Designation date: 07/12/2004 **Ramsar Site no. 1440**

Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version

Available for download from http://www.ramsar.org/ris/key_ris_index.htm.

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

Notes 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. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 14, 3rd edition). A 4th edition of the Handbook is in preparation and will be available in 2009.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

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

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DD MM YY

Designation date | Site Reference Number

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2. Date this sheet was completed/updated:

June 14, 2012

3. Country:

The People's Republic of China

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Napahai Wetland

N

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only)**:**
a) Designation of a new Ramsar site ❑; or
b) Updated information on an existing Ramsar site ☑

6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area

The Ramsar site boundary and site area are unchanged: ❑

or
If the site boundary has changed:
i) the boundary has been delineated more accurately ☑; or
ii) the boundary has been extended ❑; or
iii) the boundary has been restricted** ❑

and/or

If the site area has changed:
i) the area has been measured more accurately ☑; or
ii) the area has been extended ❑; or
iii) the area has been reduced** ❑

** **Important note**: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

Compared with the previous RIS, the ecological character and application of the Criteria of the Ramsar site remain unchanged.

7. Map of site:
Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:
i**) a hard copy** (required for inclusion of site in the Ramsar List): ❑;

ii**) an electronic format** (e.g. a JPEG or ArcView image) ☑;

iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** ☑.

b) Describe briefly the type of boundary delineation applied:
e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

This Ramsar site is located within Yunnan Napahai Provincial Nature Reserve. Its boundary is roughly the same with the reserve.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):
Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Center: 27°51'16"N, 99°38'44"E

Extent: 27°48'44"N-27°54'23"N, 99°37'11"E-99°40'25"E.

9. General location:
Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

This Ramsar site is located in the territory of Shangri La County, Yunnan Province, Southwest China. It is located about 8 km to north of the Shangri La County capital.

10. Elevation: (in metres: average and/or maximum & minimum)

Average: 3,266 m;
Maximum: 4,449 m; Minimum: 3,260 m.

11. Area: (in hectares)

2,083 ha.

12. General overview of the site:
Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Napahai Wetland is situated in the upstream area of the Yangtze River. It is located in the core zone of the Hengduan Mountains Region, one of the three major biodiversity centers in China. It is a seasonal plateau karst swamp wetland that composed of meadows, swamps, lakes and surrounding forests. It is developed on the limestones of the Hengduan Mountains with low latitude but high elevation. Long term geographic isolation makes the site support many endemic species. This Ramsar site preserves alpine and sub-alpine meadows, swamps and lakes, rare waterbirds (such as *Grus nigricollis*, *Ciconia nigra*, *Haliaeetus albicilla*, *Grus grus* and *Anser indicus*) as well as their habitats.

13. Ramsar Criteria:
Tick the box under 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). All Criteria which apply should be ticked.

1	2	3	4	5	6	7	8	9
☑	☑	☑	☑	☑	☑	❑	❑	❑

14. Justification for the application of each Criterion listed in 13 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:

This Ramsar site is located in the core zone of Szechwan Highlands Biogeographic Province, Palaearcitc Realm with rich biodiversity. As a seasonal karst swamp wetland, this Ramsar site is unique in this biogeographic region.

Criterion 2:

Species Name	Latin Name	IUCN Redlist Category	CMS Appendix	CITES Appendix	National Protection Class
Bird					
Black-necked Crane	*Grus nigricollis*	VU	I/II	I	I
Plant					
-	*Picea brachytyla* var. complanata	VU	-	-	II

Criterion 3:

This Ramsar site is a biodiversity hotspot in the Szechwan Highlands Biogeographic Province, Palaearcitc Realm. It holds highly abundant species. There are 115 plant species from 38 genera in 38 families, and 130 bird species from 32 families in 14 orders. These much exceed the average species richness in this biogeographic region.

Criterion 4:

This site is situated on the Central Asia and East Asian-Australasian Flyways of migratory birds, and forms an important wintering site and stopover for numerous rare and endangered wintering birds (such as *Grus nigricollis*, *Ciconia nigra*, *Tadorna ferrugnea*, *Anas platyrhynchos* and *Anser indicus*).

Grus nigricollis and *Ciconia nigra* generally take the shallow waters and swamps as their habitats. During the wintering period of 2010-2011, the population of *Grus nigricollis* presented 125, 367 and 242 individuals; and that of *Ciconia nigra* presented 197, 321 and 242 individuals.

Criterion 5:

Large populations of waterbirds (such as *Tadorna ferruginea*, *Anas platyrhnchos* and *Anser indicus*) inhabit in this site. According to the observation records, there were total bird individuals of 55,000, 64,000 and 70,000 in 2001, 2002 and 2003, respectively. According to the observation in 2008-2010, the total number of bird individuals maintains at the level of over 70,000.

