



**Report of Rapid Biodiversity Assessments at
Nonggang National Nature Reserve,
Southwest Guangxi, China, 19 to 27 May 1998**

Kadoorie Farm and Botanic Garden
in collaboration with
Guangxi Forestry Department
Guangxi Institute of Botany
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Report of Rapid Biodiversity Assessments at Nonggang National Nature Reserve, Southwest Guangxi, China, 19 to 27 May 1998

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Background

The present report details the findings of a trip to Southwest Guangxi by members of Kadoorie Farm & Botanic Garden (KFBG) in Hong Kong and their colleagues, as part of KFBG's South China Biodiversity Conservation Programme. The overall aim of the programme is to minimise the loss of forest biodiversity in the region, and the emphasis in the first phase is on gathering up-to-date information on the distribution and status of fauna and flora.

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Common geographical descriptions and their Chinese phonetics

English meaning	Chinese phonetics (pinyin)
East	dong
South	nan
West	xi
North	bei
mountain	shan
range	ling
peak	feng, ding
valley	keng, gu
island	dao
river	he, chuan, jiang
stream	xi, yong
lake	hu, chi
sea	hai
harbour	gang
bay	wan
outlet	kou
city	shi
county	xian
village	xiang, cun
hamlet	tun
the Chinese system of geomancy	feng shui

Report of Rapid Biodiversity Assessments at Nonggang National Nature Reserve, Southwest Guangxi, China, 19 to 27 May 1998

Objectives

The aims of the survey were to collect up-to-date information on the fauna and flora of Nonggang National Nature Reserve, and to use this to help determine conservation priorities within South China.

Methods

On 18 May 1998 a team of ecologists from Hong Kong (BH, BC, JRF, ML and LKS from Kadoorie Farm and Botanic Garden (KFBG), joined by GJC, PJJ and KW) travelled to Nanning. Here they met partners from the Guangxi Institute of Botany (WFN and ZXG), and from Guangxi Normal University (LLR). The combined team met Guangxi Forestry Department officials including Zhang Sua (Deputy Director), Liu Zimin (Director of Wild Animals and Plants and Nature Reserve Management Station (WAPNRMS)), Su Zhili (Deputy Director of WAPNRMS) and Liang Qingyuan (Forest Park Tourism Section). The opportunities for collaborative work were discussed.

During fieldwork visual searching for plants, mammals, birds, reptiles, amphibians, fish, ants, butterflies and dragonflies was conducted. Calls of birds and amphibians were also used to identify them. Estimates of the status of large and medium sized mammals (excluding Erinaceidae, Talpidae, Soricidae, Muridae and Chiroptera) were based on interviews with reserve staff and residents, with reference to colour pictures. For these purposes a list of South China mammals was compiled from various sources including Guangdong Forestry Department & South China Institute of Endangered Animals (1987), Corbet & Hill (1992) and Zhang Y. *et al.* (1997).

Plant records in the surveys were made or verified by WFN and edited by NSC, except in the case of orchids, which were verified by Gloria L.P. Siu. Mammal records were made or verified by JRF or ML. Records of birds were made or verified by GJC, PJJ, LKS or KW, reptiles and amphibians by ML or Prof. Zhao Ermi, fish by BC, ants by JRF, butterflies by GTR or ML, dragonflies by KW, and rove beetles by GDR, formerly of Hong Kong.

Nomenclature in the report is standardised based, unless otherwise stated, on the following references:

- Flora (Pteridophyta, Gymnospermae and Angiospermae, excluding Orchidaceae): Anon. (1959-2000); Anon. (1991); Anon. (1996-2000); Anon. (2001); and The Plant Names Project (2001);
- Orchids (Angiospermae: Orchidaceae): Chen (1999) and Tsi (1999);
- Mammals (Mammalia): Wilson & Cole (2000);
- Birds (Aves): Inskipp *et al.* (1996);
- Reptiles & Amphibians (Reptilia and Amphibia): Zhao E. *et al.* (2000);
- Fish (Actinopterygii): Nelson (1994); Wu *et al.* (1999);
- Ants (Insecta: Hymenoptera: Formicidae): named species according to Bolton (1995); unnamed species with reference numbers according to the collection currently held by KFBG.
- Dragonflies (Insecta: Odonata): Schorr *et al.* (2001a, 2001b);
- Butterflies (Insecta: Lepidoptera): Bascombe (1995);

- Rove Beetles (Insecta: Coleoptera: Staphylinidae): G. de Rougemont (unpublished).

Information on the global status of species is from IUCN publications, notably IUCN Species Survival Commission (2001). Protected status in China is based on Hua & Yan (1993) for animals, and State Forestry Administration & Ministry of Agriculture (1999) for plants. Certain taxa, including orchids, reptiles, amphibians, fish and invertebrates, have yet to be properly assessed for global status.

Location and management

Nonggang National Nature Reserve is a composite of several protected areas in two counties (Longzhou and Ningming), and the name “Nonggang” is ambiguous, being applied sometimes to the whole, sometimes to one or more of the parts in Longzhou County. The total area is apparently 121.6 km² (Liang, 1988). The Longzhou sections, located at 22°13’56”- 22°33’09”N and 106°42’28”-107°04’54”E, stretch 34 km from east to west and 5 to 11 km from north to south (Figure 1). From west to east, the first section is Longhu (not to be confused with Longhushan Natural Medicine Nature Reserve, at 23° 00’N, 107° 40’E in Longan County), which covers 10 km² in the west. The second section is Nonggang itself, covering 54.3 km², while the third, to the east, is Longshan, covering 36.5 km², and falling partly within Ningming County. Longrui is the part of Longshan within northwest Ningming County, along the eastern bank of the Mingjiang. It covers 20.8 km², at 22° 12’ - 22° 20’ N, 107° 10’ - 107° 15’E.

Nonggang Nature Reserve was designated by the Guangxi Government in 1979 to protect the northern tropical monsoon limestone hill rainforest, and upgraded to a National Nature Reserve (NNR) in 1980 by the State Council (Forestry Department of Guangxi Zhuangzu Autonomous Region, 1993). Longshan was designated by the Guangxi government in 1982, intended to protect monsoon rainforest, leaf monkeys, *Camellia chrysantha*, and their habitat. In the late 1990s Longshan was merged administratively with Nonggang NNR. The combined reserve is listed as a National-level Forest Ecosystem Nature Reserve (Zhang W., 1998). Longhu, Nonggang and the part of Longshan within Longzhou are managed by the Nonggang NNR Management Station in Longzhou County Town. Each section also has at least one field management station. Longrui is managed by a management station in Ningming County Town. In the present report, the Nonggang section of the reserve is referred to as “Nonggang section”, while the whole reserve is referred to as “Nonggang NNR”.

The landscape of the area consists of lowland depressions interrupted by limestone hills 300 to 700 m in height, running from east to west (Liang, 1988); there are from 10 to 80 limestone peaks (an average of 20) per km². The altitude in the lowlands is about 150-200 m, while most of the hills are about 300-700 m in altitude. Nonggang NNR is at the northern margin of the tropics, south of the Tropic of Cancer, and has a seasonal tropical monsoon climate with distinct wet (May to September) and dry (December to February) seasons. Average temperature is 22°C, and annual precipitation is 1,150 to 1,550 mm, but can reach 2,000 mm.

Vegetation

Nonggang NNR formerly encompassed one of the largest and most intact soil and karst mountain forest ecosystems in Guangxi, but much of the forest observed during this survey has been degraded. The zonal vegetation of the region is tropical monsoon limestone rainforest (Su *et al.*, 1988). About twenty years ago, although some limestone hill were 80 to 90% barren, overall canopy cover was 60-70%, with the forest dominated by trees 25 m to 35 m in height (Su *et al.*, 1988). By 1998 much of this forest had been degraded, especially in and around low basins where

it had been converted to young secondary forest, tall shrubland or farmland. Relatively intact and undisturbed forest could be seen only in the interior of each section. Of the three sections, Nonggang section had the largest patch of good forest. Vertical zonation of the plant community is not obvious due to the relatively low altitudinal range in the area, but the composition of the plant community and vegetation is very diverse.

Unlike tropical forests in other landscapes, the dominant tree species in limestone areas are obvious, and the following association types were identified (Su *et al.*, 1988):

- (1) *Horsfieldia hainanensis* association is found mainly in low altitude depressions with better moisture conditions and is one of the typical community types in the reserve, especially common in Longshan. It has a rather complex composition and structure with trees that can reach rather high, and is dominated by evergreen species adapted to a warmer and more humid environment. Other major canopy trees include *Ficus glaberrima*, *Cleistanthus petelotii*, *Dracontomelon duperreanum*, *Dysoxylum mollissimum*, *Cleidion brevipetiolata* and *Arenga pinnata*.
- (2) *Parashorea chinensis* H. Wang - *Horsfieldia hainanensis* association is rare and found on the hillsides. It was not seen in the present survey. Community structure is typical of tropical forest. Among the dominant species, *P. chinensis* can reach 60 m tall and 1 m dbh. It forms a rather stable community with *Horsfieldia hainanensis*, *Excentrodendron hsienmu*, *Cephalomappa sinensis*, *Garcinia paucinervis*, *Acrocapus fraxinifolius* and *Saraca dives*.
- (3) *Deutzianthus tonkinensis* association is widely distributed in the area. It is composed predominantly of evergreen species but has obvious seasonal leaf-changing periods. Other important tree species include *Bischofia javanica*, *Cephalomappa sinensis*, *Streblus tonkinensis*, *Sterculia nobilis* and *Drypetes perreticulata*.
- (4) *Saraca dives* - *Horsfieldia hainanensis* association is commonly found in relatively undisturbed and well-conserved areas in and around lowland depressions. Other canopy tree species found here include *Sterculia nobilis*, *S. lanceolata*, *Garcinia paucinervis*, *Cleistanthus petelotii*, *Litsea foveolata* and *Ixora henryi*.
- (5) *Vites kwangsiensis* association is found on lower altitude slopes. It is secondary, having regenerated after major disturbance to lowland forest. It is dominated by evergreen species. Other major canopy trees include *Bischofia javanica*, *Hainania tricosperma*, *Alphonsea mollis*, *A. monogyna*, *Baccaurea ramiflora*, *Streblus tonkinensis* and *Urobotrya latisquama*. Deciduous trees found here include *Spondias lakonensis*. In addition to saplings of the canopy species, shrubs found here include *Orophea anceps*, *Excoecaria venenata*, *Ardisia thyrsoiflora*, *Leea indica* and *Psychotria prainii*.
- (6) *Excentrodendron hsienmu* association is one of the most prominent communities of the area and is widely distributed on hillsides at medium altitude. The community is composed predominantly of evergreen species. Despite severe recent damage, some large and medium size trees still remain. The dominant species *E. hsienmu* shows plank buttress roots at the base. Other dominant species include *Walsura robusta*, *Hydnocarpus hainanensis*, *Garcinia paucinervis*, *Cleistanthus saichikii*, *Cephalomappa sinensis*, *Drypetes perreticulata* and *Lagerstroemia caudata*.
- (7) *Cephalomappa sinensis* association is also widespread in the area and usually occurs in the middle of lowland depressions, in more shady environments than (6). *C. sinensis* usually co-occurs with *Excentrodendron hsienmu* and *Garcinia paucinervis*, or occasionally as pure stands. It is mainly composed of evergreen species. Other dominant species in the community include *Streblus tonkinensis*, *Arenga pinnata*, *Cleistanthus petelotii*, *Ficus gibbosa* and *Rinorea bengalensis*.
- (8) *Cleistanthus saichikii* association is a secondary community formed after destruction of (6), and is also widespread in the reserve. It has relatively low trees and a simple structure. Apart from *C. saichikii*, most tree species are evergreen. Other major species include *Urobotrya*

latisquama, *Walsura robusta*, and *Rinorea bengalensis*. Deciduous trees include *Pistacia chinensis*, *Toxicodendron succedanea* and *Pterospermum heterophyllum*.

- (9) *Sinosideroxylon pedunculatum* H. Chuang var. *pubifolium* H. Chuang - *Pistacia weinmannifolia* association is found on the limestone hill and summits. Its species composition is rather rich, although it has simple structure and dwarf trees with irregular branching due to drought and impoverishment. Other important evergreen trees include *Memecylon scutellatum*, *Ficus tinctoria* ssp. *gibbosa*, *Sterculia euosma*, *Clausena dunniana* and *Dracaena cochinchinensis*, while deciduous trees include *Croton euryphyllum*, *Tirpitzia ovoidea*, *Boniodendron minor* and *Campylotropis delavayi*.

Results

Flora

Earlier studies of Nonggang NNR recorded 1,431 species of wild vascular plants (Liang *et al.*, 1988). Based on the present geographical distribution of the genera recorded in the plant communities, 31% of genera are tropical and 30% are tropical-subtropical, indicating that the flora is predominantly tropical in nature. The community belongs biogeographically to the Malaysia and the Gulf of Tonkin subunit of the palaeo-tropical unit.

The present survey recorded 349 vascular plant species including eight species of ferns in six families, two species of gymnosperms in two families, 309 dicot angiosperms in 72 families, and 30 monocot angiosperms in 12 families (Table 1). Only two orchid species were recorded, both of which are widespread in South and Southwest China, but this is unlikely to be a representative sample of the orchid flora of Nonggang NNR.

