



**Report of a Rapid Biodiversity Assessment at
Mulun National Nature Reserve, North Guangxi,
China, 18 to 23 July 1998**

Kadoorie Farm and Botanic Garden
in collaboration with
Guangxi Forestry Department
Guangxi Institute of Botany
Guangxi Normal University
South China Normal University
Xinyang Teachers' College

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Report of a Rapid Biodiversity Assessment at Mulun National Nature Reserve, North Guangxi, China, 18 to 23 July 1998

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Background

The present report details the findings of a trip to the north of Guangxi Zhuang Autonomous Region by members of Kadoorie Farm and 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 a Rapid Biodiversity Assessment at Mulun National Nature Reserve, North Guangxi, China, 18 to 23 July 1998

Objectives

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

Methods

On 16 July 1998 part of the team (LHJ, LPK) left Guangzhou with the South China Biodiversity Study vehicle, driven by Mr Cheng Jisheng (South China Institute of Botany, SCIB); they arrived in Guilin on 17 July. On the same evening six representatives of KFBG (BH, ML, JRF, LKS, GTR and GS) flew to Guilin from Hong Kong. The team was joined by colleagues from Guangxi Forestry Department (XZH) and Guangxi Normal University (LLR). On 18 July the team, joined by members of the Guangxi Institute of Botany (WFN, WHQ, WYG and driver Mr Liao Jinshu), drove to Huanjiang County in North Guangxi, staying at the County Town. Here they met officials of the County Forestry Bureau, including Department Deputy Director Mr Meng Guigen; they also met the Mulun Nature Reserve Director (QWG) and Deputy Director (TWN), both of whom accompanied the team during subsequent fieldwork at Mulun.

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. Some fish specimens, captured locally by residents, were purchased. The status of large and medium sized mammals (excluding Erinaceidae, Talpidae, Soricidae, Muridae and Chiroptera) was inferred on the basis of interviews and field observations and of a recent paper (Zhou F., 1995), itself based on a combination of market and field surveys. In the present study one hunter, one reserve warden and two local residents were interviewed, with reference to colour photographs. 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 *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 made by GS. Mammal records were made by ML or BH. Records of birds were made or verified by LKS, reptiles and amphibians by ML, fish by BC, ants by JRF, butterflies by GTR, and dragonflies by GTR or KW.

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); The Plant Names Project (2001);
- Orchids (Angiospermae: Orchidaceae): Chen (1999); Lang (1999); Tsi (1999);
- Mammals (Mammalia): D.E. 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).

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

Location and management

Mulun National Nature Reserve is in Huanjiang Maonanzu Autonomous County, North Guangxi, at 107°54' to 108°05' E, 25°07' to 25°12' N. The reserve was established in 1991 to protect the subtropical limestone mixed evergreen-deciduous broadleaf forest ecosystem. It was upgraded to Autonomous-Regional (i.e. provincial) level in 1994 and approved as a National Nature Reserve in August 1998 (http://www.naturereserve.gov.cn/search/pages/jbqkcx_jieguo.asp). It has an area of 301 km² (Forestry Department of Guangxi Zhuang Autonomous Region, 1993). The reserve is under the management of the provincial Forestry Department, with one management centre, three officials and several forest wardens.

The area has a subtropical monsoon climate, with an average annual temperature of 19.3°C and average annual precipitation of approximately 1,500 mm, which occurs mainly from April to August. The altitudinal range is from 400 to 1,000 m, with altitudes generally decreasing from northwest to southeast. The geology is predominantly soluble and porous limestone resulting in a karst landscape, characterised by sharp hills and peaks separated by lowland depressions, and with numerous holes and caves, but with extensive aboveground streams. The soil type is mainly rendzina, and soil cover is generally low especially on limestone hills where it is usually less than 20%. Within the forest the litter is rich, and up to 60 mm deep. In the north it abuts the Maolan National Nature Reserve of Libo County, southern Guizhou, which has a similar landscape and vegetation (Ning *et al.*, 1998).

Vegetation

A report in the mid-1990s claimed almost 95% of the Mulun reserve area was forested, making it one of the best-preserved karst forests in China (Zheng, 1995). However this was based on a cited reserve size of 90 km². The forested area of the nature reserve was about 85 km² (28% of the official reserve area), mainly around Hongtong, northwest Waitong and Dashapo. The Forestry Department of Guangxi Zhuang Autonomous Region (1993) cited 110 km² of karst forest at Mulun, or 37% of the reserve area. The figure is difficult to enumerate; during this survey in 1998 much of the forest was in narrow and patchy stands, but still quite extensive. The zonal vegetation of the region is subtropical mixed evergreen and deciduous broadleaf forest. Under this zonal vegetation, the following vegetation types have been identified (Zhao T.L. & Ning, 1995):

- 1) Limestone mixed evergreen and deciduous broadleaf forest was the dominant vegetation of the region. It was mainly distributed on limestone hillsides and ravines. The major associations found in this vegetation type included *Cyclobalanopsis glauca*-*Boniodendron minius*, *Machilus pauhoi*-*Eurycorymbus cavaleriei*, *Platycarya strobilacea*-*Acer laevigata*, *Pteroceltis tatarinowii*-*Mysine kwangsiensis*, *Kmeria septentrionalis*-*Loropetalum chinense*, *Beilschmiedia kweichowensis*-*Illicium majus*, *Cleidion bracteosum*-*Handeliidendron*

bodinieri, *Itoa orientalis*-*Machilius pauhoi*, and *Dendrocnide urentissima*-*Mallotus microcarpa*.

- 2) Montane dwarf forest was found mainly above medium and high altitude. The major associations found in this vegetation type were *Calocedrus macrolepis*-*Carpinus luochengensis* and *Quercus phillyraeoides*-*Platycarya strobilacea*.
- 3) Bamboo forest, composed mainly of *Phyllostachys sulphurea*, was uncommon and found only at Tonglai.
- 4) Shrubland, composed mainly of *Bauhinia* sp., *Alangium chinense*, *Vitex negundo* and *Alchornea trewiodes*, was found mainly at low altitudes. It was formed after human disturbance such as deforestation.

Vegetation types 1 and 2 are relatively primary, with a stable structure and composition as reflected by the heterogeneous age structure shown by the dominant species. Type 4 would gradually develop into secondary forest of type 1 if left undisturbed.

Results

Flora

Nine hundred and fifteen species of vascular plants in 173 families have previously been identified in the Mulun area, including 64 fern species in 26 families, 11 gymnosperm species in six families, and 840 flowering plant species in 141 families (Wei F.N. *et al.*, 1995). The plant communities are composed mainly of families with tropical to subtropical distribution, with subtropical species dominant. Compared with forests in nearby sites such as Jiuwanshan, the dominant flora at Mulun has a preponderance of limestone specialists, such as *Cinnamomum saxatile*, *Boniodendron minius* and *Sapium rotundifolium*.

The present survey recorded 203 vascular plant species, including ten ferns in nine families, four gymnosperms in three families and 189 angiosperms in 70 families (Tables 1 and 2). The most speciose family was Orchidaceae (see Table 2), for which the findings are detailed below. Among the other species recorded, *Garcinia paucinervis* and *Dendrocnide urentissima* are globally Endangered. *Amentotaxus argotaenia* is globally Vulnerable. *Zenia insignis* and *Eurycorymbus cavaleriei* are at Lower Risk (Near-threatened) and under National Class II Protection. *Handeliendron bodinieri* and *Taxus wallichiana* var. *chinensis* are under National Class I Protection; the former species is endemic to limestone areas of southern Guizhou and north to northwest Guangxi. *Fokienia hodginsii* is under National Class II Protection. While only about ten saplings of *Garcinia paucinervis* were found, at Dashapo, these constitute the northernmost record of the species. *Dendrocnide urentissima*, *Handeliendron bodinieri*, *Eurycorymbus cavaleriei* and *Zenia insignis* are among the dominant tree species of Mulun.

In addition to these threatened and protected species, eleven narrowly distributed or regionally rare species were recorded in the survey: *Cryptocarya microcarpa* (endemic to Mulun only), *Pithecellobium multifoliatum* (Mulun), *Acer tonkinense* ssp. *kwangsiense* (Guangxi), *Phoebe calcarea* (Guangxi), *P. crassipedicella* (Guangxi), *Stephania mshanica* (Guangxi), *Oreocnide kwangsiensis* (Guangxi), *Hemiboea magnibracteata* (South Guizhou and North to Northwest Guangxi), *Ampelocalamus calcareus* (South Guizhou and North to Northwest Guangxi), *Mahonia flavida* (Southeast Yunnan and Northwest Guangxi) and *Machilius bonii* (Guangxi and West Guangdong) and *Rhapis multifida* (Southeast Yunnan, North and West Guangxi).