Criterion 6:

Species Name	Latin Name	Count			1% Level
		2008-2009	2009-2010	2010-2011	
Black-necked Crane	*Grus nigricollis*	340	312	367	80

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15. 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:

Mixed Mountain and Highland Systems with Complex Zonation, Szechwan Highlands Biogeographic Province, Palaearcitc Realm

b) biogeographic regionalisation scheme (include reference citation):

A Classification of the Biogeographical Provinces of the World (Miklos D.F. Udvardy, 1975)

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16. 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.

Geology and geomorphology: Napahai Wetland is located in the eastern region of three great parallel rivers of the Hengduan Mountains in the southeastern edge of the Qinghai-Tibet Plateau. It is an alpine swamp wetland that inlaid in the incised faults of the gorges in the Hengduan Mountains. The geomorphologic character of the region is so complex that it is composed of glacial, surface runoff, lake, karst and tectonic forms. Due to the great impacts of the karst process, the bottom of the Napahai Lake was eroded into several large underground caves.

Origin: Naturally originated.

Soil: The main soil types in this site are bog soil and peat soil, which are alkali soils (the pH value is about 8). The average soil organic matter content is 85.30 g/kg, belonging to fertile soil types.

TN: 1.64-2.83 g/kg, NH_4^+-N: 223.71-339.95 mg/kg, NO_3^--N: 138.26-238.54 mg/kg, available P: 21-37 mg/kg, available K: 250-380 mg/kg.**Hydrology:** Water recharge mainly comes from precipitation, surface runoff, snow and ice-melt water, as well as spring, accounting for 2.57×10^4 m^3 per year in total. Affected by the southwest monsoon, the water level of the lake rises during early June when rainfall is abundant. But because of the leakage in limestone structures, the level retreats after August. Water level rises again around October due to the retreat of the autumn monsoon and increment of precipitation, and then shrinks after November. After the retreat of water level, the surface area of the lake shrinks greatly. Lake water drains into underground streams through nine limestone caves at the northwest corner, running underground for 10 km, exposed to land surface and converge into the Jinsha River.

Water quality: Water quality of the wetland in this site is very good at the Class-I of national standard (presenting the best water quality among the classes).

pH: 7.0-8.2, TN: 0.5-1.2 mg/L, NH_4^+-N: 0.2-0.3 mg/L, TP: 0.1-0.6mg/L.

Water depth: Napahai Wetland is a shallow-water swamp with the mean water depth of less than 20 cm. Water depth in the center of the lake lowers down to 1 m in dry seasons, while reaches 4-5 meters in precipitation-rich seasons.

Water level: The elevation of the lake surface is 3,260 m.

Climate: Napahai is located in a transitional zone between regions of abundant and scarce precipitations, belonging to western monsoon climate in the temperate plateau monsoon zone. Due to the impact of south-north parallel terrains and atmospheric circumfluence, southerly and south-westerly winds prevail throughout the year. Distinct dry/wet seasons are represented in this site. The mean annual rainfall is 619.9 mm. The season character is long winter, absent summer, short spring and autumn. The mean annual temperature is 5.4 ºC.

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17. Physical features of the catchment area:

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

The catchment of Napahai Wetland belongs to the Jinsha River watershed covering 660 km^2. The lake is surrounded by mountains, and its basin is developed on limestone parental rocks of the Zhongdian Plateau. The lake basin stretches 12 km from the south to the north and 6 km from the east to the west. Nachi River, Wangchi River, Gongbi River and Qinglongtan River, together with numerous creeks, run into the lake. Soil types include brown soil, dark brown soil and brown coniferous-forest soil and sub-alpine meadow soil. Organic matter content in the soils is rich. The soils are acidic (pH: 5-6). Land use types include timberland, grassland and farmland. Climate type belongs to the west monsoon climate, but with remarkable plateau climatic features.

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18. Hydrological values:

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

Napahai captures abundant water from snow/ice-melt water and runoff from rainfall. This site plays an important role in recharging groundwater, controlling flood, conserving soil and water, as well as regulating regional climate. On another hand, large amounts of soils carried by surface runoff are deposited in Napahai wetland. The average annual sedimentation is as much as 61,000 m^3, contributing significantly to the capacity of flood control in the upstream Yangtze River.

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19. 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.

U, Va, P, Zk(b)

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20. General ecological features:
Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

Napahai Wetland is composed of shallow swamp/lake and surrounding forests, with significant characters of elevation difference. Due to the karst process, the water level fluctuates seasonally. From the center to the surroundings of the lake, the wetland can be divided in to permanent swamp vegetation areas (permanent flooding with deep water), swamp meadow vegetation areas (deep water during the wet season and shallow water), surrounding meadow vegetation areas and forest vegetation areas.