Among the species recorded, *Garcinia paucinervis* is globally Endangered (IUCN Species Survival Commission, 2001). *Hydnocarpus hainanensis*, *Dalbergia balansae*, *Cephalomappa sinensis*, *Excentrodendron hsienmu*, and *Madhuca pasquieri* are Vulnerable. *Zenia insignis*, *Deutzianthus tonkinensis*, and *Aglaiia odorata* are considered to be at Lower Risk (near threatened). *Excentrodendron hsienmu*, *Zenia insignis*, and *Deutzianthus tonkinensis* are also Class II Protected plant species, whereas *Cephalomappa sinensis* is endemic to limestone area of Guangxi. *Cycas miquelii* is a Class I Protected species, whereas *Horsfieldia hainanensis* and *Hainania trichosperma* are Class II Protected. Although not found in this survey, earlier comprehensive surveys of the area (Liang *et al.*, 1988) have found *Cycas micholitzii* Dyer (Protected I), *Parashorea chinensis* (Endangered, Protected I), *Dendrocnide urentissima* Chew. (Endangered), and *Litsea dilleniifolia* P.Y. Pai & P.H. Huang (Endangered). The two orchids found are regulated under CITES Appendix II.

In addition to these endangered and protected species, there are a number of narrowly restricted species found in this survey, including *Maytenus confertiflora*, *Diospyros siderophylla* (Guangxi), *Camellia flavida*, *Excoecaria venenata*, *Passiflora papilio*, *Vitex kwangsiensis* (southwest Guangxi), *Trigonostemon lutescens* (southern Guangxi), *Pittosporum pulchrum* (southwest Guangxi and northern Vietnam), *Eriolaena kwangsiensis* (southwest Guangxi and southern Yunnan), and *Actinodaphne kweichowensis* (west Guangxi and southwest Guizhou). Due to its special physical and chemical conditions, a number of plant species found here are found only in limestone forest, such as *Diospyros saxatilis*, *D. siderophylla*, *Canscora lucidissima*, *Tirpitzia ovoidea*, *Excentrodendron hsienmu* and *Croton euryphyllum*.

Table 1. Vascular plants of Nonggang National Nature Reserve. Species that are Nationally Protected (Class I or II) (State Forestry Administration & Ministry of Agriculture, 1999), globally Threatened or Lower Risk (Near-threatened) (IUCN Species Survival Commission, 2001) or endemic are indicated under Remarks.

Families	Species name	Remarks
PTERIDOPHYTA		
Aspleniaceae	<i>Neottopteris antrophyoides</i> (H. Christ) Ching	
Dryopteridaceae	<i>Cyrtomium fortunei</i> J. Sm.	
Lygodiaceae	<i>Lygodium conforme</i> C. Chr. <i>Lygodium japonicum</i> (Thunb.) Sw.	
Nephrolepidaceae	<i>Nephrolepis auriculata</i> (L.) Trimea	
Pteridaceae	<i>Pteris vittata</i> L.	
Selaginellaceae	<i>Selaginella delicatula</i> (Desv. ex Poir.) Alston <i>Selaginella uncinata</i> (Desv.) Spring	
GYMNOSPERMAE		
Cycadaceae	<i>Cycas miquelii</i> Warb.	Protected I
Gnetaceae	<i>Gnetum montanum</i> Markgr.	
ANGIOSPERMAE		
Dicotyledonae		
Actinidiaceae	<i>Actinidia latifolia</i> (Gardner et Champ.) Merr. <i>Saurauia tristyla</i> DC.	
Alangiaceae	<i>Alangium chinense</i> (Lour.) Harms.	
Amaranthaceae	<i>Cladostachys frutescens</i> D. Don	
Anacardiaceae	<i>Choerospondias axillaris</i> (Roxb.) B.L. Burtt et. A.W. Hill <i>Dracontomelon duperreanum</i> Pierre <i>Pegia sarmentosa</i> (Lecomte) Hand.-Mazz. <i>Pistacia chinensis</i> Bunge <i>Pistacia weinmannifolia</i> J. Poiss. ex Franch. <i>Rhus chinensis</i> Mill. <i>Spondias lakonensis</i> Pierre	
Annonaceae	<i>Alphonsea mollis</i> Dunn <i>Alphonsea monogyna</i> Merr. et Chun <i>Artabotrys hongkongensis</i> Hance <i>Desmos chinensis</i> Lour. <i>Fissistigma chloroneurum</i> (Hand.-Mazz.) Tsiang <i>Fissistigma retusum</i> (H. Lév.) Rehder <i>Goniothalamus donnaiensis</i> Finet & Gagnep. <i>Miliusa chunii</i> W. T. Wang <i>Orophea anceps</i> Pierre <i>Uvaria tonkinensis</i> Finet & Gagnep.	
Apocynaceae	<i>Alstonia scholaris</i> (L.) R. Br. <i>Baumontia grandiflora</i> Wall. <i>Urceola rosea</i> (Hook. & Arn.) D.J. Middleton <i>Wrightia arborea</i> (Dennst.) Mabb. <i>Wrightia pubescens</i> R. Br.	
Araliaceae	<i>Aralia armata</i> (Wall.) Seem. <i>Aralia dasyphylla</i> Miq. <i>Eleutherococcus trifolius</i> (L.) S.Y. Hu <i>Schefflera glomerulata</i> H.L. Li <i>Schefflera leucantha</i> R. Vig. <i>Trevesia palmata</i> (DC.) Vis.	
Aristolochiaceae	<i>Aristolochia fangchi</i> Y.C. Wu ex L.D. Chow & S.M. Hwang <i>Aristolochia kwangsiensis</i> Chun & F. C. How <i>Asarum caudigerum</i> Hance	
Asclepiadaceae	<i>Cryptolepis buchananii</i> R. Br. ex Roem. & Schult. <i>Cryptolepis sinensis</i> (Lour.) Merr. <i>Hoya villosa</i> Costantin	
Asteraceae	<i>Cissampelopsis volubilis</i> (Blume) Miq. <i>Eupatorium odoratum</i> L.	introduced

Families	Species name	Remarks
	<i>Wedelia urticifolia</i> DC.	
Balsaminaceae	<i>Impatiens chlorosepala</i> Hand.-Mazz. <i>Impatiens</i> sp.	
Begoniaceae	<i>Begonia leprosa</i> Hance <i>Begonia palmata</i> D. Don	
Bignoniaceae	<i>Markhamia stipulata</i> (Wall.) Seem. ex K. Schum. var. <i>kerrii</i> Sprague <i>Oroxylum indicum</i> (L.) Kurz <i>Radermachera frondosa</i> Chun & F.C. How <i>Radermachera hainanensis</i> Merr. <i>Stereospermum chelonoides</i> DC.	
Burseraceae	<i>Garuga forrestii</i> W.W. Sm.	
Caesalpiniaceae	<i>Acrocarpus fraxinifolius</i> Wight & Arn. <i>Bauhinia aurea</i> H. Lév. <i>Bauhinia championii</i> (Benth.) Benth. <i>Bauhinia ornata</i> Kurz var. <i>kerrii</i> (Gagnep.) K. Larsen & S.S. Larsen <i>Caesalpinia crista</i> L. <i>Caesalpinia decapetala</i> (Roth) Alston <i>Caesalpinia sinensis</i> (Hemsl.) J. E. Vidal <i>Pterolobium punctatum</i> Hemsl. <i>Saraca dives</i> Pierre <i>Zenia insignis</i> Chun	Lower Risk (IUCN); Protected II
Campanulaceae	<i>Campanumoea javanica</i> Blume	
Capparaceae	<i>Capparis cantoniensis</i> Lour. <i>Capparis masaikai</i> H. Lév. <i>Capparis urophylla</i> F. Chun	
Caprifoliaceae	<i>Viburnum fordiae</i> Hance	
Celastraceae	<i>Euonymus fortunei</i> (Turcz.) Hand.-Mazz. <i>Maytenus confertiflora</i> J.Y. Luo & X.X. Chen	endemic to Guangxi limestone forests
Clusiaceae	<i>Cratoxylum cochinchinense</i> (Lour.) Blume <i>Garcinia bracteata</i> C.Y. Wu ex Y.H. Li <i>Garcinia paucinervis</i> Chun ex F.C. How	Endangered (IUCN)
Combretaceae	<i>Combretum alfredii</i> Hance	
Convolvulaceae	<i>Argyreia capitiformis</i> (Poir.) Ooststr. <i>Porana spectabilis</i> Kurz	
Cucurbitaceae	<i>Gymnopetalum chinensis</i> (Lour.) Merr. <i>Gynostemma pentaphylla</i> (Thunb.) Makino	
Ebenaceae	<i>Diospyros eriantha</i> Champ. ex Benth. <i>Diospyros saxatilis</i> S.K. Lee <i>Diospyros siderophylla</i> H.L. Li	limestone plant endemic to Guangxi limestone forests
Euphorbiaceae	<i>Acalypha kerrii</i> Craib <i>Actephila merrilliana</i> Chun <i>Alchornea rugosa</i> (Lour.) Müll. Arg. <i>Alchornea trewioides</i> (Benth.) Muell.-Arg. <i>Antidesma bunioides</i> (L.) Spreng. <i>Antidesma montanum</i> Blume <i>Aporosa dioica</i> (Roxb.) Müll. Arg. <i>Baccaurea ramiflora</i> Lour. <i>Bischofia javanica</i> Blume <i>Breynia fruticosa</i> (L.) Hook. f. <i>Bridelia insulana</i> Hance (<i>B. balansae</i> Tutch.) <i>Cephalomappa sinensis</i> (Chun & F.C. How) Kosterm. <i>Cladogynos orientalis</i> Zipp. ex Span. <i>Claoxylon indicum</i> (Reinw. ex Bl.) Hassk. <i>Cleidion brevipetiolatum</i> Pax & K. Hoffm. <i>Cleistanthus petelotii</i> Merr. ex Croizat	Vulnerable (IUCN); endemic to Guangxi

Families	Species name	Remarks
	<i>Cleistanthus sumatranus</i> (Miq.) Muell. Arg.	
	<i>Croton euryphyllus</i> W.W. Sm.	
	<i>Deutzianthus tonkinensis</i> Gagnep.	Lower Risk (IUCN); Protected II
	<i>Drypetes perreticulata</i> Gagnep.	
	<i>Excoecaria venenata</i> S.K. Lee & F.N. Wei	endemic to limestone areas in SW Guangxi
	<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt.	
	<i>Glochidion eriocarpum</i> Champ. ex Benth.	
	<i>Jatropha curcas</i> L.	
	<i>Macaranga adenantha</i> Gagnep.	
	<i>Macaranga denticulata</i> (Blume) Müll. Arg.	
	<i>Mallotus barbatus</i> (Wall.) Müll. Arg.	
	<i>Mallotus microcarpus</i> Pax & K. Hoffm.	
	<i>Mallotus philippinensis</i> (Lam.) Mull. Arg.	
	<i>Mallotus yunnanensis</i> Pax & K. Hoffm.	
	<i>Phyllanthus emblica</i> L.	
	<i>Phyllanthus reticulatus</i> Poir.	
	<i>Sapium chihsinianum</i> S.K. Lee	
	<i>Sapium sebiferum</i> (L.) Roxb.	
	<i>Sauropus bonii</i> Beille	
	<i>Strophoblachia fimbriicalyx</i> Boerl.	
	<i>Trigonostemon chinensis</i> Merr. fo. <i>fungii</i> (Merr.) Y.T. Chang	
	<i>Trigonostemon lutescens</i> Y.T. Chang & J.Y. Liang	endemic to S. Guangxi
Fagaceae	<i>Castanopsis jucunda</i> Hance	
	<i>Lithocarpus areca</i> (Hickel & A. Camus) A. Camus	
Flacourtiaceae	<i>Bennettiodendron brevipes</i> Merr.	
	<i>Flacourtia rukam</i> Zoll. & A. Mortizi	
	<i>Hydnocarpus hainanensis</i> (Merr.) Sleumer	Vulnerable (IUCN)
	<i>Xylosma longifolium</i> Clos	
Gentianaceae	<i>Canscora lucidissima</i> (H. Lév. & Vaniot) Hand.-Mazz.	limestone plant
Hamamelidaceae	<i>Liquidambar formosana</i> Hance	
Hernandiaceae	<i>Illigera rhodantha</i> Hance	
Hippocrateaceae	<i>Loeseneriella merrilliana</i> A. C. Sm.	
	<i>Pristimera arborea</i> (Roxb.) A. C. Sm.	
Icacinaceae	<i>Apodytes dimidiata</i> E. Mey. ex Arn.	
	<i>Gomphandra hainanensis</i> Merr.	
	<i>Iodes ovalis</i> Blume var. <i>vitiginea</i> (Hance) Gagnep.	
Lauraceae	<i>Actinodaphne kweichowensis</i> Yen C. Yang & P. H. Huang	endemic to SW Guangxi & SW Guizhou
	<i>Cinnamomum burmanni</i> (Nees et T. Nees) Blume	
	<i>Cinnamomum saxatile</i> H.W. Li	
	<i>Cinnamomum wilsonii</i> Gamble	
	<i>Lindera communis</i> Hemsl.	
	<i>Litsea elongata</i> (Nees) Benth. et Hook. f.	
	<i>Litsea foveolata</i> Yang P.H. Huang	
	<i>Litsea glutinosa</i> (Lour.) C. B. Rob.	
	<i>Litsea monopetala</i> (Roxb. ex Baker) Pers.	
	<i>Litsea variabilis</i> Hemsl. var. <i>oblonga</i> Lecomte	
	<i>Neolitsea pulchella</i> (Meissn) Merr	
Linaceae	<i>Tirpitzia ovoidea</i> Chun & How ex W. L. Sha	limestone plant
Lythraceae	<i>Lagerstroemia caudata</i> Chun & F.C. How ex S.K. Lee & L.F. Lau	
Magnoliaceae	<i>Magnolia paenetaulauma</i> Dandy	
Malpighiaceae	<i>Aspidopterys concava</i> (Wall.) A. Juss.	
Malvaceae	<i>Memecylon scutellatum</i> (Lour.) Hook. & Arn.	
	<i>Sida subcordata</i> Span.	
	<i>Urena lobata</i> L.	pantropical weed
Meliaceae	<i>Aglaiia odorata</i> Lour.	Lower Risk (IUCN)
	<i>Amoora tetrapetala</i> (Pierre) Pellegr.	
	<i>Aphanamixis grandifolia</i> Blume	

