
WTP	Willingness To Pay

Organizations

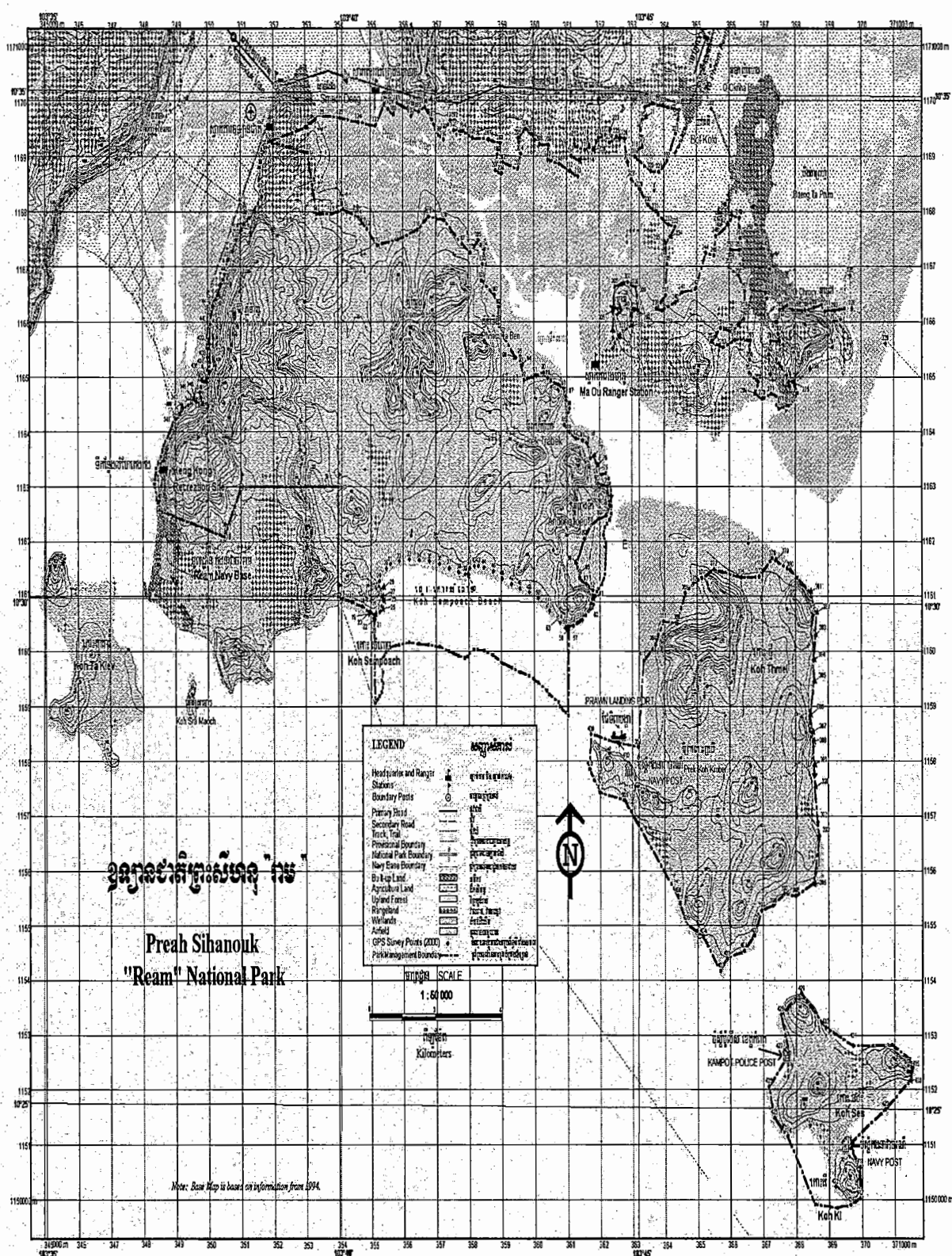
ADB	Asian Development Bank
DNPC	Department of Nature Protection and Conservation
DoF	Department of Fisheries
EEPSEA	Economy and Environment Program for Southeast Asia
ETAP	Environmental Technical Advisory Program
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
IUCN	World Conservation Union
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoE	Ministry of Environment
MRC	Mekong River Commission
NGO	Non Governmental Organization
PSC	Parks Society of Cambodia
UN	United Nations
UNDP	United Nations Development Programme
WB	World Bank
WCMC	World Conservation Monitoring Centre
WWF	World Wide Fund for Nature