The permanent swamp vegetation is mainly composed of *Myriophyllum spicatum*, *Potamogeton tepperi*, and *Nymphoides peltatum* communities; the swamp meadow vegetation is dominated by *Hippuris vulgaris*, *Zizania caduciflora*, *Polygonum hydropiper*, *Blysmus sinocompressus -Carex pleistoguna*, and *Eleocharis liouana* communities; the meadow vegetation is mainly dominated by *Potentilla anserine*, *Pedicularis longiflora* var. tubiformis, *Deschampsia caespitose-Sanguisorba filiformis* communities; and *Picea brachytyla* var. complanata, *Picea likiangensis*, *Abies georgei*, *Abies forrestii* and *Abies georgei* var. smithii are the dominant trees in the surrounding forests.

Presently, no invasive species have been found in the wetland. The various habitats provide large areas of feeding and hiding sites for water birds. Many raptors and birds of Corvidae live in the forests to seek foods.

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21. Noteworthy flora:
Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, 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.*

Diverse aquatic plants and complex wetland vegetation types have been recorded at this site. And many plant species are rare, endangered and endemic. It is the upper elevation limit of the distribution for *Potamogeton lucens*, *Scirpus tabernaemontani*, *Alectoria virens* and *Phragmites communis*, all of which are the worldwide-ranging species; and the lower elevation limit of the distribution for *Hippuris vulgaris* which is an Arctic-alpine species. The surrounding forests are mainly composed of spruce-fir forest. In addition, it is the ideal habitats for national Class-II protected plant species (*Cordyceps sinensis, Tricholoma matsutake*) and other important plant species (such as *Hippuris vulgaris* and *Sparganium simplex*).

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22. Noteworthy fauna:
Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. 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.*

Fauna from the north and south converge in the region with a high degree of vertical zonal speciation and endemism. Many endemic species with narrow distribution in the Hengduan Mountains were found here. Vertebrates are characterized by small population size. Of those, many are endangered and protected species (as shown in the table below).

Species Name	Latin Name	IUCN Category	CMS Appendix	CITES Appendix	National Protection Class
White Eared-pheasant	*Crossoptilon crossoptilon*	NT	-	I	II
Black headed Ibis	*Threskiornis melanocephalus*	NT	-	-	II
White-tailed Eagle	*Haliaeetus albicilla*	LC	I/II	I	I
Black Stork	*Ciconia nigra*	LC	II	II	I
Bearded Vulture	*Gypaetus barbatus*	LC	-	II	I
Whooper Swan	*Cygnus cygnus*	LC	II	-	I
Eurasian Spoonbill	*Platalea leucorodia*	LC	II	II	II
Himalayan Vulture	*Gyps himalayensis*	LC	-	II	II
Ruddy Shelduck	*Tadorna ferruginea*	LC	-	II	-

Besides, there are many other rare birds, such as *Anser indicus, Anas penelope, Anas poecilorhyncha, Anas platyrhynchos, Anas crecca, Mergus merganser, Aythya nyroca, Tringa nebularia, Vanellus vanellus, Gypaetus barbatus* and *Gyps himalayensis*. In addition, there are many rare endemic amphibian species, such as *Bufo tibetanus* and *Rana chaochiaoensis*.

23. Social and cultural values:

a) Describe if the site has any general social and/or 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:

Tibetans, living around the wetland, have traditional ecological ethics and religions, such as respecting nature and appreciating life (do not kill lives or eat fish). This is the important reason that the ecological features of Napahai Wetland are maintained. And this does great contribution to wildlife protection.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

No.

If Yes, tick the box ❑ and describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

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24. Land tenure/ownership:

a) within the Ramsar site:

State ownership; Napahai Provincial Nature Reserve has the tenure of land use.

b) in the surrounding area:

State ownership; the local government has the tenure of land use.

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25. Current land (including water) use:

a) within the Ramsar site:

The lake area has been strictly protected. The swamps and meadows are used for grazing and tourism with relatively low intensity.

b) in the surroundings/catchment:

The surroundings are mainly covered by shrublands, coniferous forests and broad-leaved forests. In addition, there are farmlands of 177.4 ha, which have already been covered by the *Natural Forest Conservation Project*.

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26. 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:

Grazing and tourism activities with low intensity in the experiment area of the reserve might have some influences on the wetland.

b) in the surrounding area:

Once there were some timbering activities in the surrounding areas in the past, but the vegetation is under protection now.

