# Field Study: Cambodia

## Bokor, Kirirom, Kep and Ream National Park

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# Section 1

## Introduction

The Cambodia field study concentrates on the economic benefits yielded by four national parks, collectively termed the South-West Cluster Protected Areas: Phnom Bokor, Preah Suramarit Kossamak (Kirirom), Preah Sihanouk (Ream), and Kep (Figure 1). These parks were selected by the Ministry of Environment as field sites because of their conservation significance and management importance in Cambodia, according to the following criteria:

- they comprise a cluster of protected areas;
- they are under pressure from a range of existing and potential major developments, such as hydro-electric plants, irrigation schemes, industrial agriculture, forestry and fisheries operations and infrastructure;
- they contain natural resources of critical importance to national development; and
- they have existing support projects for the management of the protected areas.

Figure 1. South-West Cluster Protected Areas

The field study investigated the contribution of these four protected areas to local and regional economic activities in the towns, villages and communes in Sihanoukville, Kampot and Kompong Speu provinces.

The first step in defining the scope and content of the study was assessing and describing the various economic benefits of the South-West Cluster PAs in terms of their development connections and beneficiary groups. Selected benefits were then chosen for detailed analysis, according to the following criteria:

- they form a diverse, representative and generally relevant range of economic sectors and groups found within the study area;
- they are regarded by economic and protected area planners as being of critical importance to development goals;
- practicable and achievable data collection, methodology and analysis can be carried out within the limited time frame, resources and capacity of the field study; and
- they be analysed so as to point to management responses that are likely to result in significant net development benefits.

In line with these criteria, the following benefits were selected as detailed case studies:

- the economic value of Ream National Park to local communities;
- the contribution of tourism in Bokor National Park to the Kampot provincial economy; and
- the economic value of Bokor and Kirirom National Parks for hydro-electric generation.

# Section 2

## The South-West Cluster Protected Areas

Cambodia has been divided into seven biodiversity conservation regions on the basis of biological resources, geology and soils, and past and present use (IUCN 1997a). One of these regions is the southwestern coastal ranges and marine zone. It includes wet tropical forest, coastal formations and marine areas generally associated with sandstones. The region has low but rapidly increasing population densities and is dominated by natural and modified landscapes used for forestry, fisheries and the maintenance of biodiversity. It is one of the three highest priority regions for biodiversity conservation in the country (IUCN 1997a) and contains four protected areas, which together cover an area of some 201,000 ha: Phnom Bokor, Preah Suramarit Kossamak (Kirirom), Preah Sihanouk (Ream) and Kep national parks (Figure 2).

### 2.1 Phnom Bokor National Park

Bokor National Park lies in Kampot Province, and covers a total area of 140,000 ha. It is estimated that 97 per cent of the land use within the park is natural or semi-natural, and three per cent transformed (IUCN 1997a). The park is centred on a sandstone massif, rising north from the coast to an altitude of more than 1,100 metres (the only high mountain on the coast). The area is characterised by high rainfall. It contains a wide range of habitats, including both low- and medium-altitude vegetation and numerous waterfalls. The park provides habitat for a number of internationally endangered species, including tigers, leopards, Asian elephants, gaur, sun bears, pileated gibbons and hornbills as well as a wide range of fauna of conservation significance including peafowl and a number of hornbill species.

Figure 2. Land use and infrastructure, South-West Cluster Protected Areas

As well as being an important source of water for Kampot Town, Bokor is a popular tourist and leisure destination that attracts both foreign and domestic visitors. In 2001 more than 9,000 tourists visited the park's forest, plateau and waterfall areas.

## 2.2 Preah Suramarit Kossamak (Kirirom) NP

Kirirom National Park lies in Kompong Speu Province, along the border of Koh Kong Province. It covers a total area of 35,000 ha, estimated to be composed of natural or semi-natural vegetation (IUCN 1997a). The park is centred on the 700-metre-high Kirirom Plateau, and is renowned for its 13,000-ha Pinus merkusii forest, the largest in Cambodia. The park also contains lowland evergreen and deciduous forests, as well as some medium-altitude evergreen forest. The area was once connected to Bokor National Park by the forests of Pechnil Mountain, and shares a number of endangered species with it. Now the main road linking Phnom Penh with Sihanoukville separates the two parks. There is a small tea plantation (1,500 ha) within the park as well as a small hydro-electric dam on the headwaters of the Prek Kampong Leu.

Kirirom's high-altitude plateau forms the headwaters for numerous streams feeding Kompong Speu Town. The plateau area has been a holiday destination since the 1960s and contains a large recreational complex, although roads and other infrastructure were largely destroyed during the Khmer Rouge era. Some buildings have recently been rehabilitated, and the park has again become a popular weekend location for nearby urban dwellers and residents of Phnom Penh.

## 2.3 Preah Sihanouk (Ream) National Park

Ream NP is located in Sihanoukville Province and covers an area of 21,000 ha. It is estimated that over one third of the park has been heavily modified or transformed. Ream is dominated by the estuary of the Prek Toek Sap, featuring extensive areas of mangrove and associated rear mangrove forests and mudflats. Low hills rise to the west of the river, covered with lowland and dwarf evergreen forest, and isolated hills also occur to the east of the river. The northern and eastern portions of the park contain freshwater marshes in association with mangrove and rear mangrove formations. Ream National Park also encompasses the uninhabited islands of Koh Thmei and Koh Ses (6,000 ha in total) to the southeast. Beaches, rocky shores, seagrass beds and coral reefs are found along the coast of the mainland and the islands.

Ream NP is close to the towns of Kampot and Sihanoukville, and the area around the park is relatively well served by infrastructure, including Cambodia's main highway, National Route No. 4. The park is an important fishery area (for local use, as well as by commercial trawlers and push nets) and tourism spot.

## 2.4 Kep National Park

Kep NP is a small coastal park (5,000 ha) centred on the seaside resort of Kep in Kampot Province. The park is comprised of a range of coastal hills surrounded by National Road No.16 and Road No.162 (ADB 2000). The park includes Kep Toch, Kep Thom, and Krasaing mountains, as well as two major islands, Koh Tonsay and Koh Po. Both the mainland and the islands contain lowland tropical rainforest isolated from the country's vast southeastern floodplain. Long sand beaches on the mainland coast extend east to the innermost part of Kep Bay and Tonsay Island. A small mangrove area occurs on the headland west of the island. Fringing coral reefs are found around the island. An estimated 47 per cent of the land and vegetation in the park is heavily modified, and 53 per cent is transformed (IUCN 1997a). Faced with continued and extensive agricultural encroachment, the park retains little of biological value except for a small area of evergreen forest at the south end of the hills.

# Section 3

## Economic and development connections

The South-West Cluster NPs are surrounded by a population of almost 125,000 people living in 23 communes. The principal ethnic groups in this area are the Khmer, Pear, Chong and Sóach, whose main forms of livelihood are agriculture, fishing, small trade, contract labouring and the collection of non-timber forest products (NTFPs). High levels of poverty, limited access to basic infrastructure and other services, and a lack of income and employment opportunities mean that park-adjacent communities are extremely dependent on natural resources for both income and subsistence.

Bokor, Kirirom, Ream and Kep national parks are located in Sihanoukville, Kampot and Kompong Speu provinces. They generate a wide range of benefits to surrounding areas and contribute to provincial economies. Economic benefits include contributions to local subsistence, income, employment and trade, as well as revenue from energy, agriculture, fisheries, health, water and tourism sectors. The national parks contribute significant revenues to government, support private sector profits, sustain rural and urban household livelihoods, and are an important component of provincial economic output and growth.

### *3.1 Socio-economic context*

Almost 25,000 households (125,000 people) live in or adjacent to the South-West Cluster National Parks in Sihanoukville, Kampot and Kompong Speu Provinces (Table 1). The population growth rate in these communes is estimated to be just under three per cent, and there are high levels of in-migration into the park-adjacent area (IUCN 1997b). The populations in and around the SW Cluster PAs include the following:

- 11 communes surrounding Bokor National Park, with around 50,000 people (9,600 households);
- two communes, Treng Troyoeung and Chambak, bordering Kirirom National Park and containing just under 14,500 people. Except for about 800 soldiers, security police and their families, there is no official settlement inside the boundary of Kirirom National Park (Khim and Taylor-Hunt 1995);
- almost 30,000 people (5,300 households) living in the five communes in and next to Ream National Park, including Ream Naval Base; and
- Kep Town and beach resort, inside the original Kep National Park boundaries, with a population of approximately 30,000 (5,600 households, in five communes).