Families	Species name	Remarks
	<i>Cipadessa cinerascens</i> (Pellegr.) Hand.-Mazz.	
	<i>Dysoxylum mollissimum</i> Blume	
	<i>Melia azedarach</i> L.	
	<i>Walsura robusta</i> Roxb.	
Menispermaceae	<i>Cocculus laurifolius</i> DC.	
	<i>Cyclea hypoglauca</i> (Schauer) Diels	
	<i>Diploclisia glaucescens</i> (Blume) Diels	
	<i>Fibraurea recisa</i> Pierre	
	<i>Pericampylus glaucus</i> (Lam.) Merr.	
	<i>Stephania kwangsiensis</i> H.S. Lo	
	<i>Tinomiscium petiolare</i> Hook. f. & Thomson	
	<i>Tinospora sinensis</i> (Lour.) Merr.	
Mimosaceae	<i>Acacia concinna</i> (Willd.) DC.	
	<i>Adenantha pavonina</i> L.var. <i>microsperma</i> (Teijsm.et Binnend.) I. C. Nielsen	
	<i>Albizia chinensis</i> (Osbeck) Merr.	
	<i>Albizia kalkora</i> (Roxb.) Prain	
Moraceae	<i>Broussonetia papyrifera</i> (L.) L'Hér. ex Vent.	
	<i>Cudrania cochinchinensis</i> (Lour.) Kudo et Masam.	
	<i>Cudrania pubescens</i> Trécul	
	<i>Cudrania tricuspidata</i> (Carrière) Bureau ex Lavalley	
	<i>Ficus cyrtophylla</i> Wall. ex Miq.	
	<i>Ficus glaberrima</i> Blume	
	<i>Ficus hispida</i> L. f.	
	<i>Ficus hispida</i> L. f. var. <i>rubra</i> Corner	
	<i>Ficus laevis</i> Blume	
	<i>Ficus microcarpa</i> L. f.	
	<i>Ficus orthoneura</i> H. Lév. & Vaniot	
	<i>Ficus tinctoria</i> G. Forst. subsp. <i>gibbosa</i> (Blume) Corner	
	<i>Streblus tonkinensis</i> (Dubard & Eberh.) Corner	
Myristicaceae	<i>Horsfieldia hainanensis</i> Merr.	Protected II
Myrsinaceae	<i>Ardisia brunnescens</i> E. Walker	
	<i>Ardisia hanceana</i> Mez	
	<i>Ardisia purpureovillosa</i> C.Y. Wu & C. Chen ex C.M. Hu	
	<i>Ardisia thyrsoiflora</i> D. Don	
	<i>Embelia scandens</i> (Lour.) Mez	
	<i>Embelia undulata</i> (Wall.) Mez	
	<i>Maesa balansae</i> Mez	
	<i>Maesa japonica</i> (Thunb.) Moritz et Zoll.	
	<i>Myrsine kwangsiensis</i> (E. Walker) Pipoly & C. Chen	
Myrtaceae	<i>Decaspermum gracilentum</i> (Hance) Merr. & L.M. Perry	
	<i>Psidium guajava</i> L.	introduced
	<i>Syzygium chunianum</i> Merr. & L.M. Perry	
Oleaceae	<i>Erythralium scandens</i> Blume	
Oleaceae	<i>Chionanthus hainanensis</i> (Merr. & Chun) B.M. Miao	
	<i>Fraxinus insularis</i> Hemsl.	
	<i>Jasminum albicalyx</i> Kobuski	endemic to Guangxi
Onagraceae	<i>Ludwigia prostrata</i> Roxb.	
Opiliaceae	<i>Cansjera rheedii</i> J.F. Gmel.	
	<i>Urobotrya latisquama</i> (Gagnep.) Hiepko	
Papilionaceae	<i>Bowringia callicarpa</i> Champ. ex Benth.	
	<i>Campylotropis delavayi</i> (Franch.) Schindl.	
	<i>Cladrastis platycarpa</i> (Maxim.) Makino	
	<i>Dalbergia balansae</i> Prain	Vulnerable (IUCN)
	<i>Dalbergia pinnata</i> (Lour.) Prain	
	<i>Dalbergia rimosa</i> Roxb.	
	<i>Dendrolobium triangulare</i> (Retz.) Schindl.	
	<i>Desmodium laxiflorum</i> DC.	
	<i>Erythrina variegata</i> L.	
	<i>Flemingia macrophylla</i> Kuntze ex Prain	
	<i>Fordia cauliflora</i> Hemsl.	

Families	Species name	Remarks
	<i>Lysidice rhodostegia</i> Hance	
	<i>Millettia oosperma</i> Dunn	
	<i>Millettia pachycarpa</i> Benth.	
	<i>Millettia reticulata</i> Benth.	
	<i>Ormosia fordiana</i> Oliv.	
	<i>Phyllodium pulchellum</i> (L.) Desv.	
	<i>Pueraria lobata</i> (Willd.) Ohwi	
	<i>Rhynchosia volubilis</i> Lour.	
	<i>Tadehagi triquetrum</i> (L.) H. Ohashi	
Passifloraceae	<i>Passiflora papilio</i> H. L. Li	endemic to SW Guangxi
Piperaceae	<i>Piper hancei</i> Maxim.	
	<i>Piper hongkongense</i> C. DC.	
	<i>Piper kadsura</i> (Choisy) Ohwi	
	<i>Piper sarmentosum</i> Roxb.	
Pittosporaceae	<i>Pittosporum pulchrum</i> Gagnep.	endemic to SW Guangxi & N. Vietnam
Polygalaceae	<i>Securidaca inappendiculata</i> Hassk.	
	<i>Polygonum chinense</i> L.	
Ranunculaceae	<i>Clematis armandii</i> Franch.	
Rhamnaceae	<i>Berchemia floribunda</i> (Wall.) Brongn.	
	<i>Berchemia lineata</i> (L.) DC.	
	<i>Gouania javanica</i> Miq.	
	<i>Paliurus ramosissimus</i> (Lour.) Poir.	
	<i>Sageretia thea</i> (Osbeck) M.C. Johnst.	
	<i>Ziziphus incurva</i> Roxb.	
	<i>Ziziphus oenoplia</i> (L.) Mill.	
Rosaceae	<i>Laurocerasus zippeliana</i> (Miq.) T.T. Yu & L.T. Lu	
	<i>Pyrus calleryana</i> (L.) Lindl.	
	<i>Rubus cochinchinensis</i> Tratt.	
	<i>Rubus feddei</i> H. Lév. & Vaniot	
	<i>Rubus hanceanus</i> Kuntze	
Rubiaceae	<i>Canthium dicoccum</i> (Gaertn.) Teysmann et Binnedijk	
	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	
	<i>Duperrea pavettifolia</i> (Kurz) Pit.	
	<i>Hymenodictyon flaccidum</i> Wall.	
	<i>Mussaenda hirsutula</i> Miq.	
	<i>Myrioneuron tonkinensis</i> Pit.	
	<i>Pavetta hongkongensis</i> Brem.	
	<i>Psychotria asiatica</i> L.	
	<i>Psychotria prainii</i> H. Lév.	
	<i>Sinoadina racemosa</i> (Siebold & Zucc.) Ridsdale	
	<i>Tarenna depauperata</i> Hutch.	
	<i>Tarennoidea wallichii</i> (Hook. f.) Tirveng. et Sastre	
	<i>Uncaria hirsuta</i> Havil.	
Rutaceae	<i>Wendlandia uvariifolia</i> Hance	
	<i>Clausena anisum-olens</i> (Blanco) Merr.	planted
	<i>Clausena dunniana</i> H. Lév.	
	<i>Clausena emarginata</i> C.C. Huang	
	<i>Clausena excavata</i> Burm. f.	
	<i>Evodia trichotoma</i> (Lour.) Pierre	
	<i>Glycosmis parviflora</i> (Sims) Little	
	<i>Micromelum integerrimum</i> Roem.	
	<i>Murraya paniculata</i> (L.) Jack	
	<i>Zanthoxylum armatum</i> DC.	
	<i>Zanthoxylum dissitum</i> Hemsl.	
	<i>Zanthoxylum nitidum</i> (Roxb.) DC.	
Santalaceae	<i>Osyris wightiana</i> Wall. ex Wight	
Sapindaceae	<i>Amesiodendron chinense</i> (Merr.) Hu	
	<i>Boniodendron minius</i> (Hemsl.) T.C. Chen	
	<i>Delavaya toxocarpa</i> Franch.	
	<i>Dimocarpus confinis</i> (F.C. How & C.N. Ho) H.S. Lo	

Families	Species name	Remarks
Sapotaceae	<i>Madhuca pasquieri</i> (Dubard) H.J. Lam	Protected II, Vulnerable (IUCN)
	<i>Pouteria annamensis</i> (Pierre) Baehni	
	<i>Sinosideroxylon wightianum</i> (Hook. & Arn.) Aubrév.	
Schisandraceae	<i>Kadsura coccinea</i> (Lem.) A.C. Sm.	
Simarubaceae	<i>Brucea mollis</i> Wall. ex Kurz	
	<i>Picrasma quassioides</i> (D. Don) Benn.	
Solanaceae	<i>Solanum erianthum</i> D. Don	
	<i>Solanum torvum</i> Sw.	introduced
Sterculiaceae	<i>Eriolaena kwangsiensis</i> Hand.-Mazz.	endemic to SW Guangxi & S. Yunnan
	<i>Pterospermum heterophyllum</i> Hance	
	<i>Pterospermum truncatolocatum</i> Gagnep.	
	<i>Sterculia euosma</i> W.W. Sm.	
	<i>Sterculia lanceolata</i> Cav.	
	<i>Sterculia nobilis</i> Sm.	
Theaceae	<i>Camellia flavida</i> H.T. Chang	endemic to SW Guangxi
Tiliaceae	<i>Excentrodendron hsienmu</i> (Chun & F.C. How) H.T. Chang & R.H. Miao	Vulnerable (IUCN); Protected II; endemic to limestone areas in Guangxi
	<i>Grewia eriocarpa</i> Juss.	
	<i>Grewia henryi</i> Burret	
	<i>Hainania trichosperma</i> Merr.	Protected II
	<i>Microcos paniculata</i> L.	
Ulmaceae	<i>Triumfetta rhomboidea</i> Jacq.	
	<i>Celtis biondii</i> Pamp.	
	<i>Celtis philippensis</i> Blanco	
	<i>Ulmus tonkinensis</i> Gagnep.	
Verbenaceae	<i>Clerodendrum japonicum</i> (Thunb.) Sweet	
	<i>Clerodendrum mandarinorum</i> Diels	
	<i>Clerodendrum serratum</i> (L.) Moon	
	<i>Premna fulva</i> Craib	
	<i>Vitex canescens</i> Kurz	
	<i>Vitex kwangsiensis</i> P'ei	endemic to SW Guangxi
	<i>Vitex negundo</i> L.	
Violaceae	<i>Rinorea bengalensis</i> (Wall.) Kuntze	
Vitaceae	<i>Cayratia japonica</i> (Thunb.) Gagnep.	
	<i>Cissus repens</i> Lam.	
	<i>Leea indica</i> (Burm. f.) Merr.	
	<i>Tetrastigma caudatum</i> Merr. & Chun	
	<i>Tetrastigma cauliflorum</i> Merr.	
Monocotyledonae		
Amaryllidaceae	<i>Crinum asiaticum</i> L. var. <i>sinicum</i> (Roxb. ex Herb.) Baker	
Araceae	<i>Alocasia macrorrhiza</i> (L.) Schott	
	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson	
	<i>Amorphophallus rivieri</i> Durieu ex Carrierre	
	<i>Arisaema</i> sp.	
	<i>Colocasia gigantea</i> (Blume) Hook. f.	
	<i>Epipremnum pinnatum</i> (L.) Engl.	
	<i>Pothos kerrii</i> Buchet ex Gagnep.	
	<i>Rhaphidophora hongkongensis</i> Schott	
	<i>Rhaphidophora hookeri</i> Schott	
Areaceae	<i>Arenga pinnata</i> (Wurmb) Merr.	
	<i>Calamus balansaeanus</i> Becc.	
	<i>Caryota mitis</i> Lour.	
	<i>Caryota ochlandra</i> Hance	
	<i>Caryota urens</i> L.	
Commelinaceae	<i>Amischotolype hispida</i> (Less. & A. Rich.) D.Y. Hong	

Families	Species name	Remarks
Dioscoreaceae	<i>Pollia secundiflora</i> (Blume) Bakh. f.	
	<i>Dioscorea esquirolii</i> Prain & Burkill	
	<i>Dioscorea persimilis</i> Prain & Burkill	
Liliaceae	<i>Dracaena cochinchinensis</i> (Lour.) S.C. Chen	
	<i>Smilax bracteata</i> C. Presl	
	<i>Smilax hypoglauca</i> Benth.	
Marantaceae	<i>Phrynium placentarium</i> (Lour.) Merr.	
Musaceae	<i>Musa balbisiana</i> Colla	
Orchidaceae	<i>Acampe rigida</i> (Buch.-Ham. ex J.E. Sm.) P.F. Hunt	epiphytic
	<i>Cymbidium aloifolium</i> (L.) Sw.	epiphytic
Poaceae	<i>Indocalamus longiauritus</i> Hand.-Mazz.	
Taccaceae	<i>Tacca chantrieri</i> André	
Zingiberaceae	<i>Alpinia kwangsiensis</i> T.L. Wu & S.J. Chen	
	<i>Amomum villosum</i> Lour.	

