

**An Agenda for linking Conservation and Development through
Land Use Re-Arrangement and Landscape Planning**
- Experiences from Cat Tien National Park and Surrounding Forests -

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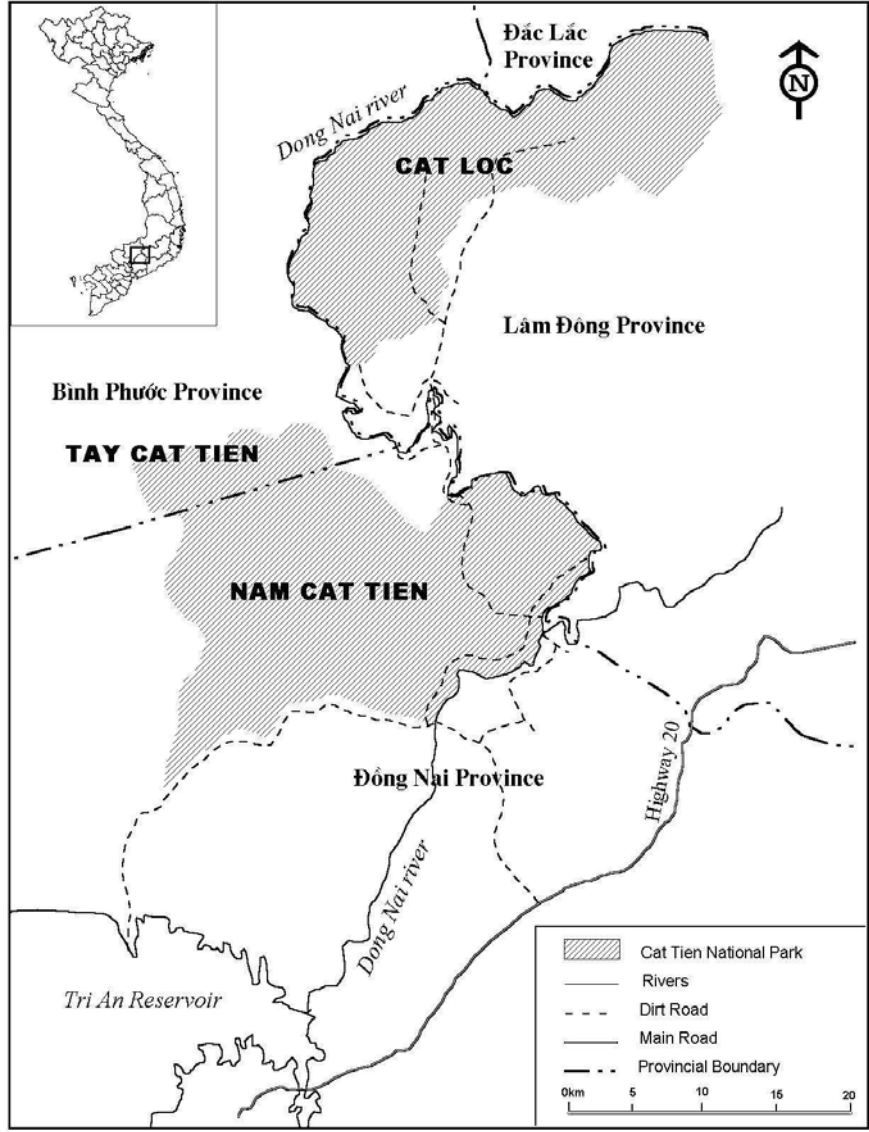
CAT TIEN NATIONAL PARK CONSERVATION PROJECT
Dong Nai Province, Vietnam

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Map 1: Cat Tien National Park



1 INTRODUCTION

Cat Tien National Park (CTNP), located in southern Vietnam, is a protected area of national and international importance for biodiversity conservation. It also plays an important role in local and regional socio-economic development, for example, by protecting the watershed of the Tri An Reservoir, which is the major electricity supplier to the southern region, including Ho Chi Minh City. Currently, however, the natural habitat of CTNP is threatened by deforestation, fragmentation and increasing pressure on forest resources. A main cause is the confusion and uncertainty over land and resource use inside the protected area and along its boundaries, which has been ongoing for more than 20 years in some instances. The confusion has created hardship for local communities and constrained socio-economic development. From a conservation standpoint, the current situation threatens the park's ecological integrity and is especially threatening for rare and endangered large mammals, including its flagship species the Javan Rhino *Rhinoceros sondaicus annamiticus*.

To resolve these dilemmas, the Boundary Re-Demarcation and Resettlement Action Plan was developed by CTNP and the WWF Indochina Programme in the CTNP Conservation Project. Currently, some 9,500 people live and farm inside CTNP, which is considerable for a park of less than 75,000 ha. Based on scientific surveying, park zoning and extensive multi-stakeholder consultation, the plan proposes to excise some 8,500 people from park boundaries and resettle a few small and isolated villages located in key areas for biodiversity conservation, which would displace about 1,000 people. Resettlement is a complex and complicated process that brings inevitably risk and disruption, as well as financially costly. Boundary re-demarcation was designed to focus the park's conservation efforts on key areas for biodiversity, while also minimizing the scale of resettlement. CTNP has also agreed to apply international guidelines for resettlement to help ensure that no displaced person is made worse off because of the project.

CTNP is part of a larger forest complex that spreads around the buffer zone and extends into the South East Agro-Ecological Region (SEAR), which consists of seven southern provinces. CTNP, WWF and others are currently exploring possibilities for a conservation strategy for buffer zone forests and the agro-ecological region, based on the process for land-use re-arrangement and planning applied inside CTNP. The possibility for a conservation strategy for the forest complex that is linked with development benefits holds much promise. Working at the landscape level could help secure more feasible conditions for conservation of the large mammals in and around CTNP that require large range areas, such as rhino, elephant, tiger, dhole, gaur and other wild cattle. Working with forests at a larger scale could also allow for a wider range of management options that would benefit local and regional development, such as community-owned forest enterprises.

2 OVERVIEW OF CAT TIEN NATIONAL PARK

2.1 Location

CTNP is located approximately 150 km north of Ho Chi Minh City in the south of Vietnam. Its approximate co-ordinates are:

11°20'50" N to 11°50'20" N Latitude
107°09'05" E to 107°35'20" E Longitude

CTNP occupies a geographic transition zone between the Truong Son Mountain Range and the Nam Bo Delta. It is also part of the forest complex that protects the watershed for the Dong Nai River, which passes along its borders. The total area of CTNP is 73,878 ha and is geographically separated into two areas of roughly equal size (Map 1). On one side is Nam and Tay Cat Tien in Dong Nai and Binh Phuoc Province, respectively. On the other side is the Cat Loc Sector in Lam Dong Province (Table 2.1).

Table 2.1: Area of Cat Tien National Park

Sector	Area (ha)	Province
Nam Cat Tien	38 302	Dong Nai
Tay Cat Tien	5 141	Binh Phuoc
Cat Loc	30 435	Lam Dong
Cat Tien NP	73 878	---

The buffer zone covers an area of 330,000 ha (pers. comm. Project Management Unit - FPRDP, 2003) and is comprised of the 34 communes and 2 district towns immediately surrounding CTNP. The buffer zone overlaps on four provinces, including Dak Lak Province. It also contains six State Forest Enterprises (SFE), namely Vinh An, La Nga, Da Teh, Loc Bac, Loc Bao and Nghia Trung. These SFEs contain a mix of forest stands of conservation importance and sizeable areas that have been converted into agriculture by SFE employees and spontaneous immigrants (see below).

2.2 Legislation

CTNP came into its current shape through a series of legislative decisions over a period of twenty years. The first government legislation related to CTNP was Decision No. 360/TTg of the Prime Minister, dated 7 July 1978, which decreed the establishment of 35,000 ha of protected forest as Nam Cat Tien. Subsequently, an investment plan was prepared, which proposed upgrading Nam Cat Tien to national park status with a total area of 38,900 ha. The investment plan was approved on 13 January 1992 by Decision No. 08/CT of the Chairman of the Council of Ministers (Anon, 1993a) and, on the same day, a management board was established for the Nam Cat Tien National Park (CTNP Management Board, 2000).

Initially, Tay Cat Tien and the Cat Loc Sector were institutionally separate protected areas from Nam Cat Tien. Decision No. 194/CT of the Chairman of the Council of Ministers, dated 9 August 1986, decreed the establishment of a 10,000 ha nature reserve as Tay Cat Tien (MARD 1997). At a meeting held at the former Song Be Provincial People's Committee on 11 January 1993, the area of Tay Cat Tien was defined as 5,134 ha (Anon. 1993a). However, an investment plan specifically for Tay Cat Tien Nature Reserve was never prepared (Gilmour & N.V. San, 1999).

Following the rediscovery of Javan Rhinoceros *Rhinoceros sondaicus annamiticus* in 1989 (Schaller *et al.*, 1990), an investment plan was prepared for the establishment of the Cat Loc Rhinoceros Sanctuary. The investment plan defined the total area of the sanctuary as 30,635 ha, comprising areas previously managed by Cat Tien and Loc Bac State Forest Enterprises (SFE) (Anon. 1992). The investment plan was approved by Official Letter No. 686/CV of Lam Dong Provincial People's Committee, dated 23 October 1992 (Anon, 1993b). However, the site remained under the direct management of Cat Tien District People's Committee until 1996, when a nature reserve management board was established under direct management by the province.

Decision No. 08/CT of the Chairman of the Council of Ministers, dated 13 January 1992, requested the former Ministry of Forestry to prepare a comprehensive investment plan, which would combine Nam Cat Tien National Park, Tay Cat Tien Nature Reserve and Cat Loc Rhinoceros Sanctuary into a single management unit with national park status (Gilmour & N.V. San, 1999). The first version of the investment plan was completed in June 1993, proposing a total area of 74,219 ha for the national park (Anon, 1993a). However, the government did not approve this investment plan.

In 1997, Forestry Institute of Planning and Inventory (FIPI) and the Forest Protection Department (FDP) of the Ministry for Agriculture and Rural Development (MARD), with the support of the World Wide Fund for Nature (WWF), prepared a revised investment plan for CTNP. This investment plan defined the total area of the national park as 73,100 ha (Anon, 1997). The

investment plan was approved on 5 December 1998, by Decision No. 1090/TTg of the Prime Minister (CTNP Management Board, 2000), at which time the management responsibility for the national park was transferred from the provincial People's Committees to the central Government's Ministry of Agriculture and Rural Development (MARD).

2.3 Management objectives and protected area values

CTNP was established with the following four main objectives:

- Conserve the local ecosystem;
- Preserve the watershed of the Tri An Reservoir;
- Provide research opportunities for national and international scientists; and
- Act as a destination for sustainable tourism.

These objectives define CTNP as an important asset for both biodiversity conservation and socio-economic development (e.g., watershed protection, tourism development). In addition, CTNP makes important contributions to other economic sectors, such as industry, fisheries and forestry.

2.3.1 Local ecosystem and biodiversity conservation

CTNP is one of the few lowland forest ecosystems in Southeast Asia that are still relatively intact and conservable (CTNP, 2000). CTNP supports a variety of habitat types, including primary and secondary lowland evergreen forest dominated by species in the Dipterocarpaceae; primary and secondary lowland semi-deciduous forest, dominated by *Lagerstroemia* spp; freshwater wetlands with open lakes and seasonally inundated grasslands, containing *Saccharum spontaneum*, *S. arundinaceum* and *Neyraudia arundinacea*; flooded forest, dominated by *Hydnocarpus anthelmintica* mixed with *Ficus benjamina*; and a range of secondary habitat types, including grassland and areas dominated by bamboo (FIPI, 1993). The flora of CTNP includes more than 1,300 species of vascular plants, among which are 34 species listed in the *Red Data Book of Vietnam*. *Azelia xylocarpa*, *Dalbergia bariensis*, *Dalbergia cochinchinensis*, *Diospyros Mun*, *Dipterocarpus alatus*, *Dipterocarpus dyeri* and *Hopea odorata* are of international conservation concern (IUCN-SSC, 2000).