Most of the people in the villages located in or adjacent to the South-West Cluster PAs are Khmer, although a significant minority of Cham live in and around Ream and Bokor NPs, fishing and farming. The population includes a mix of more recent immigrants (most of whom came to the area during or after the Khmer Rouge era), and longer-term settlers.

The South-West Cluster NPs are surrounded by a mixed agricultural landscape. Most irrigated agriculture is rain-fed, and there are few irrigation schemes with storage facilities for smallholders in the park-adjacent areas. The main livelihoods for these communities are agriculture, fishing, small trade, contract labouring on large plantations, and the collection of forest products. Few households rely on a single livelihood source; most people combine different economic activities to reduce risk and generate sufficient subsistence and income.

**Table 1. Population adjacent to the South-West Cluster Protected Areas**

| Commune | Households | Persons |
|---|---|---|
| **Bokor National Park** | | |
| Samaki | 548 | 2,362 |
| Toek Laak | 588 | 3,213 |
| Toek Thla | 735 | 4,096 |
| Prek Thnot | 1,405 | 7,839 |
| Koh Touch | 905 | 4,989 |
| Boeung Touk | 814 | 4,272 |
| Mak Prang | 904 | 4,910 |
| Stung Kaev | 876 | 4,260 |
| Andong Khmer | 1,700 | 9,127 |
| Trapeang Pleang | 361 | 1,657 |
| Taken Koh Sla | 816 | 3,487 |
| **Subtotal, Bokor National Park** | **9,652** | **50,212** |
| **Kep National Park** | | |
| 5 Communes | 5,600 | 30,000 |
| **Subtotal, Kep National Park** | **5,600** | **30,000** |
| **Kirirom National Park** | | |
| Chambak | 595 | 2,789 |
| Treng Troyoeung | 2,357 | 11,644 |
| **Subtotal, Kirirom National Park** | **2,952** | **14,433** |
| **Ream National Park** | | |
| O Chrouv | 1,035 | 5,625 |
| Boeng Ta Prum | 1,230 | 6,583 |
| O Oknha Heng | 1,141 | 6,622 |
| Ream | 1,348 | 7,507 |
| Bot Trang | 568 | 3,390 |
| **Subtotal, Ream National Park** | **5,322** | **29,727** |
| **Total, South-West Cluster PAs** | **23,256** | **124,372** |

*Source: Ministry of Planning 2000*

Rural poverty is widespread in the area, and basic amenities such as water, food and adequate housing are lacking (ADB 1999). This is particularly notable in villages farther from the main road, and nearer to the protected areas; there are few income or employment opportunities, little infrastructure and few services. Per-household cash income is estimated at less than US$1 per day.

Many households have few alternatives to forest resources for household income and subsistence. As well as domestic energy, food, construction materials and supplies for handicrafts, forest resources provide an important source of income and employment for many community members. Sales of fish, trade in wild animals, firewood sales, charcoal production, and timber extraction (either for sale or as hired labour) are all used to generate cash income.

## 3.2 PA contribution to provincial economies

The South-West Cluster Protected Areas provide many economic benefits for the surrounding villages, communes and provinces (Figure 3). They generate resources for consumption (direct benefits), environmental and ecological services that perform vital life support functions (indirect benefits), they provide the possibility of future economic uses and services (option values), and have intrinsic economic significance regardless of their use (existence values).

Figure 3.
Total economic value
of the South-West Cluster
PAs to provincial economies

*Local use of forest products*

People living in and around Bokor, Kirirom and Ream national parks use a wide range of forest products (the economic value of forest use for communities in and around Ream NP is examined in detail in 4.1). These products include firewood, wild foods, wild animals, plant-based medicines, materials for house construction, and fibres used for ropes, baskets and mats. Some of them are also sold, and form an

important component of household income; medicinal plants, wild animals, timber, firewood and charcoal all fetch high market prices around the national parks.

In Bokor National Park adjacent communities mainly make a living from resource extraction (DNCP 1999). Local people harvest some 46 species of non-timber forest products that are used as food, construction or handicrafts, and for medicinal purposes (ADB 2000). The most important of these in terms of quantity and value of products harvested are fruits from Sam Rong *(Sterculia lychnophora)*, rattans, Vor Romiet *(Coscinium usitatum)*, resin from *Shorea sp.*, bamboo and fruits from Khos *(Castanopsis cambodiana)*.

> Many residents of villages located around Kirirom collect NTFPs there, and forest resource use is currently the largest income generator in the area. Products that are harvested for sale include rattan, the medicinal plant Vor Romiet, Klum Chan (a valuable wood oil used for perfumes) and bamboo. Local soldiers hunt small mammals for their own consumption, including barking deer, hog deer, sambar, civet and squirrels (Khim and Taylor-Hunt 1995). Some small-scale logging for personal use also occurs, mainly near the roads. Both charcoal and fuelwood are important sources of income for some households, and provide the major source of cash in two PA-adjacent communes, Chambak and Treng Troyoeung.

Not all these resource uses are sustainable. The total value of non-timber forest products harvested from Bokor National Park was estimated to be more than 570 million riel (US$152,250) in 1998, with a sustainable harvest of only 250 million riel (US$66,800; Feil et al. 1998). Hunting pressure in Bokor is the greatest of the four parks (IUCN 1997b), especially for wild pig, hog badger, deer, pangolin and python. There are well-established markets for wildlife, charcoal and firewood harvested from the park (DNCP 1999).

### *Fisheries*

Ream and Kep National Parks, which both contain marine and mangrove areas, constitute important fisheries resources (the economic value of park fisheries for communities in and around Ream National Park is examined in detail in 4.1). A wide range of species have important commercial value, including Andeng (catfish), Kamong (mackerel), Kbhok (Mullet), Khok (large headed hairtail), Ki (snapper), Koun (sardine) and Ptuok (Striped snakehead murrel). Crustaceans are also harvested, including Bankea (shrimp), Kdam Ses (blue swimming crab), Kdam Tmor (rock and mud crabs) and lobster. Fish, shrimp and shells are all exported to neighbouring Vietnam. Up to 2,000 households who live in and near Ream and Kep national parks rely on sea fishing for their livelihoods (DNCP 1998, ADB 2000). There are serious concerns about the sustainability of these activities.

### *Tourism*

All of the SW Cluster PAs support tourism and recreation to some extent (the economic value of tourism in Bokor NP is examined in detail in Section 4.2). Kep Beach has long been a favourite recreational site for tourists and weekenders, and is famous for its seafood restaurants and swimming crab. The offshore islands and associated waters are considered to be ideal sites for nature-based tourism development (ADB 2000). These include Koh Tonsay and the coral reef at Koh Po Koh Tonsay, which once a transition tourist destination and contains 12 bungalows, as well as a number of trails around the island. In 2000, over 1,000 foreign tourists and 132,000 domestic tourists visited Kep, generating almost $3,500 in car parking fees (about half the government budget for the park). It is impossible to visit the forest and hill area of Kep National Park, as the track is impassable, but a proposal has been made to rehabilitate both the road and the highway linking Kampot and Kep towns.

In 1962 development of Chuolong City began. Situated on the Kirirom Plateau, it was targeted as a tourist and holiday area (Khim and Taylor-Hunt 1995). Roads were upgraded and villas, hotels and some light industries were developed. After 1971, however, the area was under the control of the Khmer Rouge, and most of the buildings and infrastructure were destroyed. The area was reoccupied by the Cambodia armed forces in 1992, and in 1993 Kirirom was designated a national park. In 1994 the King's palace and four guesthouses were built on the plateau, and in the following year a park headquarters and visitor centre were constructed. Over recent years Kirirom Plateau has again become a popular destination for visitors.