Certain species of conservation concern have previously been recorded at Mulun, though were not seen in the present survey. A large population of *Calocedrus macrolepis*, a globally Vulnerable species, was previously found to be locally abundant around Kutong and Zhonglun

where its density was the highest recorded in Guangxi. *Pinus kwangtungensis*, a Class II Protected species, was known to be widespread and locally common at Mulun. *Kmeria septentrionalis*, a species endemic to northwest Guangxi and southeast Guizhou, was widely distributed in Mulun, and especially concentrated on a certain location. Small patches of *Metabriggsia ovalifolia*, a genus endemic to Guangxi, were also locally common as small patches over the NR (Jiang, 1995; Ning *et al.*, 1998).

Table 1. Vascular plants of Mulun National Nature Reserve. Including all plant species recorded on 19 to 22 July 1998. Species which 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 regionally restricted are indicated in notes.

Family	Species	Notes
PTERIDOPHYTA		
Aspleniaceae	<i>Asplenium ensiforme</i> Wall. ex Hook. & Grev.	
Dryopteridaceae	<i>Cyrtomium fortunei</i> J. Sm.	
Equisetaceae	<i>Equisetum debile</i> Roxb.	
Lygodiaceae	<i>Lygodium japonicum</i> (Thunb.) Sw.	
Osmundaceae	<i>Osmunda japonica</i> Thunb.	
Polypodiaceae	<i>Pyrrhosia lingua</i> (Thunb.) Farw	
Pteridaceae	<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>latiusculum</i> (Desv.) Underw. ex A. Heller <i>Pteris vittata</i> L.	
Sinopteridaceae	<i>Aleuritopteris argentea</i> (S.G. Gmel.) Fée	
Stenochlaenaceae	<i>Cyclosorus aridus</i> (D.Don) Ching	
GYMNOSPERMAE		
Cupressaceae	<i>Fokienia hodginsii</i> (Dunn) Henry & Thomas	Protected II
Gnetaceae	<i>Gnetum montanum</i> Markgr.	
Taxaceae	<i>Amentotaxus argotaenia</i> (Hance) Pilg. <i>Taxus wallichiana</i> Zucc. var. <i>chinensis</i> (Pilg.) Florin	Vulnerable (IUCN) Protected I
ANGIOSPERMAE		
Dicotyledonae		
Aceraceae	<i>Acer oblongum</i> Wall. ex DC. <i>Acer tonkinense</i> Lecomte ssp. <i>kwangsiense</i> (W.P. Fang & M.Y. Fang) W.P. Fang	
Actinidiaceae	<i>Saurauia thyrsoiflora</i> C.F. Liang & Y.S. Wang	
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>Pistacia chinensis</i> Bunge <i>Toxicodendron vernicifluum</i> (Stokes) F.A. Barkley	
Annonaceae	<i>Artabotrys hongkongensis</i> Hance <i>Desmos chinensis</i> Lour. <i>Fissistigma polyanthum</i> (Hook. f. & Thomson) Merr. <i>Milium chinii</i> W. T. Wang	
Apocynaceae	<i>Rauvolfia verticillata</i> (Lour.) Baill.	
Araliaceae	<i>Aralia dasyphylla</i> Miq. <i>Brassaiopsis glomerulata</i> (Blume) Regel <i>Schefflera glomerulata</i> H.L. Li <i>Tetrapanax papyrifera</i> (Hook.) K. Koch	
Asclepiadaceae	<i>Secamone sinica</i> Hand.-Mazz.	
Balsaminaceae	<i>Impatiens chlorosepala</i> Hand.-Mazz.	
Begoniaceae	<i>Begonia edulis</i> H. Lév.	
Berberidaceae	<i>Dysosma versipellis</i> (Hance) M. Cheng <i>Mahonia flavida</i> C.K. Schneid.	endemic to SE Yunnan & N-NW Guangxi
Bignoniaceae	<i>Radermachera sinica</i> (Hance) Hemsl.	

Family	Species	Notes
Melastomataceae	<i>Oxyspora paniculata</i> (D. Don) DC.	
Meliaceae	<i>Chukrasia tabularis</i> A. Juss. <i>Cipadessa cinerascens</i> (Pellegr.) Hand.-Mazz. <i>Dysoxylum hongkongense</i> (Tutcher) Merr. <i>Toona sinensis</i> (Juss.) Roem.	
Menispermaceae	<i>Cocculus laurifolius</i> DC. <i>Diploclisia glaucescens</i> (Blume) Diels <i>Stephania mashanica</i> H.S. Lo & B.N. Chang	endemic to limestone areas of Guangxi
Mimosaceae	<i>Albizia chinensis</i> (Osbeck) Merr. <i>Bauhinia brachycarpa</i> Wall. ex Benth. var. <i>cavaleriei</i> (H. Lév.) T.C. Chen <i>Pithecellobium multifoliatum</i> H.Q. Wen	endemic to Guangxi, Mulun
Moraceae	<i>Ficus cyrtophylla</i> Wall. ex Miq. <i>Ficus oligodon</i> Miq. <i>Ficus tsiangii</i> Merr. ex Corner	
Myrsinaceae	<i>Maesa japonica</i> (Thunb.) Moritzi et Zoll.	
Myrtaceae	<i>Decaspermum esquirolii</i> (H. Lév.) H.T. Chang & R.H. Miao	
Papilionaceae	<i>Millettia pachycarpa</i> Benth. <i>Sophora prazeri</i> Prain	
Piperaceae	<i>Piper hancei</i> Maxim.	
Pittosporaceae	<i>Pittosporum tonkinense</i> Gagnep.	
Polygalaceae	<i>Polygala caudata</i> Rehder & E.H. Wilson	
Ranunculaceae	<i>Anemone hupehensis</i> (Lemoine) Lemoine <i>Clematis chingii</i> W.T. Wang	
Rhamnaceae	<i>Chaydaia rubrinervis</i> (H. Lév.) C. Y. Wu ex Y. L. Chen <i>Gouania javanica</i> Miq.	
Rosaceae	<i>Laurocerasus australis</i> T.T. Yu & L.T. Lu <i>Laurocerasus spinulosa</i> (Siebold & Zucc.) C.K. Schneid. <i>Photinia serrulata</i> Lindl. <i>Rubus pinfaensis</i> H. Lév. & Vaniot	
Rubiaceae	<i>Canthium dicoccum</i> (Gaertn.) Teysmann et Binnedijk <i>Paederia scandens</i> (Lour.) Merr. var. <i>tomentosa</i> (Blume) Hand.-Mazz. <i>Sinoadina racemosa</i> (Siebold & Zucc.) Ridsdale	
Rutaceae	<i>Evodia trichotoma</i> (Lour.) Pierre <i>Murraya paniculata</i> (L.) Jack <i>Zanthoxylum armatum</i> DC.	
Sabiaceae	<i>Sabia dielsii</i> H. Lév.	
Sapindaceae	<i>Boniodendron minius</i> (Hemsl.) T.C. Chen <i>Eurycorymbus cavaleriei</i> (H. Lév.) Rehder & Hand.-Mazz. <i>Handeli dendron bodinieri</i> (H. Lév.) Rehder	Protected II, Lower Risk (Nt) (IUCN) Protected I, endemic to S Guizhou & N-NW Guangxi
Sapotaceae	<i>Sinosideroxylon wightianum</i> (Hook. & Arn.) Aubrév.	
Saururaceae	<i>Houttuynia cordata</i> Thunb.	
Schisandraceae	<i>Kadsura coccinea</i> (Lem.) A.C. Sm. <i>Kadsura heteroclita</i> (Roxb.) Craib <i>Schisandra viridis</i> A.C. Sm.	
Simarubaceae	<i>Picrasma quassioides</i> (D. Don) Benn.	
Staphyleaceae	<i>Turpinia affinis</i> Merr. & L.M. Perry	
Sterculiaceae	<i>Pterospermum heterophyllum</i> Hance <i>Reevesia pubescens</i> Mast. <i>Sterculia euosma</i> W.W. Sm. <i>Sterculia lanceolata</i> Cav.	
Thymelaeaceae	<i>Daphne papyracea</i> Wall. ex Steud.	
Ulmaceae	<i>Aphananthe aspera</i> (Thunb.) Planch. <i>Boehmeria dolichostachya</i> W.T. Wang <i>Pteroceltis tatarinowii</i> Maxim.	