Mammals

Pallas's Squirrel *Callosciurus erythraeus* was regularly seen and heard at Longhu, Nonggang section and Longshan.

On 23 May, several macaques were seen. The group included three adults and one juvenile. Although too distant to firmly identify, they were believed to be Rhesus Monkeys *Macaca mulatta*.

An unidentified bamboo rat *Rhizomys* sp. was seen at Longhu on 23 May.

At Longshan a large adult Crab-eating Mongoose *Herpestes urva* was seen on 26 May, foraging in the forest. Footprints and diggings of Wild Boar *Sus scrofa* were found. Footprints of an unidentified small deer were also present in the marsh. The barking of a deer (probably *Muntiacus* sp.) was heard on 26 May.

Hare-like droppings, probably from Chinese Hare *Lepus sinensis*, were common around the Longshan resort.

The status of large and medium sized mammals was inferred based on the above records, on observations of human disturbance, and on interviews with Nonggang section reserve warden Mr. Lee and two local farmers at Longshan (Table 2).

Table 2. The status of mammals (excluding Erinaceidae, Talpidae, Soricidae, Muridae and Chiroptera) at Nonggang National Nature Reserve, Guangxi, based partly on interviews with reserve warden Mr. Lee and two farmers at Longshan. Species names and sequence follow Wilson & Cole (2000); synonyms and names commonly used by Chinese scientists are included in brackets. (“+” = rare, “++” = common, “+++” = abundant)

Scientific name	English name	Nonggang section			Probable status
		(Mr. Lee)	Farmer A	Farmer B	
<i>Tupaia belangeri</i>	Northern Tree Shrew	+++	+++	-	insecure
<i>Nycticebus</i> sp.	loris sp.	+	-	+++	insecure or extirpated
<i>Macaca arctoides</i>	Stump-tailed Macaque	+	-	-	insecure or extirpated
<i>Macaca assamensis</i>	Assam Macaque	+++	+	+++	insecure
<i>Macaca mulatta</i>	Rhesus Monkey	+++	-	-	insecure
<i>Trachypithecus</i> (or <i>Semnopithecus</i> or <i>Presbytis</i>)	Black Leaf Monkey	+	-	-	insecure or extirpated

Scientific name	English name	Nonggang	Longshan		Probable status
		section (Mr. Lee)	Farmer A	Farmer B	
<i>francoisi francoisi</i>					
<i>T. f. leucocephalus</i>	White-headed Leaf Monkey	+	-	-	insecure or extirpated
<i>Hylobates concolor</i>	Crested Gibbon	-	-	-	extirpated
<i>Vulpes vulpes</i>	Red Fox	+	-	-	insecure or extirpated
<i>Nyctereutes procyonoides</i>	Raccoon Dog	++	-	-	insecure or extirpated
<i>Cuon alpinus</i>	Dhole	+	-	-	insecure or extirpated
<i>Catopuma (or Felis) temminckii</i>	Asiatic Golden Cat	+	+	+	insecure or extirpated
<i>Prionailurus (or Felis) bengalensis</i>	Leopard Cat	++	+	+	insecure
<i>Neofelis (or Pardofelis) nebulosa</i>	Clouded Leopard	+	+	+	insecure or extirpated
<i>Panthera pardus</i>	Leopard	+	-	-	extirpated
<i>Herpestes javanicus</i>	Javan Mongoose	++	-	-	uncertain
<i>Herpestes urva</i>	Crab-eating Mongoose	++	+++	+++	present
<i>Lutra lutra</i>	Eurasian Otter	+	-	-	extirpated
<i>Arctonyx collaris</i>	Hog Badger	-	+	+++	insecure
<i>Meles meles</i>	Eurasian Badger	-	+	-	uncertain
<i>Melogale moschata</i>	Chinese Ferret-badger	+	+	+++	insecure
<i>Martes flavigula</i>	Yellow-throated Marten	+	-	+	insecure or extirpated
<i>Mustela kathiah</i>	Yellow-bellied Weasel	+	+++	++	present
<i>Mustela sibirica</i>	Siberian Weasel	+	+++	+++	present
<i>Ursus (Selenarctos) thibetanus</i>	Asiatic Black Bear	++	-	-	insecure or extirpated
<i>Paguma larvata</i>	Masked Palm Civet	++	+++	+++	present
<i>Paradoxurus hermaphroditus</i>	Asian Palm Civet	++	-	-	uncertain
<i>Prionodon pardicolor</i>	Spotted Linsang	++	+	+	insecure
<i>Viverra zibetha</i>	Large Indian Civet	++	-	-	insecure or extirpated
<i>Viverricula indica</i>	Small Indian Civet	++	+++	+++	present
<i>Sus scrofa</i>	Wild Boar	+++	+++	+++	present
<i>Moschus berezovskii</i>	Chinese Forest Musk Deer	+	-	-	insecure or extirpated
<i>Cervus unicolor</i>	Sambar	-	+++	-	insecure or extirpated
<i>Muntiacus muntjak</i>	Indian Muntjac	-	-	+++	insecure
<i>Muntiacus reevesi</i>	Reeves's Muntjac	+++	-	-	uncertain
<i>Naemorhedus caudatus</i> (<i>N. goral arnouxianus</i>)	Chinese Goral	-	-	+++	insecure
<i>Naemorhedus sumatraensis</i>	Serow	++	-	+++	insecure
<i>Manis pentadactyla</i>	Chinese Pangolin	+	+	+++	insecure
<i>Callosciurus erythraeus</i>	Pallas's Squirrel	+++	+++	+++	present
<i>Dremomys pyrrhomerus</i>	Red-hipped Squirrel	?	-	-	uncertain
<i>Ratufa bicolor</i>	Black Giant Squirrel	?	-	-	uncertain
<i>Tamiops maritimus</i> (<i>T. swinhoei</i>)	Maritime Striped Squirrel	+++	-	+++	present
<i>Petaurista philippensis</i> (or <i>petaurista</i>)	Indian (or Red) Giant Flying Squirrel	+++	-	-	insecure
<i>Rhizomys pruinosus</i>	Hoary Bamboo Rat	+++	+++	+++	present
<i>Rhizomys sinensis</i>	Chinese Bamboo Rat	+++	-	-	present
<i>Hystrix brachyura</i> (<i>H. hodgsoni</i>)	Malayan Porcupine	+++	+++	+++	present
<i>Lepus sinensis</i>	Chinese Hare	+++	-	+++	present

Based on a survey in 1979, the following species were reported to occur by Long (1988): Northern Tree Shrew *Tupaia belangeri* (as *Iupaia glis*) at Longshan; Leschenault's Rousette *Rousettus leschenaulti* at Longshan; Black Leaf Monkey *Trachypithecus f. francoisi* at Nonggang section and Longhu; White-headed Leaf Monkey *Trachypithecus francoisi leucocephalus* (as *Presbytis leucocephalus*) at Longshan; Chinese Pangolin *Manis pentadactyla* at Nonggang section; Pallas's Squirrel at Nonggang section, Longhu and Longshan; Black Giant Squirrel *Ratufa bicolor* at Longhu; Red Giant Flying Squirrel *Petaurista petaurista* at Nonggang section; Hoary Bamboo Rat *Rhizomys pruinosus* at Longhu; Edwards's Long-tailed Giant Rat *Leopoldamys edwardsi* (as *Rattus edwardsi*) at Nonggang section; Malayan Porcupine *Hystrix brachyura* at Nonggang section; Chinese Ferret-badger *Melogale moschata* at Nonggang section; Masked Palm Civet *Paguma larvata* at Longshan; Spotted Linsang *Prionodon pardicolor* at Nonggang section; Leopard Cat *Prionailurus bengalensis* at Longhu and Longshan; Wild Boar at Longshan; Chinese Forest Musk Deer *Moschus berezovskii* at Longshan; and Serow *Naemorhedus sumatraensis* at Nonggang section.

Of the species reported to occur, Assam Macaque *Macaca assamensis*, Black Leaf Monkey, White-headed Leaf Monkey and Clouded Leopard *Neofelis nebulosa* are considered globally Vulnerable and Class I protected in China. Stump-tailed Macaque *Macaca arctoides*, Dhole *Cuon alpinus*, Asiatic Black Bear *Ursus thibetanus*, Chinese Goral *Naemorhedus caudatus* and Serow are globally Vulnerable and Class II protected. Malayan Porcupine is globally Vulnerable. Chinese Pangolin, Rhesus Monkey, Asiatic Golden Cat *Catopuma temmincki* and Chinese Forest Musk Deer are globally Near-threatened and Class II protected in China. Slow Loris *Nycticebus coucang* and Leopard *Panthera pardus* are Class I protected, while Yellow-throated Marten *Martes flavigula*, Eurasian Otter *Lutra lutra*, Large Indian Civet *Viverra zibetha*, Small Indian Civet *Viverricula indica*, Spotted Linsang and Sambar *Cervus unicolor* are Class II protected.

The present survival of many of these rarer species in Nonggang NNR must be considered doubtful, in view of the high human impact and the fragmented nature of the remaining natural habitats.

Birds

Eighty-one bird species were recorded from the three sections of Nonggang NNR (Table 3). The most frequently recorded were Striped Tit Babbler *Macronous gularis*, Streak-breasted Scimitar Babbler *Pomatorhinus ruficollis*, Black-naped Monarch *Hypothymis azurea*, Red-whiskered Bulbul *Pycnonotus jocosus*, Rufous-capped Babbler *Stachyris ruficeps*, Common Tailorbird *Orthotomus sutorius*, Black-crested Bulbul *Pycnonotus melanicterus*, Fork-tailed Sunbird *Aethopyga christinae*, Drongo Cuckoo *Surniculus lugubris* and Rufescent Prinia *Prinia rufescens*.

Table 3. Birds recorded in Nonggang National Nature Reserve from 19 to 27 May 1998. Sequence based on Clements (2000).

Scientific name	English name
<i>Tachybaptus ruficollis</i>	Little Grebe
<i>Gorsachius melanolophus</i>	Malayan Night Heron
<i>Spilornis cheela</i>	Crested Serpent Eagle
<i>Accipiter trivirgatus</i>	Crested Goshawk
<i>Spizaetus nipalensis</i>	Mountain Hawk Eagle
<i>Falco severus</i>	Oriental Hobby
<i>Francolinus pintadeanus</i>	Chinese Francolin
<i>Gallus gallus</i>	Red Junglefowl
<i>Lophura nycthemera</i>	Silver Pheasant
<i>Amaurornis akool</i>	Brown Crake

Scientific name	English name
<i>Hierococyx sparverioides</i>	Large Hawk Cuckoo
<i>Cacomantis sonneratii</i>	Banded Bay Cuckoo
<i>Cacomantis merulinus</i>	Plaintive Cuckoo
<i>Surniculus lugubris</i>	Drongo Cuckoo
<i>Phaenicophaeus tristis</i>	Green-billed Malkoha
<i>Centropus sinensis</i>	Greater Coucal
<i>Otus spilocephalus</i>	Mountain Scops Owl
<i>Otus bakkamoena</i>	Collared Scops Owl
<i>Otus sunia</i>	Oriental Scops Owl
<i>Glaucidium brodiei</i>	Collared Owlet
<i>Glaucidium cuculoides</i>	Asian Barred Owlet
<i>Alcedo atthis</i>	Common Kingfisher
<i>Eurystomus orientalis</i>	Dollarbird
<i>Anthracoceros albirostris</i>	Oriental Pied Hornbill
<i>Megalaima virens</i>	Great Barbet
<i>Megalaima oorti</i>	Black-browed Barbet
<i>Celeus brachyurus</i>	Rufous Woodpecker
<i>Blythipicus pyrrhotis</i>	Bay Woodpecker
<i>Psarisomus dalhousiae</i>	Long-tailed Broadbill
<i>Hirundo rustica</i>	Barn Swallow
<i>Motacilla alba</i>	White Wagtail
<i>Coracina novaehollandiae</i>	Large Cuckooshrike
<i>Pericrocotus solaris</i>	Grey-chinned Minivet
<i>Hemipus picatus</i>	Bar-winged Flycatcher-shrike
<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul
<i>Pycnonotus melanicterus</i>	Black-crested Bulbul
<i>Alophoixus pallidus</i>	Puff-throated Bulbul
<i>Hemixos flava</i>	Ashy Bulbul
<i>Hypsipetes castanonotus</i>	Chestnut Bulbul
<i>Hypsipetes leucocephalus</i>	Black Bulbul
<i>Prinia rufescens</i>	Rufescent Prinia
<i>Prinia hodgsonii</i>	Grey-breasted Prinia
<i>Prinia flaviventris</i>	Yellow-bellied Prinia
<i>Orthotomus sutorius</i>	Common Tailorbird
<i>Phylloscopus ricketti</i>	Sulphur-breasted Warbler
<i>Cyornis hainanus</i>	Hainan Blue Flycatcher
<i>Eumyias thalassina</i>	Verditer Flycatcher
<i>Copsychus saularis</i>	Oriental Magpie Robin
<i>Hypothymis azurea</i>	Black-naped Monarch
<i>Garrulax pectoralis</i>	Greater Necklaced Laughingthrush
<i>Garrulax chinensis</i>	Black-throated Laughingthrush
<i>Garrulax canorus</i>	Hwamei
<i>Pomatorhinus hypoleucos</i>	Large Scimitar Babbler
<i>Pomatorhinus ruficollis</i>	Streak-breasted Scimitar Babbler
<i>Pomatorhinus erythrocnemis</i>	Spot-breasted Scimitar Babbler
<i>Napothera brevicaudata</i>	Streaked Wren Babbler
<i>Stachyris ruficeps</i>	Rufous-capped Babbler
<i>Stachyris chrysaea</i>	Golden Babbler
<i>Stachyris nigriceps</i>	Grey-throated Babbler
<i>Macronous gularis</i>	Striped Tit Babbler
<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta
<i>Yuhina castaniceps</i>	Striated Yuhina
<i>Yuhina nigrimenta</i>	Black-chinned Yuhina
<i>Yuhina zantholeuca</i>	White-bellied Yuhina
<i>Parus major</i>	Great Tit
<i>Parus monticolus</i>	Green-backed Tit
<i>Nectarinia jugularis</i>	Olive-backed Sunbird
<i>Aethopyga christinae</i>	Fork-tailed Sunbird
<i>Arachnothera longirostra</i>	Little Spiderhunter
<i>Arachnothera magna</i>	Streaked Spiderhunter