Although Sihanoukville is a popular tourist destination — with nearly 8,000 foreign tourists and 53,000 domestic visitors in 2000 — only about 200 people, most of them foreign, visited nearby Ream NP. Some of them took boat tours around the park's mangroves and islands (paying $15-20 a trip if hired from the PA authorities or about $10 for a local boat). Recent surveys suggest that Ream's tourist potential is currently underdeveloped. Although few visitors to Sihanoukville are aware of Ream's existence, on hearing about the park many people expressed interest in visiting it. On average, domestic and foreign tourists are willing to pay $9-10 per person for a boat ride around Ream, suggesting that there are great opportunities to raise revenues above the current sum of $2,500 a year earned from tourism (De Lopez et al. 2001).

### *Catchment protection*

The high plateaus and mountain ranges of Bokor and Kirirom national parks form important watersheds. Bokor NP provides a catchment area for several rivers, including Stoeng Toek Chou, which flows south from the park and brings freshwater to Kampot Town. About three quarters of the park forms the watershed of another major river, the Stoeng Toek Chham, which runs south to the coast of Kampot (ADB 2000). Kirirom NP is the watershed for numerous rivers and streams which flow down through Kompong Speu Province, including the O Koarseh, O Nimul, O Traseik, O Rumchoat and Prek Kampong Leu.

The rivers and streams that rise in these protected areas supports a variety of economic uses in the surrounding provinces of Kampot and Kompong Speu and beyond. They provide domestic and industrial water supplies for Kampot and Kompong Speu Towns and for other towns and villages; they also feed small-scale and commercial irrigation developments (planted with rice, oil palm, pepper and fruit trees) and sustain downstream fisheries. Hydro-electric facilities utilising the rivers whose headwaters lie in the PAs are being established in Kirirom and Bokor NPs. These economic uses of water depend on water supplies originating in Bokor and Kirirom national parks. The protected status of the national parks, and of their forest cover, maintains the quality, quantity and seasonal flow of these rivers (the economic value of Bokor and Kirirom national parks for hydro-electric is examined in detail in 4.3).

### *Mangroves*

Mangroves are found in most of Ream NP and in a small part of Kep NP. They are also abundant in the coastal zone between Ream, Bokor and Kep. *Avicennia officinalis* and *Rhizophora apiculata* are the most abundant species; some *Bruguiera cylindrica* and *Xylocarpus granatum* are also found. Mangrove products provide direct use (for fuel, medicinal plants, building poles and roofing), and also support a wide range of essential ecological functions. They provide a breeding and nursery ground for fish and crustaceans, and habitat for migratory birds. Their root systems bind and stabilise soil and slow down waterflow, decreasing coastal

erosion and protecting against coastal storms and surges. Because mangroves facilitate sediment deposits, they act as a filter for through-flowing waters and help remove nutrients and toxins, such as pesticides, fertilisers, industrial waste and human sewage. Mangroves also act as a sink for carbon sequestration, helping to mitigate global warming. (The economic value of the mangroves of Ream National Park is examined in detail in 4.1).

*Biodiversity and habitat*

The SW Cluster National Parks provide habitat for a range of rare, endangered and important plant and animal species. Although records are incomplete, Bokor NP is known to contain populations of internationally endangered species, including tiger *(Panthera tigris)*, leopard *(Panthera pardus)*, Asian elephant *(Elephas maximus)*, gaur, Malayan sun bears *(Helarctos malayanus)* and pileated gibbons *(Hylobates pileatus)* (IUCN 1997b). Spore of the endangered Javan rhino *(Rhinocerous sondaicus)* has also been encountered in past years. Some 223 bird species have been recorded in the park, of which six are globally significant, 13 are regionally significant, and 12 were the first ever recorded in the country (ADB 2000). The six globally significant species are Lesser adjutant stork *(Leptopilus javanicus)*, Rufous-winged buzzard *(Butastur liventer)*, Greyheaded fish-eagle *(Ichthyophaga ichthyaetus)*, Chestnut-headed partridge *(Arbophila cambodiana)*, Green peafowl *(Pavo muticus)* and Spot-bellied eagle-owl *(Bubo nipalensis)*. Bokor also includes unique high-elevation sphagnum bogs and *Podocarpus* forest, as well as a number of unusual shrubs such as *Archytaea vahlii, Syzygium zeylanicum, Eurya japonica* and *Calophylum saigonense* (ADB 2000).

Kirirom National Park shares a number of endangered species with Bokor, including the tiger, sun bear and pileated gibbon. Banteng cattle *(Bos javanicus)* and Eld's deer *(Cervus eldi)* have also been recorded, and in 1994 an unknown species of rhinoceros was reported from forests contiguous to the park's northwest region. Kirirom is also renowned for some 13,000 ha — the largest area in Cambodia — of *Pinus merkusii* forest.

In Ream National Park, the Malayan sun bear, fishing cat *(Felis viverrina)* and leopard are reported to be scarce, and the tiger may be on the verge of extinction (IUCN 1997b). Notable bird species include the green peafowl, the Indian pied hornbill *(Anthracoceros albirostris)* and great hornbill *(Becueros bicornis)*. A number of large waterbird species are found in the mangroves and associated mudflats, including the endangered milky stork *(Mycteria cinerea)* and lesser adjutant *(Leptoptilus javanicus:* shown right*)*. There are also reports of the endangered masked finfoot *(Heliopais personata)* in the mangroves. Crocodiles have also been occasionally reported in the Prek Toek Sap, and at least two species of marine dolphin have also been observed (ADB 2000).

# Section 4

## Key economic values of protected areas

### 4.1 Ream NP's economic value for local communities

Five communes and 16 villages overlap or abut Ream National Park. Although communities used to be widely dispersed, they became increasingly concentrated along the roadside after the upgrading of National Route No. 4 during the 1960s. This concentration increased during the Khmer Rouge era, as villages grouped together as a security measure. After 1979 villagers were allocated equal portions of land, but due to a shortage of draft animals much of the land was abandoned to those who had the resources to cultivate it.

Today almost 30,000 people live in or next to the park, and population growth rates are estimated at nearly 3 per cent (DNCP 1996). With few other sources of income and employment available to them, people's livelihoods depend on park resources (DNCP 1996). Most household income is generated from farming, fishing and NTFP collection; almost all of these resources come from Ream National Park.

It is estimated that up to 84 per cent of households gather firewood, three per cent collect construction materials from the park (De Lopez et al. 2001), 25 per cent are involved in timber harvesting and 18 per cent collect wild plants for food, medicines and handicrafts (DNCP 1996). Farmers gather more than 50 different wild products from the park, and use more than 200 species of plants for medicines (De Lopez et al. 2001).

Between a quarter (DNCP 1996) and a third (De Lopez et al. 2001) of the population fish as their main form of livelihood, with almost 500 boats operating in or near the park (Box 1). Nearly 30 species of marine fishes, crustaceans and shells, along with eight species of freshwater fish, are harvested in the park. The main fishing area is near the mouth of the Prek Toek Sap, around Koh Kchang village; nearly three quarters of the total catch is harvested from this 20-sq.-km area (De Lopez et al. 2001).

Some farming also takes place in the park, although relatively few people own their own land. Rice is cultivated in low-lying areas close to villages, while field crops such as watermelon, pineapple, durian and pepper are grown in upland areas close to the foothills. Just over a quarter of households depend on farming as their main source of income, although half have access to a plot (the majority of which are less than one ha), cultivating a total area of just under 3,000 ha (De Lopez et al. 2001). Fewer than a fifth of households own cattle and buffalo; about a third of households raise pigs and chickens (DNCP 1996).

Several conservation and management initiatives have taken place in Ream NP in recent years. Between 1997 and 1999 the Ministry of Environment, with the support of UNDP, implemented a project to prepare a zoning and management plan for the park, construct facilities, train park staff, and develop institutional arrangements for park management. This was followed (between 1999 and 2000) by initiatives, funded by the Asian Development Bank (ADB), testing approaches to refine policy, legal, procedural and institutional frameworks for coastal and marine management. The participation of local communities in coastal and marine environmental management was a key component of these activities. Recommendations were made for the zoning of the park's marine areas, management guidelines

were developed, and work was carried out on community fisheries regulations and organisational structures (GEC, WWF and WIAP 2000). Today, 49 Village Fishing Groups and a Village Fisheries Committee work to regulate, conserve and manage marine resources in the park according to the fisheries management guidelines and regulations that they have developed.

