

# Information Sheet on Ramsar Wetlands (RIS)

*Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.*

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Bureau. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

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**1. Name and address of the compiler of this form:**

WWF Indochina Programme,  
Hanoi Office, 40 Cat Linh Str.,  
Hanoi, Vietnam

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Designation date

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Site Reference Number

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**2. Date this sheet was completed/updated:**

16 November 2004

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**3. Country:** Vietnam

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**4. Name of the Ramsar site:** Bau Sau (Crocodile Lake) Wetlands and Seasonal Floodplain

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**5. Map of site included:**

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps.

a) **hard copy** (required for inclusion of site in the Ramsar List): *yes*  -or- *no*

b) **digital (electronic) format** (optional): *yes*  -or- *no*

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**6. Geographical coordinates** (latitude/longitude):

**107° 23' 9" E, 11° 27' 51" N**

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**7. General location:**

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

The Bau Sau Wetlands and Seasonal Floodplain are located approximately 150 km north of Ho Chi Minh City and around 150km south of Da Lat. The wetlands are located in Tan Phu District (administrative centre - Tan Phu town), Dong Nai Province.

This site is located in the South Eastern part of Vietnam in a transition region between the furthest south of the Great Annamite range and the lower Mekong river delta, which is also a large administrative region of the country. The nearest large town to this site is the Bien Hoa city, capital of Dong Nai province.

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**8. Elevation:** (average and/or max. & min.) 100-150m ASL

**9. Area:** (in hectares) The total area of the site is **13,759** ha, which includes islands and surrounding vegetation. The actual inundated area during the rainy season is estimated at 5,360 ha. At the height of the dry season, 151 ha of permanent open water remains on the floodplain.

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**10. Overview:**

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The Bau Sau Wetlands and Seasonal Floodplain are tropical freshwater wetlands influenced by the monsoon climate. The area is located within a protected area (Cat Tien National Park) and surrounded by southern Vietnam's most important remaining lowland tropical rainforest. In dry season, it shrinks to individual permanent lakes and retreats into the Dong Nai River, while in the rainy season it expands considerably creating flooded forest and grassland habitats. A large proportion of this natural lowland wetland has experienced relatively little human impact and is a key habitat for various threatened species of flora and fauna.

**11. Ramsar Criteria:**

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8

**12. Justification for the application of each Criterion listed in 11. above:**

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

**Criterion 1:**

Cat Tien National Park (CTNP) contains one of the last and most important remaining examples of Semi-evergreen/Evergreen Lowland Forest in southern Vietnam (FIPI, MoF and WWF, 1995), and also one of very few remaining examples within the entire "Indochinese region" (GRSV & GEFP, 1994; Schmid, 1993). The vegetation of the seasonally flooded areas and that surrounding the permanent wetlands falls within this category.

Many institutions and authors have recognized and emphasized the importance of these wetlands (Schmid, 1993; Vanderkerkhove *et al.*, 1993; FIPI, MoF & WWF, 1994, 1995; GSRV & GEFP, 1994; Blanc, 1998; WWF, 1999; Bembrick & Cannon, 1999; Nguyen Phi Nga; 1999; Polet & Van Mui, 1999b; Ling, 2000). Both of the wetland inventories that have been made in Vietnam to date evaluate these wetlands to be of national importance (Le Dien Duc, 1989; GSRV & GEFP, 1994). Furthermore, very few examples of this habitat remain in the whole of Vietnam (GSRV & GEFP, 1994).

Despite both past and present disturbances, large areas of the wetlands seem to be amongst the best-conserved habitats in CTNP. Human disturbances to the wetlands are now much more infrequent due to the Park's enhanced protection structure. In general, the majority of the site can still be considered as pristine, with a variety of diverse habitats providing attractive scenery and good opportunities to see wildlife. Much of the remaining area is also now regenerating well thanks to the enhanced protection. BirdLife International (1999) states that habitats least modified by anthropogenic activity should be evaluated as being of high conservation priority.

**Criterion 2:**

According to the IUCN Red List (Hilton-Taylor, 2000), a total of 4 data-deficient, 16 *near-threatened*, 21 *vulnerable*, 11 *endangered* and 2 *critically endangered* species are found to occur in the Bau Sau Wetlands and Seasonal Floodplain area. When the area is further researched and monitored, more species are likely to be added to this list.

Some of these species rely (to a varying extent) on the wetland for only part of their life cycle, however some others, such as the Asian Arowana (*Scleropages formosus*), IUCN (2000) listed as Endangered, and the Siamese Crocodile (*Crocodylus siamensis*), listed as Critically Endangered, rely totally on the wetland habitats.