Scientific name	English name
<i>Dicaeum concolor</i>	Plain Flowerpecker
<i>Dicaeum ignipectus</i>	Fire-breasted Flowerpecker
<i>Zosterops japonicus</i>	Japanese White-eye
<i>Oriolus chinensis</i>	Black-naped Oriole
<i>Lanius cristatus</i>	Brown Shrike
<i>Dicrurus aeneus</i>	Bronzed Drongo
<i>Dicrurus annectans</i>	Crow-billed Drongo
<i>Urocissa whiteheadi</i>	White-winged Magpie
<i>Corvus macrorhynchos</i>	Large-billed Crow
<i>Passer montanus</i>	Eurasian Tree Sparrow
<i>Lonchura striata</i>	White-rumped Munia

The records of Banded Bay Cuckoo *Cacomantis sonneratii*, Ashy Bulbul *Hemixos flava*, Grey-throated Babbler *Stachyris nigriceps*, Striped Tit Babbler, Golden Babbler *Stachyris chrysaea*, Little Spiderhunter *Arachnothera longirostra* and Dusky Crag Martin *Hirundo concolor* (which was recorded by the river near Longshan) are believed to be the first from Guangxi. Nonggang NNR is on or near the eastern limit of the range of these species. Striped Tit Babbler was also found at Chunxiu (Kadoorie Farm and Botanic Garden, 2002b), and although highly restricted in South China, was the most frequently encountered bird species in the present survey. Golden Babbler was also found at Chunxiu (Kadoorie Farm & Botanic Garden, 2002b).

In addition to these, many species were recorded from the reserve for the first time, including Crested Goshawk, Mountain Hawk Eagle *Spizaetus nipalensis*, Chinese Francolin, Brown Crake *Amaurornis akool*, Large Hawk Cuckoo, Plaintive Cuckoo *Cacomantis merulinus*, Drongo Cuckoo, Collared Owlet *Glaucidium brodiei*, Asian Barred Owlet *Glaucidium cuculoides*, Collared Scops Owl *Otus bakkamoena*, Oriental Scops Owl *Otus sunia*, Great Barbet *Megalaima virens*, Black-browed Barbet, Hoopoe, Bay Woodpecker *Blythipicus pyrrhotis*, Dollarbird *Eurystomus orientalis*, Chestnut Bulbul *Hypsipetes castanonotus*, Red-whiskered Bulbul, Large Cuckoo Shrike, Grey-chinned Minivet *Pericrocotus solaris*, Bar-winged Flycatcher Shrike *Hemipus picatus*, Barn Swallow *Hirundo rustica*, Grey-throated Babbler *Stachyris nigriceps*, Large Scimitar Babbler *Pomatorhinus hypoleucos*, Golden Babbler, Spot-breasted Scimitar Babbler *Pomatorhinus erythrocnemis*, Greater Necklaced Laughingthrush *Garrulax pectoralis*, Black-chinned Yuhina, Striated Yuhina, Grey-breasted Prinia *Prinia hodgsonii*, Rufescent Prinia, Sulphur-breasted Warbler *Phylloscopus ricketti*, Hainan Blue Flycatcher *Cyornis hainanus*, Verditer Flycatcher *Eumyias thalassina*, Streaked Spiderhunter, Fire-breasted Flowerpecker *Dicaeum ignipectus*, Plain Flowerpecker *Dicaeum concolor*, Olive-backed Sunbird *Nectarinia jugularis*, Green-backed Tit *Parus monticolus*, Black-naped Oriole *Oriolus chinensis*, Bronzed Drongo *Dicrurus aeneus*, Crow-billed Drongo *Dicrurus annectans* and White-winged Magpie *Urocissa whiteheadi*.

The following species were recorded at Nonggang, Longhu or Longshan sections of Nonggang NNR in 1979 by Long (1988), but were not recorded in the present survey: Yellow Bittern *Ixobrychus sinensis*, Grey-headed Lapwing *Vanellus cinereus*, Eurasian Curlew *Numenius arquata*, Emerald Dove *Chalcophaps indica*, Spotted Dove *Streptopelia chinensis*, Lesser Coucal *Centropus bengalensis*, Red-headed Trogon *Harpactes erythrocephalus*, White-throated Kingfisher *Halcyon smyrnensis*, Eurasian Hoopoe *Upupa epops*, White-browed Piculet *Sasia ochracea*, Blue-rumped Pitta *Pitta soror*, Olive-backed Pipit *Anthus hodgsoni*, Scarlet Minivet *Pericrocotus flammeus*, Sooty-headed Bulbul *Pycnonotus aurigaster*, Orange-headed Thrush *Zoothera citrina*, Scaly Thrush *Zoothera dauma*, Eurasian Blackbird *Turdus merula*, Pale Thrush *Turdus pallidus*, Yellow-bellied Prinia *Prinia flaviventris*, Pallas's Leaf Warbler *Phylloscopus proregulus*, Yellow-browed Warbler *Phylloscopus inornatus*, Yellow-bellied Warbler

Abroscopus superciliaris, Orange-flanked Bush Robin *Tarsiger cyanurus*, Common Stonechat *Saxicola torquata*, Grey Bushchat *Saxicola ferrea*, Asian Brown Flycatcher *Muscicapa dauurica*, Fujian Niltava *Niltava davidi*, Daurian Redstart *Phoenicurus aureus*, White-tailed Robin *Myiomela leucura*, White-throated Fantail *Rhipidura albicollis*, Spot-necked Babbler *Stachyris striolata*, Brown-cheeked Fulvetta *Alcippe poioicephala*, Sultan Tit *Melanochlora sultanea*, Scarlet-backed Flowerpecker *Dicaeum cruentatum*, Long-tailed Shrike *Lanius schach*, Spangled Drongo *Dicrurus hottentottus*, Lesser Racket-tailed Drongo *Dicrurus remifer*, Collared Crow *Corvus torquatus* and Common Myna *Acridotheres tristis*. Some of these species are winter visitors or migrants, and are unlikely to have been in the area during the present survey in May.

Crested Goshawk, Crested Serpent Eagle, Mountain Hawk Eagle, Oriental Hobby, Red Junglefowl, Silver Pheasant, Greater Coucal, Lesser Coucal, Blue-rumped Pitta, Collared Pygmy Owllet, Asian Barred Owllet, Collared Scops Owl, Oriental Scops Owl, Mountain Scops Owl, Oriental Pied Hornbill and Long-tailed Broadbill are Category II nationally protected species in China.

The presence of many forest-dependent species such as Malayan Night Heron, Mountain Hawk Eagle, Red Jungle Fowl, Oriental Pied Hornbill, Drongo Cuckoo, various barbets, woodpeckers, owls, babblers, yuhinas, flycatchers, flowerpeckers, spiderhunters and sunbirds indicated that the forest remnants left at Nonggang NNR are still important bird habitats. However, certain taxa susceptible to hunting, such as pigeons and other large-bodied birds, appeared to be highly depleted.

Reptiles and amphibians

Fourteen species of amphibians, 13 species of lizards and ten species of snakes were recorded from the various sections of Nonggang NNR during this survey (Table 4). Of these, 23 species were found in the Longhu section, 23 in the Nonggang section and 22 at Longshan. The most frequently encountered species included the frogs *Rana limnocharis*, *Rana guentheri*, *Microhyla ornata* and *Microhyla pulchra*, the lizards *Sphenomorphus indicus*, *Acanthosaura lepidogaster* and *Calotes microlepis*, and the snake *Psammodynastes pulveratus*. Calls of *Gekko gekko* were also commonly heard.

A snake believed to be *Ahaetulla prasina* was seen only from a distance and its identity could not be confirmed. A dead viper, probably *Vipera russelli*, was found at Longhu but it could not be positively identified due to the very poor state of the specimen.

Table 4. Amphibians and reptiles recorded at Nonggang National Nature Reserve, 19–27 May 1998. Sequence follows Zhou E.-M. & Adler (1993).

Species	Habitat	
AMPHIBIA		
<i>Bufo melanostictus</i>	forest	✓
	abandoned field	✓
	river	✓
	village	✓
<i>Hyla sanchiangensis</i>	forest edge	✓
<i>Occidozyga lima</i>	river	✓
	paddy field	✓
<i>Rana guentheri</i>	abandoned field	✓
	pool	✓
	stream	✓
	forest	✓
	forest edge	✓

Species	Habitat	
<i>Rana limnocharis</i>	grassland	✓
	abandoned field	✓
	forest	✓
	pool	✓
	agricultural field	✓
	river	✓
<i>Rana rugulosa</i>	abandoned field	✓
	pool	✓
	spring	✓
	river	✓
<i>Chirixalus vittatus</i>	forest edge	✓
	seasonal marsh	✓
<i>Philautus odontotarsus</i>	forest edge	✓
	pool	✓
	forest	✓
	seasonal marsh	✓
<i>Polypedates megacephalus</i>	Pool	tadpoles
	forest edge	✓
	forest	✓
	seasonal marsh	✓
<i>Theلودerma asperum</i>	forest	✓
<i>Kaloula pulchra</i>	well	✓
<i>Microhyla butleri</i>	forest	✓
	forest edge	✓
<i>Microhyla ornata</i>	grassland	✓
	forest	✓
	abandoned field	✓
	pool	tadpoles
	forest edge	✓
<i>Microhyla pulchra</i>	forest edge	✓
	pool	tadpoles
	shrubland	✓
REPTILIA		
<i>Gekko chinensis</i>	cliff	✓
	cave	? (eggs)
<i>Gekko gecko</i>	cliff	✓
	forest/cliff	✓
	forest edge	✓
<i>Acanthosaura lepidogaster</i>	forest edge	✓
	forest	✓
	agricultural field	✓
<i>Calotes emma</i>	forest edge	✓
	forest edge	✓
<i>Calotes microlepis</i>	forest edge	✓
	forest	✓
<i>Calotes versicolor</i>	abandoned field	✓
	shrubland	✓
	parkland	✓
	forest edge	✓
<i>Draco maculatus</i>	forest	✓
	forest	✓
<i>Platyplacopus intermedius</i>	forest	✓
<i>Ateuchosaurus chinensis</i>	forest edge	✓
<i>Eumeces quadrilineatus</i>	forest	✓
<i>Sphenomorphus indicus</i>	forest	✓
	forest edge	✓
	shrubland	✓
<i>Sphenomorphus incognitus</i>	stream	✓
<i>Takydromus sexlineatus</i>	agricultural field	✓
	forest/agricultural field	✓
	grassland/plantation	✓

Species	Habitat	
<i>Ahaetulla prasina</i> ?	forest edge	✓
	forest	✓
<i>Amphiesma stolatum</i>	agricultural field	✓
	river	✓
<i>Enhydris plumbea</i>	agricultural field	✓
<i>Oligodon chinensis</i>	forest edge	✓
<i>Oligodon joysoni</i>	forest	✓
<i>Psammodynastes pulverulentus</i>	forest	✓
	agricultural field	✓
<i>Rhabdophis subminiatus</i>	pool	✓
	river	✓
<i>Xenochrophis piscator</i>	stream	✓
	river	✓
<i>Vipera russelii</i> ?	Plantation	✓
<i>Trimeresurus albolabris</i>	agricultural field	✓

The grey kukri snake *Oligodon joysoni* has previously been reported from Southeast Asia only, and constitutes a new record for China. The records of *Calotes emma* and *Calotes microlepis* are new for Guangxi. Seven amphibians (*Occidozyga lima*, *Philautus odontotarsus*, *Theلودerma asperum*, *Kaloula pulchra*, *Microhyla butleri*, *Microhyla ornata* and *Microhyla pulchra*), eight lizards (*Gekko chinensis*, *Acanthosaura lepidogaster*, *Calotes emma*, *Calotes microlepis*, *Draco maculatus*, *Sphenomorphus indicus*, *Sphenomorphus incognitus* and *Takydromus sexlineatus*) and four snakes (*Amphiesma stolatum*, *Enhydris plumbea*, *Xenochrophis piscator* and *Trimeresurus albolabris*) are apparently new records for the Longhu and Nonggang sections of the reserve. Four amphibians (*Hyla sanchiangensis*, *Chirixalus vittatus*, *Philautus odontotarsus* and *Microhyla butleri*), nine lizards (*Gekko chinensis*, *Acanthosaura lepidogaster*, *Calotes microlepis*, *Calotes versicolor*, *Draco maculatus*, *Ateuchosaurus chinensis*, *Eumeces quadrilineatus*, *Sphenomorphus indicus* and *Platyplacopus intermedius*) and one snake (*Oligodon joysoni*) are new records for Longshan.