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27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

Napahai Wetland was approved by the People's Government of Yunnan Province as a provincial nature reserve in 1984. This site has been designated by the Government of Yunnan Province as "Conservation Site for the Wintering Habitats of the Black-necked Crane".

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ☑;Ib ❑; II ❑; III ❑; IV ❑; V ❑; VI ❑

c) Does an officially approved management plan exist; and is it being implemented?:

Comprehensive Treatment Project for Napahai Wetland of International Importance has been carried out since 2008. Based on this project, vegetations in the meadows and shallow water areas

with a total area of 674 ha were restored; and hydrological regulations were conducted to stabilize the water level.

d) Describe any other current management practices:

The reserve has been insisting to publicize the relevant regulations and laws to the surrounding communities in order to raise their awareness of wetland protection. At the same time, the reserve keeps on enhancing management efforts and fighting against hunting. On the other hand, the reserve has carried out the long term monitoring research on the ecological environments of Napahai Wetland.

In 1997, the reserve put the swamp meadows and meadows with good natural status into the core area as an approach to enhancing the water birds' wintering site protection in Napahai Wetland. In 2002, co-management agreements were established with 14 communities in the adjacent zone of Napahai Wetland. Since the wetland has been designated as a Ramsar site in 2004, with the help of the local government, the Reserve has carried out many actions, such as fighting against disordered exploiting, turfs digging and fishing.

28. Conservation measures proposed but not yet implemented:
e.g. management plan in preparation; official proposal as a legally protected area, etc.

Currently there is no proposed measure but not yet implemented.

29. Current scientific research and facilities:
e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Since 2004, the reserve has collaborated with the Department of Forestry of Yunnan Province and completed a series of projects including *Grus nigricollis and Other Wintering Birds Observation in 2006-2007, Grus nigricollis and Other Wintering Birds Observation in 2007-2008* and *Proceedings of Napahai Wetland*. In 2007, with the financial support of China Crane Foundation, the Reserve finished the research project *The Influence of Grus nigricollis on Surrounding Farmland*. In 2008, with the support of Department of Science and Technology of Yunnan Province, the Reserve collaborated with National Plateau Wetlands Research Center to carry out a 3-years work on *The Experimental Demonstration Project for Ecological Restoration in Closed and Semi-closed Plateau Wetlands*. There are only one patrol vehicle and some basic equipments for daily birds observation. Research equipments and facilities of the Napahai Wetland Nature Reserve are lacking.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:
e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

During "Bird-Loving Week" and "Forest Fire Prevention Period" in each year, the reserve publicizes protecting birds, wildlife and "green home" to the surrounding communities by TVs, radios, newspapers, posters and other forms. In 2008, the Reserve had successfully held the *Napahai Wetland of International Importance Seminar* in the surrounding communities, and taught the villagers how to identify rare plants and how to observe birds.

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

Napahai Wetland is located in the Shangri La County which is a famous scenery area in the world. With beautiful and unique landscapes, this Ramsar site has great values of tourism. In recent years, scenery-seeing and bird-watching tourisms in the local region bring considerable economic and social benefits.

As one of the important scenery areas in Shangri La County, sightseeing and birds-watching are the main types of tourism. During 2004-2009, the annual tourist number was around 200,000. To

protect the wetlands and birds, the tourists are strictly limited outside the core area of the reserve, and the disturbance to the wetland ecosystem is strictly forbidden. No permanent tourism facility has been established in this site.

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

Territorial:
Shangri La County Government, Yunnan Province.

Functional:
Forestry Bureau of Shangri La County.

33. 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.

Principal: Long Min (Director)
Institution: The Management Office of Napahai Provincial Nature Reserve
Address: The Management Office of Yunnan Napahia Provincial Nature Reserve, Shangri La County, Yunnan Province.
Zip: 674400
Telephone: +86-887-829045
Email: yebao.guanli@yahoo.com.cn

34. Bibliographical references:
Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

The Inventory, Planning and Design Institute of the State Forestry Administration. 2002. *The Master Plan of Bitahai* (including *Napahai*) *Nature Reserve.*

Southwest Forestry College. *Report of the Multidisciplinary Comprehensive Inventory of Bitahai* (including *Napahai*) *Nature Reserve*.

Wen, XJ., Yang, L., and Yang, XJ. 1995. Distribution of Water Birds in Plateau Wetlands of Yunnan. *China Wetland Research*, Edited by Yiyu Chen.Changchun: Jilin Science and Technology Publishing House, pp: 248~255.

Yang, L. 1990. Analysis of the Status Quo of the Distribution of Crane Species and Habitats in Yunnan Province: International Crane Protection and Research, edited by Heilongjiang Provincial Forestry Department. Beijing: China Forestry Publishing House, pp: 15~88.