Family	Species	Notes
Urticaceae	<i>Dendrocnide urentissima</i> (Gagnep.) Chew	Endangered (IUCN)
	<i>Oreocnide frutescens</i> (Thunb.) Miq.	
	<i>Oreocnide kwangsiensis</i> Hand.-Mazz.	endemic to N-NW Guangxi
Verbenaceae	<i>Callicarpa longifolia</i> Lam. var. <i>floccosa</i> Schauer	
	<i>Clerodendrum mandarinorum</i> Diels	
Vitaceae	<i>Cissus assamica</i> (G. Lawson) Craib	
	<i>Tetrastigma obtectum</i> (Wall. ex Lawson) Planch. ex Franch.	
Monocotyledonae		
Araceae	<i>Epipremnum pinnatum</i> (L.) Engl.	
Areaceae	<i>Guihaia grossefibrosa</i> (Gagnep.) J. Dransf., S. K. Lee & F. N. Wei	
	<i>Dioscorea persimilis</i> Prain & Burkill	
Orchidaceae	(see Table 2)	
Poaceae	<i>Ampelocalamus calcareus</i> C.D. Chu & C.S. Chao	endemic to S Guizhou & N-NW Guangxi
	<i>Indocalamus longiauritus</i> Hand.-Mazz.	
	<i>Phyllostachys nidularia</i> Munro	
Zingiberaceae	<i>Alpinia kwangsiensis</i> T.L. Wu & S.J. Chen	

Orchids have been previously surveyed at Mulun Nature Reserve; an intensive survey from 19 August to 3 September 1993, following the trails Mulun-Leyi-Kutong-Waitong-Changtong-Waitong-Zhonglun-Mulun-Shecun-Limingguan-Shecun, recorded 45 orchid species in 20 genera (Wei F.N. *et al.*, 1995). The present rapid survey, covering Yaomengcun-Jiucun-Xiazaicun-Jiucun-Yaomengcun, Dashapo and Leyi-Hongtong-Waitong (Xiagenghuatong), recorded 47 species in 24 genera (Table 2). Of these 20 were not recorded in 1993. *Malaxis calophylla* has not previously been recorded from Guangxi. Together the two surveys recorded 65 species in 27 genera. Most are subtropical species. In adjacent Maolan National Nature Reserve in Guizhou, 85 species in 32 genera have been recorded (Wei L.M. *et al.*, 1997), making Orchidaceae the most speciose family in both reserves.

Table 2. Orchids recorded in Mulun National Nature Reserve, Guangxi from 19 to 22 July 1998. *Species not previously recorded (Wei F.N. *et al.* 1995).

Species	Habitat	Remarks
<i>Anoectochilus elwesii</i> (Clarke ex Hook. f.) King & Pantl.	forest floor with rich humus	terrestrial
* <i>Anoectochilus zhejiangensis</i> Z. Wei & Y.B. Chang	forest floor with rich humus	terrestrial; endemic to China; Endangered
unknown sp. 2 (cf. <i>Anoectochilus moulmeinensis</i>)	on forest floor with rich humus	terrestrial
<i>Acampe rigida</i> (Buch.-Ham. ex Sm.) P.F. Hunt	on rock beside road	epiphytic
* <i>Bletilla formonsana</i> (Hayata) Schltr.	grassy slope with rocks beside stream	terrestrial; Endangered
<i>Bulbophyllum andersonii</i> (Hook. f.) J.J. Sm.	on rock in forest & roadside	epiphytic
<i>Bulbophyllum</i> sp.1	on rock,	epiphytic
<i>Bulbophyllum</i> sp.2	on rock with humus in forest	epiphytic
<i>Bulbophyllum</i> sp.3	on rock with humus in forest	epiphytic
<i>Bulbophyllum</i> sp.4	on rock with humus in forest	epiphytic
* <i>Cheirostylis</i> sp.1	on rock covered with rich humus in forest	terrestrial
* <i>Cheirostylis</i> sp.2	forest floor with rich humus beside road	terrestrial
<i>Cymbidium cyperifolium</i> Wall. ex Lindl.	forest floor with rich humus	terrestrial
<i>Cymbidium ensifolium</i> (L.) Sw.	forest floor with rich humus	terrestrial; Endangered
<i>Cymbidium lancifolium</i> Hook.	forest floor with rich humus	terrestrial

Species	Habitat	Remarks
* <i>Dendrobium officinale</i> Kimura & Migo	on large rock beside stream	epiphytic; endemic to China; Endangered
<i>Dendrobium</i> sp.1 (cf. <i>fimbriatum</i>)	rock crevice with humus in forest,	epiphytic; Vulnerable
* <i>Eria clausa</i> King & Pantl.	on rocks in forest	epiphytic
<i>Eria corneri</i> Rchb. f.	on rock in forest beside path	epiphytic
* <i>Eria coronaria</i> (Lindl.) Rchb. f.	on rock with rich humus in forest	terrestrial
* <i>Eria rhomboidalis</i> T. Tang & F.T. Wang	on rocks in forest	epiphytic; endemic to Guangxi, Yunnan and Hainan
<i>Habenaria ciliolaris</i> Kraenzl.	on forest floor with rich humus	terrestrial; endemic to China
* <i>Habenaria dentata</i> (Sw.) Schltr.	grassy slope along stream & road	terrestrial
* <i>Liparis bootanensis</i> Griff.	on mossy rock in forest beside the road	epiphytic
* <i>Liparis distans</i> C.B. Clarke	on rock with rich humus on forest floor and beside path	epiphytic
<i>Liparis nervosa</i> (Thunb. ex Murray) Lindl.	on forest floor with rich humus beside road	terrestrial
<i>Liparis viridiflora</i> (Blume) Lindl.	on rock in forest beside path	epiphytic
<i>Liparis</i> sp.1	on rock in forest	epiphytic
<i>Liparis</i> sp.2	on rock surface with rich humus	epiphytic
* <i>Malaxis calophylla</i> (Rchb. f.) Kuntze	forest floor with rich humus	terrestrial; new to Guangxi
* <i>Malaxis</i> sp.1	forest floor with rich humus	terrestrial or semi-terrestrial
<i>Nervilia fordii</i> (Hance) Schltr.	on rock with humus	terrestrial; Endangered
<i>Oberonia</i> sp.1	on rock in forest,	epiphytic
* <i>Paphiopedilum micranthum</i> T. Tang & F.T. Wang	on rock with rich humus	terrestrial or semi-terrestrial; endemic to Guangxi, Yunnan & Guizhou; Vulnerable
* <i>Pecteilis susannae</i> (R. Br.) Raf.	grass lawn beside road	terrestrial
* <i>Peristylus</i> sp.1	grassy slope beside road	terrestrial
<i>Phaius columnaris</i> C.Z. Tang & S.J. Cheng	forest floor with rich humus beside path	terrestrial; endemic to N Guangdong, S Yunnan, S Guizhou & N Guangxi; Endangered
<i>Phaius flavus</i> (Blume) Lindl.	forest floor with rich humus	terrestrial
<i>Phaius tankervilleae</i> (Banks ex L' Herit.) Blume	grass lawn & shrubs beside path	terrestrial
<i>Phaius</i> sp.	on forest floor	terrestrial
* <i>Pholidota chinensis</i> Lindl.	on rock in forest	epiphytic
<i>Pholidota</i> sp.1	on rocks in forest	epiphytic
<i>Podochilus khasianus</i> Hook. f.	on rock in the forest	epiphytic
* <i>Tropidia angulosa</i> (Lindl.) Blume	on forest floor with rich humus and beside road	terrestrial
* <i>Vanda</i> sp.	on tree trunk in forest beside path	epiphytic
* <i>Vandopsis gigantea</i> (Lindl.) Pfitzer	on rock near road	epiphytic
<i>Vanilla</i> sp.	on tree trunk and on rock in forest	epiphytic; one individual bearing a green capsule
unknown sp.1	on rock in forest	epiphytic

Paphiopedilum micranthum (Bubblegum Slipper Orchid) was listed as globally Endangered by Walter & Gillett (1998). Six species recorded in the present survey (*Anoectochilus zhejiangensis*, *Bletilla formonsana*, *Cymbidium ensifolium*, *Dendrobium officinale*, *Nervilia fordii* and *Phaius columnaris*) are considered Endangered in China and one (*Paphiopedilum micranthum*) as Vulnerable (Wang *et al.*, in press). All are threatened by over-collection for medicinal and ornamental uses, and habitat destruction. Some species are restricted to certain limestone areas: *Phaius columnaris* (only in N. Guangdong, S. Yunnan, Maolan N.R. in Guizhou and Mulun),

Eria rhomboidalis (N-NW Guangxi, SW Yunnan and Hainan) and *Paphiopedilum micranthum* (in Guangxi, Yunnan and Guizhou). National protection status is still under review, but *Paphiopedilum micranthum* is listed in CITES Appendix I, and all other orchid species are listed in CITES Appendix II.