In addition to the above, the following species have been reported from Nonggang and Longhu sections: *Geoemyda spengleri*, *Dendrelaphis pictus*, *Elaphe moellendorffi*, *Cyclophiops multicinctus*, *Boiga guangxiensis*, *Ptyas korros* and *Naja atra* (as *Naja naja*) (Long, 1988; Wen, 1998). The frogs *Rana limnocharis* and *Rana rugulosa*, the tortoise *Geoemyda spengleri*, the gecko *Hemidactylus bowringi*, and the snakes *Python molurus*, *Elaphe moellendorffi*, *Elaphe radiata*, *Amphiesma stolatum*, *Ptyas korros* and *Naja atra* have been reported from Longshan (Long, 1988).

Gekko gekko is a Class II nationally protected species. The presence of forest-dependent species such as *Theلودerma asperum*, *Acanthosaura lepidogaster*, *Draco maculatus*, *Calotes microlepis* and *Platyplacopus intermedius* indicates that parts of the limestone forest within the reserve have retained ecological integrity.

Fish

A total of 11 freshwater fish species were recorded in the small rivers and spring-fed pools in the valleys of Nonggang and Longhu sections (Table 5). Some species await specialist identification. As Table 5 indicates, different freshwater bodies in Nonggang support distinct fish communities. At Longshan no surface flowing water was encountered during the survey, due to the limestone geology. Nevertheless one species of fish, in the subfamily Labeoninae, was caught.

Table 5. Freshwater fishes recorded at Nonggang National Nature Reserve, 19–27May 1998. Sequence of families follows Nelson (1994).

Species	Habitat
<i>Rasbora steineri</i>	river
Danioninae sp.	river
<i>Rhodeus ocellatus</i>	river
<i>Capoeta semifasciolata</i>	river
Labeoninae sp.	spring-fed pool
<i>Oreonectes furcicaudalis</i>	spring-fed river
<i>Cobitis</i> sp.	spring-fed river
<i>Oryzias</i> sp.	river
<i>Philypnus hainanensis</i>	river
<i>Rhinogobius duospilus</i>	river
<i>Macropodus opercularis</i>	river

Due to the limited sampling effort and the lack of surface water in some areas, the recorded fish fauna of Nonggang NNR was not particularly species-rich. However a number of species could not be positively identified, and may prove to be of both scientific and conservation interest. *Oreonectes furcicaudalis* was known only from the subterranean rivers in Rongshui County, northern Guangxi prior to this survey. The present record therefore represents a substantial range extension.

Ants

At least 88 ant species were recorded from the study area, of which 44 species were at Longhu, 60 at Nonggang section and 57 at Longshan (Table 6). Some species have yet to be firmly identified. The most frequently encountered species included *Odontomachus monticola*, *Odontoponera* (cf. *denticulata*) sp. 1, *Pristomyrmex pungens*, *Technomyrmex albipes*, *Pachycondyla* (cf. *nigrita*) sp. 17, *Dolichoderus* sp. 10, *Tapinoma* sp. 1 and *Pheidole* (cf. *noda*) sp. 1.

Table 6. Ant species at Nonggang National Nature Reserve, 19 - 27 May 1998.

Species	Habitat
<i>Aenictus</i> (<i>ceylonicus</i> group) sp. 1	forest edge
<i>Aenictus binghami</i>	forest
<i>Anochetus graeffei</i>	open forest
<i>Anochetus</i> (cf. <i>yunnanensis</i>) sp. 4	forest, open shrubland
<i>Anochetus</i> (cf. <i>myops</i>) sp. 3	forest
<i>Anoplolepis gracilipes</i>	forest, shrubland, fields
<i>Aphaenogaster</i> (cf. <i>exasperata</i>) sp. 2	shrubland
<i>Calyptomyrmex</i> (cf. <i>wittmeri</i>) sp. 1	forest,
<i>Camponotus</i> (cf. <i>aethiops vitiosus</i>) sp. 21	agricultural fields, shrubland
<i>Camponotus</i> (nr. <i>aethiops vitiosus</i>) sp. 27	shrubland
<i>Camponotus</i> (cf. <i>mitis</i>) sp. 11	fields
<i>Camponotus nicobarensis</i>	open forest, fields, shrubland
<i>Camponotus rufoglaucus</i>	grassland, agricultural fields, shrubland
<i>Camponotus</i> (nr. <i>vitreus praerufus</i>) sp. 32	forest edge, shrubland
<i>Cataulacus granulatus</i>	shrubland
<i>Crematogaster</i> (cf. <i>biroi</i>) sp. 4	forest edge
<i>Crematogaster</i> (cf. <i>dohrni</i>) sp. 8	forest, shrubland, fields
<i>Crematogaster</i> (cf. <i>laboriosa</i>) sp. 3	open low forest
<i>Crematogaster</i> (cf. <i>matsumurai</i>) sp. 7	agricultural fields, shrubland
<i>Crematogaster</i> (cf. <i>travancorensis</i>) sp. 2	fields, shrubland, open forest
<i>Crematogaster</i> sp. 23	agricultural fields
<i>Diacamma</i> (nr. <i>rugosum</i>) sp. 1	forest, shrubland, fields
<i>Dolichoderus</i> sp. 9	forest, fields
<i>Dolichoderus</i> sp. 10	forest, shrubland, fields
<i>Gnamptogenys bicolor</i>	fields, shrubland, open forest
<i>Gnamptogenys binghami</i>	forest edge,

Species	Habitat
<i>Harpegnathos venator</i>	agricultural fields
<i>Hypoponera</i> (cf. <i>excoecata</i>) sp. 2	forest
<i>Hypoponera</i> sp. 6	forest
<i>Iridomyrmex</i> (<i>anceps</i> group) sp. 1	agricultural fields
<i>Lepisiota</i> (cf. <i>capensis</i>) sp. 3	shrubland
<i>Leptogenys</i> (cf. <i>kraepelini</i>) sp. 7	forest,
<i>Leptogenys kitteli</i>	forest, shrubland, fields
<i>Mayriella transfuga</i>	forest
<i>Monomorium</i> (cf. <i>bimaculatum</i>) sp. 9	open forest
<i>Monomorium</i> (cf. <i>impexum</i>) sp. 2	forest
<i>Monomorium</i> sp. 4	open low forest
<i>Myrmecina</i> sp. 1	forest
<i>Myrmecaria</i> sp. 1	open vegetation
<i>Myrmoteras</i> (cf. <i>cuneinodum</i>) sp. 1	open forest
<i>Odontomachus monticola</i>	forest, shrubland, fields
<i>Odontoponera</i> (cf. <i>denticulata</i>) sp. 1	forest, shrubland, fields
<i>Oecophylla smaragdina</i>	forest, shrubland, fields
<i>Oligomyrmex</i> (cf. <i>hunanensis</i>) sp. 3	forest
<i>Oligomyrmex</i> sp. 4	tall forest,
<i>Pachycondyla</i> (<i>javana</i> group) sp. 1	fields, shrubland, forest
<i>Pachycondyla leeuwenhoekii</i>	open forest
<i>Pachycondyla</i> (cf. <i>luteipes</i>) sp. 2	fields, forest, shrubland
<i>Pachycondyla</i> (cf. <i>nigrita</i>) sp. 17	forest, fields
<i>Pachycondyla rufipes</i>	forest, open vegetation
<i>Paratrechina</i> (cf. <i>bourbonica</i>) sp. 4	fields, forest
<i>Paratrechina longicornis</i>	forest
<i>Paratrechina</i> (cf. <i>opaca</i>) sp. 26	forest, shrubland,
<i>Paratrechina</i> (nr. <i>indica</i>) sp. 9	forest
<i>Pheidole gatesi</i>	agricultural fields
<i>Pheidole</i> (cf. <i>noda</i>) sp. 1	fields, shrubland, forest edge
<i>Pheidole</i> (<i>rinae</i> group) sp. 3	forest
<i>Pheidole</i> (<i>rinae</i> group) sp. 9	forest, forest edge
<i>Pheidole tijbodana</i>	fields, forest, shrubland
<i>Pheidole</i> sp. 7	open forest
<i>Pheidole</i> sp. 11-A	shrubland, fields
<i>Pheidole</i> sp. 13-A	forest
<i>Pheidologeton affinis</i>	low forest
<i>Pheidologeton</i> sp. 8	open shrubland
<i>Polyrhachis demangei</i>	shrubland, fields
<i>Polyrhachis dives</i>	fields, forest edge
<i>Polyrhachis halidayi</i>	forest
<i>Polyrhachis</i> (<i>mucronata</i> group) sp. 13	open forest
<i>Polyrhachis</i> (cf. <i>phalerata</i>) sp. 2	low forest, open shrubland
<i>Polyrhachis</i> (nr. <i>sculpturata</i>) sp. 5	forest, open vegetation
<i>Polyrhachis tyrannica</i>	shrubland, open forest
<i>Polyrhachis wolffi</i>	open forest
<i>Polyrhachis</i> (<i>Myrma</i>) sp. 24	open low forest
<i>Prenolepis</i> (cf. <i>emmae</i>) sp. 1	forest, shrubland
<i>Pristomyrmex pungens</i>	forest, shrubland, fields
<i>Pseudolasius</i> sp. (not yet identified)	agricultural fields
<i>Pyramica</i> spp. (not yet identified)	forest
<i>Rhoptromyrmex wroughtoni</i>	fields, low forest
<i>Strumigenys</i> spp. (not yet identified)	forest
<i>Tapinoma</i> sp. 1	fields, shrubland
<i>Technomyrmex albipes</i>	fields, shrubland, forest
<i>Technomyrmex</i> sp. 2	open low forest
<i>Technomyrmex</i> sp. 6	forest, shrubland
<i>Tetramorium bicarinatum</i>	agricultural fields
<i>Tetramorium nipponense</i>	fields, open shrubland
<i>Tetramorium</i> (cf. <i>tonganum</i>) sp. 12	open forest
<i>Tetraponera binghami</i>	shrubland

Species	Habitat
<i>Vollenhovia</i> sp. (not yet identified)	forest

Some of the species found are probably new to science, but require further study. Several species, including *Aenictus binghami*, *Anochetus* (cf. *myops*) sp. 3, *Calyptomyrmex* (cf. *wittmeri*) sp. 1, *Gnamptogenys binghami*, *Monomorium* (cf. *bimaculatum*) sp. 9, *Myrmecina* sp. 1, *Myrmoteras* (cf. *cuneinodum*) sp. 1, *Polyrhachis* (nr. *sculpturata*) sp. 5, and *Polyrhachis* sp. 24, are believed to survive only in or near primary forest. However, various tramp and alien invasive species, including *Anoplolepis gracilipes* and *Paratrechina longicornis*, were also present in the reserve.

Dragonflies

Sixty-two species of dragonfly were recorded over the course of the study period, of which 40 were found in the Nonggang section, 33 at Longhu and 19 at Longshan (Table 7). Most of these are new records for the reserve. A new species of *Coeliccia* (Zygoptera: Platycnemididae) was discovered. *Orolestes selysi* is a new record for mainland China, but is also known from Hainan, Taiwan, India, Laos and Vietnam. *Dysphea basitincta* is a new record for mainland China. It is also known from Hainan and was described from Vietnam. *Euphaea superba* is a new record for China. It too was described from Vietnam.

Table 7. Dragonflies recorded, and maximum daily abundance, at Nonggang National Nature Reserve, 19-27 May 1998. Sequence follows Schorr *et al.* (2001a; 2001b).