The Siamese Crocodile is one of the rarest crocodylians on earth as it is almost extinct in the wild. Although the species became locally extinct through overexploitation, the increased protection of the national park allowed the initiation of a Siamese Crocodile Re-establishment Programme. This programme is the first of its kind for this species with the aim of establishing a secure breeding population (Polet *et al.*, 2002). Monitoring work conducted since the commencement of re-introduction has shown that there is currently a stable population of Siamese Crocodile in Bau Sau.

Other species of conservation priority include:

For reptiles, Yellow Tortoise (*Indotestudo elongata*), and Yellow-headed Temple Turtle (*Hieremys annandalii*) – Endangered; Asian Box Turtle (*Cuora amboinensis kamaroma*), Asian Giant Terrapin (*Heosemys grandis*), Smiling Terrapin (*Siebenrockiella crassicollis*), and Southeast Asian Soft-shelled Turtle (*Amyda cartilaginea*) – Vulnerable.

For mammals, Black-shanked Douc (*Pygathrix nigripes*) and Asian Elephant (*Elephas maximus*) – Endangered; Gaur (*Bos gaurus*) Yellow-cheeked Crested Gibbon (*Nomascus gabriellae*) - Vulnerable, and Smooth-coated Otters (*Lutrogale perspicillata*) – Vulnerable.

For birds, White-shouldered Ibis (*Pseudibis davisoni*) – Critically Endangered; White-winged Wood Duck (*Cairina scutulata*) – Endangered; Sarus Crane (*Grus antigone*) and Lesser Adjutant (*Leptoptilos javanicus*) – Vulnerable:

For plants, Chhieutiel Chgor (*Dipterocarpus dyeri*) and Blume (*Diospyros mun*) – Critically Endangered; Black Rosewood (*Azelia xylocarpa*), Burmese Rosewood (*Dalbergia bariensis*), and *Dipterocarpus alatus* – Endangered; and *Dalbergia cochinchinensis* and *Hopea odorata* – Vulnerable.

For fish, 8 species are listed in the Vietnamese Red List:

1. *Scleropages formosus* (Schlegel & Muller, 1844): E
2. *Chitala ornata* (Gray, 1831) syn. *Notopterus chitala* (Hamilton, 1822): T
3. *Cosmochilus harmandi* (Sauvage, 1878): T
4. *Morulius chrysophekadion* (Bleeker 1850): T
5. *Bagarius bagarius* (Hamilton et Buchanan, 1822): V
6. *Gyrinocheilus aymonieri* (Tirant, 1883): R
7. *Channa striata* (Bloch, 1795) syn. *Ophicephalus striatus*: T
8. *Channa micropeltes* (Cuvier, 1831) syn. *Ophicephalus micropeltes* : T

Numerous additional priority species have been recorded by surveys but are not yet classified as confirmed as present in the area.

### Criterion 3:

International organisations, like WWF, and the Government of Vietnam both recognise CTNP and its wetlands as a biodiversity hotspot of national importance (FIPI, MoF & WWF, 1995). The Government of Vietnam also recognises the Bau Sau Wetland Complex as a wetland with “biodiversity level A” (GSRV & GEFP, 1994). Siamese crocodile (*Crocodylus siamesis*), which could potentially have become locally extinct in the area, was re-introduced to the site in early 2002. This species is listed by IUCN as critically endangered (Hilton-Taylor, 2000), and its known global distribution is restricted to this site along with a few other pocket populations in Southeast Asia. The population at this site is the only confirmed population in Vietnam.

However, it is impossible to separate much of the biodiversity of the wetlands from that of CTNP as a whole because they are intricately linked. For example Gaur (*Bos gaurus*) and other even-toed ungulates, whose occurrence can be considered exceptional in Vietnam nowadays, utilise several habitat areas in CTNP but rely on these wetlands as an integral part of their range. As a result of these intrinsic and intricate links, it can be said that the overall biodiversity of CTNP reflects that of the wetlands.

Table 1 gives a comparison between the faunal diversity of CTNP with other National Parks in Vietnam, and shows the high conservation value of CTNP. When compared to the other protected areas within Vietnam, the table shows CTNP to be of high conservation value. Ling (2000) stated that the mammal community of CTNP is diverse when compared with other protected areas in the region, and is of high regional significance. He highlights that when compared with Xe Pian National Biodiversity Conservation Area in Lao (one of the most important protected areas in Lao PDR and three times the size of CTNP) more threatened species are found in CTNP.