Forest condition, particularly between Leyi, Hongtong and Waitong, was good, and reflected in the high frequency of forest-dependent terrestrial orchids (e.g. *Anoetochilus* spp., *Cymbidium lancifolium*, *Eria rhomboidalis* and *Habenria ciliolaris*); 51% of species found were terrestrial.

Mammals

Only one mammal species was directly recorded during the survey: a Pallas's Squirrel *Callosciurus erythraeus* seen at the edge of a young forest near Hongtong on 21 July. In addition two tails of this squirrel and a skin of Red Giant Flying Squirrel *Petaurista philippensis* were observed in a farmer's hut on the way from Waitong to Tonglai. From other reports, Mulun is believed to support a high number of mammal species (Table 3).

Table 3. The status of mammals (excluding Insectivora, Chiroptera and Muridae) at Mulun National Nature Reserve, Guangxi, based on interviews with residents and on Zhou F. (1995). Sequence and names follow D.E. Wilson & Cole (2000).

Scientific name	English name	Hunter	Reserve warden & villagers	Zhou F. (1995)	Probable status
<i>Tupaia belangeri</i>	Northern Tree Shrew	+++	+++		present
<i>Macaca assamensis</i>	Assam Macaque	+++	+++		present
<i>Macaca mulatta</i>	Rhesus Monkey	-	+++	+	insecure
<i>Macaca arctoides</i>	Stump-tailed Macaque	-	+		insecure or extirpated
<i>Macaca thibetana</i>	Père David's Macaque	-	-	+	insecure or extirpated
<i>Vulpes vulpes</i>	Red Fox	-	-	+	insecure or extirpated
<i>Nyctereutes procyonoides</i>	Raccoon Dog	-	-	+	insecure or extirpated
<i>Catopuma temminckii</i>	Asiatic Golden Cat	-	-	+	insecure
<i>Prionailurus bengalensis</i>	Leopard Cat	-	+++	+	present
<i>Panthera pardus</i>	Leopard	-	-	+	insecure or extirpated
<i>Herpestes javanicus</i>	Javan Mongoose	-	+++		present
<i>Herpestes urva</i>	Crab-eating Mongoose	-	+		insecure
<i>Arctonyx collaris</i>	Hog Badger	-	-	+	insecure
<i>Melogale moschata</i>	Chinese Ferret-badger	+	+++	+	present
<i>Mustela kathiah</i>	Yellow-bellied Weasel	-	+++	+	present
<i>Mustela sibirica</i>	Siberian Weasel	-	-	+	insecure
<i>Mustela strigidorsa</i>	Black-striped Weasel	?	?		uncertain
<i>Ursus thibetanus</i>	Asiatic Black Bear	-	+	+	insecure
<i>Paguma larvata</i>	Masked Palm Civet	+	+++	+	present
<i>Prionodon pardicolor</i>	Spotted Linsang	-	+	+	insecure
<i>Viverra zibetha</i>	Large Indian Civet	-	-	+	insecure
<i>Viverricula indica</i>	Small Indian Civet	-	+	+	insecure
<i>Sus scrofa</i>	Wild Boar	+	+	+	present
<i>Moschus berezovskii</i>	Chinese Forest Musk Deer	-	+	+	insecure
<i>Elaphodus cephalophus</i>	Tufted Deer	-	-	+	insecure
<i>Muntiacus muntjak</i>	Indian Muntjac	-	-	+	insecure
<i>Muntiacus reevesi</i>	Reeves's Muntjac	-	+	+	insecure
<i>Naemorhedus sumatraensis</i>	Serow	-	-	+	insecure
<i>Naemorhedus caudatus</i>	Chinese Goral	-	-	+	insecure
<i>Manis pentadactyla</i>	Chinese Pangolin	-	+	+	insecure
<i>Callosciurus erythraeus</i>	Pallas's Squirrel	-	+++	+	present

Scientific name	English name	Hunter	Reserve warden & villagers	Zhou F. (1995)	Probable status
<i>Tamiops maritimus</i>	Maritime Striped Squirrel	+++	+++	+	present
<i>Dremomys pernyi</i>	Perny's Long-nosed Squirrel	-	-	+	insecure
<i>Dremomys pyrrhomerus</i>	Red-hipped Squirrel	-	+++	+	present
<i>Belomys pearsonii</i>	Hairy-footed Flying Squirrel	+++	-		insecure
<i>Petaurista alborufus</i>	Red and White Giant Flying Squirrel	-	-	+	insecure
<i>Petaurista elegans (P. clarkei)</i>	Spotted Giant Flying Squirrel	?	?	+	insecure
<i>Petaurista philippensis (P. petaurista, P. yunnanensis)</i>	Red Giant Flying Squirrel	-	+++	+	present
<i>Hystrix brachyura</i>	Malayan Porcupine	-	-	+	insecure
<i>Rhizomys sinensis</i>	Chinese Bamboo Rat	-	-	+	insecure
<i>Lepus sinensis</i>	Chinese Hare	-	+++		insecure
<i>Lepus capensis</i>	Brown Hare	?	?	+	present

In addition to these Zhou F. (1995) reported Asian House Shrew *Suncus murinus*, Indochinese Shrew *Crocidura attenuata*, Little Japanese Horseshoe Bat *Rhinolophus cornutus*, Great Roundleaf Bat *Hipposideros armiger*, Japanese Pipistrelle *Pipistrellus abramus*, Common Pipistrelle *Pipistrellus pipistrellus*, Edwards's Long-tailed Giant Rat *Leopoldamys edwardsi* (as *Rattus edwardsi*), House Mouse *Mus musculus*, Chestnut White-bellied Rat *Niviventer fulvescens* (as *Rattus fulvescens huang*), Chinese White-bellied Rat *Niviventer confucianus* (as *Rattus niviventer*), House Rat *Rattus rattus flavipectus* (as *R. flavipectus*), Lesser Rice-field Rat *Rattus losea* and Brown Rat *Rattus norvegicus*. Zhou F.'s (1995) record of Brown Hare *Lepus capensis* at Mulun may be the southernmost record of this species in China.

Among the mammal species whose recorded range includes North Guangxi, some were unfamiliar to all the respondents at Mulun, and not reported by Zhou F. (1995). These species included Grey Wolf *Canis lupus*, Dhole *Cuon alpinus*, Yellow-throated Marten *Martes flavigula*, Eurasian Badger *Meles meles*, Eurasian Otter *Lutra lutra*, Oriental Small-clawed Otter *Amblyonyx cinereus*, Clouded Leopard *Neofelis nebulosa*, Tiger *Panthera tigris*, Chinese Water Deer *Hydropotes inermis*, Sambar *Cervus unicolor* and Asiatic Brush-tailed Porcupine *Atherurus macrourus*. These species may be absent, locally extinct or overlooked.

Of the species reported to occur at Mulun, Assam Macaque *Macaca assamensis* is globally Vulnerable and Class I protected in China; Stump-tailed Macaque *Macaca arctoides*, Asiatic Black Bear *Ursus thibetanus*, Serow *Naemorhedus sumatraensis* and Chinese Goral *Naemorhedus caudatus* are globally Vulnerable and Class II protected. Malayan Porcupine *Hystrix brachyura* is globally Vulnerable. Chinese Pangolin *Manis pentadactyla*, Rhesus Monkey *Macaca mulatta*, Asiatic Golden Cat *Catopuma temminckii* and Chinese Forest Musk Deer *Moschus berezovskii* are globally Near-threatened and Class II protected in China; Hairy-footed Flying Squirrel *Belomys pearsonii* is also globally Near-threatened. Père David's Macaque *Macaca thibetana*, Small Indian Civet *Viverricula indica* and Spotted Linsang *Prionodon pardicolor* are Class II protected nationally.