Species	Notes
<i>Mnais mneme</i>	
<i>Neurobasis chinensis chinensis</i>	
<i>Libellago lineata lineata</i>	
<i>Rhinocypha perforata</i>	
<i>Agriocnemis femina</i>	
<i>Agriocnemis pygmaea</i>	
<i>Cercion calamorum dyeri</i>	
<i>Ceriagrion auranticum</i>	
<i>Ischnura senegalensis</i>	
<i>Pseudagrion microcephalum</i>	
<i>Pseudagrion pruinosum</i>	
<i>Pseudagrion rubriceps</i>	
<i>Pseudagrion spencei</i>	
<i>Dysphea basitincta</i>	new record for mainland China
<i>Euphaea superba</i>	new record for China
<i>Lestes nodalis</i>	
<i>Lestes praemorsus decipiens</i>	
<i>Orolestes selysi</i>	new record for mainland China
<i>Coeliccia</i> sp.	new species: (to be described as <i>Coeliccia galbina</i> in prep., name not yet available for use)
<i>Copera ciliata</i>	new species
<i>Copera marginipes</i>	
<i>Prodasineura autumnalis</i>	
<i>Anax guttatus</i>	
<i>Anax nigrofasciatus</i>	
<i>Gynacantha subinterrupta</i>	
<i>Polycanthagyna erythromelas</i>	
<i>Tetracanthagyna waterhousei</i>	
<i>Chlorogomphus</i> sp.	(sight record)
<i>Epophthalmia elegans</i>	
<i>Asiagomphus</i> sp. B	pending identification
<i>Burmagomphus</i> sp.	pending identification
<i>Gomphidia abbotti</i>	
<i>Ictinogomphus pertinax</i>	
<i>Labrogomphus torvus</i>	
<i>Lamelligomphus</i> sp. A	pending identification

Species	Notes
<i>Macrogomphus guilinensis</i>	
<i>Merogomphus</i> sp.	pending identification
<i>Nychogomphus duaricus</i>	caught in hotel
<i>Paragomphus capricornis</i>	
<i>Sinictinogomphus clavatus</i>	
<i>Stylurus</i> sp. A	pending identification
<i>Stylurus</i> sp. B	pending identification
<i>Acisoma panorpoides panorpoides</i>	
<i>Brachydiplax farinosa</i>	
<i>Brachythemis contaminata</i>	
<i>Cratilla lineata lineata</i>	
<i>Crocothemis servilla</i>	
<i>Diplacodes trivialis</i>	
<i>Lyriothemis</i> sp.	pending identification
<i>Neurothemis fulvia</i>	
<i>Onychothemis testaceum tonkinensis</i>	
<i>Orthetrum luzonicum</i>	
<i>Orthetrum pruinosum</i>	
<i>Orthetrum sabina sabina</i>	
<i>Palpopleura sexmaculata</i>	
<i>Pantala flavescens</i>	
<i>Pseudothemis zonata</i>	
<i>Rhodothemis rufa</i>	
<i>Tetrathemis platyptera</i>	
<i>Tholymis tillarga</i>	
<i>Tramea virginia</i>	
<i>Trithemis aurora</i>	
<i>Trithemis festiva</i>	
<i>Zygonyx iris insignis</i>	

Despite the lack of surface streams in the porous limestone hills of Nonggang and Longhu sections, the dragonfly fauna was very rich, and included a number of rare species. Several species were good forest indicators, including *Dysphaea* sp., *Polycanthagyna erythromelas*, and many gomphid species. At Longshan the odonates encountered were, with the exception of *Libellago lineata*, *Pseudagrion rubriceps*, *Coeliccia* sp., *Stylurus* sp. B and *Tetrathemis platyptera*, largely typical of lentic habitats.

Butterflies

One hundred and forty-two species of butterfly were recorded at Nonggang NNR (Table 8). Of these 56 were at Longhu, 105 in Nonggang section, and 82 were at Longshan. The Maizu-Dalong records of *Acropolis thalia*, *Ragadia crisilda*, *Lexias pardalis*, *Tongeia potanini* and *Thoressa* sp., and the Longshan record of *Mimathyma ambica*, are all apparently new provincial records (cf. Chou, 1994).

Table 8. Butterfly species and rank of abundance level at Nonggang National Nature Reserve, 19 - 27 May 1998.

Species	Habitat
<i>Abraximorpha davidii</i>	forest edge
<i>Astictopterus jama</i>	forest edge
<i>Bibasis gomata</i>	abandoned field
<i>Bibasis oedipodea</i>	forest
	abandoned field
	forest edge
<i>Celaenorrhinus aurivittatus</i>	forest edge
<i>Choaspes benjamini</i>	forest
	abandoned field
	forest edge

Species	Habitat
<i>Gerosis phisara</i>	forest
<i>Hasora anura</i>	forest edge
<i>Iambrix salsala</i>	forest edge forest
<i>Jamides bochus</i>	forest edge
<i>Mooreana trichoneura</i>	forest
<i>Nacaduba kurava</i> ?	forest edge
<i>Notocrypta</i> sp.	forest
<i>Odontoptilum angulatum</i>	abandoned field/licks
<i>Parnara guttata</i>	agricultural field
<i>Pelopidas agna</i>	agricultural field
<i>Pelopidas subochracea barneyi</i>	abandoned field/licks
<i>Pithauria</i> sp.	forest
<i>Polytremis lubricans</i>	abandoned field/licks
<i>Pseudoborbo bevani</i>	abandoned field/licks
<i>Udaspes folus</i>	abandoned field
<i>Sebastonyma</i> sp. ?	cave/forest
<i>Tagiades litigiosa</i>	forest edge forest
<i>Thoressa</i> sp.	abandoned field/licks
<i>Graphium agamemnon</i>	abandoned field/licks agricultural field/licks forest edge
<i>Graphium (Pathysa) antiphates</i>	forest
<i>Graphium doson</i>	abandoned field/licks forest agricultural field/licks forest edge
<i>Graphium (Paranticopsis) macareus</i>	abandoned field shrubland forest edge
<i>Graphium sarpedon</i>	forest edge forest abandoned field/licks agricultural field
<i>Lamproptera meges</i>	abandoned field/licks agricultural field/licks
<i>Pachliopta aristolochiae</i>	forest forest edge abandoned field/licks
<i>Papilio bianor</i>	forest abandoned field/licks
<i>Papilio castor</i>	abandoned field/licks forest edge
<i>Papilio (Chilasa) clytia</i>	forest forest edge abandoned field agricultural field
<i>Papilio demoleus</i>	agricultural field abandoned field forest edge
<i>Papilio memnon</i>	forest forest edge abandoned field/licks agricultural field/licks
<i>Papilio nephelus</i>	forest edge forest agricultural field abandoned field/licks

Species	Habitat
<i>Papilio paris</i>	forest forest edge abandoned field/licks agricultural field/licks
<i>Papilio polytes</i>	forest edge forest abandoned field/licks agricultural field/licks
<i>Papilio protenor</i>	forest edge forest agricultural field abandoned field
<i>Papilio xuthus</i>	agricultural field
<i>Paranticopsis macareus</i>	abandoned field/licks agricultural field/licks
<i>Pathysa antiphates</i>	forest edge forest forest edge abandoned field/licks agricultural field/licks
<i>Troides sp.</i>	forest edge
<i>Appias albina</i>	abandoned field/licks agricultural field/licks forest forest edge
<i>Catopsilia pomona</i>	abandoned field
<i>Catopsilia pyranthe</i>	agricultural field abandoned field
<i>Cepora nadina</i>	forest
<i>Cepora nerissa</i>	abandoned field/licks forest edge agricultural field shrubland
<i>Delias pasithoe</i>	forest edge
<i>Dercas verhuelli</i>	forest edge abandoned field/licks agricultural field
<i>Eurema blanda</i>	forest edge abandoned field agricultural field
<i>Eurema hecabe</i>	abandoned field forest edge agricultural field shrubland
<i>Hebomoia glaucippe</i>	forest forest edge abandoned field/licks agricultural field
<i>Ixias pyrene</i>	forest edge abandoned field
<i>Pieris (Artogeia) canidia</i>	agricultural field
<i>Prioneris thestylis</i>	abandoned field/licks agricultural field/licks forest
<i>Abisara echerius</i>	forest edge shrubland
<i>Acytolepis puspa</i>	abandoned field/licks agricultural field/licks
<i>Artipe eryx</i>	forest edge

Species	Habitat
<i>Chilades pandava</i>	abandoned field forest edge
<i>Curetis acuta</i>	forest edge
<i>Heliophorus epicles</i>	forest edge
<i>Mahathala ameria</i>	forest plantation
<i>Pithecopus corvus</i>	forest
<i>Prosotas nora</i>	abandoned field
<i>Spindasis syama</i>	abandoned field
<i>Tongeia potanini</i>	abandoned field/licks
<i>Udara albocaerulea</i>	abandoned field/licks forest
<i>Yasoda androconifera</i>	forest
<i>Yasoda tripunctata ?</i>	forest
<i>Zemeros flegyas</i>	abandoned field forest edge forest shrubland
<i>Zizeeria maha</i>	abandoned field agricultural field
<i>Zizina otis</i>	shrubland
<i>Acraea issoria</i>	agricultural field abandoned field forest edge
<i>Acraea (Rohana) parisatis</i>	forest forest edge abandoned field
<i>Acropolis thalia</i>	forest
<i>Apatura (Mimathyma) ambica</i>	forest
<i>Apatura (Rohana) parisatis</i>	abandoned field forest forest edge
<i>Argyreus hyperbicus</i>	forest edge forest edge abandoned field agricultural field
<i>Ariadne ariadne</i>	forest edge abandoned field agricultural field
<i>Athyma nefte ?</i>	forest forest edge
<i>Athyma perius</i>	shrubland
<i>Athyma selenophora</i>	forest
<i>Cethosia biblis</i>	abandoned field agricultural field forest edge forest
<i>Cethosia cyane evanthes</i>	abandoned field forest forest edge
<i>Charaxes bernardus</i>	forest
<i>Charaxes marmax</i>	agricultural field/licks forest edge abandoned field forest
<i>Charaxes sp.</i>	agricultural field/licks
<i>Chersonesia risa</i>	forest edge forest
<i>Cirrochroa tyche lesseta</i>	forest

Species	Habitat
<i>Cupha erymanthis</i>	forest edge shrubland forest
<i>Cyrestis nivea tonkiniana</i>	abandoned field/licks
<i>Cyrestis thyodamas</i>	abandoned field/licks forest agricultural field/licks agricultural field
<i>Danaus chrysippus</i>	agricultural field
<i>Danaus genutia</i>	forest edge
<i>Euploea core</i>	forest edge abandoned field agricultural field
<i>Euploea eunice</i>	abandoned field/licks forest edge
<i>Euploea midamus</i>	forest abandoned field agricultural field/licks forest edge
<i>Euploea mulciber</i>	forest edge forest edge abandoned field/licks agricultural field abandoned field
<i>Euthalia lubentina</i>	abandoned field
<i>Euthalia monina</i>	forest
<i>Euthalia phemius</i>	forest
<i>Faunis aerope</i>	forest
<i>Herona marathus</i>	forest edge forest
<i>Hypolimnas bolina</i>	shrubland
<i>Ideopsis similis</i>	forest edge abandoned field/licks
<i>Lethe confusa</i>	abandoned field forest
<i>Lethe (Neope) muirheadii</i>	abandoned field/licks
<i>Lexias cyanipardus</i>	forest edge forest
<i>Lexias pardalis</i>	forest edge forest
<i>Limenitis sulphita</i>	shrubland
<i>Limenitis (Moduza) procris</i>	abandoned field/licks forest
<i>Melanitis leda</i>	forest forest edge
<i>Melanitis phedima</i>	forest
<i>Mycalesis gotama ?</i>	forest
<i>Mycalesis mamerta memerta</i>	forest
<i>Mycalesis mineus</i>	forest edge
<i>Mycalesis panthaka</i>	forest edge
<i>Neptis clinia</i>	forest forest edge shrubland
<i>Neptis hylas</i>	forest edge abandoned field shrubland
<i>Orsotriaena medus ?</i>	abandoned field
<i>Pantoporia hordonia</i>	shrubland
<i>Parantica aglea</i>	abandoned field/licks agricultural field

Species	Habitat
<i>Parantica melanea</i>	forest edge abandoned field/licks
<i>Polygonia (Kaniska) canace</i>	forest village agricultural field
<i>Polyura athamas ?</i>	forest edge forest
<i>Precis (Junonia) almana</i>	abandoned field agricultural field grassland
<i>Precis (Junonia) atlites</i>	agricultural field grassland
<i>Precis (Junonia) iphita</i>	forest edge
<i>Precis (Junonia) orithya</i>	agricultural field grassland
<i>Ragadia crisilda</i>	forest
<i>Stibochiona nicea</i>	forest
<i>Stichophthalma fruhstorferi</i>	forest edge forest
<i>Symbrenthia lilaea</i>	forest
<i>Tanaecia julli indochinensis</i>	forest
<i>Terinos atlita guangxiensis</i>	forest
<i>Thauria lathyi</i>	forest
<i>Tirumala limniace</i>	forest edge abandoned field/licks
<i>Vindula erota</i>	abandoned field/licks forest edge agricultural field/licks
<i>Ypthima baldus</i>	forest edge shrubland
<i>Ypthima chinensis ?</i>	forest forest edge

The very high diversity and the presence of many forest-dependent butterfly species indicate that the reserve plays an important role in the conservation of butterfly fauna; roughly 25% of the species recorded at Longshan may be considered forest-dependent. *Stichophthalma fruhstorferi*, *Thauria lathyi* and *Mooreana trichoneura* are thought to be confined to forest of high ecological integrity.

Rove Beetles

At least 21 staphylinid beetle species were recorded from the area, of which one was at Longhu, 12 at Nonggang section and 11 at Longshan (Table 9). At least two (*Edaphus* sp. and *Thoracochirus* sp.), and up to 15 species, are new to science. The genus *Mimogonus*, and possibly the species *Indolinus mitomorphoides*, are new records for China. The genus *Holotrochus*, and the species *Pachymedon granulicollis*, *Stiliderus cicatricosus* and *Xanthophius filum*, are new to Guangxi.

Table 9. Rove beetles (Staphylinidae) at Nonggang National Nature Reserve, 19 - 27 May 1998.