Table 1: Comparison of the faunal biodiversity of CTNP with other National Parks in Vietnam

National Park	N <sup>o</sup> mammal sp.	N <sup>o</sup> bird sp.	N <sup>o</sup> reptile sp.	N <sup>o</sup> amphibians	Total N <sup>o</sup> of faunal sp. (rank)
Cat Tien	82	318	58	28	486 (1)
Cuc Phuong	64	137	36	17	254 (2)
Yok Don	62	196	--	13	271 (3)
Ba Vi	38	113	41	27	219 (4)
Bach Ma	55	158	--	--	213 (5)
Ba Be	38	111	18	6	173 (6)
Ben En	41	82	3	27	153 (7)
Con Dao	18	62	19	6	105 (8)
Cat Ba	28	37	20	--	85 (9)

Source: Le Trong Trai et al, 1999; except for Cat Tien National Park – Polet, 2001.

The first major region-wide biodiversity assessment was conducted by WWF for the Forests of the Lower Mekong Ecoregion Complex (covering all of Indochina except for the far north of Laos and Vietnam, which falls within a distinctly different biogeographic region). This assessment delineated and ranked priority areas based on biodiversity value, habitat integrity and threat level, and listed CTNP and its surrounding area as of critical importance (the highest rank), within the Greater Annamites Ecoregion (Baltzer *et al*, 2001). The full list of

birds, mammals, herps, fishes, and water-dependant plant in CTNP is attached to this RIS (see Appendix I).

**Criterion 4:**

In the dry season, the wetland complex provides an essential water source since many of the Park's streams are seasonal and dry up during this period. Thus, in the dry season large terrestrial animals (e.g. endangered *Bos gaurus*) are known to concentrate around the permanent water bodies for water, and the surrounding grasslands (flooded during the wet season) for food.

Other species like the vulnerable Smooth-coated Otters (*Lutrogale perspicillata*) and numerous amphibians like the Long-legged Grass Frog (*Hylarana macrodactyla*) depend on the wetland for the majority of their lifecycle, particularly heavily on permanent water bodies, which sustain their populations during the adverse conditions in dry season.

In addition to the site's function as a breeding site for several birds such as the critically endangered White-shouldered Ibis (*Pseudibis davisoni*) and the vulnerable Lesser Adjutant (*Leptoptilos javanicus*), the wetlands are also an important migration stop-off and wintering place for migrating birds like the vulnerable Sarus Crane (*Grus antigone*). The site is located along the East Asian – Australian Flyway (Wetlands International, 2002), and is vital to allow birds to break their journey and reconstitute their reserves.

**Criterion 7:**

Among 134 fish species that have been identified for Cat Tien National Park there are 131 indigenous species, including 38 species of which specimens have been collected in Bau Sau lake and floodplain area (according to unpublicized data of Bui Huu Manh, 2002). Several species are likely to be added to the list when further researched. The estimated number of freshwater species for Southern Vietnam is 250 (Dinh Yen, 1992) and 450 in Vietnam as a whole (www.fishbase.org). Therefore, the fish fauna of the site represents 53.6% of the estimated southern Vietnamese fauna and 29.7% of the Vietnamese estimated fish fauna. (See the full updated list of fishes of Cat Tien National Park, including Bau Sau wetland and floodplain, in the Appendix I).

**Criterion 8:**

The rainy season represents the reproduction period for many species in the Dong Nai River, and numerous fish migrate to the wetland to spawn. This can be easily witnessed when the Dong Nai River is in spate and spills into the Dac Lua Stream, reversing its flow. The Dac Lua Stream is an important migration route for the spawning fish. During this period, the fish are also able to ingest a large quantity of food (directly from the newly submerged land and from increased allochthonous input). Several species also enter the floodplain in the rainy season to feed on the spawn, young fish, or on spawning fish. Forty species were found to be heavily depended, while 33 other species are believed to be dependent on the wetland for spawning. Reserves accumulated during this period of plenty allow the fish to survive in the dry season when food is scarcer (Bui Huu Manh, pers. comm.; Roggeri, 1995). Some of the residents of the permanent water bodies also migrate to spawn in shallow inundated areas during the rainy season. Even in the dry season the permanent lakes host a very abundant fish population, comprised of both swamp/lake species and more riverine species.

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**13. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**

Cat Tien National Park (CTNP) is situated in a bio-geographic region characterised as “Semi-evergreen/Evergreen Lowland Forest” in the “Indochinese region” (GRSV & GEFP, 1994; www.WCMC.org, 1996; Schmid, 1993). The forest surrounding and within the Bau Sau Wetland Complex is considered to be of this type. In general, the habitat of the Bau Sau Wetland Complex has to be considered as rare within this bio-geographic region as the region experienced major forest losses over the last decades.

The first major region-wide biodiversity assessment was conducted by WWF for the Forests of the Lower Mekong Ecoregion Complex (covering all of Indochina except for the far north of Laos and Vietnam, which falls within a distinctly different biogeographic region). This assessment delineated and ranked priority areas based on biodiversity value, habitat integrity and threat level, and listed CTNP and its surrounding area as of critical importance (the highest rank), within the Greater Annamites Ecoregion (Baltzer *et al*, 2001).