Key Statistics

<i>Demographics</i>	
Total population	26,600
Total number of households	4,640
Average household size (number of individuals)	6.5
Population below 16 years old (%)	50
Population below 33 years old (%)	75
Literacy rate (%)	62
Population of Khmer ethnic group (%)	83
Population of Cham ethnic group (%)	17
Population born at Ream (%)	58
Population settled before creation of park (%)	89
Mean annual household income (US\$/year)	528
Median annual household income (US\$/year)	316
Mean annual income per capita (US\$/year)	92
Population whose main source of income is farming (%)	30
Population whose main source of income is fishing (%)	28
Population whose main source of income is small trade (%)	16
Population not self-sufficient (%)	43
<i>Agriculture</i>	
Total area cultivated in the park (ha)	2,978
Mean plot size (ha)	1.1
Mean annual rice yield (tons/ha/year)	1.5
Market value of annual crop production (US\$/year)	316,594
Market value of annual animal production (US\$/year)	182,317
<i>Non timber forest products</i>	
Population gathering firewood in the park (%)	97
Annual quantity of firewood collected (m ³ /year)	44,788
Net annual income from firewood (US\$/year)	100,274
Annual quantity of medicinal plants collected (kg/year)	47,240
Net annual income from medicinal plants (US\$/year)	9,653
Annual quantity of construction wood collected (m ³ /year)	4,192
Net annual income from construction wood (US\$/year)	21,170
Net annual income from all non timber products (US\$/year)	158,919

<i>Environmental attitude of local communities</i>	
Population rating forest in poor condition (%)	40
Population rating forest in good condition (%)	26
Population rating estuary in poor condition (%)	38
Population rating estuary in good condition (%)	19
Population rating illegal fishing as most important problem (%)	52
Population rating deforestation as most important problem (%)	34
Population very satisfied with park authorities (%)	48
Population very dissatisfied with park authorities (%)	8
Population requesting illegal fishing be stopped (%)	96
Population requesting commercial logging be stopped (%)	94
<i>Fish catch</i>	
Total annual fish catch (tons/year)	3,173
Net annual income from fish (US\$/year)	1,373,664
Population stating illegal fishing as main reason for decline of fish catch (%)	43
Population stating overfishing as main reason for decline of fish catch (%)	37
Population stating pushnets as main reason for decline of fish catch (%)	27
<i>Mangroves</i>	
Total mangroves area (ha)	1,812
Mean volume (m ³ /ha)	62.1
Projected net income from clear cutting mangroves (US\$)	629,988
<i>Cambodian tourists in Kompong Som</i>	
Population ranking corruption as most important problem in Cambodia (%)	59
Population interested in visiting Ream National Park (%)	97
Mean value for willingness to pay for boat ride (US\$/person)	9.2
Mean value for willingness to pay for guided walk (US\$/person)	6.6
<i>Foreign tourists in Kompong Som</i>	
Population ranking corruption as most important problem in Cambodia (%)	36
Population assessing national park budget as too little (%)	65
Population interested in visiting Ream National Park (%)	90
Mean value for willingness to pay for boat ride (US\$/person)	10.4
Mean value for willingness to pay for guided walk (US\$/person)	7.6
<i>Cambodian tourists in Ken Kong</i>	
Population ranking corruption as most important problem in Cambodia (%)	54
Population assessing national park budget as too little (%)	51
Population interested in visiting Ream National Park (%)	2
Mean value for willingness to pay for boat ride (US\$/person)	4.2
Mean value for willingness to pay for guided walk (US\$/person)	2.4

<i>Foreign visitors of Ream National Park</i>	
Population ranking human rights as most important problem in Cambodia (%)	33
Population assessing national park budget as too little (%)	54
Mean value for willingness to pay for donation to environmental fund (US\$/person)	48.7
Mean value for willingness to pay for boat ride (US\$/person)	12.6
Mean value for willingness to pay for guided walk (US\$/person)	7.9
Population very satisfied with visit (%)	31
Population generally satisfied with visit (%)	57
<i>Cost benefit analysis</i>	
Net present value of experimental park (base case) at 10% (US\$ million)	9.8
Net present value of ghost park at 10% (US\$ million)	10.0
Net present value of dream park at 10% (US\$ million)	11.9
Net present value to local communities under ghost park at 10% (US\$ million)	4.3
Net present value to local communities under dream park at 10% (US\$ million)	12.6
Net present value of commercial operators under dream park at 10% (US\$ million)	0
Net present value of commercial operators under ghost park at 10% (US\$ million)	5.7



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