**Box 1. The value of local fisheries in Ream NP**

A total of 500 boats (300 un-motorised *touk chaev* and 200 boats with motors) fish within Ream National Park, employing 30 per cent of the population or 1,597 households. The annual catch of 537.6 tonnes is worth a total of $687,291 a year at market prices, or $1,375 per boat. Taking into account the costs of boats, equipment and operating, this translates into an annual net value of $0.515 million overall ($1,031 per boat, or $323 per fishing household).

| | Catch (kg/year) | Local price (CR/kg) | Value (US$/yr ) |
|---|---|---|---|
| Shells | 72,000 | 5,000 | 92,426 |
| Shells | 60,000 | 3,000 | 46,213 |
| Prawns | 48,000 | 15,000 | 184,852 |
| Marine fish | 200,000 | 3,000 | 154,044 |
| Crab | 32,000 | 8,000 | 65,725 |
| Small shrimp | 30,000 | 2,500 | 19,255 |
| Lobster | 1,600 | 25,000 | 10,270 |
| Squid | 24,000 | 4,000 | 24,647 |
| Freshwater fish | 70,000 | 5,000 | 89,859 |
| Total gross value | 537,600 | | 687,291 |
| Average gross value per boat | 1,075 | | 1,375 |
| Total costs | | | 171,767 |
| Total net value | | | 515,525 |
| Average net value per boat | | | 1,031 |
| Average net value per fishing household | | | 323 |

Ream National Park is an extremely important economic resource for local communities. Up to 84 per cent of households depend on park resources for their basic subsistence and income (Figure 4), to a net value of some US$1.24 million per year, an average of US$233 for every household in and beside the park (Figure 5, Box 2). In an area where the median family income is only US$316 per year, one third of families earn less than US$200, and half of the households can barely provide for their own subsistence (De Lopez et al. 2001), this figure is extremely significant. Without access to the basic subsistence, income and employment that the park provides, many of the 30,000 local people — who lack access to other sources of livelihood — would find it difficult to survive.

Figure 4. Resource use in Ream NP

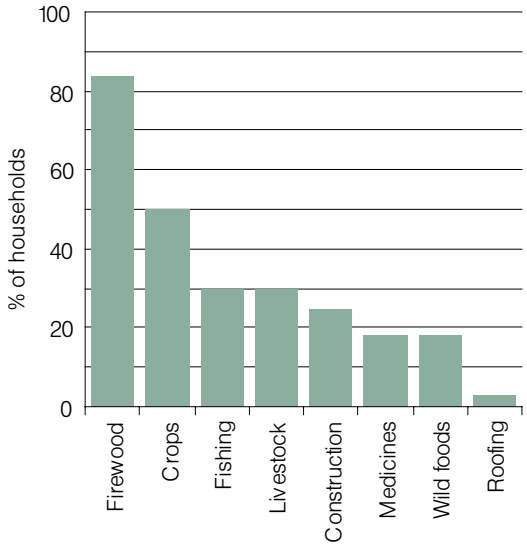
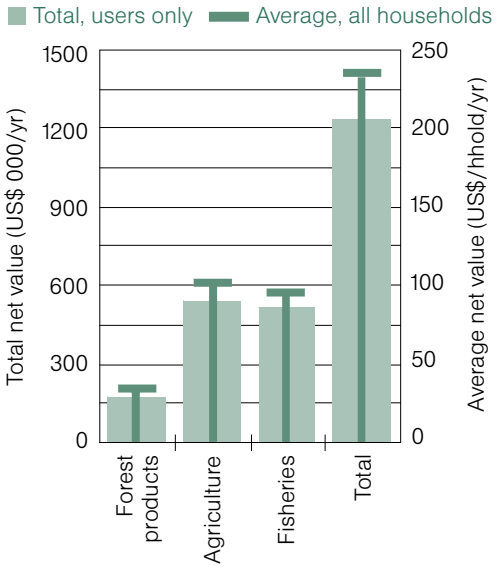



Figure 5. Local economic value of Ream NP




**Box 2. Value of other land and resource use in Ream NP**

A wide range of forest products are gathered in the park, worth a total of $190,672 at market prices. Livestock and crop production in the park has a gross value of $520,344. Taking into account the costs of harvesting these products, this translates into a net total value of $721,897 per year.

| | Gross value (US$/yr) | Net value (US$/yr) | Average value per user hh (US$/yr) |
|---|---|---|---|
| Firewood | 125,133 | 112,062 | 25 |
| Construction wood | 23,659 | 23,659 | 18 |
| Medicinal plants | 10,788 | 10,788 | 11 |
| Food | 17,695 | 17,695 | 18 |
| Roofing materials | 13,397 | 13,397 | 84 |
| **Sub-total, forest products** | **190,672** | **177,601** | |
| Crops | 316,594 | 316,594 | 119 |
| Livestock | 203,750 | 227,702 | 143 |
| **Sub-total, farming** | **520,344** | **544,296** | |
| **Total, forest products and farming** | **711,015** | **721,897** | |

*Mangrove conservation in Ream NP*

There are approximately 1,800 ha of mangroves in Ream, with a total volume of 111,645 cubic metres (De Lopez et al. 2001). The park's mangrove area is particularly important to local households. Much of the fishery in the area depends on the habitat, nursery and breeding grounds provided by mangroves, and a significant proportion of firewood, medicinal plants and construction materials are also obtained from them (Box 3). Mangroves act as a carbon sink, prevent saltwater intrusion and coastal erosion, and buffer against storms and floods, enabling human habitation and farming in the villages which lie along the coast. There is pressure to harvest the mangroves for immediate financial gain, and then turn them over to

another land use. This is a real threat to Ream. Part of the mangroves have already been illegally clear-cut, a prawn-crab farm has been developed inside the park (over an area of nearly 50 ha), and approval has been given for a ten-ha cockle farm (ADB 2000).

### Box 3. Value of mangrove conservation in Ream NP

A simple cost-benefit analysis demonstrates the high value of mangrove conservation in terms of local socio-economic and environmental benefits. Under realistic recovery and harvesting conditions, clear-cutting the mangroves would yield a one-time income of less than $630,000 (De Lopez et al. 2001). Although prawn farms can, under the best conditions, realise a net income of almost $4,500/ha/yr, few actually do. In Koh Kong, a similar mangrove area lying to the west of Ream National Park, half the prawn farms are operating at a loss, with a realistic productivity rate of 3.6 tonnes per harvest. This loss is nearly $9,950/ha/yr, an aggregate loss of $1,103 per ha per year (Bann 1997).

Even if only half of the forest, fisheries and agricultural production in surrounding villages depended on mangroves in the park, their clearance would result in a loss of local income of around $620,000 a year ($344/ha/yr). Data for similar mangrove areas in Thailand estimate the local use of mangroves to be worth between $230 (Christensen 1982) and $1,200 (Sathirathai 1998) per year; values in Koh Kong Province, which include charcoal, exceed $500 per ha (Bann 1997).

Other economic losses would also occur from mangrove clearance, such as damage to houses, infrastructure, farmland, employment, markets and the reduction in general local welfare that results from the loss of vital environmental functions and ecological services. In Southern Thailand, the economic benefits of mangroves in terms of coastline protection have been estimated at between $76.5/ha/year (Sathirathai 1998) and $165/ha/year (Christensen 1982). Carbon sequestration benefits have been valued at $2.2/ha, and mangrove storm protection functions at $32/ha in Koh Kong Province (Bann 1997). Taking these indirect economic benefits into account increases the annual economic value of conserving Ream's mangroves to $900,000 a year. This is far more than the one-time gain of clear-cutting the mangroves and converting them to prawn farms. The economic costs of destroying these valuable natural ecosystems, both immediate and long-term, far exceed the benefits. Biodiversity conservation in Ream National Park is a demonstrably economically worthwhile activity.