**b) biogeographic regionalisation scheme** (include reference citation):

Several bio-geographic recitals described the forest cover of CTNP:

- ☛ In the WWF Global 200 Eco-regions, the Park is classified as being situated in the “*Eastern Indochina Dry and Monsoon Forest*” of which the vegetation cover is considered as “*Tropical and Sub-tropical Dry and Monsoon Broadleaf Forest*”.
- ☛ The internationally recognised map of Floristic Bio-diversity Centers in Vietnam, Laos and Cambodia by Schmid (1993), shows that Nam Cat Tien borders a region of botanical biodiversity and is itself recognized as a “*Major Center of Plant Bio-diversity*” with 2,500 plant species. Also in this floristic inventory, the vegetation is catalogued as “*Lowland evergreen/semi-evergreen forest with a freshwater swamp*” (GSRV & GEFP, 1994).
- ☛ In the Bio-diversity Action Plan for Vietnam, the forest of Nam Cat Tien is mainly catalogued in “the map of original vegetation cover and bio-units” as “*Lowland evergreen/semi-evergreen broadleaf forest*” in the “*South Central Indochina bio-unit*” (GSRV & GEFP, 1996).
- ☛ In 1996 the WCMC published a map where Nam Cat Tien is classified as “*Lowland Monsoon Forest*” ([www.WCMC.org](http://www.WCMC.org)).

REFERENCES

- Dien Duc L. 1996, “*Wetland management and conservation in vietnam,*”, SIDA/IUCN, MOSTE/NEA. In “*National Wetland Conservation and Management Strategy*”, p. 1-9.
- Polet G., Van Mui T. 1999a, “*Notes on the wetlands of Cat Tien National Park, Vietnam*”, VIDA Silvestre Neotropical, 46-48
- Ramsar Convention Bureau 1999, “*Convention on wetlands, 2 February, Wetlands Day*”.
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- Le Dien Duc, 1989, “*Inventory of wetlands in Vietnam*”, Hanoi. / Le Dien Duc, 1993, “*Wetland’s Reserves in Vietnam*”.
- Wikramanayake E., Dinerstein E., Hedao P. and Olson D., “*A Conservation Assessment of Terrestrial Ecoregions of the Indo-Pacific Region*”, Washington DC: WWF-US Conservation Science Programme.

- Dang Huy Huynh (1998) “*Division of Geo-biological Regions and the system of Special Use Forests in Vietnam*”, In: Vietnamese studies 3 (129): 109-120. Hanoi: The Gioi Publishers
- Mac Kinnon J. (1996), “*Protected Areas System Review of the Indo-Malayan Realm*”, Canterbury, UK: The Asian Bureau for Conservation (ABC) and the world Conservation Monitoring Centre (WCMC).
- Baltzer, M.C., Nguyen Thi Dao, and R.G. Shore. (Eds.) 2001. *Towards a Vision for Biodiversity Conservation in the Forests of the Lower Mekong Ecoregion Complex. WWF Indochina/WWF US, Hanoi and Washington D.C.*

#### 14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

**Soil:** The soil types differ greatly between the permanent lakes, their inundation zone, and the seasonal river floodplain. The soils of the permanent lakes and their inundation zone are alluvial soils, with gleyed alluvial (Pg) found in permanent flooded areas and spotted gleyed alluvial (Pf) in higher locations, which are inundated during the rainy season. The seasonal floodplain of the Dong Nai River is generally comprised of three types of feralitic soil:

- Feralitic soil developed on old alluvium
- Feralitic soil developed on basalt bedrock
- Feralitic soil developed on shale

These three soil types have a very complex distribution pattern within the seasonal floodplain.

**Climate:** CTNP is located in the tropical monsoon zone. There are two distinctive seasons: a dry season (November/December to March/April) and a wet season (April/May to October/November).

Table 2: Overview of the meteorological characteristics of Cat Tien National Park

NAM CAT TIEN	
ANNUAL AVERAGE TEMPERATURE (°C)	26.5
MAXIMUM AVERAGE TEMPERATURE (°C)	28.6 (JUNE)
MINIMUM AVERAGE TEMPERATURE (°C)	20.5 (JANUARY)
ANNUAL AVERAGE RAINFALL (MM)	2,845
MAXIMUM AVERAGE RAINFALL (MM)	575 (AUGUST)
MINIMUM AVERAGE RAINFALL (MM)	12.7 (FEBRUARY)
ANNUAL AVERAGE HUMIDITY (%)	82
AVERAGE PERIOD OF RAINY SEASON	APRIL – NOVEMBER (8 MONTHS)
RAINFALL RAINY SEASON/ANNUAL RAINFALL (%)	96.9

**Hydrology:** The majority of the sites permanent lakes are drained by the Dac Lua Stream, which flows into the Dong Nai River - the second largest river system in South Vietnam. The other permanent water bodies either flow into the Dong Nai River through other smaller tributaries or are stationary bodies filled by precipitation and groundwater.