To date, 76 mammal species, 322 bird species, 73 reptile species, 35 amphibian species and 99 fish species have been confirmed at the national park. These include 40 globally threatened species and 58 species included in the Vietnam Red Data Book (Table 2.2).

Table 2.2: Species totals recorded to date in Cat Tien National Park

Taxa	All species		IUCN Red List 2000
	Total	% of VN total	
Mammals	76 (108)	30 (43)	16 (27)
Birds	322 (340)	37 (40)	15 (16)
Reptiles	73 (84)	27 (31)	8 (8)
Amphibians	35 (39)	29 (38)	0
Fresh water fish	99 (130)	21 (28)	1
Butterflies	435 (439)	43 (44)	n.a.

Note: Non-bracketed figures are confirmed records, figures in () include possible records

Source: Updated after Polet & Ling (in press)

An outstanding feature of CTNP is that it is one of the most important sites for the conservation of large mammals in Vietnam. Among the confirmed large mammal species in the park are the Asian Elephant *Elephas maximus*, Javan Rhinoceros, Wild Boar *Sus scrofa*, Sambar Deer *Cervus unicolor* and Gaur *Bos gaurus*. The latter three species occur at high densities relative to other areas in Vietnam (Ling, 2000). The Park is a site of national importance for primate conservation. All six native primate species occurring in CTNP are of international conservation concern, including Black-shanked Douc Langur *Pygathrix nigripes*, Silvered Leaf Monkey

Trachypithecus cristatus, Pig-tailed Macaque *Macaca nemestrina* and Yellow-cheeked Crested Gibbon *Hylobates gabriellae* (Polet & Ling, in press). Northern Smooth-tailed Treeshrew *Dendrogale murina*, Black-shanked Douc Langur, Lesser Slow Loris *Nycticebus pygmaeus* and Yellow-cheeked Crested Gibbon are endemic to the region (Polet & Ling, in press).

Of the large mammals at CTNP, the most significant is the Javan Rhinoceros. This is the only known population of the sub-species *Rhinoceros sondaicus annamiticus* in the world. However, the population size and range of this species at the park has declined over the last two decades. Current estimates put the population size at seven or eight individuals and the range at 6,500 ha (Polet *et al.*, 1999).

CTNP is also situated in the South Vietnamese Lowlands Endemic Bird Area (EBA), and supports populations of three bird species endemic to this EBA. They are the Orange-necked Partridge *Arborophila davidi*, Germain's Peacock Pheasant *Polyplectron germaini* and Grey-faced Tit Babbler *Macronous kelleyi* (Polet & P.H. Khanh 1999). The Orange-necked Partridge is endemic to the local area and the only confirmed population in the world. Apart from being of global conservation value for Phasianidea, the park is also an important site for the conservation of waterbirds. Among the globally threatened waterbird species that have been recorded at the park are the White-shouldered Ibis *Pseudibis davisoni*, White-winged Duck *Cairina scutulata* and Lesser Adjutant *Leptoptilos javanicus* (Polet & P.H. Khanh 1999).

Siamese Crocodile *Crocodylus siamensis* (globally critically endangered) has been eradicated from the park but was re-introduced in 2001 (Polet *et al.*, 2002). Other reptiles of global conservation concern include six turtle species (CTNP, 2000).

2.3.2 Watershed protection

The Tri An Reservoir is located on the Dong Nai River approximately 40 km south of CTNP in Dong Nai Province. It is fed by the Dong Nai and La Nga rivers. The Tri An Reservoir is the major electricity supplier for the southern region of Vietnam, including Ho Chi Minh City, which has the highest energy consumption rate in the country (MARD, 2003).

The linked forest systems of CTNP and its buffer zone are important to maintaining water supply and reducing sedimentation in the Tri An Reservoir. Several other major hydroelectric dams have been planned and proposed for the Dong Nai River Basin both above and below CTNP, such as the Dai Ninh Hydropower Project and the Dong Nai 3 and 4 Combined Hydropower Project. They present both opportunities and threats to CTNP. Developing financial mechanisms that recognize the environmental services that CTNP provides to the dams could help fund park conservation, as well as socio-economic development in adjacent communities. However, poor planning by the dams or disregard for the protected area could also result in further forest and biodiversity loss, notably through flooding and construction.

2.3.3 National and international scientific research

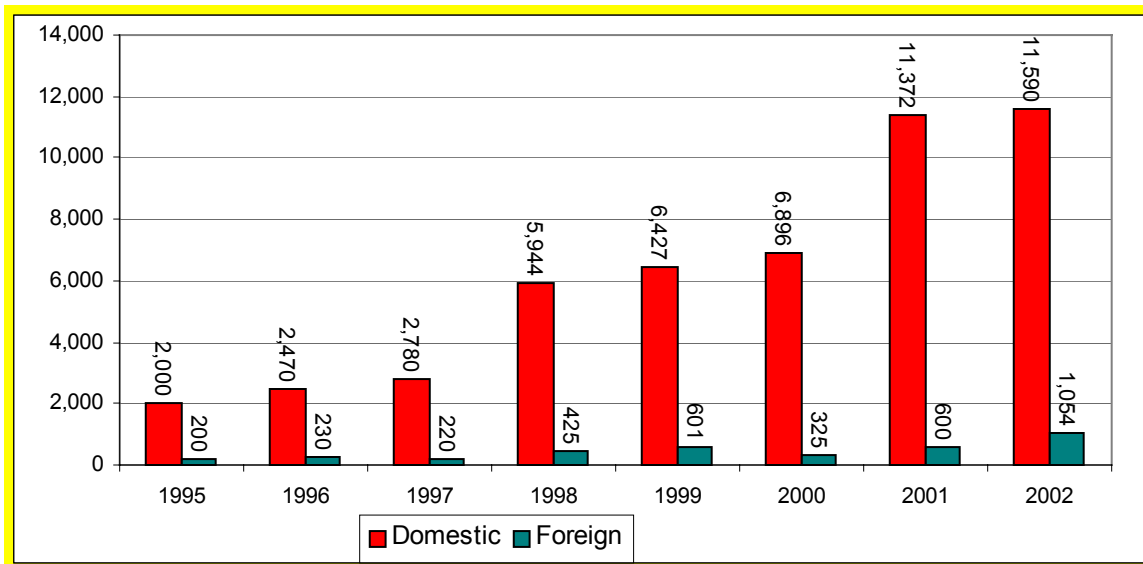
CTNP is an important destination for national and international scientists, research institutes and universities. Vietnamese organizations that have conducted research in CTNP include the Institute for Ecology and Biological Resources (IEBR), Forest Inventory and Planning Institute (FIPI), Saigon Zoo, Crocodile Conservation and Development Farm and the universities of Hanoi, Ho Chi Minh City and Dalat. International organizations have included the Vietnam-Russia Tropical Research Centre, US Fish and Wildlife Service, International Rhino Foundation, IUCN Crocodile Specialist Group, London College, Cambridge Universities and other universities in Australia, Belgium, Canada, France, Holland and the United States.

2.3.4 Destination for sustainable tourism

Nature-based tourism is a rapidly expanding sub-sector nationally and worldwide. CTNP presents a unique tourism experience in Vietnam. It is located only 150km north of Ho Chi Minh City, midway on the national highway to Dalat (another major tourism destination). While relatively close to urban areas, it provides an impressive natural landscape and is one of the few

areas in Vietnam where wildlife is relatively easy to view. The number of domestic and international visitors to CTNP has increased by more than five times in the past 8 years (Figure 2.1). Like hydro-electric dams, tourism presents both opportunities and threats to CTNP. Tourism can be an important source of revenue for the park and local communities, which, in turn, could create stronger incentives for the local community to support the conservation of CTNP. But uncontrolled or poorly managed tourism can lead to increased pollution, disturbance to wildlife and degradation of habitat.

Figure 2.1: Number of visitors to Cat Tien National Park (1995 – 2002)



Source: Becker & Tran Van Mui (2003)

2.3.5 Benefits to other economic sectors

CTNP also provides important environmental goods and services to other economic sectors, such as industry, fisheries and forestry, which have yet to be fully recognized. Again, they provide both opportunities and threats to CTNP.

Industry is a major economic driver in the southern region and has grown rapidly in Dong Nai Province since 1995 (MARD, 2003). The principal industries are food processing, chemicals, textiles and garments, each of which has high demands for water (MARD, 2003). The linked forest systems of CTNP can help secure and regulate water supply, as well as play a role in filtration of air pollution and provision of raw materials, particularly in processing of forestry products. These industries are also potential heavy water polluters, which could be a major threat to CTNP and other fragile eco-systems.

The Dong Nai River and its tributaries have provided humans with vital sources of fish, frogs and other aquatic species, including crocodiles. In recent years, inland wild capture fisheries from streams and rivers has collapsed in the southern region (MARD, 2003). Primary reasons are overexploitation, loss in water quality and obstruction of water courses (MARD, 2003). Currently, no strategy or investment is available for rehabilitating wild fisheries. The rivers and wetland complexes inside CTNP can be part of such a strategy by providing protected breeding and nursery habitats for aquatic species, as well as protection from erosion and destruction of fish habitat, protection from increased sedimentation and associated impacts, and maintenance of nutrient levels in water bodies.

Forest products extracted from CTNP also make a substantial contribution to local economies, despite their illegality and the potential consequences of unsustainable extraction. If violation records are any indication, CTNP is an important source of fuel, construction materials and foods

(pers. comm. Forest Protection Dept. – CTNP, 2003). Forest products are also a source of ready cash for local communities, especially from animal trapping and collecting certain foods and materials, such as rattan, bamboo shoots and *u'oi* fruit. The relevant questions for CTNP are to what extent and which products, if any, could be harvested on a sustainable basis and without compromising major conservation objectives. In certain cases, establishing collaborative forest management regimes with local communities based on limited harvesting rights could improve conservation effectiveness and gain local support for the park.

3 HUMAN POPULATIONS AND CONSERVATION THREATS

3.1 History of settlements

Prior to the American War, the CTNP region was like most of the Central Highlands, sparsely populated and forest abundant. The original inhabitants of the CTNP region are mainly from the Mon-Khmer ethno-linguistic group, such as the Chau Ma and X'tieng. Traditionally, they practiced sedentary shifting cultivation (N.V. San 2000), which are generally low-labour intensity and environmentally sustainable land and resource use systems over large areas. Probably only a couple of villages, however, can be said to have traditionally occupied the territories that they currently inhabit inside CTNP. Other groups of indigenous peoples moved inside CTNP in the early 1990s—particularly in the Cat Loc Sector, which was a largely defunct State Forest Enterprise at the time—in response to mass migration of Kinh and non-indigenous ethnic minorities into their territories.

Mass immigration of Kinh and non-indigenous ethnic minorities into the CTNP region began shortly after the American War. Immigration was both spontaneous and planned, especially under government programs to establish New Economic Zones (NEZ). The first waves of immigrants were mainly Kinh, attracted by the availability of land and escaping over-population in the lowlands. In 1975, an ex-military unit of Kinh households settled an area in Dak Lua Commune (Dong Nai Province) that, three years later, was decreed as part of Nam Cat Tien. Throughout the 1980s and 1990s, government established NEZs in areas adjacent to CTNP, notably along the eastside of the Dong Nai River in Dong Nai province and in large areas in Lam Dong province. The NEZs resulted in massive forest clearing and, in certain cases, displacement of the indigenous peoples, who sold off or in other ways lost their lands to the lowland immigrants.