Birds

Seventy bird species were recorded at Mulun during this survey (Table 4). The most frequently encountered species were Streak-breasted Scimitar Babbler *Pomatorhinus ruficollis*, Chestnut Bulbul *Hemixos castanonotus*, Grey-cheeked Fulvetta *Alcippe morrisonia*, Black-browed Barbet *Megalaima oorti*, Striated Yuhina *Yuhina castaniceps*, Hainan Blue Flycatcher *Cyornis hainanus* and Collared Finchbill *Spizixos semitorques*.

Table 4. Birds recorded at Mulun, Guangxi, 19-23 July 1998. Sequence follows Clements (2000).

Scientific name	English name
<i>Egretta garzetta</i>	Little Egret
<i>Ixobrychus cinnamomeus</i>	Cinnamon Bittern
<i>Dupetor flavicollis</i>	Black Bittern
<i>Aviceda leuphotes</i>	Black Baza
<i>Spilornis cheela</i>	Crested Serpent Eagle
<i>Accipiter trivirgatus</i>	Crested Goshawk
<i>Hieraaetus fasciatus</i>	Bonelli's Eagle
<i>Spizaetus nipalensis</i>	Mountain Hawk Eagle
<i>Falco subbuteo</i>	Eurasian Hobby
<i>Bambusicola thoracica</i>	Chinese Bamboo Partridge
<i>Amaurornis akool</i>	Brown Crake
<i>Chalcophaps indica</i>	Emerald Dove
<i>Clamator coromandus</i>	Chestnut-winged Cuckoo
<i>Cuculus poliocephalus</i>	Lesser Cuckoo
<i>Surniculus lugubris</i>	Drongo Cuckoo
<i>Centropus bengalensis</i>	Lesser Coucal
<i>Apus pacificus</i>	Fork-tailed Swift
<i>Collocalia brevirostris</i>	Himalayan Swiftlet
<i>Alcedo atthis</i>	Common Kingfisher
<i>Megalaima virens</i>	Great Barbet
<i>Megalaima oorti</i>	Black-browed Barbet
<i>Blythipicus pyrrhotis</i>	Bay Woodpecker
<i>Hirundo rustica</i>	Barn Swallow
<i>Hirundo daurica</i>	Red-rumped Swallow
<i>Motacilla alba</i>	White Wagtail
<i>Pericrocotus solaris</i>	Grey-chinned Minivet
<i>Spizixos semitorques</i>	Collared Finchbill
<i>Pycnonotus sinensis</i>	Light-vented Bulbul
<i>Pycnonotus aurigaster</i>	Sooty-headed Bulbul
<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul
<i>Hemixos castanonotus</i>	Chestnut Bulbul
<i>Hypsipetes mcclllandii</i>	Mountain Bulbul
<i>Hypsipetes leucocephalus</i>	Black Bulbul
<i>Chloropsis hardwickii</i>	Orange-bellied Leafbird
<i>Prinia atrogularis</i>	Hill Prinia
<i>Prinia rufescens</i>	Rufescent Prinia
<i>Prinia hodgsonii</i>	Grey-breasted Prinia
<i>Prinia inornata</i>	Plain Prinia
<i>Prinia flaviventris</i>	Yellow-bellied Prinia
<i>Cettia fortipes</i>	Brownish-flanked Bush Warbler
<i>Bradypterus seebohmi</i>	Russet Bush Warbler
<i>Orthotomus cuculatus</i>	Mountain Tailorbird
<i>Niltava macgrigoriae</i>	Small Niltava
<i>Cyornis hainanus</i>	Hainan Blue Flycatcher
<i>Rhyacornis fuliginosus</i>	Plumbeous Water Redstart
<i>Garrulax pectoralis</i>	Greater Necklaced Laughingthrush
<i>Garrulax chinensis</i>	Black-throated Laughingthrush
<i>Garrulax canorus</i>	Hwamei
<i>Garrulax sannio</i>	White-browed Laughingthrush
<i>Pomatorhinus ruficollis</i>	Streak-breasted Scimitar Babbler
<i>Napothera brevicaudata</i>	Streaked Wren Babbler
<i>Pnoepyga pusilla</i>	Pygmy Wren Babbler
<i>Stachyris ruficeps</i>	Rufous-capped Babbler
<i>Leiothrix lutea</i>	Red-billed Leiothrix
<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta
<i>Yuhina castaniceps</i>	Striated Yuhina
<i>Aegithalos concinnus</i>	Black-throated Tit
<i>Parus major</i>	Great Tit
<i>Parus spilonotus</i>	Yellow-cheeked Tit

Scientific name	English name
<i>Aethopyga christinae</i>	Fork-tailed Sunbird
<i>Dicaeum concolor</i>	Plain Flowerpecker
<i>Dicaeum ignipectus</i>	Fire-breasted Flowerpecker
<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker
<i>Zosterops japonica</i>	Japanese White-eye
<i>Lanius collurio</i>	Burmese Shrike
<i>Lanius schach</i>	Long-tailed Shrike
<i>Urocissa erythrorhyncha</i>	Red-billed Blue Magpie
<i>Dendrocitta formosae</i>	Grey Treepie
<i>Lonchura striata</i>	White-rumped Munia
<i>Melophus lathami</i>	Crested Bunting

The following species are apparently new records for the reserve: Black Bittern *Dupetor flavicollis*, Black Baza *Aviceda leuphotes*, Mountain Hawk Eagle *Spizaetus nipalensis*, Bonelli's Eagle *Hieraetus fasciatus*, Emerald Dove *Chalcophaps indica*, Chestnut-winged Cuckoo *Clamator coromandus*, Lesser Coucal *Centropus bengalensis*, Great Barbet *Megalaima virens*, Grey-chinned Minivet *Pericrocotus solaris*, Black-throated Laughingthrush *Garrulax chinensis*, Grey-breasted Prinia *Prinia hodgsonii*, Rufescent Prinia *Prinia rufescens*, Brownish-flanked Bush Warbler *Cettia fortipes*, Russet Bush Warbler *Bradypterus seebohmi*, Mountain Tailorbird *Orthotomus cuculatus*, Hainan Blue Flycatcher, Small Niltava *Niltava macgrigoriae*, Fire-breasted Flowerpecker *Dicaeum ignipectus*, Scarlet-backed Flowerpecker *Dicaeum cruentatum*, Burmese Shrike *Lanius collurio* and Grey Treepie *Dendrocitta formosae*.

In addition to the above species, Zhou F. (1995) reported Chinese Pond Heron *Ardeola bacchus*, Common Teal *Anas crecca*, Black Kite *Milvus migrans*, Chinese Sparrowhawk *Accipiter soloensis*, Eurasian Sparrowhawk *Accipiter nisus*, Japanese Sparrowhawk *Accipiter gularis*, Common Buzzard *Buteo buteo*, Hen Harrier *Circus cyaneus*, Chinese Francolin *Francolinus pintadeanus*, Japanese Quail *Coturnix japonica*, Blue-breasted Quail *Coturnix chinensis*, Silver Pheasant *Lophura nycthemera*, Common Pheasant *Phasianus colchicus*, Yellow-legged Buttonquail *Turnix tanki*, Slaty-legged Crake *Rallina eurizonoides*, Slaty-breasted Rail *Gallirallus striatus*, Eurasian Coot *Fulica atra*, Little Ringed Plover *Charadrius dubius*, Eurasian Woodcock *Scolopax rusticola*, Green Sandpiper *Tringa ochropus*, Common Sandpiper *Actitis hypoleucos*, Red Collared Dove *Streptopelia tranquebarica*, Oriental Turtle Dove *Streptopelia orientalis*, Spotted Dove *Streptopelia chinensis*, Large Hawk Cuckoo *Hierococcyx sparverioides*, Indian Cuckoo *Cuculus micropterus*, Common Cuckoo *Cuculus canorus*, Asian Emerald Cuckoo *Chrysococcyx maculatus*, Greater Coucal *Centropus sinensis*, Grass Owl *Tyto capensis*, Collared Scops Owl *Otus bakkamoena*, Asian Barred Owllet *Glaucidium cuculoides*, Grey Nightjar *Caprimulgus indicus*, Red-headed Trogon *Harpactes erythrocephalus*, White-throated Kingfisher *Halcyon smyrnensis*, Black-capped Kingfisher *Halcyon pileata*, Dollarbird *Eurystomus orientalis*, White-browed Piculet *Sasia ochracea*, Great Spotted Woodpecker *Dendrocopos major*, Grey-capped Pygmy Woodpecker *Dendrocopos canicapillus*, Fairy Pitta *Pitta nympha*, Forest Wagtail *Dendronanthus indicus*, Grey Wagtail *Motacilla cinerea*, Richard's Pipit *Anthus richardi*, Olive-backed Pipit *Anthus hodgsoni*, Black-winged Cuckooshrike *Coracina melaschistos*, Scarlet Minivet *Pericrocotus flammeus*, Brown-breasted Bulbul *Pycnonotus xanthorrhous*, Blue Whistling Thrush *Myophonus caeruleus*, Orange-headed Thrush *Zoothera citrina*, Japanese Thrush *Turdus cardis*, Pale Thrush *Turdus pallidus*, Eurasian Blackbird *Turdus merula*, Zitting Cisticola *Cisticola juncidis*, Dusky Warbler *Phylloscopus fuscatus*, Yellow-streaked Warbler *Phylloscopus armandii*, Arctic Warbler *Phylloscopus borealis*, Yellow-browed Warbler *Phylloscopus inornatus*, Pallas's Leaf Warbler *Phylloscopus proregulus*, Chestnut-crowned Warbler *Seicercus castaniceps*, Dark-sided Flycatcher *Muscicapa sibirica*, Asian Brown Flycatcher *Muscicapa dauurica*, Brown-breasted Flycatcher *Muscicapa muttui*, Verditer Flycatcher *Eumyias thalassina*, Grey-headed Canary Flycatcher *Culicicapa ceylonensis*, Hill Blue