During the rainy season the area covered by the permanent lakes expands greatly, several temporary lakes are formed, and the Dong Nai river overflows its banks and spills into its

floodplain. This expansion of the sites inundated area is predominantly due to the water levels in the Dong Nai River, but is also influenced on a smaller scale by direct run-off within the catchment of the Dac Lua Stream. The Dong Nai river typically inundates its floodplain several times within one wet season.

The flooded area reaches its maximum in September (month with the highest rainfall) with a surface area of 5,360 ha with depth ranging from 3 m in the permanent lakes, sloping towards much more shallow levels in the seasonally flooded areas.

During peak discharge from the Dong Nai River, the flow direction the of Dac Lua Stream reverses, preventing drainage of these permanent wetlands. This unusual event takes place approximately from July to September, however this reverse flooding is not continuous during this period.

During the dry season the temporary lakes and seasonal floodplain can completely dry out, although small lakes can form for a few days after heavy rainfall. Water remains in the permanent lakes and pools with a total surface area of 151 ha. The water depth during this period is approximately 0.5-0.8m, depending on precipitation, drainage capacities, and evaporation. The area around these lakes also gets easily saturated with rainwater after incidental cloudbursts, causing short-term expansion of the open-water bodies.

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#### **15. Physical features of the catchment area:**

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The area of Cat Tien National Park is currently 71,920ha, according to the updated data in July 2004. This includes two separate forest blocks: the Cat Loc sector (27,850ha) in the North and the Nam Cat Tien and Tay Cat Tien sectors (44,070ha) in the South. The topography of the area varies greatly between the three sectors. Cat Loc is situated at the beginning of the southern foothills of the Central Highlands and, although elevations only reach 659m, the topography is steep. Nam Cat Tien and Tay Cat Tien are situated in lowlands typical of southern Vietnam and the topography of this area is characterised by low, gentle hills.

Numerous springs and streams originates in the area and drain into the Dong Nai River. The Dong Nai River flows through the Park, forming the western boundary of Cat Loc and the eastern boundary of Nam Cat Tien. The lowlands in the north of Nam Cat Tien are poorly drained, resulting in a network of swamps and lakes, which expands and contracts seasonally. Annual rainfall ranges from 2,300mm in the lowlands to 2,850mm at higher elevations.

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#### **16. Hydrological values:**

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

These topics have not received detailed study yet, however, functions like flood control and flow regulation appear significant. As the flow direction of the Dac Lua stream reverses to flow into (rather than out of) the Bau Sau wetlands at the peak of the rainy season, it is assumed that the swelling wetlands are acting as a “sponge” to absorb water that would otherwise flow downstream and could potentially cause flooding in heavily populated areas.



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## 17. Wetland Types

**a) presence:**

Circle or underline the applicable codes for the wetland types of the Ramsar “Classification System for Wetland Type” present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va •  
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

**b) dominance:**

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Xf – Ts – P – O – M – N – Tp

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**18. General ecological features:**

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

The habitats and vegetation types of the Bau Sau Wetlands and Seasonal Floodplain are complex. Broadly, the wetland areas are dominated by *Hydnocarpus anthelmintica* mixed with *Ficus benjamina* (flood forests) and the seasonally flooded grasslands contain *Saccharum spontaneum*, *S. arundinaceum* and *Neyraudia arundinacea*. The surrounding areas are catalogued as “Semi-evergreen/evergreen lowland forest” with species of the *Dipterocarpaceae* and *Lagerstroemia* families. Following is a more detailed list of the main vegetation types in the area (Nguyen Phi Nga, 1999; FIPI, 1999): Distribution of predominant vegetation communities is shown in Map 2.

*Mitragyna diversifolia* community

*Hydnocarpus anthelmintica* – *Xanthophyllum columbarium* community

*Saccharum spontaneum* community

*Scleria levis* community

*Scirpus grossus* community

*Oryza rufipogon* – *Hymenachne acutigluma* community

*Utricularia aurea* – *Hydrilla verticillata* community

*Ebenaceae* – *Annonaceae* – *Sapindaceae* community

*Xanthophyllum* – *Cleistanthus* community

*Bambusa* – *Fabaceae* – *Tiliaceae* community

*Imperata cylindrica* – scrub

*Erianthus arundinaceus* community

*Ebanaceae* – *Annonaceae* – *Lythraceae* community

*Lagerstroemia* – *Ebenaceae* – *Mischocarpus* community

*Lythraceae* – *Myrtaceae* – *Dipterocarpaceae* community

*Sterculiaceae* – *Ebenaceae* – *Bambusa* community

A part of the wetland is also threatened by the invasive exotic species *Mimosa pigra* and Water Hyacinth (*Eichhornia crassipes*).