Beginning in the late 1980s, large groups of Tay, Nung, Dao and H'mong communities migrated into the CTNP region from northern Vietnam. They migrated mostly into the Da Bong Cua area in northeast corner of Nam and Tay Cat Tien. Most of them arrived spontaneously, driven by land scarcity in the northern provinces. Many knew of land availability in the Central Highlands from when they had served in the army during the war with Cambodia. These ethnic groups traditionally practiced a mix of wet rice and shifting cultivation and became locally renowned for their skills in hunting and trapping.

3.2 Current population and ethnicity

Currently, some 9,500 people inhabit CTNP (Table 3.1). They comprise eleven (11) different ethnic groups, which can be grouped into three main categories:

- Indigenous peoples (e.g., Chau Ma, X'tieng)
- Non-indigenous ethnic minorities from the north (e.g., Tay, Nung, Dzao, H'mong)
- Kinh (i.e., Lowland Vietnamese)

(N.V. San, 2000)

Thirty-eight percent of the inhabitants of CTNP are Kinh, while 32% are indigenous peoples and 30% are non-indigenous ethnic minorities.

Most of the population lives on the edges of CTNP, namely Kinh communities enwrapping the southern tip of the Cat Loc Sector, non-indigenous ethnic minorities in the Da Bong Cua area in the northeast corner of Nam and Cay Tay Tien, the ex-military unit of Kinh households on the eastern corner of Nam Cat Tien, and a group of indigenous peoples on the south side of Nam Cat Tien that was previously established under a government sedentarization program. Only a few communities live deep inside CTNP, namely one large village of predominantly indigenous peoples located in the centre of northern half of the Cat Loc Sector, several small and isolated villages of indigenous peoples connected by an old logging road in a band that cuts across the middle of the Cat Loc Sector, and non-indigenous ethnic minorities in the Da Bong Cua area that have broken away from the main settlement areas. Notably, the large village of more than 1,000 people inside the Cat Loc Sector, Village 5, has recently been upgraded to commune status as Dong Nai Thuong.

In addition, 180,000 people live in the buffer zone. According to commune level statistics, the population grew from 140,987 in 1992 to 188,479 in 2002 (Polet *et al.* 2003). This was an average growth rate of 34%, which is extremely high. The national average is 1.3-1.5%. Population trends also show a lot of variation in growth and decline among communes, which suggests a high level of mobility. Curiously, trends of declining population growth were evident in all provinces over the period from 1994-1998. These trends reversed after 1998, which was about the same time as began the CTNP Conservation Project and the \$32 million World Bank-funded Forest Protection and Rural Development Project (FPRDP), operating in the buffer zone. Currently, in- and out-migration seem to have stabilised at around 2%, but increased natural growth can be expected because of a young buffer zone population. Currently, 74% of the buffer zone population is Kinh, while 7% are indigenous peoples and another 19% are non-indigenous ethnic minorities.

Table 3.1: Human Population inside Cat Tien National Park in 2000

LOCATION			EDGE VILLAGES		ENCLAVE VILLAGES		TOTAL	
Province	Commune	Village	HH	People	HH	People	HH	People
Dong Nai	Dac Lua	Village 4 / Cau Sat	40	180	-	-	40	217
	Talai	Village 4	315	1,341	-	-	315	1,341
TOTAL NAM CAT TIEN			355	1,521	-	-	355	1,558
Lam Dong	Phuoc Cat 2	Phuoc Hai	480	2,297	-	-	480	2,297
		Phuoc Son						
		Phuoc Thai						
		Phuoc Trung						
		N.Q. Vinh Ninh						
	Village 3	27	139	-	-	27	139	
		Village 4	-	-	18	93	18	93
	Gia Vien	Van Minh	402	2,100	-	-	402	2,100
		Thanh Tien						
		Tan Xuan						
		Cao Sinh						
	Tien Hoang	K'lo – K'it	-	-	18	83	18	83
		Village 5	-	-	225	1,083	225	1,083
K'lut		-	-	9	44	9	44	
An Nhon	Thung Co / Village 6	-	-	11	51	11	51	
	Buon Quoc	-	-	6	30	6	30	
TOTAL CAT LOC SECTOR			909	4,536	287	1,384	1,196	5,920
Binh Phuoc	Dang Ha	Da Bong Cua area	318	1,598	94	410	412	2,008
TOTAL TAY CAT TIEN			318	1,598	94	410	412	2,008
TOTAL CAT TIEN NATIONAL PARK			1,582	7,655	381	1,794	1,963	9,486

Source: CTNP, 2003

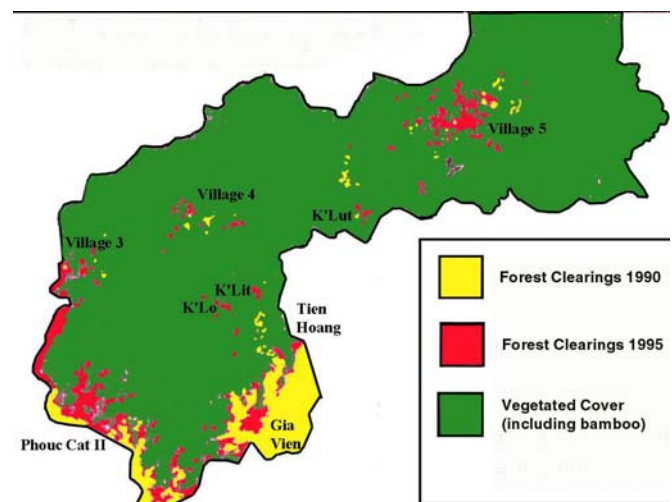
3.3 Conservation threats

The region's settlement history, characterized by massive migration and internal mobility, and the staggered evolution of CTNP as a national park has created a highly complicated situation regarding land rights and natural resource management in the area. The resulting confusion has created hardship for communities and constrained local socio-economic development, while also posing major threats and obstacles to effective conservation.

A recent threat analysis conducted by staff of CTNP and the Conservation Project identified "Encroachment and habitat loss" as the most important threat to CTNP (Annex 1), particularly around the inhabited areas inside CTNP. The other major threats identified were also closely related to human activity, such as hunting, introducing and releasing invasive species, grazing domestic cattle and harvesting NTFPs. Minor threats focused on management issues for the park itself and developments in the buffer zone or beyond, notably hydro-electric dams. A table of "indirect threats" showed underlying factors that hamper the effective functioning of CTNP, such as poor coordination between governmental departments and protected area investment plans that emphasize infrastructure—as opposed to formulating budget activities according to the recognized threats to biodiversity and overall conservation (Annex 1).

According to the CTNP Conservation Management Plan (2000), which formed the basis for the Boundary Re-demarcation and Resettlement Action Plan, encroachment in the past decade has caused serious habitat loss and fragmentation, particularly in the Cat Loc Sector (see **Map 2**). Habitat loss and fragmentation have restricted the natural ranges of wildlife and their access to key resources. The band of villages cutting across the the Cat Loc Sector seem to have deterred the rhino from entering areas previously ranged in the northeast. Human settlements along the Dong Nai river have reduced its access to permanent water bodies. Rice cultivation on the valley floors has cut the rhino off from critically important saltlicks, wallows and feeding grounds. Furthermore, encroachment also increases human access to remaining forests and disturbance. Fragmentation also increases the area of degraded edge habitat.

Map 2: Forest clearing expansion in Cat Loc Sector, 1990-1995



Information based on Landsat 5 TM (124/052)-1990 & Spot HRV (277/327)-1995

Hunting pressure inside CTNP is also reported to be growing (Polet & Ling, in press), driven by an increasingly wealthy urban population with an increasing demand for expensive wild meat. While small animals and medium-sized ungulates are the main targets, certain snares can cause serious injury to larger animals. Hunting with guns also threatens endangered primates and wild cattle. Fishing inside CTNP is prevalent and may pose a risk to the re-introduction program for the Siamese Crocodile. NTFP collection is reported to have a low impact, but it increases possibilities of opportunistic hunting and could become a problem if rising market demands drive over-harvesting for certain products, as has happened with rattan in the past.

Current problems with invasive species include the spread of *Mimosa pigra* into the wetland ecosystem, the breeding of Pacu (Piranha species) in fish farms in the buffer zone (which could potentially escape during the flood season and establish wild populations), and the introduction of alien Rhesus Macaques. These species risk disturbance to the local eco-systems and native species. Grazing of domestic livestock inside CTNP is an increasing threat, particularly as population densities increase along the park's boundary. Grazing of domestic livestock risks

inter-breeding with native species, spread of disease to wild populations and out-competing for key resources.

Based on this threat analysis, the current situation with human populations living inside and around CTNP poses many challenges for biodiversity conservation.

3.4 Constraints to socio-economic development inside CTNP

Living inside a national park is also far from ideal. Communities living inside CTNP are unable to receive formal land use rights (although some land was previously allocated to certain households in CTNP), which, in turn, restricts access to formal credit and may discourage long-term investments in land and housing. During a Review Mission of the resettlement project, such opinions were expressed by the Kinh households of the ex-military unit in Nam Cat Tien (Ohlsson, 2002). They asked CTNP to resolve the situation as soon as possible, either by resettling them with fair and adequate compensation or allowing them normal land use rights.

Government and international donors are also reluctant to invest inside protected areas, especially in infrastructure. As a result, villagers have to travel long distances on difficult roads to reach markets, health stations, schools, government administration offices and other public services and infrastructure. The roads into the Cat Loc Sector are accessible only by motorbike and impassable during certain periods in the rainy season. Recent socio-economic surveys have shown that few children attend formal schooling and almost none are at an age-appropriate grade level (pers. comm. N.Q. Nha & Morris, 2003).

However, it should also be noted that moving inside CTNP has also provided solutions to many of these communities. Many villagers encountered during the Review Mission also expressed some satisfaction with their current living situation and preferred it to the possibilities currently available to them in the lowlands (pers. comm. Ohlsson & Morris, 2002). At least a couple other villages, Village 3 and 4, claim their current settlements as ancestral territories. Hence, while it is important to note the difficulties of living inside a protected area, it is equally important not to overstate them. Resettlement can be a solution to these difficulties, but neither is it the only solution, nor is any kind of resettlement justified.

4 BOUNDARY RE-DEMARCATON AND RESETTLEMENT ACTION PLAN

4.1 Rationale

The Boundary Re-demarcation and Resettlement Action Plan was designed to address the particular conservation and development dilemmas described above. According to the Conservation Management Plan (CTNP, 2000), the central conservation problem for CTNP is “the small area available and continuing loss and degradation of good quality habitat” (p.xii). Although CTNP is abundant in wildlife compared to other protected areas in Vietnam, total population sizes are described as modest, at best. These problems are compounded by the geographical separation of the park, which makes migration nearly impossible for non-volant species. Large mammals, in particular, occur in small numbers, especially those with specific habitat requirements or were persecuted in the past. Notably, the current rhino and elephant populations are non-viable. The two Gaur populations are somewhat larger, but still not secure. Large cats and dhole may still use the area, but CTNP in its current shape would probably be unable to support viable populations of either.

The main rationale for resettlement is to consolidate and increase the current area of natural habitat available inside CTNP. The reasons why resettlement was selected over other options, particularly ones that might have integrated human settlements with park management, are described in the Conservation Management Plan (CTNP, 2000) as the small area of natural habitat currently available in CTNP, non-sustainable use of forest resources, increasing population pressures from the enclave communities, lack of positive experiences in Vietnam of

communities existing inside protected areas, and improved development opportunities for displaced communities outside the protected area. In sum, the current area of natural habitat inside CTNP was deemed too small and fragile to withstand the continued presence of human communities. The risk of further habitat loss and fragmentation from expanding populations added to the urgency of the matter. Where resettlement appeared feasible and acceptable to local communities, among others, it was proposed as the first option.