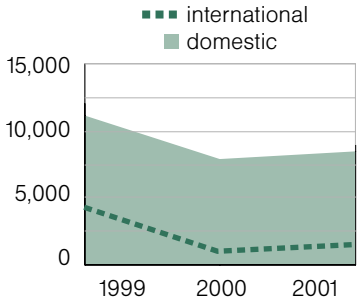
| | Net value (US$/ha/yr) | Total value (US$000/yr) |
|---|---|---|
| Local use | 344 | 619,200 |
| Storm protection | 32 | 57,600 |
| Coastal erosion prevention | 122 | 219,600 |
| Carbon sequestration | 2 | 3,600 |
| Total value | 500 | 900,000 |

## 4.2 The contribution of tourism in Bokor NP to the Kampot provincial economy

Bokor National Park is a popular leisure destination both for domestic and international tourists. It was used for recreation by colonial authorities and, in the 1960s, by affluent Cambodians. The mild climate, the scenic beauty of the forest, numerous waterfalls and viewpoints, and the history of the site are all part of its appeal. Tourism development is foreseen as being a major focus of the park (ADB 2000), and is ranked as the main source of income in the Management Plan for Bokor (DNCP 1999).

Three sites in Bokor NP (two waterfalls and the plateau area) receive high numbers of visitors. It has been estimated that roughly 100,000 domestic and 1,250 international tourists stayed in Kampot Town in 2001. About 8 per cent of domestic visitors and 60 per cent of international tourists visited Bokor National Park in 2000, approximately 8,000 domestic visitors and 750 international tourists visited the plateau and forest area (Figure 6). The Ministry of Environment charges a park entry fee of 20,000 riel (US$5) per international tourist and 5,000 riel (US$1.3) per car.

Figure 6. Number of tourists visiting Bokor National Park




Another popular park destination is Toek Chou waterfall, a short distance from Kampot town. Many town residents and domestic visitors, as well as international tourists, go there. Visitor numbers are especially high on weekends and public holidays. The waterfall area is under the control of the Department of Tourism, which charges fees for parking (CR 3,000) and collects a range of levies from the 100 or so small-scale restaurateurs, souvenir traders and food sellers who operate there.

Tourism in Bokor has a major economic influence in the province, generating revenues for park and tourism agencies and through the multiplier effects of visitor expenditures. As well as the traders operating at Toek Chou waterfall, the 3 hotels, 9 guesthouses and 13 restaurants in Kampot Town benefit from park visitors, as do the owners of the 30 cars and 20 motorcycles available for hire. In addition, all of these services contribute to provincial and Central tax revenues through the fees, levies and charges they remit.

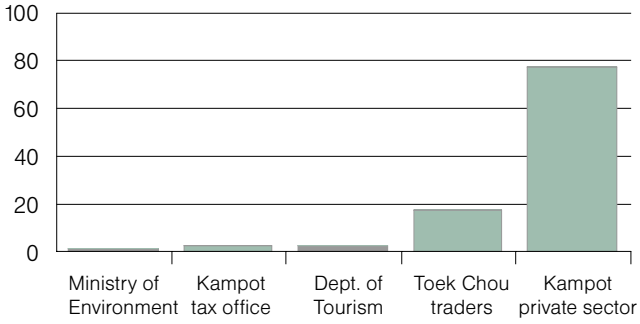
Bokor generates substantial earnings for park authorities. Even though tourism in the park is relatively undeveloped, tourism income already equals the entire annual park budget received from the Central Government (Box 4). Unfortunately, the Ministry of Environment is unable to retain all of this income at the park level; it is remitted to the Central Treasury, which returns just 50 per cent. This is subsequently split 60:40 between the park and the province. The same arrangement holds for the provincial Department of Tourism, which generates revenues from Toek Chou waterfall that are estimated to exceed $16,000 a year.

### Box 4. Tourism revenues for Bokor NP authorities

The Ministry of Environment authorities at Bokor NP operate on an extremely limited budget. With core funding only sufficient to cover salaries (estimated at less than $10,000 a year), little money is available to carry out basic park management activities, let alone invest in equipment and infrastructure. Although a small amount of donor support has been provided to the park in recent years, there is no guarantee that it will continue. Tourism represents a small but significant (currently the sole) source of earnings for park authorities. In 2000, tourism generated revenues for the ministry of nearly $10,000 in park entry fees and parking charges. Even with relatively low numbers of visitors (tourism is not yet well-developed in the park) and low entry fees (about $5 for a foreign tourist and just over $1 for a car), tourism earnings equalled the entire government budget allocated to the park for that year.

But to measure the value of tourism in Bokor National Park in terms of government revenues alone massively underestimates its total economic value, and ignores its importance to the provincial economy. Tourism in the park supports a high and growing level of private-sector activity. Small-scale traders based in Kampot Town gain significant income and employment from park-related tourist activities. More than 95 per cent of the total estimated value of tourism in Bokor National Park ($675,000 a year) accrues to the 150 or so local hotels, restaurants, food sellers, motorcycle and car operators. This in turn generates more than $11,000 a year in local tax revenues (Figure 7, Box 5 and 6).

Figure 7. The value of tourism in Bokor National Park for different stakeholders




## Box 5. Tourist earnings for traders at Toek Chou Waterfall

Toek Chou Waterfall is a popular visitor destination in Bokor National Park. Both domestic and foreign tourists visit the waterfall in order to relax, and to enjoy picnics and swimming. The waterfall is also an important source of local employment and income, as there are a large number of food and souvenir sellers there. Approximately 100 traders operate in the waterfall area, although this number varies between different seasons at weekends and on public holidays, for example, a large volume of tourists visit the area, and many traders also congregate. Assuming that a third of all traders operate at any one time in the low season, and three quarters in the high season, the gross income earned by these 100 small-scale traders may reach almost $118,000 a year. Deducting the various fees, charges and other levies paid to the Department of Tourism, their net income reaches nearly $114,000.

| | No. traders | High-season revenues (riel/day) | Low-season (riel/day) (riel/day) | Total revenues ($/yr) |
|---|---|---|---|---|
| Restaurants | 50 | 85,000 | 15,000 | 97,721 |
| Fruit tables | 30 | 20,000 | 4,000 | 14,095 |
| Shelters | 20 | 10,000 | 5,000 | 5,969 |
| Gross income | | | | 117,786 |
| Net income | | | | 113,823 |

**Box 6. Nature tourism and the provincial economy**

Tourism in Bokor NP not only generates revenues for the Ministry of Environment and the small-scale traders at Toek Chou waterfall, it supports a service industry in Kampot town and earns income and tax revenue for other government departments. There are three hotels, nine guest-houses and 13 restaurants in Kampot town. All of them benefit from the expenditures of domestic and foreign visitors. Approximately 30 cars and 20 motorcycles can be rented to take visitors to the waterfall and park for between $2 (for a return trip to Toek Chou) and $40 (for a day trip by car to the park). The Department of Tourism collects levies and charges from the small-scale traders operating at Toek Chou, and collects fees for parking. Provincial earnings amount to approximately $550,000 per year.

| | Income sources | Net earnings ($/year) |
|---|---|---|
| Department of Tourism | Car parking fees, levies, fees from traders at Toek Chou | 16,379 |
| Kampot Town private sector | Motorcycle and car hire, hotels and restaurants | 522,680 |
| Tax office | Taxes from hotels | 11,630 |
| Total provincial earnings | | 550,689 |

## 4.3 Economic value of Bokor and Kirirom NPs for hydro-electric generation

Both Bokor *(photo, bottom left)* and Kirirom national parks form the watersheds for numerous rivers and streams which flow through Kampot and Kompong Speu provinces. This water is essential to many aspects of downstream human habitation and economic production, including domestic and industrial water supplies, fisheries and aquaculture, and subsistence-level and large-scale commercial farming. Hydro-electric generation is another economically valuable use of this water, and is also critical in development terms. Two generation projects are being developed that depend directly on land and water resources in Kirirom and Bokor NPs: the Kirirom and Kamchay hydro-electric dams.

Four major rivers, the O Koarseh, O Nimul, O Traseik and O Rumchoat, originate on the northern side of Kirirom plateau and flow down to join the O Koarklei. In 1968 the O Koarklei was dammed for hydro-electric power as part of the general development of infrastructure and services on the plateau of Kirirom NP and in nearby Chuolong City. The dam and reservoir, which were constructed with Yugoslavian technical and financial help, lie within the southern boundary of the park. It operated for only 20 months before being destroyed during the Khmer Rouge period. Following a positive appraisal in 1994 it is being rehabilitated with financing from China, under a 30-year build-operate-transfer (B.O.T.) contract with a Chinese company. The scheme is planned to have a total capacity of 12 MW, supplying 53 GWh of power per year to Kompong Speu Province and Phnom Penh. This US$25 million project is planned to be operational in 2003.