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**19. Noteworthy flora:**

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Due to limited and variable survey coverage of the biogeographic region as a whole, it is difficult to properly assess the precise value of the area's flora. Being listed as the third-largest of only eight important "freshwater swamps" in Vietnam (FIPI, 1994), the natural floral communities undoubtedly hold regional significance.

The wetland complex is situated in the biogeographic region described as "semi-evergreen-evergreen lowland tropical rain forest", which is considered a rare and highly threatened habitat in South-Vietnam.

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#### **20. Noteworthy fauna:**

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

To date a total of 334 bird species have been recorded in the area (including unconfirmed species), of these, 52 species are classified as waterbirds (Wetlands International, 2001) and a further 20 are species which rely heavily on aquatic habitats (including water-hunting raptors and kingfishers).

Amongst the other taxonomic groups recorded in the area, a total of 54 amphibians and reptiles, plus 5 mammals are heavily dependant upon aquatic habitats and prey.

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#### **21. Social and cultural values:**

e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

The Bau Sau Wetlands and Seasonal Floodplain are predominantly situated within Cat Tien National Park, in which no human interference with its biodiversity is permitted. The only area outside the park is half of the Dong Nai River itself, as this river forms the boundary of the park. Local communities use this stretch for fishing, but not on a large/commercial scale.

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#### **22. Land tenure/ownership:**

(a) within the Ramsar site:

The wetland is predominantly situated in Cat Tien National Park comes under the jurisdiction of the Central Government Ministry of Agriculture and Rural Development (MARD). A very small portion outside the National Park (see point 19), is under structured/tiered Commune, District and Provincial control.

(b) in the surrounding area:

The area surrounding Bau Sau wetlands and Seasonal Floodplain is under the structured/tiered Commune, District and Provincial control.

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#### **23. Current land (including water) use:**

(a) within the Ramsar site:

The vast majority of the site falls within Cat Tien National Park, which is catalogued as a “Special-Use Forest”. Under this classification the Park’s primary function is to conserve the existing gene pool. Secondary functions are scientific research and tourism. No other activities are permitted in the Park by Vietnamese law.

(b) in the surroundings/catchment:

The immediate surroundings (in all directions apart from the eastern bank of the Dong Nai river) are also covered by Cat Tien National Park. Beyond the Park is both densely populated agricultural land and State Forest Enterprises (government-owned logging concessions).

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**24. Factors (past, present or potential) adversely affecting the site’s ecological character, including changes in land (including water) use and development projects:**

(a) within the Ramsar site:

Human activities that impact biodiversity are illegal within the National Park, the extent to which these occur is significantly lower now that the Park has been established and enforcement activities have been set up. These activities have undoubtedly impacted the sites ecological character in the past (as can be seen by the drastic decline in Siamese crocodile populations), and are still having lesser impacts. Ranked from most to least important, these human activities can be listed as:

- Fishing
- Hunting
- Encroachment
- Burning of grasslands
- Collection of forest products (such as bamboo, rattan, fire wood and resin)

Fishing is the primary activity as it directly impacts the biological and ecological character through over-exploitation and damaging methods. However, the impacts of other activities are more indirect but still significant, as they can impact the integrity of the surrounding landscape and biological processes that require and influence the wetlands. Activities such as hunting and collection of forest products also impact as these activities invariably conduct fishing as a sideline activity for sustenance.

Population fragmentation and very small existing populations of faunal species threaten the genetic vitality and therefore, survival of several species in and around the wetlands. The current invasion of exotic species (*Mimosa pigra* and Water Hyacinth) threatens the existing niches of natural species although the extent of this threat has not been studied at the site. The succession of open water bodies to swamp forests certainly threatens to change the current biological character of the wetlands, although whether this would result in a deleterious change is unclear.

The possible construction of a flood prevention dam at the mouth of the Dac Lua Stream is undoubtedly a future threat to the ecological character of the Bau Sau wetlands.

(b) in the surrounding area:

The potential construction of two hydroelectric power dams upstream of the Bau Sau Wetlands and Seasonal Floodplain on the Dong Nai river (called Dong Nai 3 and Dong Nai 4) are the greatest single future threat to the ecological character of the site. Increasing populations and the associated increased land and resource pressures they exert have, and continue to, pose significant threats.