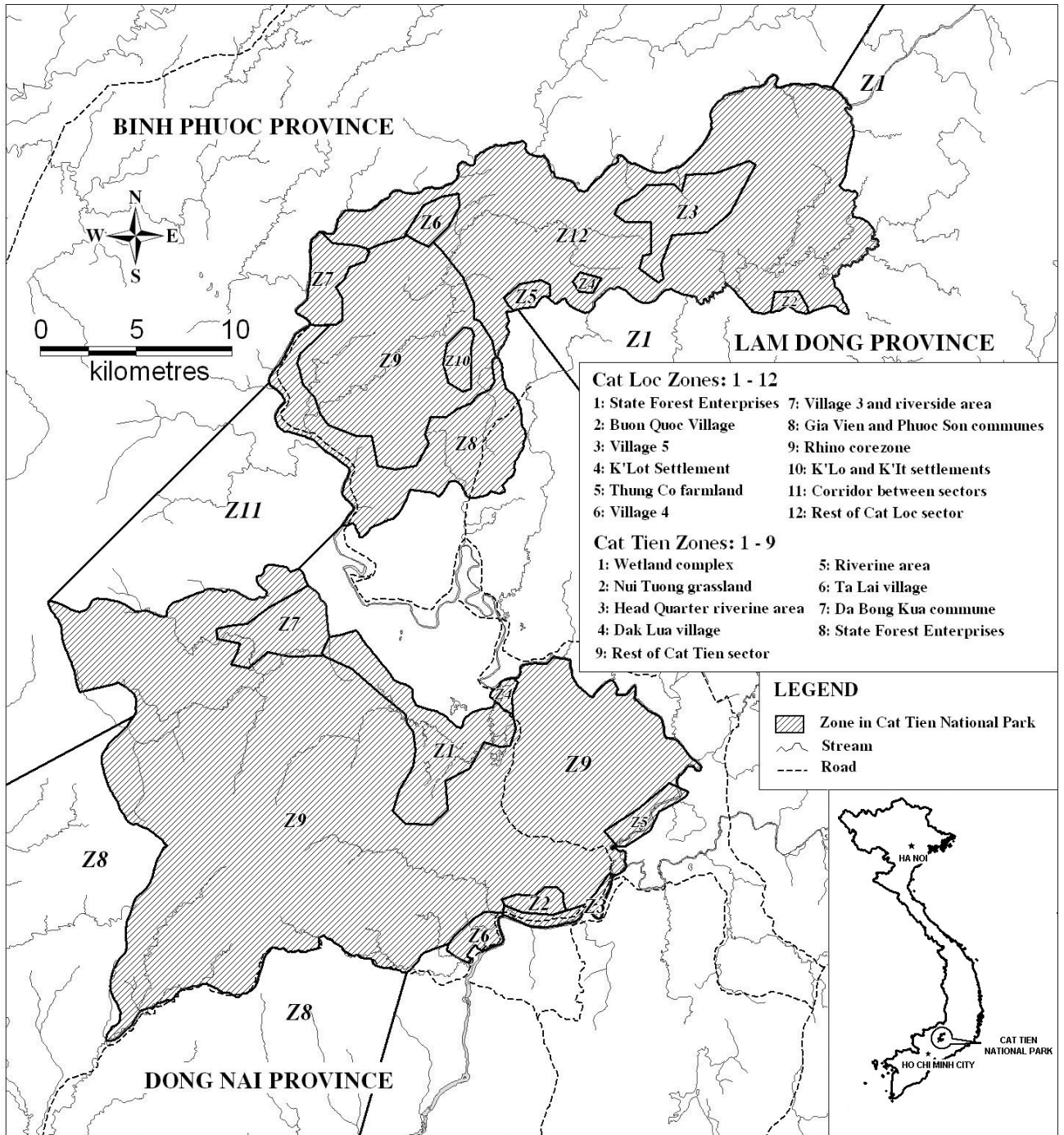
The main rationale for boundary re-demarcation was to clarify the existing confusion over boundaries, as well as simplify and consolidate the park boundary (e.g., through land acquisition) to facilitate patrolling and enforcement (CTNP, 2000). Boundary re-demarcation was also used as an alternative where resettlement was not feasible, as well as to help CTNP focus its conservation efforts on key biodiversity areas.

4.2 Process

The Boundary Re-demarcation and Resettlement Action Plan was based on scientific surveying, park zoning and extensive consultation at all levels. It began with biological and socio-economic surveys to provide information on biodiversity, key species, human populations and conflicts. The information was used to divide CTNP and its surrounding areas into 21 “management zones,” which determined individual villages and known ranges of the most important species or discrete important habitats (e.g., the Crocodile Lake Wetlands Complex) (Map 3). Management options were recommended for each zone, based on whether socio-economic activities conflicted with biodiversity conservation or whether such conflicts could be foreseen in the future (see Annex 2). These options, which included boundary re-demarcation and resettlement, were pragmatic, being directly related to realities on the ground and based on direct consultation with affected communities.

A summary of the management options was then presented to representatives from each of the affected communities and relevant District and Commune officials. The conclusions from this meeting were written into the *Plan for Re-Demarcation and Re-Arrangement of Human Settlements* (CTNP, 2000a) and its *Technical Support Document* (i.e., the Conservation Management Plan; CTNP, 2000). These documents were then presented at a meeting with the Ministry of Agriculture and Rural Development (MARD), provincial People’s Committees and project donors for CTNP (viz., World Bank and Royal Netherlands Embassy), among others. The overall conclusion from the meeting was that if no urgent conservation measures were taken, the biodiversity value of CTNP would be lost in the foreseeable future. MARD agreed to the overall contents of the plan and instructed CTNP to prepare a detailed plan for boundary re-demarcation and resettlement. CTNP spent the next year and a half preparing this plan, based on direct consultation with affected persons to identify preferences, take inventory of land and assets, and formulate development plans for the resettlement sites. In April 2003, the Government of Vietnam agreed to finance 3.3 million USD for the project, while the Royal Netherlands Embassy agreed to fund boundary re-demarcation and resettlement for two pilot villages through the CTNP Conservation Project.

Map 3: Conservation management zones in Cat Tien National Park



Source: CTNP, 2000

4.3 Boundary re-demarcation

Boundary re-demarcation will reduce the total area of CTNP by approximately 10%. It affects the large majority of the population inside CTNP and effectively avoids resettlement for nearly 8,500 people (Table 4.1). These communities will be excised from edge areas with little or no remaining biodiversity value. The main areas are Gia Vien and Phuoc Son in the Cat Loc Sector, the Da Bong Cua Area in Tay Cat Tien, and Ta Lai in Nam Cat Tien (Map 4). They are areas of predominantly Kinh, non-indigenous ethnic minorities and indigenous peoples, respectively. The exception is Village 5, which is a community indigenous peoples critically located in the northeast half of the Cat Loc Sector. It was proposed to be established as an enclave village with a containment strategy because it was deemed too large for resettlement at this time.

The new boundary will be drawn according to natural features as much as possible and marked with posts, signs and “green fences” (i.e., trees). Communities excised through boundary re-demarcation will receive buffer zone status and normal land use rights. CTNP will also acquire some areas of agricultural land that would otherwise continue to stretch like fingers into the park. These households will be compensated according to the same policies and procedures as applied for resettlement, as described below.

4.4 Resettlement

Resettlement will displace approximately 1,000 people (Table 4.1). Resettlement has been proposed for a few small and isolated villages located deep inside CTNP and the ex-military unit of Kinh households on the edge of Nam Cat Tien, which is an integral part of the Bau Sau Wetlands Complex. The other main areas for resettlement are the villages of indigenous peoples that cut across the Cat Loc Sector and the non-indigenous ethnic minority households deep inside Tay Cat Tien (Map 5). Resettlement will also include acquisition of lands from absentee landlords who cultivate land inside CTNP but live outside its boundary. These lands are located mostly around the resettlement villages and in the Nui Tuong area farmed by ex-CTNP staff in Nam Cat Tien. The ethnic distribution of households proposed for resettlement is roughly consistent with the ethnic distribution of households currently living inside the park. However, it is worth noting that ethnic minorities comprise 73% of people displaced by resettlement (33% indigenous, 40% non-indigenous), while comprising only 14% of the national population.

CTNP has agreed to implement resettlement according to World Bank guidelines, which emphasize informed consent and participatory processes, compensation rates determined at replacement value according to local markets, land for land options where available, maintenance of pre-displacement living standards and group relocation (if desired), among others. Indeed, most households have indicated a preference to be resettled as a village and have identified areas in the buffer zone mostly within 10 km of their current settlements. A couple of villages of indigenous peoples, K’lut and Village 4, have been proposed to move into the Village 5 enclave. Two other villages of indigenous peoples, K’lo-K’it and Thung Co, will be assisted to regain lowlands that they previously occupied. As a result, the project will also have to resettle people currently living in the buffer zone to make room for people resettling out of the park.

In preliminary consultation, only Village 4 has refused resettlement, while mixed reports have been given on the interests of Village 3. Both of these villages consider their current settlements as ancestral territories. The remaining villages have indicated initial consent, provided that they can agree with the compensation and resettlement arrangements. Boundary re-demarcation and resettlement of two pilot villages, K’lo-K’it and Thung Co, are currently in implementation.

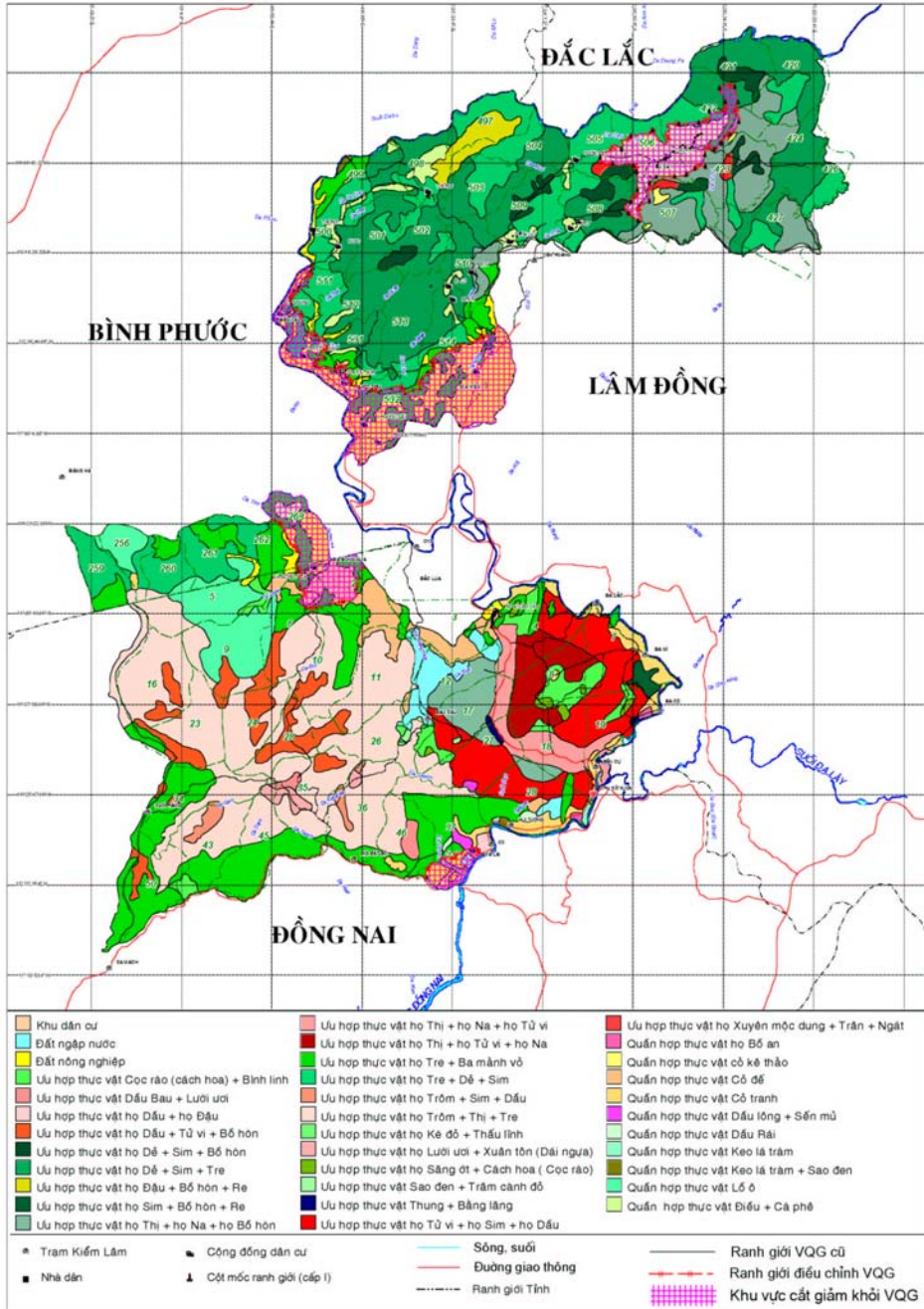
Table 4.1: Overview of Boundary Re-Demarcation and Resettlement Action Plan