Species	Habitat	Notes
<i>Anotylus glareosus</i> (Woll.)	low open-canopy forest litter	pantropical
<i>Anotylus</i> spp.	forest litter, shrubland/ grassland	unid., 1-4 spp.
<i>Coproporus bruneicollis</i> Mots.	low closed-canopy forest litter	widespread and common in forest litter in Asia
<i>Diochus conicollis</i> Mots	forest litter	widespread in Asia

Species	Habitat	Notes
<i>Edaphus</i> sp.	forest litter	new to science
<i>Holotrochus</i> sp.	forest litter	Genus new to Guangxi
<i>Indolinus mitomorphoides</i> Coiff.	low open-canopy forest litter	possibly new to China
<i>Medon</i> sp.	forest litter	found from Yunnan, Burma & Malaysia
<i>Mimogonus</i> sp.	closed-canopy forest litter	genus new to China
<i>Myllaena laterita</i> Kr.	forest	new to Guangxi; widespread in Asia
<i>Oxytelopsis</i> sp.	forest litter	different to Guangdong spp.
<i>Pachymedon granulicollis</i> (Bnh.)	very tall open-canopy forest	new to Guangxi
<i>Stilicoderus strigosus</i> Rougemont	low closed-canopy forest	probably a new race or subspecies; recorded from Burma south to Sumatra, including Yunnan
<i>Stilicopsis</i> sp.	low closed-canopy forest	probably new to science
<i>Stilicopsis umbilicata</i> Fv.	low open-canopy forest litter	widespread in S. Asia
<i>Stiliderus cicatricosus</i> Mots.	forest litter	new to Guangxi
<i>Thoracochirus</i> sp.	forest litter	new to science; genus not recorded from China (though found by GdR in Yunnan)
<i>Xanthophius filum</i> (Kr.)	shrubland/grassland at dusk	new to Guangxi
Aleocharinae sp.	low open forest, on fruiting Stinkhorn fungus	unidentified
Aleocharinae sp.	low closed-canopy forest litter	unidentified
Aleocharinae sp.	open forest/ agricultural	unidentified
Aleocharinae sp.	forest litter	unidentified

Summary of flora and fauna

Nonggang National Nature Reserve is situated at the northern margin of the tropics and the vegetation is tropical monsoon limestone rainforest. Due to the special geographical location and geology, Nonggang NNR is an important reserve for plants. The present survey recorded 349 species of vascular plants in 99 families in about five days of field survey, suggesting that the flora is rather species-rich for a limestone area. A considerable proportion of the plants recorded are restricted to limestone forest habitats. The survey found 12 globally threatened or nationally protected plant species, of which several, such as *Excentrodendron hsienmu*, *Cephalomappa sinensis*, *Hydnocarpus hainanensis*, and *Horsfieldia hainanensis*, are locally abundant and dominant species of the forest. The reserve is also rich in species with a narrowly restricted distribution including *Camellia flavida*, *Excoecaria venenata*, *Passiflora papilio*, *Vitex kwangsiensis* and *Trigonostemon lutescens*. Certain taxa expected to be species-rich in such a tropical limestone area, such as orchids, were under-recorded in this survey due to the lack of specialists in the team. Unfortunately, all three surveyed sections of Nonggang NNR had only fragments of forest remaining. Of the three Nonggang section had the largest forest patches and the highest plant species richness, whereas Longhu also had a large number of plant species.

Despite extensive deforestation Nonggang NNR still supported many rare bird species such as Oriental Hobby, Oriental Pied Hornbill, Banded Bay Cuckoo, Grey-throated Babbler, Golden Babbler, Ashy Bulbul, Little Spiderhunter and White-winged Magpie. Certain mammals survive, including Rhesus Monkey, but others previously recorded, such as Forest Musk Deer, Black Giant Squirrel, Black Leaf Monkey, White-headed Leaf Monkey and Chinese Pangolin, must be considered highly endangered locally if they still survive. Nonggang NNR also harbours some

unique fauna - a cat snake species, *Boiga quangxiensis*, has been reported only from this reserve (Wen, 1998), while the kukri snake *Oligodon joyntsoni* is recorded nowhere else in China. The remaining forest and its edges also have a high diversity of ants, butterflies and dragonflies, and presumably other insect groups, boosted by tropical taxa that are near the northern limit of their range in southern Guangxi. Due to the biogeographic position of this reserve, the fauna has a particularly high proportion of Indochinese species, many of which are near their northeastern limit here. Despite the lack of surface water in the limestone hills, the spring-fed streams, caves and pools support an interesting fish and dragonfly fauna. Based on studies elsewhere, endemism among cave-dwelling and subterranean aquatic organisms is probably high.

MacKinnon *et al.* (1996) considered the combined Nonggang NNR of global significance in biodiversity conservation. The findings of the present survey support this evaluation, although continued degradation would call it into question.

Threats and problems

The forests surveyed in southwest Guangxi are severely disturbed and little lowland primary forest remains. Some limestone hills remain forested but the forest patches are generally not well-established, small in size and fragmented. All lowland areas in the Nonggang and Longhu sections of the reserve have been turned into agricultural fields. Remaining forests are restricted to limestone hills and are small and fragmented. Although the remaining forest cover of the core areas has reportedly been relatively well conserved since the last comprehensive survey of the area 20 years ago, villagers' activities have caused significant degradation to these forest patches. The forest around the monkey observation station in Longshan had been destroyed and transformed to shrubland, in which White-headed Leaf Monkeys can no longer be seen. It was also reported that hunters continue to kill monkeys by night. During the present surveys, people were seen entering the reserves to collect frogs, geckos and rare plants, with no apparent control. At Longshan rare *Camellia* plants were openly consumed by residents, including reserve staff. The impacts of hunting and collecting are obvious, with a paucity of larger-bodied birds. Hunting has probably contributed to the decline in mammals, including such threatened species as the langurs, whose survival could not be confirmed.

Opportunities and recommendations

The several nature reserves established in the region, which include Nonggang NNR (with the three sections of Longhu, Nonggang and Longshan), Chunxiu and Qinglongshan, and those across the border in Vietnam, have served to prevent the total eradication of the forest and its specialist fauna and flora. The surviving forests are generally small, and under continued pressure from human activities including logging and hunting. Thus their conservation is an urgent concern. MacKinnon *et al.* (1996) recommended forming a large transfrontier protected area including Nonggang NNR, Trung Khanh Nature Reserve in Vietnam, and seven other reserves nearby. Improved exchange of information would undoubtedly help, particularly as some flying species probably move between the reserves. However, the most urgent need is for improved management in each reserve.

Illegal and inappropriate activities should be immediately stopped at Nonggang NNR, with increased patrolling and enforcement as necessary. Staff should thoroughly understand the objectives of biodiversity and habitat protection, and motivated to achieve them. It may be necessary to review and refine the previous objectives of the reserve, giving particular attention to conserving endangered and unique elements of the current biota at Nonggang NNR, including those highlighted in this report.

Although patchy, the forest at Longhu is particularly good. It is suggested that agricultural activity in the small valleys adjacent to the more mature forest should be stopped, enabling re-establishment of lowland forest and minimization of disturbance (by reducing the need of the villagers to pass through the forest every day to tend their fields). In view of the isolation and small size of these fields, the financial costs would be low. Wherever possible, lowland forests should be recreated between existing limestone forests to increase the size of suitable habitats for animals such as leaf monkeys which are unlikely to cross agricultural fields. Regular patrolling by reserve wardens will be needed to stop hunting in the reserve. Without such strict control, the conservation and economic value of the reserve will be steadily degraded.

Unlike the other sections of the Nonggang NNR, the lowland area at Longshan is not being utilized by villagers for agriculture. Reforestation, using native tree species, in some of the abandoned fields could be carried out to recreate the lowland forest that appears to no longer exist at Nonggang NNR. The presence of fragmented forest on the adjacent steep limestone slopes may facilitate lowland forest regeneration. Harvesting of threatened species should be stopped, and education of reserve staff on biodiversity conservation and management is suggested. Alternative sources of income that do not conflict with biodiversity conservation should be explored.

The large seasonal marsh at Longshan was dry at the time of the present survey, before the wet season. This habitat type is very rare in South China reserves and may have important ecological value. Also the presence of a large body of water in the generally dry limestone landscape may be important to certain wildlife. Further study during the wet season is recommended.

Longer-term improvements in reserve management would be facilitated by the compilation of a management plan, taking into account the perspectives of different stakeholders. Plans should incorporate the following elements:

- (1) Capacity building needs and schedule. Plans should include specific needs and proposals for personnel recruitment, training and deployment. This will help ensure that funding is directed to achieve the objectives. Increased communication and collaboration between reserve staff and researchers (such as those of the Chinese Academy of Forestry) would enable better understanding of management implications and priorities.
- (2) Zoned management. The borders of the reserve and zones should be reviewed to ensure protection of habitats of conservation importance. An important step would be a study to allow the mapping of different animal and plant communities. This study could form a basis for the future monitoring, protection and restoration of biodiversity and ecological integrity. In habitats with high integrity, management should be directed toward maintaining this integrity. In degraded habitats, restoration of ecological diversity and functioning should be among the objectives.
- (3) Building of public awareness. The reserve's potential for increasing public understanding and appreciation of nature should be harnessed. This could be facilitated by collaboration with academic institutions and environmental organisations.
- (4) Provision of incentives for conservation. Some of the benefits of conserving biodiversity should be returned to local residents, in accordance with the Convention on Biological Diversity. Possible mechanisms include ecological compensation, ecotourism and sustainable propagation, each of which would require exploratory assessments. Such studies might identify native plants and animals suitable for propagation without endangering wild populations.
- (5) Implementation of conservation guidelines. IUCN has produced guidelines on various aspects of biodiversity conservation, including ecotourism, reintroduction and control of alien invasive species. These are a valuable resource for effective management planning.

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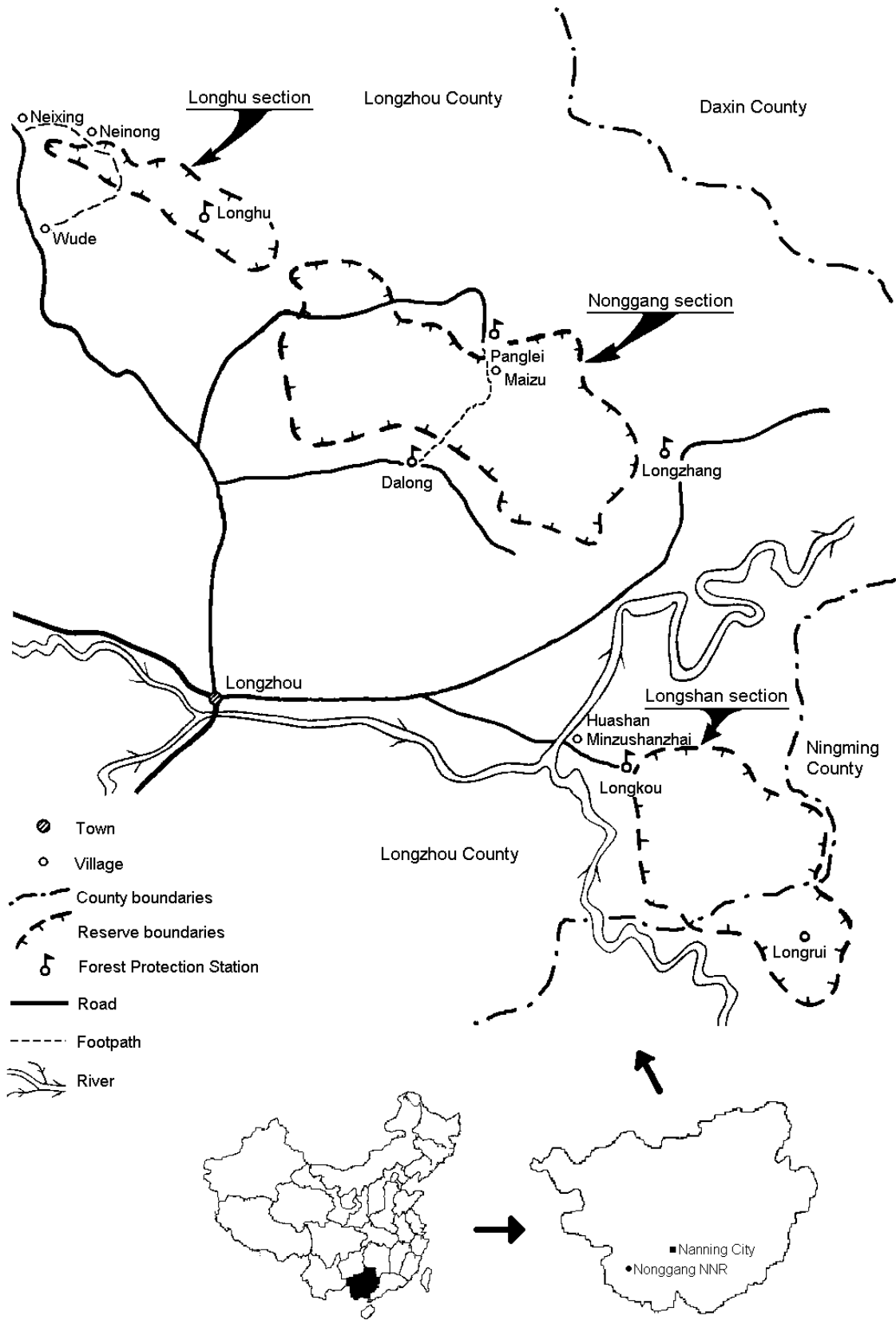


Figure 1. Map showing location of the sections of Nonggang National Nature Reserve, Southwest Guangxi, China. Not to scale.