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**25. Conservation measures taken:**

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Cat Tien National Park consists of three sectors (Cat Loc, Tay Cat Tien and Nam Cat Tien) with a total area of 74,219 ha, which were integrated into one National Park in 1998. The Bau Sau Wetlands and Seasonal Floodplain are situated in the southern portion of Cat Tien National Park, namely the Nam Cat Tien sector. A management plan was formulated in 1998 with the creation of the Cat Tien National Park, and a five-year strategy (2003-2008) has recently been developed for the park's technical department. No particular management plan exists for the wetland.

Regular activities in the wetland area include routine clearing and burning of floating weeds, bi-weekly Siamese crocodile censuses, seasonal waterbird surveys, and regular ranger patrols (4 times daily). The site includes four of the park's guard stations, and illegal activities have now been vastly reduced, although not fully halted.

The Bau Chim (Birds lakes) has an area of 50 ha, being suitable habitat for water bird species. For the past some years, an exotic plant species (*Mimosa pigra*) has spread widely over the water surface. From 1999 to present, the Park has continuously cut and burnt these plants in the dry season with the financial support from Cat Tien NP conservation project. Every year, about 30 ha was treated. Even some areas were treated again and again. At present, water surface of this lake has been more opened, resulting in more occurrences of water birds and large mammals in and around the area. At this time, the Park is cooperating with the Institute of Vegetation Protection to carry out survey on the reproduction and spreading capacity of this *Mimosa* plant, in order to propose effective prevention measures.

“Trap” grasses are combinations of some different species of grasses and water-ferns floating on the water surface of Bau Sau. Each of these grasses combination is of 2-3 ha large, about 2 meters deep under the surface, and about 1.5-2 meters high. For the past years, these grasses developed very strongly, covering the 50 ha surface area of Bau Sau. This narrowed down the habitat of water birds, plus the sedimentation of other aquatic plants, causing the potential loss of Bau Sau in the future. The Park has had a solution to deal with this “Trap” grasses. During the rainy season, the blocks of these grasses are pushed by strong winds towards the bank of the lake. Park's staff will bind them at the bank by metal cables. When the water is withdrawn in the dry season, these grasses wither and about 2 ha of these grasses were treated every year.

**26. Conservation measures proposed but not yet implemented:**

e.g. management plan in preparation; official proposal as a legally protected area, etc.

Currently, the latest final draft of Conservation Management and Operational Plan (2003-2008) is available for the Government of Vietnam to approve. In this management plan, the Bau Sau Wetland Complex will be considered as one zone (Z1) with relevant management options: enhanced protection, conducting comprehensive EIA's for planned construction of dams, plus continued control of exotic plant species, control of floating vegetation, and re-introduction of Siamese crocodile.

In addition, to the direct protection such as annual removal of *Mimosa pigra* in Bau Chim and floating vegetation in Bau Sau, the indirect measures are also taken such as to have surrounding communes and districts to organise large scale *Mimosa pigra* eradication programme focusing upstream from CTNP, as well as the awareness of control techniques of this species among farming communities. As for water pollution, the Park will seek support of local authorities to regulate the type and strength of chemicals used; awareness amongst farmers on the correct use of agricultural chemicals, and about their impacts on human and environmental health when heavily used.

Threats to Bau Sau wetland complex includes poaching (especially crocodile hunting), presence of fishing nets (accidental drowning of crocodiles), invasive species, visitors' impacts, and the planed dams (Dong Nai 3 & 4). Proposed conservation management includes patrol focused on crocodile hunting, removal of fishing nets, annual removal of floating vegetation, annual check for *Mimosa pigra* and control as required, a limit of 10 visitors/day-overnight, lobby against dams, and pursue for recognition of the Ramsar Convention.

Water birds like White-winger Wood Duck and White-shoulder Ibis live in Bau Sau Wetland complex but with the unconfirmed small and isolated populations. Their habitat is also disturbed by human-related activities. Therefore, the Park will survey to confirm the population, and keep the patrols focused at key sites (in compliance with species' distribution). Annual monitoring of water related birds will be used as an indirect monitoring index of habitat quality (in controlling floating vegetation and *Mimosa pigra*).

The park also plans to extend its focus to the surrounding state forest enterprises and nature reserves to develop a broader landscape managed to benefit conservation. This has implications for the Bau Sau Wetlands and Seasonal Floodplain as several of these areas lie to the west and north of the site and fall within the upstream catchment of the wetlands.

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**27. Current scientific research and facilities:**

e.g.: details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Cat Tien National Park has a Technical Department, which is in charge of executing research. This department and its research are funded by the Government of Vietnam and a number of separate projects. In addition, one external PhD study is currently being conducted on the Bau Sau Wetland Complex:

- O'Dwyer - The relationship between the vegetation cover and sedimentation in the Bau Sau wetlands by means of remote sensing.

A further PhD student has been proposed to follow up on an aspect of research identified by this work.