LOCATION	Boundary Re-Demarcation Area				Resettlement Area			
	Area of land to be excised from CTNP		Area of agricultural land remaining inside CTNP to be seized		Area of land to be seized from people being resettled		Area of agricultural land operated by people outside CTNP to be seized	
	Area (ha)	HH (people) excised	Area (ha)	HH affected	Area (ha)	HH (people) affected	Area (ha)	HH affected
DONG NAI PROVINCE	1,126	1,341 (315)	0	0	44.5	217 (40)	67.1	8
Village 4 – Dac Lua Commune	0	0	0	0	44.5	217 (40)	0	0
Nuoi Tuong area – Dac Lua Commune	0	0	0	0	0	0	67.1	8
Village 4 – Talai Commune	360	1,341 (315)	0	0	0	0	0	0
Da Bong Cua area – Dac Lua Commune	766	0	0	0	0	0	0	0
BINH PHUOC PROVINCE	831	1,588 (292)	28.3	26	129.8	420 (94)	0	0
Da Bong Cua area – Dang Ha Commune	831	1,588 (292)	28.3	26	129.8	420 (94)	0	0
LAM DONG PROVINCE	5,969	5480(1074)	128.6	51	544.0	410 (83)	140.0	36
Phuoc Hai – Phuoc Cat 2 Commune	?	2,297 (429)	0	0	0	0	0	0
Phuoc Son – Phuoc Cat 2 Commune	?		74	27	0	0	0	0
Phuoc Thai – Phuoc Cat 2 Commune	?		54.6	24	0	0	0	0
Phuoc Trung – Phuoc Cat 2 Commune	?		0	0	0	0	0	0
N.Q. Vinh Ninh – Phuoc Cat 2 Commune	?		0	0	0	0	0	0
Village 3 – Phuoc Cat 2 Commune	0	0	0	0	124.0	139 (27)	0	0
Village 4 – Phuoc Cat 2 Commune	0	0	0	0	131.0	93 (18)	0	0
Van Minh – Gia Vien Commune	?	2,100 (420)	0	0	0	0	0	0
Thanh Tien – Gia Vien Commune	?		0	0	0	0	0	0
Tan Xuan – Gia Vien Commune	?		0	0	0	0	0	0
Cao Sinh – Gia Vien Commune	?		0	0	0	0	0	0
K'Lo – K'it – Gia Vien Commune	0	0	0	0	98.0	83 (18)	43.0	10
Village 5 – Tien Hoang Commune	1,800	1,083 (225)	0	0	0	0	0	0
K'Lut – Tien Hoang Commune	0	0	0	0	121.0	44 (9)	0	0
Thung Co – Tien Hoang Commune	0	0	0	0	70.0	51(11)	97.0	26
TOTAL CTNP	7,926	8,409 (1,681)	156.9	77	718.3	1,047 (217)	207.1	44
PERCENT CTNP	88%	83%	2%	4%	8%	11%	2%	2%

Map 4: Overview of New Boundaries in Cat Tien National Park

Areas to be excised are chequered.

BẢN ĐỒ QUY HOẠCH LẠI RANH GIỚI VQG CÁT TIÊN



4.5 Intended outcomes and impacts

If boundary re-demarcation and resettlement are successful, CTNP will be able to clarify and re-affirm its boundary, consolidate its existing natural habitat (despite losing 10% of its total area) and have possibilities to expand into adjacent SFEs to enlarge the total area of contiguous forest. For communities, households will have formally recognized land use rights and displaced communities will be closer to markets, public services and infrastructure. In this scenario, both the park and local communities will be better off.

However, if resettlement, in particular, is unsuccessful, displaced persons could suffer severe impoverishment, as has been seen in other resettlement projects in Vietnam and Southeast Asia, which could also have negative consequences for CTNP and surrounding forests. Destabilization could lead to increased pressure on natural resources and new forest clearing, as communities struggle to re-establish their livelihood base. Poverty could lead to more pressure on the park as people resort to more desperate and urgent means of income, such as selling fuelwood, burning charcoal, cutting timber and poaching. An unsuccessful resettlement project could also result in deteriorated relations between forest guards and the local community, eroding local support for the park and complicating enforcement. A key assumption for both boundary re-demarcation and resettlement is that CTNP will be able to enforce the new boundary and prevent further encroachment and forest clearing. This has not always been the case in similar projects for protected areas and must be understood as a key risk to the current project. In this scenario, the displaced people are clearly worse off and the park and forests are at risk.

The Boundary Re-demarcation and Resettlement Plan at CTNP has employed various measures to achieve the successful scenario. First, the Plan was based on realistic and scientifically-informed planning, although the specific necessity of resettlement may be debated. Second, the project minimized resettlement through boundary re-demarcation and has applied international guidelines to help ensure that no person will be worse off because of resettlement or land acquisition. Third, the Conservation Project has promoted voluntary agreements with affected communities in the sense that no village should be forced to resettle. However, whether villages will be truly able to exercise this right in the coming time has yet to be seen. CTNP also has a number of tree-planting and forest protection projects for re-greening the evacuated areas and establishing “green fences.” Displaced persons will receive priority for tree-planting and forest protection contracts to reduce the risk of them, or other people, moving back into the evacuated areas, as well as provide them with additional income during the transition period.

CTNP is still also faced with the challenge of developing an effective containment strategy for Village 5, and quite possibly also for Village 4. CTNP will need to work with these villages to develop such measures as community forestry programs, forest protection contracts, eco-tourism and involvement in wildlife and natural resource monitoring. Once the majority of villages and absentee landlords are resettled outside of CTNP, there may be more scope for such initiatives, despite a non-supportive legal framework. For the time being, resettlement is being proposed to affected villages as a opportunity to improve livelihoods and socio-economic development, as well as conservation of CTNP. If some villages refuse, then CTNP may be required to consider other options more fully.

5 FORESTS IN THE LARGER LANDSCAPE

Immediately adjacent to CTNP are a number of State Forest Enterprises (SFE), operating at various levels, where CTNP, WWF and provincial government have already begun to scope out possibilities for improved forest management and resolution of the current land-use conflicts with local communities. Beyond the immediate region of CTNP, WWF is also exploring similar ideas for the larger South East Agro-ecological Region (SEAR), which contains over 30 protected areas and SFEs, as well as substantial areas of natural and semi-natural forest managed by commune and district authorities. Working at the landscape level has potential benefits for both conservation and development. For example, managing CTNP in co-ordination with contiguous

forest areas that allow for less stringent conservation regimes offers more potential for the ranging of large mammals inside and around CTNP. On the development side, opportunities may exist for communities to benefit from sustainable forest enterprises, such as bamboo harvesting. A process of analyzing current on the ground realities and developing a range of management options that would re-arrange current land uses, as was done for the CTNP, could yield many positive results for more effective conservation and development in the region.

5.1 State Forest Enterprises

Field surveys reveal substantial forest blocks adjacent to CTNP (Map 6). Most of these forests are managed as logging concessions by the five State Forest Enterprises (SFEs) bordering on CTNP, although large areas of these SFEs have been out of operation since the government's partial ban on logging in 1992 (Map 7). In addition, there are large tracks of natural and semi-natural forests that are managed by communes and districts. Several of the SFEs are highly populated and large areas have been converted into agricultural land. Because these communities live within the SFEs, they are without legal land rights and have no long-term land security. The SFEs around CTNP provide challenging but potentially rich opportunities to improve conservation effectiveness within the CTNP region, while providing a wider range of options to involve local communities directly in forest conservation and resolving conflicts over land and natural resource use.

For example, economically unviable SFEs could hand-over agricultural lands to the farmers operating them and set clear conservation standards for the areas with important biodiversity values. The latter could include forms of internationally certified¹ sustainable wood harvesting, which can attract higher prices on the international market. At the least, these forest areas should include regulations and restrictions on extracting wildlife. Certain areas in some SFEs are in good ecological condition and probably have conservation values of regional or international significance, for which the establishment of formally protected areas may be preferred. In other areas, co-managed conservation regimes between local communities and SFE authorities could be negotiated, ranging from limited sustainable harvesting of resources to complete transfer of management under contract.