Flycatcher *Cyornis banyumas*, Siberian Blue Robin *Luscinia cyane*, Orange-flanked Bush Robin *Tarsiger cyanurus*, Oriental Magpie Robin *Copsychus saularis*, Daurian Redstart *Phoenicurus auroreus*, Little Forktail *Enicurus scouleri*, White-crowned Forktail *Enicurus leschenaulti*, Common Stonechat *Saxicola torquata*, Grey Bushchat *Saxicola ferrea*, Lesser Necklaced Laughingthrush *Garrulax monileger*, Moustached Laughingthrush *Garrulax cineraceus*, Spot-breasted Scimitar Babbler *Pomatorhinus erythrocnemis*, Chinese Babax *Babax lanceolatus*, Chestnut-headed Babbler, Dusky Fulvetta *Alcippe brunnea*, White-bellied Yuhina *Yuhina zantholeuca*, Spot-breasted Parrotbill *Paradoxornis guttaticollis*, Black-naped Oriole *Oriolus chinensis*, Brown Shrike *Lanius cristatus*, Tiger Shrike *Lanius tigrinus*, Black Drongo *Dicrurus macrocercus*, Ashy Drongo *Dicrurus leucophaeus*, Spangled Drongo *Dicrurus hottentottus*, Black-billed Magpie *Pica pica*, Large-billed Crow *Corvus macrorhynchos*, Crested Myna *Acridotheres cristatellus*, Eurasian Tree Sparrow *Passer montanus*, Russet Sparrow *Passer rutilans*, Scaly-breasted Munia *Lonchura punctulata*, Chestnut Bunting *Emberiza rutila*, Little Bunting *Emberiza pusilla*, Yellow-throated Bunting *Emberiza elegans*, Black-faced Bunting *Emberiza spodocephala* and Slaty Bunting *Latoucheornis siemsseni*. The combined total is some 169 bird species.

Fairy Pitta is a globally Vulnerable species, and Class II protected in China. Brown-breasted Flycatcher and Slaty Bunting are globally Near-threatened. Black Baza, Bonelli's Eagle, Mountain Hawk Eagle, Crested Serpent Eagle *Spilornis cheela*, Crested Goshawk *Accipiter trivirgatus*, Eurasian Hobby *Falco subbuteo*, Black Kite *Milvus migrans*, Chinese Sparrowhawk, Eurasian Sparrowhawk, Japanese Sparrowhawk, Common Buzzard, Hen Harrier, Silver Pheasant, Grass Owl, Collared Scops Owl, Asian Barred Owlet, Greater Coucal and Lesser Coucal are Class II protected species in China.

The presence of many forest-dependent species (e.g. Mountain Hawk Eagle, Emerald Dove, Red-headed Trogon, Orange-bellied Leafbird *Chloropsis hardwickii*, and various barbets, woodpeckers, babblers and flycatchers) indicates that the remaining forests at Mulun are of high integrity.

Reptiles and Amphibians

Fourteen species of amphibians, five species of lizards and four species of snakes were recorded at Mulun National Nature Reserve and the surrounding area during the rapid survey (Table 5). The most frequently encountered species were *Rana limnocharis* and *Polypedates megacephalus*, in the paddy fields. *Megophrys* tadpoles were common but the species could not be identified due to the lack of adults. A blue-tailed skink (either *Eumeces quadrilineatus* or *E. elegans*) was seen but could not be positively identified.

Table 5. Amphibians and reptiles of Mulun National Nature Reserve. Sequence follows Zhao E.-M. & Adler (1993).

Species	Habitat	
AMPHIBIA		
<i>Echinotriton asperrimus</i>	seepage pool	✓, tadpoles
<i>Megophrys</i> sp.	stream	tadpoles
<i>Bufo cryptotympanicus</i>	forest	✓
<i>Rana guentheri</i>	pool	✓, tadpoles
<i>Rana latouchii</i>	stream	✓
<i>Rana limnocharis</i>	pool	✓
	paddy field	✓
<i>Philautus odontotarsus</i>	pool	✓
<i>Polypedates megacephalus</i>	bamboo	✓
	shrubland	✓
	paddy field	✓
<i>Polypedates dennysi</i>	pool	✓
<i>Polypedates</i> sp.	water container	tadpoles
<i>Microhyla butleri</i>	pool	✓
<i>Microhyla heymonsi</i>	seepage pool	tadpoles
<i>Microhyla pulchra</i>	agricultural field	✓
	paddy field	✓
<i>Microhyla ornata</i>	paddy field	✓
REPTILIA		
<i>Acanthosaura lepidogaster</i>	forest	✓
<i>Eumeces</i> sp.	shrubland	✓
<i>Sphenomorphus indicus</i> ?	forest edge	✓
<i>Tropidophorus guangxiensis</i>	seepage	✓
<i>Platyplacopus intermedius</i>	forest	✓
<i>Takydromus sexlineatus</i>	abandoned field	✓
<i>Amphiesma optata</i>	agricultural field / shrubland	✓ ✓
<i>Amphiesma stolata</i>	abandoned field	✓
<i>Ptyas korros</i>	shrubland / abandoned field	✓ ✓
<i>Xenochrophis piscator</i>	abandoned field	✓

New records for the reserve included *Echinotriton asperrimus*, *Megophrys* sp., *Bufo cryptotympanicus*, *Rana latouchii*, *Microhyla heymonsi*, *Tropidophorus guangxiensis* and *Platyplacopus intermedius*. Of these, *B. cryptotympanicus* and *T. guangxiensis* are highly restricted and had previously been reported from two and one localities respectively (Zhao E.-M. & Adler, 1993; Fellowes & Hau, 1997).

The presence of *Echinotriton asperrimus*, *Megophrys* sp., *Bufo cryptotympanicus*, *Acanthosaura lepidogaster*, *Tropidophorus guangxiensis* and *Platyplacopus intermedius* indicated that the forests and the streams at Mulun are of high integrity.