The hydro-electric potential in the upper reaches of the Kamchay River has been recognised, and subjected to periodic investigation, since the early 1960s. In recent years pre-feasibility studies have been undertaken with a view to constructing a hydro-electric dam within the boundaries of Bokor National Park. The Kamchay reservoir is planned to cover an area of just over 25 sq. km and to have

an installed capacity of 120 MW, generating 469 GWh output annually to meet the energy demands of Kampot, Sihanoukville and the Phnom Penh corridor (Pomerleau International, Hydro-Québec and Experco 1995). This US$ 270 million project is expected to be operational in 2008.

Kirirom and Bokor NPs are extremely important in the development of these dams. Not only do both projects rely on water resources originating in the protected areas, they are located wholly or partially inside the two parks. Once the dams are completed, then economic value of electricity they will generate will be significant (Box 7). The economic benefits of increased power generation and distribution are also immense. Currently only 12 per cent of households in Cambodia have access to electricity, the lowest percentage in South East Asia, with the highest cost per unit. Industrial, commercial and domestic power consumption is mainly dependent on small or medium-sized diesel generators, which provide a low-quality supply, pollute the environment and incur high operating expenses. The new hydro dams have the potential to decrease the cost of electricity and increase the availability and quality of supplies. The current electricity tariffs in Cambodia are some 1,500 riel (or 39¢) per kwh; the proposed prices for electricity generated from the new schemes are half (for Kamchay) or one seventh (for Kirirom) of this rate (Box 7). Significant increases in both industrial production and domestic connections in Kampot and Kompong Speu provinces are also predicted to develop from these schemes.

**Box 7. Value of electricity generated from Bokor and Kirirom watersheds**

For the Kirirom rehabilitation, an agreement has been signed between the Chinese Company CETIC and Cambodia's EDC *(Electricité du Cambodge)*, setting a sale price of 7¢/kwh during the first 12 years of operation, and 6.17¢/kwh thereafter until the infrastructure is transferred at the end of the 30-year period. For the proposed Kamchay dam, studies show a willingness to pay a cost of 15¢/kwh for electricity (Pomerleau International, Hydro-Québec and Experco 1995).

With an estimated investment cost of $25 million for the Kirirom dam and $270 million for Kamchay, and assuming linear depreciation, operations and maintenance costs and transmission losses of 4 per cent, 1.5 per cent and 5 per cent respectively (Pomerleau International, Hydro-Québec and Experco 1995), this represents net revenues of $2.0–2.5 million a year for the Kirirom dam and of more than $55 million a year for Kamchay once the dams are operational.

Bokor and Kirirom NPs provide other benefits to hydro-electric development. Because both of the parks are also protected forest areas, their conservation helps assure the quality and supply of water. Watershed catchment and riverbank protection helps to ensure regular water flow throughout the year, and it significantly reduces the sediment and silt loads entering the dams. If forest cover was not protected in these upper catchments, the next most likely alternative land uses — combined logging and agriculture — would undoubtedly have adverse effects on water flow and quality. An incremental economic value associated with watershed catchment protection is afforded by maintaining Bokor and Kirirom as protected areas, in terms of prolonging the life of the hydro-electric reservoirs and minimising the costs of desilting and desedimentation (Box 8).

### Box 8. Incremental value of protecting hydro-electric catchments

The proposed Kamchay hydro-electric development benefits from about 90 per cent of the Kamchay river catchment area (approximately 640 sq. km), which comprises just less than half of Bokor NP. The impacts of deforestation on catchment soil erosion and hydrological attributes are well documented. Loss of the natural forest protection afforded by the NP would affect the proposed scheme, shortening its life and reducing its annual power output.

The economic costs of soil erosion and sedimentation arising from PA degradation can be broadly estimated by looking both at the shortening of the service life of the dam, and at power generation losses resulting from the reduction of storage capacity. The most likely construction alternative for the proposed scheme has a maximum height of 145 m, a normal retention level of 170 m and a surface area of 26 sq. km, equalling a total capacity of 1,130 million cubic m and live storage of 832 million cubic m (Pomerleau International, Hydro-Québec and Experco 1995). Studies from similar areas of Malaysia (Mohd Shahwahid et al. 1997), Indonesia (Magrath and Arens 1989), the Philippines (Cruz, Francisco and Conway 1988) and Vietnam (Aylward, Chinh and Vinh 2002) suggest that soil loss arising from logging and conversion to agriculture ranges from 25 to 80 tonnes/ha/year and that "natural" erosion rates from high tropical forests range between 3 and 10 tonnes/ha/year.

| | Erosion rate (t/ha/yr) | Sediment load ($m^3$/ha/y) | Sediment yield live storage ($m^3$/ha/y) | Sediment yield dead storage ($m^3$/ha/y) | NPV power revenues (US$ mil) |
|---|---|---|---|---|---|
| Conserved forest | 5 | 4.00 | 1.00 | 3.00 | 700.23 |
| Degraded forest | 50 | 40.00 | 10.00 | 30.00 | 698.36 |
| Change | 45.00 | 36.00 | 9.00 | 27.00 | —1.87 |

Assuming an average of 5 tonnes/ha/year if Bokor NP is protected and 50 tonnes/ha/year under a scenario of deforestation, allowing for both suspended sediments and bed loads, estimating a sediment density value of 1.25 t/$m^3$, assuming that 25 per cent of sediment is deposited in the live storage area of the reservoir and 75 per cent in dead storage, gradual logging and agricultural conversion of the Bokor portion of the Kamchay catchment over a period of 25 years will lead to an increase in soil losses in deforested areas of up to 45 tonnes/ha/year or increased sediment loads of 36 $m^3$/ha/year. This increased erosion and sedimentation has the potential to reduce the value of electricity revenues to a small but not insignificant total net cost of almost US$2 million.

## 4.4 Importance to local livelihoods

Table 2 illustrates the importance of national parks for community livelihoods and local development. Many local households rely on Ream NP for agriculture, fisheries and NTFP collection. With an average value of $233 per household per year, these resources contribute a high proportion of median household income (estimated at $316 per household per year). The economic value of Ream National Park for local communities is calculated to be in excess of $1.24 million per year.

**Table 2. Economic value of Ream National Park for local communities (US$)**

| | |
|---|---|
| Number of households using PAs | 5,000 |
| % households fishing in national park | 25-30 |
| % households harvesting firewood from national park | 84 |
| % households harvesting construction materials from national park | 3 |
| % households harvesting timber from national park | 25 |
| % households harvesting wild plants from national park | 18 |
| % households with access to agricultural land | 50 |
| Median household income/year | $316 |
| Average net value of national park resource use per household/year | $ 233 |
| Total net value of national park resource use/year | $ 1,240,000 |
| Total net value of fishing in national park/year | $ 515,525 |
| Total net value of forest products harvesting in national park/year | $ 177,601 |
| Total net value of farming in national park/year | $ 544,296 |
| Total value of mangroves in national park/year | $ 900,000 |
| Total value of mangrove product harvesting/ha/year | $ 344 |
| Total value of mangrove ecosystem services and functions/ha/year | $ 176/ha/year |

Table 2 indicates that the use of funds, land and resources for protected area biodiversity conservation is economically worthwhile in comparison to other commercial land and resource uses. The conversion and clearance of mangroves, for instance, yields a value of less than $600,000, far lower than the conservation value provided by the continued provision of vital resources and ecological functions ($900,000 a year). Data from similar areas of the Cambodian coast show that the economic yields of alternative land uses, such as prawn farming, cannot compete with the conservation value of mangroves.

Protected areas also support community-based forestry and fisheries management initiatives that have been piloted over recent years in Ream NP. Given its high local value, adjacent villages have an important economic stake in managing the park and in conserving its biodiversity. With the high levels of poverty that are found in the PA-adjacent area, and the continuing and intensifying economic threats to the PA, the provision of local economic benefits from conservation must be the focus of any conservation strategy.

Table 3 illustrates the high value of Bokor NP in terms of the multiplier effects on trade, income and employment in surrounding areas of Kampot Province. There is a close and valuable link between the park and the provincial economy (both the public and private sectors). With Toek Chou waterfall generating an estimated $16,000 a year for small-scale traders and PA tourism activities earning annual income of more than half a million dollars for government agencies and private enterprises, tourism in Bokor NP is an important component of the regional economy in Kampot Province.