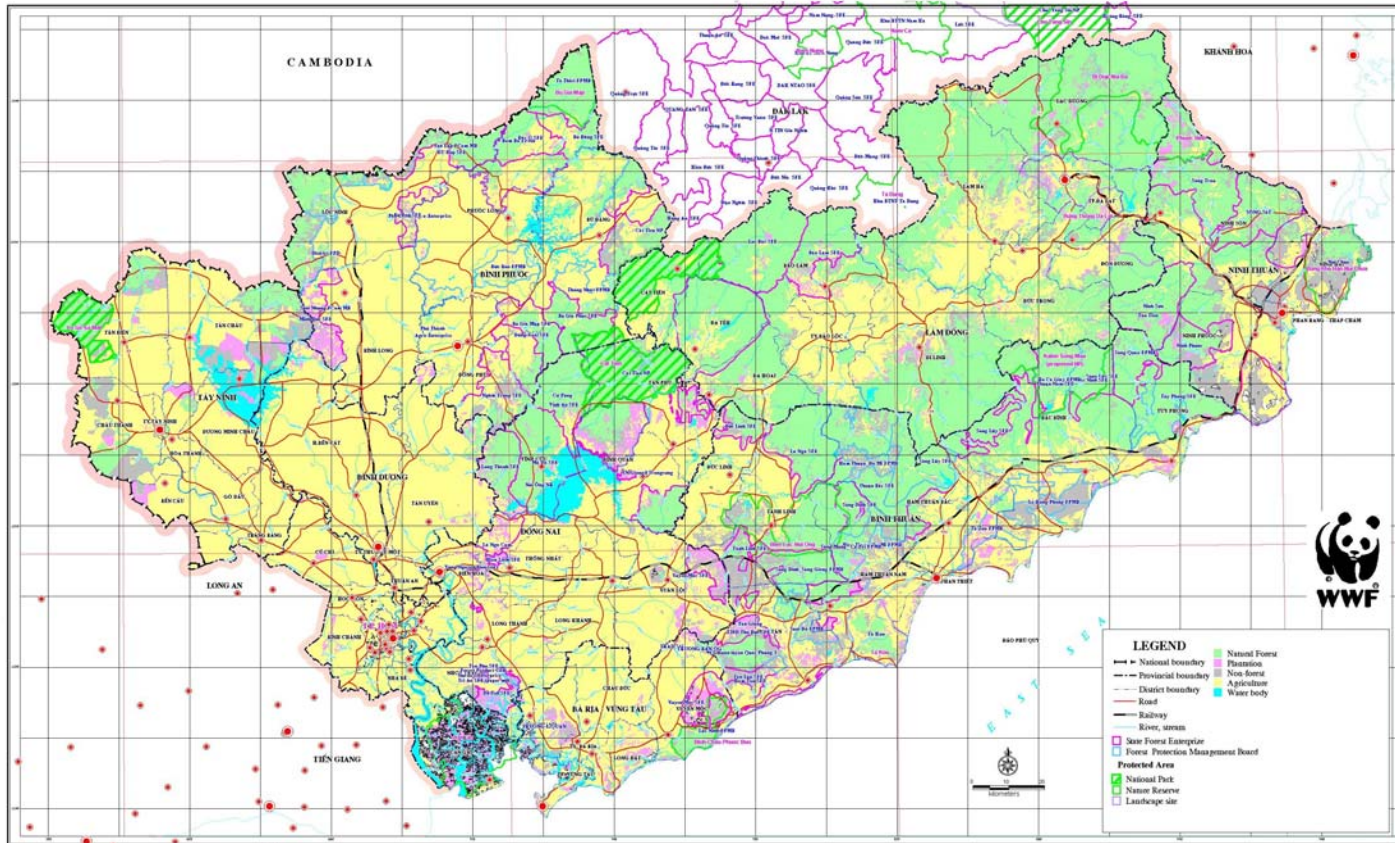
5.2 The Vinh Cuu Trail

The CTNP Conservation Project is currently exploring these options in three SFEs, referred to as the Vinh Cuu Trail. Dong Nai Province requested WWF to investigate the biodiversity importance and socio-economic situation in Vinh An, Ma Da and Hieu Liem SFEs. The SFEs have been logged, but have been out of operation since 1996. A sizeable part of the SFEs has been planted with non-indigenous *Acacia* and *Eucalyptus* trees for wood and pulp production. Bamboo is harvested in Vinh An for a factory employing about 200 people. SFE employees and spontaneous migrants have converted other parts of the SFEs into agriculture, although without legal land title. Field surveys revealed that important regenerating forest stands remain and are contiguous with Nam Cat Tien. CTNP's elephant population makes extensive use of these SFEs (Sukumar *et al.*, 2002) and effective conservation of these forests is deemed vital for the survival of other large mammals. Gaur, Black-shanked Douc Langur, Yellow-cheeked Crested Gibbon and several threatened Phasianidae, including the endemic Orange-necked Partridge, also have been confirmed to use these forests. However, wildlife is unprotected within the SFE and hunting occurs at a considerable intensity.

¹ Such as operated by the Forest Stewardship Council.

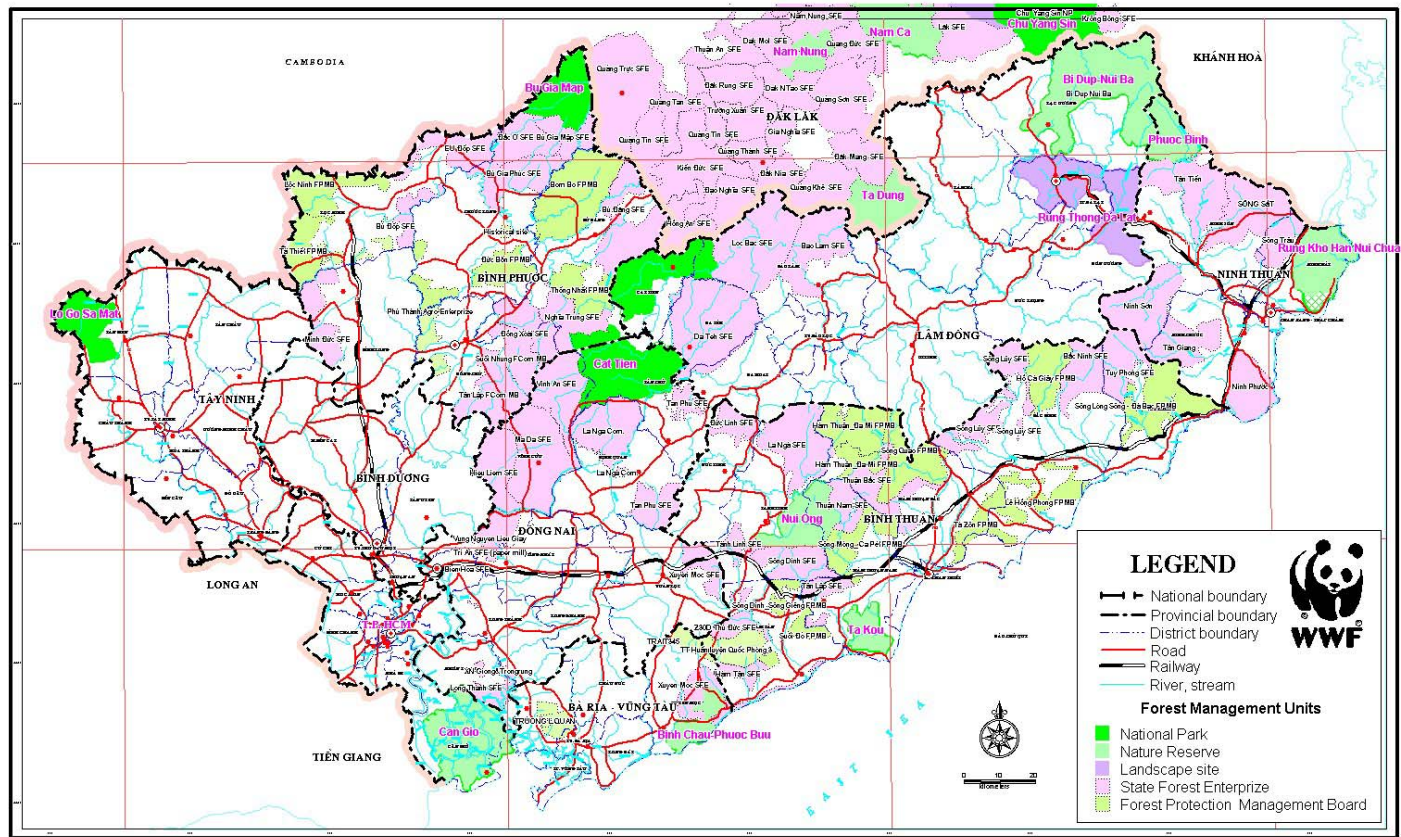
Map 6: Forest cover in the South East Agro-Ecological Region (2000)

FOREST COVER (FIELD SURVEY- FI2000) AND FOREST OWNER IN SOUTH EAST REGION



Map 7: Administrative Units and Forest Management Units in South East Agro-Ecological Region

ADMINISTRATIVE UNIT AND FOREST MANAGEMENT UNITS IN SOUTH EASTERN-LAND REGION



It has been proposed to convert the biologically important areas inside the SFEs into a new protected area contiguous with CTNP, provisionally named the Vinh Cuu Nature Reserve. The agricultural lands inside the SFEs have been proposed to be handed-over to the farmers currently operating them and placed under the commune's authority, enabling people to receive legal land title. Solutions are still being sought for the bamboo factory. Harvesting currently takes place in the richest parts of the forest and causes considerable disturbance because of noise and road construction. It has been proposed to shift bamboo harvesting closer to the factory by establishing community-operated bamboo plantations that would act as a buffer between the existing agricultural land area and the new nature reserve.

Clearly, local communities will benefit from the security of land tenure and could make important gains from the bamboo plantations. Another proposed development benefit for local communities from the Vinh Cuu Nature Reserve is tourism. The reserve contains a tunneled army base used by the revolutionary forces in the American War and will be contiguous with the Tri An hydro-electric reservoir, which is already established as a tourist attraction. The area earmarked as the tourism zone contains minimal biodiversity value and could support large numbers of visitors. It is also situated at a relatively short distance from the heavily urbanized Bien Hoa–Ho Chi Minh City area and could provide for the growing demand in outdoor recreation areas. Developing mass tourism in this area could also relieve tourism pressure from CTNP, whose biodiversity values are much more sensitive.

5.3 South East Agro-Ecological Region

Beyond the CTNP region is the larger South East Agro-ecological Region² (SEAR), which contains a mix of protected areas, SFEs, district- and commune-managed forests, and agricultural land. Hence, a sizeable area of natural and semi-natural habitats exists in the wider landscape. About twelve protected areas are situated in the SEAR. Including CTNP, their total area is around 365,000 to 375,000 ha (Annex 3). About 45 SFEs have been identified in the SEAR (Annex 3). Over three-quarters of the forest in the SEAR is found in three provinces (Binh Thuan, Dak Lak, and Lam Dong). Natural forests account for 83% of this total. In all provinces other than Ba Ria – Vung Tau, Binh Duong, and Ho Chi Minh City, the area of natural forest exceeds that of plantations. In recent years, official figures show that there has been little change in the area of natural forest. However, the area under plantation has increased in nearly all provinces, most dramatically in Binh Duong, Binh Phuoc, Binh Thuan, and Lam Dong provinces.

Most of the protected areas have substantial numbers of people living and farming within their boundaries. Biodiversity values in several of them are seriously threatened. The same applies to the SFEs. All in all, it is clear that boundaries of most protected areas are not functional. In several instances, important biodiversity values exist, but conservation is poorly managed and encroachment is a serious threat. In other instances, protected areas contain established agricultural lands and are poorly designed. WWF is currently exploring the possibilities of developing conservation strategies for the agro-ecological region, based on the approach used in CTNP. Based on solid biological information and taking into account the socio-economic realities on the ground, this process should attribute appropriate land-use functions to clearly defined areas. WWF's priority is to halt further forest cover loss and conserve threatened wildlife species, but wider discussions with the broad spectrum of stakeholders managing and benefiting from forests may show that an effective conservation strategy also has a wider range of benefits.

Forests in the agro-ecological region could include the following categories:

- Strictly protected areas to conserve significant biodiversity values;

² The South East Agro-Ecological Region refers to terminology used in the Government of Vietnam's 5 Million Hectare Programme and the related Forest Sector Support Programme agreed with an alliance of institutional donors (GoV, 2001). The Zone consists of Lam Dong, Binh Thuan, Ninh Thuan, Dong Nai, Tay Ninh, Ba Ria – Vung Tau and Binh Phuoc Provinces.

- De-gazettement of areas at fringes of protected areas, where agricultural lands have been established (agricultural enclaves within protected areas should be avoided to maintain connectivity among areas of biodiversity importance);
- Protected areas that permit sustainable harvesting of designated products by local communities;
- Areas in SFEs with significant biodiversity values converted into protected areas;
- Agricultural areas in SFEs handed-over to local communities;
- SFEs with a sustainable logging regime for the international market, with or without sustainable harvesting regimes for non-timber forest products by local communities; and
- SFEs handed-over to local communities for sustainable harvesting of wood and non-timber forest products.

Pursuing such a process should ultimately result in an integrated network of formally protected areas, commercially operated logging concessions, forests managed and co-managed by local communities within a landscape of agricultural production. Such a network should aim at conserving critical biodiversity values, while providing key development benefits to the regional economy, as were discussed for the CTNP region. Different land-use objectives should be clearly defined for each area, which is perhaps what is lacking most in the current land-use arrangement. The possibility of connecting separate protected areas via forest “corridors” with less stringent conservation regimes holds much promise for biodiversity conservation, especially for large mammals. It would also allow for a larger range of options for communities to be involved directly in the management of these forests. Conversely, losing biological connectivity to an archipelago of isolated protected areas will increase challenges for biodiversity conservation.