In addition to the species listed above, Zhou F. (1995) reported *Bufo andrewsi* (as *Bufo bufo andrewsi*), *Bufo melanostictus*, *Rana boulengeri*, *Rana livida*, *Rana schmackeri*, *Rana shini*, *Rana spinosa*, *Rana rugulosa*, *Polypedates mutus* (as *Rhacophorus mutus*), *Calotes versicolor*, *Japalura szechwanensis*, *Goniurosaurus lichtenfelderi* (as *Eublepharis lichtenfelderi*), *Sphenomorphus indicus*, *Ramphotyphlops braminus* (as *Typhlops braminus*), *Python molurus*, *Achalinus ater*, *Achalinus rufescens*, *Calamaria pavementata*, *Calamaria septentrionalis*, *Dinodon flavozonatum* (as *Dinodon septentrionalis*), *Elaphe carinata*, *Elaphe moellendorffi*, *Elaphe porphyracea*, *Elaphe radiata*, *Elaphe taeniura* (as *Elaphe rufodorsata*), *Sinonatrix aequifasciata* (as *Natrix aequifasciata*), *Sinonatrix percarinata* (as *Natrix percarinata*),

Amphiesma popei (as *Natrix popei*), *Rhabdophis subminiatus* (as *Natrix subminiata*), *Oligodon chinensis*, *Oligodon formosanus*, *Oligodon lungshenensis* (as *O. guizhouensis*), *Cyclophiops major* (as *Opheodrys major*), *Opisthotropis balteata*, *Opisthotropis latouchii*, *Pseudoxenodon bambusicola*, *Ptyas mucosus*, *Sibynophis chinensis*, *Boiga kraepelini*, *Ahaetulla prasina* (as *Dryophis prasinus*), *Enhydria plumbea*, *Bungarus multicinctus*, *Calliophis maccllellandi*, *Naja atra* (as *Naja naja*), *Ophiophagus hannah*, *Trimeresurus albolabris*, *Trimeresurus stejnegeri*, *Trimeresurus monticola* and *Trimeresurus mucrosquamatus*.

Fish

A total of 39 species of freshwater fish were recorded at Mulun; 26 were recorded during the survey and a further 13, believed to have been caught locally, were bought from villagers (Table 6). Some species await specialist verification. The diversity of habitat types (e.g. sandy and rocky streams) and geology (e.g. limestone and alluvium) may contribute to the high diversity of freshwater fishes. The most frequently encountered species were *Zacco platypus*, *Opsariichthys bidens*, *Yaoshanicus arcus*, *Acrossocheilus beijiangensis*, *Pseudorasbora parva*, *Schistura fasciolata* and *Rhinogobius duospilus*. *Sinocyclocheilus lateristriatus*? appears to be a new record for Guangxi.

Table 6. Freshwater fish species recorded at Mulun and surrounding areas. "P" = purchased from villagers. Sequence of genera follows Nelson (1994). "#" = nomenclature follows Yue *et al.*(2000).

Species	Habitat	Yaomeng- cun / Jiucun	Dashapo	Hongtong / Waitong
<i>Zacco platypus</i>	stream	✓	+	
<i>Opsariichthys bidens</i>	stream	✓	+	
<i>Yaoshanicus arcus</i>	stream	✓	+	+
<i>Nicholsicypris normalis</i>	stream	✓	+	+
<i>Pseudohemiculter hainanensis</i>	purchased	P		
<i>Paracheilognathus meridianus</i>	stream	✓	+	+

Species	Habitat	Yaomeng- cun / Jiucun	Dashapo	Hongtong / Waitong
<i>Acheilognathus barbatulus</i>	stream	✓	+	+
<i>Capoeta semifasciolata</i>	stream	✓	+	
<i>Spinibarbus hollandi</i>	purchased	P	P	P
<i>Sinocyclocheilus lateristriatus?</i>	cave seep pool	✓	+	
<i>Acrossocheilus beijiangensis</i> #	stream	✓	+	+
<i>Acrossocheilus parallens</i>	stream	✓	+	
<i>Onychostoma gerlachi</i>	stream	✓	+	
<i>Rectoris posehensis</i>	purchased	P	P	
<i>Parasinilabeo assimilis</i>	purchased	P	P	
<i>Discogobio tetrabarbatus</i>	purchased	P	P	
<i>Pseudorasbora parva</i>	stream	✓	+	
<i>Microphysogobio</i> sp. (cf. <i>kiatingensis</i>) sp.	purchased	P	P	P
<i>Pseudogobio guilinensis</i> #	purchased	P	P	
<i>Cyprinus carpio</i> #	purchased	P	P	
<i>Oreonectes platycephalus</i>	stream	✓	+	+
<i>Leptobotia zebra</i>	stream	✓	+	
<i>Misgurnus anguillicaudatus</i>	purchased	P	P	
<i>Schistura fasciolata</i>	stream	✓	++	+
<i>Triplophysa</i> sp.	stream	✓	+	
<i>Mystus macropterus</i>	purchased	P		P
<i>Silurus asotus</i>	stream	✓		+
<i>Glyptothorax fukiensis fukiensis</i>	purchased	P	P	
<i>Clarias fuscus</i>	stream	✓		+
<i>Oryzias</i> sp.	stream	✓	+	
<i>Mastacembelus armatus</i>	purchased	P	P	P
<i>Siniperca scherzeri</i>	stream	✓	+	+
<i>Rhinogobius duospilus</i>	stream	✓	+	
<i>Rhinogobius yaoshanensis</i>	stream	✓	+	
<i>Rhinogobius</i> (cf. <i>brunneus</i>) sp. 1	stream	✓	+	
<i>Rhinogobius</i> sp. 2	stream	✓	+	
<i>Macropodus opercularis</i>	stream	✓		+
<i>Channa maculata</i>	purchased	P		P

Pseudogobio guilinensis, *Rectoris posehensis* and *Leptobotia zebra* are endemic to the West River (Xijiang) drainage system. *Rhinogobius yaoshanensis* is endemic to Guangxi, and was thought to be restricted to Yaoshan district (Zhu, 1995). A number of unidentified species were collected (e.g. *Rhinogobius* spp.), some of which may prove to be of high scientific and conservation interest. Species richness was very high, with many restricted species such as *Triplophysa* sp., *Paracheilognathus meridianus* and *Sinocyclocheilus lateristriatus?*, and the presence of predatory species such as *Siniperca scherzeri* and *Channa maculata* indicated that the streams of Mulun are of very high ecological integrity.

Ants

Seventy-two ant species were recorded from the Mulun area (Table 7). The most frequently encountered species were *Crematogaster* sp. 3, *Polyrhachis tyrannica*, *Pristomyrmex pungens*, *Dolichoderus* sp. 9, *Lepisiota rothneyi*, *Pachycondyla* sp. 7, *Pachycondyla* sp. 2, *Pachycondyla* sp. 14, *Pheidole* (cf. *noda*) sp. 1 and *Rhoptomyrmex* sp. 1. Some species, including *Anochetus* sp. 4, *Lepisiota* sp. 4, *Polyrhachis* sp. 23 and *Polyrhachis* sp. 25 are believed to be new to science.

Table 7. Ant species recorded at Mulun.

Species	Habitat, altitude
<i>Acanthomyrmex</i> (cf. <i>crassispinus</i>) sp. 1	low closed forest
<i>Aenictus</i> (<i>aratus</i> group) sp. 5	low forest, fields
<i>Aenictus</i> (<i>ceylonicus</i> group) sp. 1	paddy fields, open shrubland
<i>Aenictus</i> (<i>laeviceps</i> group) sp. 2	fields