**Table 3. Contribution of tourism in Bokor National Park to the Kampot provincial economy (US$)**

| | |
|---|---|
| Number of park visitors/year | 8,750 |
| Total value of park to provincial economy/year | $ 675,000 |
| % accruing to Ministry of Environment | 1 |
| % accruing to Kampot Tax Office | 2 |
| % accruing to Department of Tourism | 2 |
| % accruing to Toek Chou small traders | 17 |
| % accruing to Kampot town private sector | 78 |
| Annual park budget, Ministry of Environment | < $ 10,000 |
| Annual park earnings, Ministry of Environment | $ 10,000 |
| Annual earnings from Toek Chou waterfall, Department of Tourism | $ 16,379 |
| Number of small traders at Toek Chou waterfall | 100 |
| Net annual tourism earnings to small traders, Toek Chou waterfall | $ 114,000 |
| Number of tourism-related private enterprises in Kampot town | 75 |
| Net annual tourism earnings to tourism-related private enterprises in Kampot town | $ 522,680 |

Park conservation must be considered a high-priority in provincial planning and development. At the moment relatively little attention is paid to Bokor, either as a tourist destination or as a potential source of income, revenues and employment for Kampot Province. Annual budget allocations to Bokor NP are extremely small — some $10,000 per year — the same amount as the entry fees collected from tourism. Investing in basic infrastructure and park management would maintain, and increase, both the conservation and tourist value of the park. This in turn would generate substantial socio-economic returns for the province, and would conserve globally significant biodiversity.

Table 4 illustrates the importance of Bokor and Kirirom National Parks to hydro-electric generation. The parks are the site of proposed developments, they are the source of water for them, and, as protected catchments, they ensure the continuity of electricity provision. Protected area conservation can make a key contribution to hydro-electric development and to the energy sector, and to the wider financial and economic benefits associated with them.

**Table 4. Economic value of Bokor and Kirirom national parks for hydro-electric generation (US$)**

| | |
|---|---|
| % of households in Cambodia with access to electricity | 12 |
| Installed capacity of Kamchay Dam | 120 MW |
| Annual power generation from Kamchay Dam | 469 Gwh |
| Investment costs for Kamchay Dam | $ 270,000,000 |
| Installed capacity of Kirirom Dam | 12 MW |
| Annual power generation from Kirirom Dam | 53 Gwh |
| Investment costs for Kirirom Dam | $ 25,000,000 |
| Annual net benefits of electricity sales | $ 57,000,000 |
| Value of watershed catchment protection services (NPV) | $ 1,900,000 |

It is also important to note that hydro-electric development will not have an unambiguously positive impact on Bokor and Kirirom NPs. The development of large-scale developments and infrastructure within protected areas inevitably gives rise to a wide range of negative environmental (and social) impacts, both within the parks themselves and in downstream areas. These impacts are not always fully considered in the design and construction of hydro-electric schemes and have not been considered in this case. The high value of Bokor and Kirirom National Parks for hydro-electric generation is a convincing economic justification for the detailed investigation of any negative environmental impacts arising from dam construction, and for their effective mitigation. Failure to do this could undermine the intended positive effects of the developments.

Hydro-electric developments are a potential source of revenue for park management and for environmental mitigation. In many parts of the world, including other countries in the Lower Mekong Basin, fees are levied against hydro-electric schemes as payment for the provision of environmental services. In Lao PDR, for example, proposals have been made to allot a proportion of hydro-electric revenues to environmental protection and catchment conservation. In Vietnam a natural resource tax of up to 2 per cent of total revenues is levied on water use for hydro-electric projects, and, in one case, a proposal has been made to channel this revenue back into conservation in the park that provides its catchment. In the case of the Kirirom and Kamchay schemes, there is a strong argument that some portion of the revenues generated by electricity sales be returned to park authorities.

# Section 5

## Conclusions and recommendations

The value and extent of PA economic benefits, and the economic costs incurred by their degradation and loss, justify investing in the SW Cluster PAs in order to maintain their high economic and development value. Economic instruments can be used to further strengthen PA management, and to increase the positive connections between conservation and development in and around the SW Cluster PAs.

### 5.1 Economic and development justification for PAs

Protected areas provide a wide range of goods (raw materials and consumption items) and services (ecological support functions). These underpin economic activities in the surrounding area at village, commune, provincial and even national levels. The economic benefits of the South-West Cluster National Parks accrue to many groups and sectors, and are reflected in a wide range of quantifiable economic indicators, including the following:

- household subsistence and consumption (fuel, foods, construction materials, handicraft items and medicines). In Ream NP, for example, local resource use contributes up to 75 per cent of the household economy;
- household cash income, small-scale enterprise and trade based on the sale of natural resources or their use in production. Bokor NP, for example, generates income worth more than $16,000 a year for 100 small-scale traders and entrepreneurs at Toek Chou waterfall;
- commercial and industrial output in many sectors of the economy. Ream NP, for example, supplies more than 500 tonnes of goods to the fisheries sector, with a value of almost $700,000 per year;
- basic socio-economic services such as clean and regular water supplies, protection against floods and storms, and a clean and healthy environment. Mangrove areas of Ream NP, for example, have a conservation value of nearly $176/ha/year in terms of storm protection, prevention of coastal erosion and carbon sequestration — far higher than alternative, and destructive, uses;
- government revenue from taxes, user fees and entry charges. Tourism in Bokor NP, for example, generates earnings of more than $10,000 a year to the PA authority, an amount equal to the entire annual government park budget; and
- savings in government expenditures in terms of damage prevented or socio-economic losses avoided. The water catchment services provided to the proposed hydro-electric scheme in Bokor NP, for example, maintain power generation through preventing sedimentation of the reservoir, avoiding revenue losses to a net present value of almost $2 million.

Protected areas provide important non-monetary development benefits as well. The SW Cluster National Parks contribute to the key economic and development goals of the Government of Cambodia, including the following:

- rural poverty alleviation. The people who live in and around PAs are some of the poorest and most vulnerable socio-economic groups in the country. Many of the goods and services provided by PAs are otherwise unavailable or unaffordable to them;

- income and employment. There are few income or employment opportunities in park-adjacent areas. A wide range of PA goods and services, such as forest resource harvesting, fishing and tourism, provides important opportunities in these areas;
- sustainable, diverse and secure livelihoods. PA goods and services ensure the stability of ecological and economic systems. They provide a wide range of economic goods and services that help to diversify local people's production base and livelihoods, so that they have other sources to turn to if specific sources of income and subsistence fail; and
- economic multiplier effects. Every economic activity that is supported by PA goods and services has a multiplier effect at local, provincial and national levels. The total economic benefit of PAs, and the number of people who benefit from them, is many times greater than the statistics cited in this study.

Protected area conservation is an integral component of local, regional and national economic welfare and development. The high economic values presented in this report provide a strong (and much needed) argument for the conservation of Bokor, Kirirom, Ream and Kep national parks as an effective use of funds, land and other resources.

## 5.2 Overcoming the economic threats to protected areas

There is another economic reason to conserve the SW Cluster Protected Areas. Their degradation or conversion will give rise to high and wide-ranging economic costs:

- foregone production and consumption opportunities (such as loss of tourism opportunities, fisheries, forests and other resources);
- preventive expenditures (i.e. the costs of dealing with decrease in the quality or flow of urban and agricultural water supplies, or of desilting reservoirs and dams);
- replacement costs (for example, new means of income and livelihoods, alternative sources of fuel or forest products);
- effects on other economic activities (for example downstream fisheries, power generation, agriculture and water supplies); and
- foregone future economic options (i.e. those based on forest utilisation, tourism, fisheries and water-based developments).

Protected areas are under threat from a wide range of economic pressures, which are likely to worsen in the future. These are some of the most serious economic pressures facing the SW Cluster National Parks:

- protected areas continue to suffer from unsustainable levels of resource exploitation, and are being rapidly converted to agriculture. Both small-scale subsistence activities, and large commercial operations contribute to this degradation and loss;
- there are few real economic penalties or disincentives for unsustainable resource utilisation or PA degradation that results from development activities;
- many local communities can still achieve more direct benefits from unsustainable resource

exploitation and agricultural encroachment than they can from PA conservation. There are few local economic incentives to support conservation, or to offset the local economic opportunity costs of PA conservation;
- protected areas are typically seen as an economically unproductive use of funds, land and resources, at both the central and provincial planning levels;
- budgets, in terms of capital investments and recurrent expenditures, are insufficient to maintain and manage national parks. There are few other sources of funding or income for PAs, aside from these very limited government budgets; and
- the effects and consequences of PA degradation and destruction are not seen as economic losses, and are not factored into planning and development decisions as economic costs.