6 CONCLUSION

The current dilemma between conservation and development agendas for land and forest use inside Cat Tien National Park (CTNP) is typical of many protected areas in Vietnam and Southeast Asia. CTNP and WWF have initiated a process to assess effectively, determine priorities and re-arrange current land uses inside and around CTNP. The ultimate objective of the process is to provide for more effective conservation, while not making any person worse off because of it. Indeed, the process intends to resolve many of the constraints and hardships that these communities suffer from living inside a protected area. The application of the approach is also being explored for State Forest Enterprises (SFE) around CTNP, notably the Vinh Cuu Trail, and the larger South East Agro-Ecological Region (SEAR). Effective management of the forest complex in these areas could have important benefits for biodiversity conservation, as well as local and regional development.

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ANNEX 1: IDENTIFIED THREATS TO BIODIVERSITY VALUES OF CTNP

Threat Matrix 1: Indirect Threats

THREAT	DESCRIPTION	SOURCE
Increasing population in the buffer zone	As with overpopulation inside the Park (below), population increases in the buffer zone increases the indirect sources for most threats that result from human pressures. Increasing population in the buffer zone can be sub-divided into: (1) Natural growth, and (2) Immigration.	Natural growth is now the greatest cause of population increase in the buffer zone.
Overpopulation inside the Park	One of the most important conservation issues for the Park (that is also the indirect source for many other threats) is a large human population living within its boundaries.	All sites of encroachment and villages 3, 4, 5, K'Lo K'It, Buon Quoc, K'Lut, and Thung Co.
Demand for agricultural land	With a growing human population and economy the demand for agricultural land also increases.	Buffer zone.
Demand for wild meat	Many restaurants in Vietnam offer wild meat. With increasing incomes there is a growing demand for wild meat as a luxury dish.	A proportion of the population of Vietnam occasionally eat wild meat in restaurants.
Geographic isolation	As the connecting habitat between existing protected areas is lost, remaining areas of habitat effectively become habitat islands in a fragmented landscape. Geographic isolation from other habitats severely limits species dispersal and ecological processes over large spatial scales. Additionally, habitat islands can only support a few individuals of species that require large areas of habitat (such as Tigers, Rhinos, Elephants etc.). As a small number of individuals are not a viable breeding population, habitat islands undergo 'species thinning', where species requiring large areas are eventually lost from the habitat island over time.	Loss of connecting habitat between existing protected areas through expansion of agricultural land and encroachment.
A lack of coordination between government bodies in land designation	Land designated as agricultural within a national park are not under the full control of national park management. National parks only control land designated as forestland. Poor coordination between different government bodies and different government levels results in an emphasis on development instead of conservation in the agricultural lands within the national park.	MARD.
Limited government budget for maintenance	Although Government budgets are available for infrastructure and other activities, there are limited allocations for maintenance that results in the useable life of structures and equipment being shortened and eventually requiring greater funds to be replaced.	MARD.

Threat Matrix 2: Direct Threats

THREAT	Ranking Categories			TOTAL RANK	DESCRIPTION	SOURCE
	Intensity	Area	Urgency			
Encroachment and habitat loss	1	2	3	1	The conversion of forestland into agricultural land further diminishes available habitat for endangered species. One such example is the string of new settlements within the protected area, established between 1990 and 1998 that have prevented rhinos from ranging into about 85% of their habitat. In addition to the direct loss of wildlife habitat, encroachment increases access to the remaining forests beyond and extends the area of forest degraded by livestock grazing and collection of forest products. Encroachment will be an even greater threat in the future if the Vietnamese Government implements a master plan for population increase in rural areas that will increase the demand for agricultural land.	Critical sites of encroachment are in Dak Lua, Da Bong Cua, Ta Lai, and Cat Loc.
Hunting	3	1	2	2	Hunting and fishing do not only harm the species targeted. Snares that are not strong enough to hold the largest key mammal species can still cause injuries to them, especially to young animals. The presence of hunters and fishermen also causes disturbance to wildlife, which can reduce their access to key habitats such as saltlicks and wetlands. Hunting can be sub-divided into: (1) Hunting for market; and (2) Hunting for own consumption. Hunting can also be sub-divided into: (3) Hunting of rare species. Rare species are often hunted opportunistically. All rare species hunted are sold to the market. The continual poaching of Siamese Crocodiles threatens the success of their re-establishment that would result in a repeated extinction of their local population; and (4) Hunting of common species. Most common species hunted are sold to the market, with wild meat offered in many restaurants throughout Vietnam.	Small group of repeat offenders. No specific ethnic group. Hunters mostly poor, but traders are rich. Rare species often hunted opportunistically. Hunting for own consumption is not easy to distinguish, as caught hunters usually say that it is for their own consumption. Often fishing is for own consumption.
Invasive species	2	3	4	3	The key invasive species that threatens habitats within CTNP is <i>Mimosa pigra</i> . As seeds of this plant are transported in the water, all aquatic sites are at risk.	For <i>Mimosa pigra</i> : all waterways, especially Bau Sau Wetland Complex, including Bau Chim, and along the banks of the Dong Nai River.
Release of non-native animals	4	4	1	4	Non-native animals can spread disease, compete with native species, and if they interbreed, can compromise the gene pool of native species. Rhesus Macaques were introduced to CTNP in 1998. They are a non-native species that pose serious threats to the unique primate community of CTNP through inbreeding and hybridisation, direct competition and disease transfer. Introduced pacu from South America are now being raised in many fish farms in the buffer zone. This species could potentially negatively impact on all connecting aquatic ecosystem if they escape into the Dong Nai River system and establish a wild population.	The FPD handle confiscated animals brought to the Park, and a lack of species knowledge by staff can result in non-native and diseased animals being released. Another source is farmed species that escape and establish in the wild (e.g. common carp). Pacu are raised in fish farms in most communes surrounding CTNP. The greatest sources for pacu are suppliers in Dong Nai and Binh Duong provinces.
Collection of non-timber forest products (NTFPs)	11	5	5	5	Collection of NTFPs can be sub-divided into: (1) Collection of rare NTFPs. Species targeted include rattan (often locally rare through over-exploitation) and certain rare tree species in the fruiting season, where the whole tree is cut down to collect the fruit. Resin tapping was ubiquitous in the past and still occurs over large areas, probably leading to the death of the large dipterocarps targeted; and (2) Collection of common NTFPs. Collection of products, such as bamboo and various food and medicinal plants is common. Although the collection of forest products presently has a relatively minor impact, the high population density around CTNP means that this activity has the potential to cause serious habitat degradation if not kept in check. The mere presence of people collecting forest products causes disturbance to wildlife and increases the potential for opportunistic hunting.	As with hunting, collectors of NTFPs are local residents who are mostly poor.

Grazing of cattle	10	8	6	6	Cattle grazing inside and around CTNP increase the chances of the spread of domestic diseases to populations of wild ungulates as well as competing directly, or indirectly, for key resources. Additionally, all villages nearby have domestic pigs, which not only can spread foot and mouth disease, but also readily interbreed with wild pigs thus changing the wild genetic stock.	The main sites of cattle grazing inside CTNP are at Ta Lai, Dak Lua, Phuoc Son, Da Bong Cua, Village 3, Village 4, and Dang Ha area.
River bank erosion	6	10	8	7	River bank erosion is caused by the loss of riparian trees and vegetation, and where sand is dredged. River bank erosion will increase in the future if more money is invested in sand dredging.	Critical sites for erosion are along the Dong Nai River between Dak Lua and Village 3, especially by Phuoc Son.
Uncontrolled tourism	8	12	7	8	Negative impacts from tourism results from large and uncontrolled groups of visitors that are especially a concern for specific habitats of a high conservation value. Uncontrolled tourism can be sub-divided into: (1) Litter; (2) Noise; and (3) Collection of forest products.	Lack of enforced tourism zonation by CTNP. Negative impacts mainly restricted to Vietnamese tourists who prefer to visit in large numbers and have a low awareness about impacts. Litter is often left by large groups of visitors. Excess noise is mainly produced by large groups and especially Vietnamese students who like entertainment/music. There is also the risk of foreign tourists who specialize in collecting insects.
Forest fires	5	11	11	9	Fires are restricted to grassland and forest edge sites in the dry season.	Fires are mostly started by humans for four main reasons, which are: (1) Hunters attracting game (most common); (2) Acts of revenge by caught poachers; (3) Carelessness by locals; and (4) To encourage grass growth for cattle grazing. Ageing grasslands build up a ground layer of dry matter that acts as a catalyst for the spread of fire.
Weapons not controlled	15	6	10	10	Firearms are mainly homemade.	Concentrated in Da Bong Cua, especially Tay and Dao. In Dak Lua FPD have a list of suspected households. However, used all over CTNP.
Development impacts inside CTNP	9	13	9	11	Development impacts inside CTNP can be sub-divided into: (1) Uncontrolled infrastructure. New structures can impact negatively on a site by the increased disturbance and waste produced. New and upgraded roads provide increased access for poachers; (2) Remnants of construction, where waste and materials are not cleared; and (3) Sourcing of construction material within CTNP, where the excavation of soil and use of wood disturbs habitats.	CTNP management.
Pollution of water	12	7	12	12	Chemicals are heavily used in agricultural areas, including rice paddy, which are connected to CTNP through waterways. Certain areas of CTNP were also heavily sprayed with chemical defoliants during the American War. The presence and impact of chemicals are unknown.	Agricultural chemical use by farmers in surrounding buffer zone. Historic use of chemical defoliants.
Planned dams	7	9	15	13	There are three dams planned along the Dong Nai River within the region of CTNP: Dong Nai dams 3, 4 and 8. Dong Nai 3 and 4 would be located upriver from CTNP and will flood a very rare intact riverine forest block. The forests along Dong Nai River are thought to link the southern lowland forest mammal habitats and the northern plateau forest mammal habitats, and if flooded will disrupt this probable migration route. These dams may also cause a reduction in peak discharge of the Dong Nai River. Peak discharges cause a reverse flow in the Dak Lua stream, thus feeding water into the Bau Sau Wetland Complex within Cat Tien National Park. A reduction in peak discharge in the Dong Nai River therefore may lead to a reduction in the size of this important wetland, with implications for migratory and resident waterbirds, fish, and grazing mammals. Dong Nai 8 would be located downriver from CTNP and flood an area of CTNP's southern boundary. Although ranked lower in comparison to other threats, there needs to be special focus on planned dams because of their potential impact and as the Vietnam Electrical Authority have recently approved the feasibility plans for Dong Nai 3 and 4.	Vietnam Electrical Authority.

Human-wildlife conflicts	14	14	13	14	Where wild animals disturb human activities outside the CTNP boundary.	Elephants: Ta Lai, Dat Do, Thanh Son. Wild Boar: Phuoc Cat 2 and where the forest edge is close to agriculture (related to encroachment).
Mining	13	15	14	15	Small-scale gold mining.	Mining is restricted to areas near Dat Do where gold mining is carried out by a small group of local residents who have issued permits.

Note: The direct threats (below) were ranked in order to highlight the most critical threats. The rank given to each threat (the lower the number, the more critical the threat) is based on the methods of Margoluis & Salafsky (2001), where each threat is ranked for its intensity (the severity of the impact to a habitat), area (the number and proportion of habitats affected), and urgency (how soon will the threat happen). The score in each category was summed for a total score for each threat, from which all threats could be ranked (total rank). Threats were ranked by: park staff during a workshop; in a survey to all staff; against FPD violation records; and during evaluation of the draft document. The most critical direct threats to CTNP are encroachment and habitat loss, and hunting.