In relation to the Bau Sau wetland complex, a background research is being conducted for a fresh water fishes list. This research is conducted by a staff of the Technical Unit of CTNP, with the financial support from the Cat Tien NP Conservation Project, which is funded by the Royal Netherlands Government and coordinated by WWF Indochina Programmes. Under this project, deep research is also conducted on the water bird species, including census and distribution of the indigenous species, inventories on migrating birds, winter birds, breeding birds, and visitor birds.

The Siamese Crocodiles (*Crocodilus siamensis*) was regarded being locally distinct in Bau Sau lakes and flooded land area. The introduction programme for this species was approved by the Ministry of Agriculture and Rural development of Vietnam to start in May 2000. This program is for the genetic conservation of an endangered species, as well as to balance the ecosystem, especially the flooded land ecosystem in Bau Sau area. To support this program, the Siamese Crocodiles Company in Ho Chi Minh City provides 25 mature individuals, the Ministry provided fund to buy 15 more individuals, Sai Gon Zoo in Ho Chi Minh City assisted in installing electronic chips and collecting samples for DNA analysis. The research on Bau Sau flooded land ecosystem and necessary conditions for crocodile re-introduction has been conducted by the Institute of Tropical Biology (Ho Chi Minh City). Queensland and Canberra Universities have assisted in DNA analysis. Up to now, the Park has released 30 crocodiles, after a period of their maintenance and genetic tests in a Park's farm near the headquarters. The Park will continue to release more 76 individuals by December 2003.

Future researches related to Bau Sau Wetland Complex are identified in the latest final management plan of the Park as follows:

- Monthly monitoring of Siamese Crocodiles: maintenance of monthly field work and datafiles.
- Annual activities: water birds survey
- Research undertaken by external partners: DNA analysis for sub-species confirmation with Australian National University (ANU) and cooperation with IUCN Crocodile Specialist Group. Only crocodiles that have been confirmed as *Crocodylus siamensis* will be released. To ensure the ongoing presence of the released population the FPD will target known poachers at Dak Lua and improve wetland protection.

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#### **28. Current conservation education:**

e.g.: visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

An information/visitors centre has been established to provide information on Cat Tien National Park in general. One of the major features of this centre is the mural covering all walls within it; one wall is currently being dedicated to the wetland site and provides information about the species and importance of the wetland. The park regularly hosts school/learning visits and has developed a number of information materials about the park,

several of these mention the wetlands but no materials have been specifically produced for the wetlands. In addition, watchtowers (which also act as bird watching hides) have been established at two wetland sites in the complex.

Conservation education in Cat Tien National Park does not focus only on the wetland and floodplain ecosystems. It is for all aspects of the Park conservation. Education Conservation work in Cat Tien NP only started in 1999. Pilot activities targeted school children in the buffer zone. To date, conservation education has been undertaken in the 36 communes. Through the past few years, the major achievement of this work is represented by the understanding of the local people in the buffer zone about the conservation work of the Park, as well as the improvement of the relationship between local people and the Park's rangers.

Over the past two years, WWF Indochina, through Cat Tien National Park Conservation Project, has been working together with the Park to conduct the Trainings of Trainers on conservation education. A total of 57 teachers and representatives from 29 schools and local organisations in the buffer zone of the Park have been trained. They will then organize conservation education activities at their schools and localities. Five staff of Eco-tourism and Environmental Education Unit of the Park also benefited from these trainings.

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#### **29. Current recreation and tourism:**

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Areas of the seasonal floodplain surrounding Cat Tien National Park's Headquarters are subject to intense tourism activity from both domestic and, to a lesser extent, international tourists. However, in the majority of the site, the tourist activity is rather limited and consists mostly of foreign tourists. Exact numbers of visitors to these areas are not known. Only selected areas are visited within these more remote portions like the guard stations at Bau Sau and Dak Lua, plus the watchtower near Bau Chim. Leaving the majority of the wetland unvisited. The area is highly regarded by birdwatchers. There are no facilities in terms of environmental and ecological education at the wetland. The Park's management foresees to work towards eco-tourism in the near future, but has not specified further details.

In the management plan (2003-2008) direction for tourism is to provide, and maintain, accommodation for visitors including Bau Sau old guard station for visitors. However, the number of visitors to Bau Sau will be limited to less than 10 people /day-overnight. A new concrete house for visitors has been recently built, just next to Bau Sau guard station for overnight visitors.

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#### **30. Jurisdiction:**

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

The site is situated in Cat Tien National Park, which lies within Dong Nai Province, and is under the jurisdiction of the Ministry of Agriculture and Rural Development (MARD) of the Government of the Socialist Republic Vietnam.

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### 31. Management authority:

Provide the name and address of the local office(s) of the agency (ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

#### **Cat Tien National Park**

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### 32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 13 above), list full reference citation for the scheme

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