The degradation and loss of Bokor, Kirirom, Ream and Kep National Parks have far-reaching economic consequences, affecting many different economic sectors and populations. The loss of PA goods and services is a cost that neither the government of Cambodia, provincial economies nor local populations can afford.

If economic threats to PAs are to be overcome, there is an urgent need to ensure that PA values are factored into development and conservation planning and practice. Failing to do so will undermine the very basis, and the intended aims, of these efforts. PAs must be seen as economic assets, not economic liabilities within the conservation and development sectors.

This requires action at the level of macro-economic, sectoral and provincial economic planning to modify the way in which activities are evaluated, planned and implemented. It also requires PA authorities to reflect the economic values of conservation — and the economic costs of PA degradation and loss — in their management decisions, and to attempt to increase and capture economic benefits for local populations. This will aid provincial and national development, and can help finance and strengthen PA management operations.

## 5.3 Using economic measures to strengthen protected area conservation

It is clear that there is a need to ensure that PA economic values are recognised, and taken into account, when development and conservation decisions are made. In order to maintain the economic values associated with Bokor, Kirirom, Ream and Kep national parks, avoid the economic costs associated with PA loss, and overcome the economic threats to PAs, it is necessary to do the following:

- **increase and diversify financing** for PA management and ensure that it is sustainable over the long term. PA management authorities in all of the SW Cluster National Parks face a chronic lack of financial resources and uncertainty about future funding;
- **strengthen economic incentives for PA conservation.** There are few economic incentives for conservation in the areas around the SW Cluster National Parks, especially for the local communities who depend on the use of PA land and resources;
- **ensure that PA economic values are recognised** and factored into development and economic planning at all levels. National, provincial and local development decisions take little account of the economic value of the SW Cluster National Parks, or of the economic losses associated with their degradation.

Economic tools and instruments can be used to strengthen PA management at the operational level in Bokor, Kirirom, Ream and Kep national parks. There are several key factors in using economic measures to strengthen PA management:

- **increasing the contribution of PA goods and services** to socio-economic development. Although the primary goal of PAs is biodiversity conservation, they can also contribute significantly to development benefits. It has become increasingly apparent that, in the face of urgent development needs and

pressures, PAs must be justified in socio-economic terms. Ensuring that development benefits are provided, and are fully realised within sustainable limits, is an integral component of PA management;

- **identifying and capturing PA values.** Protected areas generate a wide range of economic values. Many of these values are unrecognised, or are received at no cost by economic producers and consumers. There is no reason why this should be the case. PA goods and services help to generate significant income in other sectors of the economy, and many groups would be willing or able to pay for them. Ensuring that a fair price is paid for the consumption of PA goods and services, and that revenues are returned to PA management in order to ensure their continued provision, could provide significant and much-needed funds for conservation;
- **sharing PA benefits directly with local communities.** There will always be some level of economic trade-off in conservation; PAs in particular involve high costs paid by local communities in terms of land and resource use options foregone. For the most part PA-dwelling and PA-adjacent communities face urgent and pressing economic needs, and are often unable or unwilling to bear these opportunity costs. To ensure local support for protected area conservation, and to offset local economic threats and opportunity costs, clear and tangible economic benefits from PAs must be generated for surrounding communities;
- **making PAs revenue-generating units.** Protected areas are largely seen as non-economic units that need to be subsidised from central sources. Although there are strong arguments that substantial central government support continue to be provided to PAs over the long term, in recognition of the broader social benefits they generate, this does not and should not preclude making greater effort to enable PAs to generate their own revenues. A wide range of revenue-generating opportunities are available to many PAs through a variety of fees, charges and transfer payments based on the economic goods and services they yield; and
- **reflecting PA economic values in budget preparation and planning.** These values are largely unrecognised by other sectors of the economy, and are rarely acknowledged even by PA-managing authorities. PAs continue to be seen as non-economic, and as drains on scarce public resources. Unless protected areas are seen as making a demonstrable contribution to socio-economic development, it will be difficult to gain wider support for their conservation. To increase the development and budget priority accorded to them, PA budget preparation, planning and reporting should make efforts to emphasise their cross-sector links as well as their contribution to wider development processes, their role in poverty alleviation and sustainable livelihoods, and the economic value of the goods and services they yield.

# Section 6

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## Annex: Data derivation and sources, Figures 1 and 2

| | |
|---|---|
| Protected areas | Ministry of Agriculture Forestry and Fisheries (2000) |
| Proposed PAs | Ministry of Agriculture Forestry and Fisheries (2000).<br>Digitised by ICEM from preliminary maps prepared by the Ministry of Agriculture, Phnom Penh, Cambodia. |
| Roads/railways | Ministry of Planning (1999) |
| Provinces | Ministry of Planning (1999) |
| Cities | UNEP (1999) |
| Land use | Mekong River Commission (1993 & 1997) |
| Tourism | ICEM (2002). Digitised by ICEM using general opinion and tourism publications. |
| Villages | Ministry of Planning (1999) |
| Dams | UNEP (1999) |

### *Land use*

Land-use categories have been generalised to achieve cross-country land-use categories. These are detailed below:

| **Old land use** | **New land use** | **Old land use** | **New land use** |
|---|---|---|---|
| Agricultural hill fields | Agriculture | Mixed broadleaf and coniferous forest | Forest |
| Agricultural land | Agriculture | Mixed mosaic | Other vegetation |
| Agricultural plantation | Agriculture | Mixed timber and bamboo | Other vegetation |
| Agricultural wetland rice | Agriculture | Natural mangrove | Wetland |
| Bamboo | Other vegetation | Natural regeneration forest | Forest |
| Barren | Barren | Other | Unclassified |
| Barren land | Barren | Other agriculture | Agriculture |
| Cloud | Unclassified | Plantation forest | Plantation |
| Coniferous forest | Forest | Plantations | Plantation |
| Cropping mosaic, cropping area <30% | Agriculture | Pure bamboo | Other vegetation |
| Cropping mosaic, cropping area >30% | Agriculture | Regrowth | Other vegetation |
| Deciduous | Forest | Regrowth, inundated | Wetland |
| Deciduous forest | Forest | Rice paddy | Agriculture |
| Deciduous mosaic | Forest | Rocks | Barren |
| Dry dipterocarp | Forest | Sand dunes | Barren |
| Evergreen forest | Forest | Savannah | Other vegetation |
| Evergreen mosaic | Forest | Scrub | Other vegetation |
| Evergreen, high cover density | Forest | Scrub with scattered trees | Other vegetation |
| Evergreen, medium - low cover density | Forest | Seasonally inundated grassland | Wetland |
| Forest plantation | Plantation | Semi-deciduous forest | Forest |
| Grassland | Other vegetation | Semi-natural melaleuca | Forest |
| Habitat mosaic | Other vegetation | Swamp | Wetland |
| Industrial crops | Agriculture | Unclassified | Unclassified |
| Inundated | Wetland | Unstocked forest | Forest |
| Inundated mosaic | Wetland | Upland agriculture | Agriculture |
| Limestone forest | Forest | Upper mixed deciduous forest | Forest |
| Limestone karst without forest | Barren | Urban | Urban/industrial |
| Lower mixed deciduous forest | Forest | Urban or built-over area | Urban/industrial |
| Lower-dry evergreen forest | Forest | Urban/industrial | Urban/industrial |
| Mangrove | Wetland | Water | Water |
| Mangrove plantation | Plantation | Water body | Water |
| Melaleuca forest | Forest | Wetland | Wetland |
| Mixed (evergreen and deciduous) | | Wood- and shrubland, dry | Other vegetation |
| medium-low cover density | Forest | Wood- and shrubland, evergreen | Other vegetation |
| Mixed (evergreen and deciduous), high cover density | Forest | Wood- and shrubland, inundated | Wetland |