**ANNEX 2: EVALUATION OF BIODIVERSITY VIS-A-VIS SOCIO-ECONOMIC ACTIVITIES
(Modified after CTNP, 2000)**

NUMBER	MANAGEMENT ZONE	BIODIVERSITY VALUE	SOCIO-ECONOMIC ACTIVITIES	CONSERVATION MANAGEMENT ACTION REQUIRED
1	Loc Bac & Da The SFEs neighboring CTNP	Important regional value, especially riverine forest and corridors for large cats	Logging concession under logging ban (people settled & farming?)	Biodiversity & Socio-Economic Survey in order to establish new protected area where conservation value is high and provide people with secure land titles where agriculture is established.
2	Buon Quoc Village	No value (all forest converted into agricultural land)	30 people, 6 households, 10 ha cashew	Resettle hamlet to Village 5 zone.
3	Village 5	No value (all forest converted into agricultural land) but adjacent to high value area 12	1,014 people, 209 households, 472 ha cashew & coffee	Demarcate sub-boundary around permanent Village 5.
4	K'Lut Village	No value (all forest converted into agricultural land) but adjacent to high value area 12	39 people, 9 households, 44 ha cashew	Resettle hamlet to Village 5 zone.
5	Thung Co Village	No value (all forest converted into agricultural land) but adjacent to high value area 12	125 people, 27 households, 69 ha cashew	Resettle hamlet to Gia Vien Commune.
6	Village 4	No value (all forest converted into agricultural land) but adjacent to high value area 9	84 people, 15 households, 103 ha cashew	Resettle hamlet to Village 5 zone.
7	Village 3	No value (all forest converted into agricultural land) but adjacent to high value area 9	125 people, 21 households, 89 ha cashew	Resettle hamlet to Dong Nai Commune – Binh Phuoc Province (= area where people originate from).
8	Gia Vien & Phuoc Cat 2 Commune settlements	No value (all forest converted into agricultural land)	4,489 people, 903 households, 2,553 ha cashew & coffee & wet rice & other wet and dry crops	Change and demarcate Park boundaries so that agricultural area is excised from Park. Small pockets of agricultural land remaining in park to be compensated.
9	Core Rhino Range	Last known range of critically endangered <i>Rhinoceros sondaicus annamiticus</i> . Known range of endemic Orange-necked Partridge. Known range of endangered Yellow-cheeked Crested Gibbon, Black-shanked Douc Langur and Gaur. Strong indications of presence of Tiger and / or Leopard. Good quality forest stand	Poaching, NTFP collection, traffic to isolated Village 4 and 3	Strict protection.
10	K'Lo – K'It Village	No value (all forest converted into agricultural land)	70 people, 15 households, 53 ha cashew	Resettle hamlet to Tien Hoang Commune (= area where people originate from).
11	Corridor Nam Cat Tien and Cat Loc sectors of CTNP	Corridor would connect Nam & Tay Cat Tien and Cat Loc sectors of Park. Of special importance for large cats and rhinoceros.	Completely occupied; all lowland brought under rice paddy agriculture	Stop further in-migration. Corridor not feasible any longer.
12	All other forested areas in Cat Loc sector	Known range of endemic Orange-necked Partridge and Germain's Peacock Pheasant. Known range of endangered Yellow-cheeked Crested Gibbon, Black-	Poaching, NTFP collection, traffic to isolated Village 4 and 3	Strict protection, especially for large cats and primates.

		shanked Douc Langur and Gaur. Strong indications of presence of large cat (Tiger and/or Leopard). Good quality forest stands intersected by poorer vegetation.		
13	Bau Sau wetland complex	Largely intact forest wetland ecosystem, unique to lowland southern Vietnam, with permanent open-water bodies and seasonal marshes. Critically endangered Siamese Crocodile re-introduced. Indications of presence of critically endangered White-winged Duck. Dry-season refuge for endangered Gaur.	Fishing	Strict protection. Pursue RAMSAR Convention recognition.
14	Nui Toung grasslands	Floodplain grasslands with relatively high concentration of Sambar and Eurasian Wild Pig.	Poaching	Strict protection, especially for Sambar. Preventive burning of grasslands, also to provide food for ungulates.
15	Forest fringing Dong Nai River	Remnant riverine forest, heavily degraded.	+/-100 ha Fruit gardens of ex-Park staff	Convert fruit farms into indigenous species forest.
16	Dak Lua Village 4	No value (all forest converted into agricultural land). But adjacent to area of high conservation value (21).	245 people, 40 households, 51 ha wet rice & various dry crops. Cattle graze inside Park.	Immediately stop cattle entering Park. Resettle hamlet to Dak Lua Commune.
17	Riverine Islands area	High conservation value due to primates and intact riverine forest.	Poaching	Strict protection, especially for primates.
18	Talai Village	No value (all forest converted into agricultural land). But adjacent to area of high conservation value (21).	1,341 people, 315 households, 283 ha wet rice & cashew & coffee & various other dry crops	Change and demarcate boundary so that hamlet is excised from Park.
19	Da Bong Cua Village	No value (all forest converted into agricultural land). But adjacent to area of high conservation value (13 & 21).	2,008 people, 412 households, 328 ha wet rice & cashew & various other dry crops. High incidence of violations (poaching).	Change and demarcate boundary so that half of area is excised from Park. Resettle 200 households to SFE in Binh Phuoc Province.
20	SFEs neighboring CTNP	Large parts of re-generating forest of biodiversity importance (especially primates, Gaur and Asian Elephants).	Logging concession under logging ban (people settled & farming)	Biodiversity & Socio-Economic Survey in order to establish new protected area where conservation value is high and provide people with secure titles where agriculture is established
21	All other forested areas in Nam & Tay Cat Tien sector	High conservation value because last representation of lowland tropical forest in southern Vietnam with primates, endemic birds, Gaur and Asian Elephant.	Poaching.	Strict protection.

ANNEX 3: PRIORITY FOREST AREAS IN THE SEAR

Forest Management Unit	Total area (and area of production forest for SFEs)	Adjoining Special-Use Forests	Adjacent to major river, reservoir, or lake (or plays an important role in watershed protection)	Known or potential biodiversity value
Ba Ria – Vung Tau Province				
Binh Chau - Phuoc Buu NR	11,293	No	No	
Xuyen Moc SFE	?	Yes (Binh Chau – Phuoc Buu NR)	No	
Binh Phuoc Province				
Bom Bo FPMB	?	No	Yes	
Bu Dang SFE (Bamboo)	30,121 (14,885)	Yes (Cat Tien NP)	Yes	
Bu Gia Map NP	26,032	No	Protects part of watershed of the Dong Nai River	
Bu Gia Map SFE	10,236 (4,162)	Yes (Bu Gia Map NP)	Yes	
Bu Gia Phuc SFE	?	No	Yes	
Dak O SFE	15,216 (8,022)	Yes (Bu Gia Map NP)		
Dong Xoai SFE	16,758 (10,059)	Yes (Vinh Cuu NR)		
Duc Bon FPMB	21,122 (66)	No	Yes	
Nghia Trung SFE	17,442 (6,569)	Yes (Vinh Cuu NR)		
Suoi Nhung F Com MB	13,511 (4,520)	Yes (Vinh Cuu NR)		
Tan Lap F Com MB	10,834 (2,446)	Yes (Vinh Cuu NR)		
Thong Nhat FPMB	15,025 (983)	Yes (Cat Tien NP)		
Binh Thuan Province				
Bac Ninh SFE	?	No	Yes (Ca Giay Irrigation Reservoir)	Converted to Kalon – Song Mao NR, covering 20,000 ha
Ho Ca Giay FPMB	?	No	Yes (Ca Giay Irrigation Reservoir)	Converted to Kalon – Song Mao NR, covering 20,000 ha
La Nga SFE	?	Yes (Nui Ong NR)	?	
Nui Ong NR	25,500	-	No	
Song Dinh SFE	18,916 (15,745)	Yes (Nui Ong NR)	?	
Song Luy SFE	?	No	Yes (Ca Giay Irrigation Reservoir)	Converted to Kalon – Song Mao NR, covering 20,000 ha
Song Mong Ca Pet FPMB	?	Yes (Nui Ong NR)	?	
Ta Kou NR	11,886	-	No	
Tan Linh SFE	17,229 (16,333)	Yes (Nui Ong NR)	?	
Thuan Nam SFE	15,969 (13,589)	Yes (Nui Ong NR)	?	
Dak Lak Province				
Chu Yang Sin NP	54,227	-	Plays an important role in protecting the watershed of the Srepok River	
Dak Mang SFE	22,101 (19,151)	Yes (Ta Dung NR)	?	
Dak Moi SFE	?	Yes (Nam Nung NR)	?	

Dak N'Tao SFE	16,519 (15,288)	Yes (Nam Nung NR)	?	
Hong An SFE	14,706 (6,138)	Yes (Cat Tien NP)	?	
Krong Bong SFE	21,980 (14,505)	Yes (Chu Yang Sin NP)	?	
Lak SFE	21,024 (11,330)	Yes (Chu Yang Sin NP & Nam Ca NR)	?	
Nam Ca NR	24,555	-	No	
Nam Nung NR	10,849	-	No	
Nam Nung SFE	20,410 (14,907)	Yes (Nam Nung NR)	?	
Quang Duc SFE	31,802 (14,981)	Yes (Nam Ca & Nam Nung NR)	?	
Quang Ke SFE	23,300 (13,667)	Yes (Ta Dung NR)	?	
Quang Son SFE	26,490 (19,560)	Yes (Nam Nung NR)	?	
Quang Truc SFE	?	Yes (Bu Gia Map NP)	?	
Ta Dung (proposed) NR	18,893	-	Plays an important role in protecting the watersheds of the Dong Nai and Srepok Rivers	
Dong Nai Province				
Hieu Liem SFE	18,932 (11,917)	No	Yes	
La Nga Com	25,403 (11,074)	Yes (Cat Tien NP)	Yes	
Long Thanh SFE	6,375	Yes (Can Gio NR)	Yes	
Tan Phu SFE	15,932 (5,011)	Yes (Cat Tien NP)		Proposal made in 1999 to upgrade from SFE to NR, covering 13,967 ha
HCMC				
Can Gio Biosphere Reserve	75,740	-		
Lam Dong Province				
Bao Lam SFE	?	Yes (Ta Dung (proposed) NR)	?	
Bao Loc SFE	?	?	Plays an important role in protecting the watershed of the Dong Nai River	Proposed to be converted to South-west Lam Dong Nature Reserve, covering 27,700 ha
Bi Dup – Nui Ba NR	64,000	-	Plays an important role in protecting watersheds, especially the east of the NR which protects the watershed of the Da Nhim Hydropower Reservoir	
Da Teh SFE	36,252 (20,512)	Yes (Cat Tien NP)	?	
Loc Bac SFE	42,604 (27,162)	Yes (Cat Tien NP)	Plays an important role in protecting the watershed of the Dong Nai River	Proposed to be converted to South-west Lam Dong Nature Reserve, covering 27,700 ha
Rung Thong Da Lat	28,000	-	No	
Ninh Thuan Province				
Nui Chua NP	29,865	-	No	

Phuoc Binh NR	19,814	-	Plays an important role in protecting the watershed of the Cay River	
Song Trau SFE	10,853 (7,708)	Yes (Nui Chua NR)	No	
Tan Tien SFE	26,229 (3,739)	Yes (Phuoc Binh NR)	?	
Tay Ninh Province				
Lo Go Xa Mat NP	18,765	No	Performs an important role in protecting the watershed of the Vam Co River	
Multiple Provinces				
Cat Tien NP	73,878	-	Plays an important role in protecting the watershed of the Tri An Reservoir	