Species	Habitat, altitude
<i>Anochetus</i> (cf. <i>yunnanensis</i>) sp. 4	low closed forest
<i>Aphaenogaster</i> (cf. <i>feae</i>) sp. 7	open low forest/ shrubland
<i>Camponotus</i> (cf. <i>aethiops vitiosus</i>) sp. 21	open shrubland
<i>Camponotus albosparsus</i>	grassland/ low pine plantation
<i>Camponotus</i> (cf. <i>fuscivillosus</i>) sp. 28	paddy/low shrub
<i>Camponotus</i> (cf. <i>jianghuaensis</i>) sp. 15	shrubland
<i>Camponotus</i> (cf. <i>mitis</i>) sp. 11	fields, shrubland, forest
<i>Camponotus nicobarensis</i>	fields, shrubland, low forest
<i>Camponotus rufoglaucus</i>	open plantation/ agricultural
<i>Cataulacus granulatus</i>	open low vegetation
<i>Cerapachys sulcinodis</i>	open forest/ shrubland, fields
<i>Crematogaster</i> (cf. <i>biroi</i>) sp. 4	shrubland/ grassland
<i>Crematogaster</i> (cf. <i>dohrni</i>) sp. 8	low shrubland/paddy
<i>Crematogaster</i> (cf. <i>laboriosa</i>) sp. 3	forest, shrubland, fields
<i>Crematogaster</i> (cf. <i>travancorensis</i>) sp. 2	shrubland, low forest
<i>Cryptopone</i> sp. 1	forest
<i>Dilobocondyla</i> (cf. <i>fouqueti</i>) sp. 1	low shrubland/ grassland
<i>Dolichoderus</i> sp. 9	grassland, shrubland, open forest
<i>Dolichoderus</i> sp. 6	open low forest, fields
<i>Gnamptogenys bicolor</i>	open shrubland
<i>Gnamptogenys binghami</i>	low forest/ shrubland
<i>Hypoponera</i> (cf. <i>excoecata</i>) sp. 2	open low forest
<i>Lepisiota</i> (cf. <i>opaca</i>) sp. 4	not recorded
<i>Lepisiota rothneyi</i>	shrubland, grassland
<i>Leptogenys kitteli</i>	open shrubland, fields
<i>Monomorium chinense</i>	fields, shrubland
<i>Monomorium destructor</i>	open shrubland, fields
<i>Odontomachus monticola</i>	forest, shrubland
<i>Odontoponera</i> (cf. <i>denticulata</i>) sp. 1	low forest, shrubland, fields
<i>Oligomyrmex</i> (cf. <i>hunanensis</i>) sp. 3	open forest/ shrubland
<i>Pachycondyla</i> (cf. <i>astuta</i>) sp. 14	grassland, shrubland, low forest
<i>Pachycondyla</i> (<i>javana</i> group) sp. 1	low forest & fields
<i>Pachycondyla</i> (cf. <i>luteipes</i>) sp. 2	forest, fields
<i>Pachycondyla rufipes</i>	fields, shrubland, forest
<i>Pachycondyla</i> (cf. <i>sauteri</i>) sp. 7	shrubland, forest
<i>Pachycondyla</i> (cf. <i>sharpi</i>) sp. 12	open low forest
<i>Pachycondyla</i> (cf. <i>nigrita</i>) sp. 17	open shrubland
<i>Paratrechina</i> (cf. <i>bourbonica</i>) sp. 4	fields, shrubland
<i>Paratrechina longicornis</i>	grassland, low shrubland
<i>Paratrechina sauteri</i>	shrubland/ grassland
<i>Paratrechina</i> (nr. <i>indica</i>) sp. 9	open forest/ shrubland
<i>Pheidole</i> (cf. <i>noda</i>) sp. 1	shrubland, grassland
<i>Pheidole</i> sp. 3-A	low forest
<i>Pheidole</i> (cf. <i>simoni</i>) sp. 7	shrubland
<i>Pheidole</i> sp. 11	open shrubland
<i>Pheidologeton</i> (cf. <i>melasolenus</i>) sp. 8	shrubland, low forest
<i>Plagiolepis</i> (cf. <i>alluaudi</i>) sp. 3	shrubland
<i>Polyrhachis dives</i>	open shrubland
<i>Polyrhachis lamellidens</i>	open low forest
<i>Polyrhachis</i> (cf. <i>sculpturata</i>) sp. 5	shrubland, forest
<i>Polyrhachis tyrannica</i>	shrubland, fields
<i>Polyrhachis vigilans</i>	open low forest
<i>Polyrhachis</i> (<i>Myrma</i>) sp. 23	agricultural/ shrubland
<i>Polyrhachis</i> (<i>Myrma</i>) sp. 25	open low forest
<i>Prenolepis</i> (cf. <i>emmae</i>) sp. 1	open forest/ shrubland, fields
<i>Prenolepis magnocula</i>	open shrubland
<i>Prenolepis</i> sp. 3	low closed forest
<i>Pristomyrmex pungens</i>	fields, open shrubland
<i>Pseudolasius</i> sp. 1	open shrubland
<i>Recurvidris</i> sp. 1	low shrubland/ grassland
<i>Rhoptromyrmex</i> (cf. <i>wroughtonii</i>) sp. 1	shrubland, fields

Species	Habitat, altitude
<i>Tapinoma</i> sp. 1	Shrubland
<i>Technomyrmex</i> sp. 2	tall open shrubland
<i>Tetramorium</i> (cf. <i>kraepelini</i>) sp. 4	open shrubland/grassland
<i>Tetraoponera nipponense</i>	open low forest
<i>Tetramorium</i> (cf. <i>tonganum</i>) sp. 12	open shrubland
<i>Tetramorium</i> sp. 22	low shrubland/paddy
<i>Tetraoponera allaborans</i>	? (missing data)
<i>Vollenhovia</i> (cf. <i>pyrrhoris</i>) sp. 10	open forest/ shrubland

Vollenhovia (cf. *pyrrhoris*) sp. 10 is currently known only from Mulun. *Prenolepis* sp. 3 may be dependent on primary forest, while some 24 species recorded (33%) are dependent on forest habitat. Although the core forest of Mulun was not reached during this survey, the high species richness and large number of rare species indicates that the forest is of high importance for ant (and probably overall insect) biodiversity.

Dragonflies

Thirty-seven dragonfly species were recorded in the Mulun area (Table 8). The most frequently encountered were *Matrona basilaris*, *Rhinocypha perforata*, *Euphaea decorata*, *Prodasineura verticalis*, *Orthetrum pruinosum*, *O. sabina*, *Pantala flavescens* and *Sympetrum eroticum*. *Ischnura* sp. could not be identified due to taxonomic confusion regarding the *I. rufostigma* group to which the Mulun specimen belongs (K.D.P. Wilson & Reels, in prep.).

Table 8. Dragonflies recorded at Mulun, 19 to 22 July 1998.

Species name
<i>Calopteryx atrata</i>
<i>Matrona basilaris</i>
<i>Neurobasis chinensis</i>
<i>Rhinocypha perforata</i>
<i>Indocypha katharina</i>
<i>Aciagrion tillyardi</i>
<i>Agriocnemis femina</i>
<i>Agriocnemis lacteola</i>
<i>Agriocnemis pygmaea</i>
<i>Ischnura</i> sp. (<i>rufostigma</i> Selys 1876 group)
<i>Euphaea superba</i>
<i>Euphaea decorata</i>
<i>Dysphaea basitincta</i>
<i>Philosina buchi</i>
<i>Coeliccia cyanomelas</i>
<i>Prodasineura verticalis</i>
<i>Copera marginipes</i>
<i>Polycanthagyna erythromelas</i>
<i>Chlorogomphus papilio</i>
<i>Anisogomphus koxingai</i>
<i>Burmagomphus vermicularis</i>
<i>Nihonogomphus lieftincki</i>
<i>Gomphidia krugeri fukienensis</i>
<i>Crocothemis servilia</i>
<i>Orthetrum albistylum</i>
<i>Orthetrum pruinosum</i>
<i>Orthetrum sabina</i>
<i>Orthetrum triangulare</i>
<i>Palpopleura sexmaculata</i>
<i>Pantala flavescens</i>
<i>Pseudothemis zonata</i>
<i>Rhyothemis variegata</i>
<i>Sympetrum parvulum</i>
<i>Sympetrum eroticum</i>

Species name <i>Trithemis aurora</i> <i>Trithemis festiva</i> <i>Zygonyx iris insignis</i>
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The male of *Indocypha katharina* is previously undescribed. A description has now been made, based partly on the material collected at Mulun in the present survey (K.D.P. Wilson & Reels, in prep.). Prior to this, the status of *I. katharina* as a good species was unconfirmed. *Euphaea superba* and *Prodasineura verticalis* are new records for China, the former previously known only from Vietnam, and the latter known from India, Burma, Laos and East Malaysia. *Dysphaea basitincta* was recorded from mainland China for the first time in May 1998 (Kadoorie Farm and Botanic Garden, 2002b); it is also known from Hainan and Vietnam.

Butterflies

Ninety-one species of butterfly were recorded at Mulun over the period 19-22 July 1998 (Table 9). The most frequent included *Papilio nephelus*, *Neptis hylas* and *Precis almana*. Twelve species are apparently new provincial records, not recorded from Guangxi by Chou (1994) or Bascombe (1995).

Table 9. Butterflies recorded at Mulun, 19-22 July 1998. Sequence of families follows Bascombe (1995).

Species	Habitat	Notes
<i>Aeromachus dubius</i>	river, farmland	new Guangxi record
<i>Aeromachus</i> sp.	river, farmland	
<i>Bibasis gomata</i>	farmland, forest	new Guangxi record
<i>Pelopidas agna</i>	river, farmland	
<i>Polytremis lubricans</i>	farmland, forest	?new Guangxi record
<i>Pseudocoladenia dan</i>	farmland, forest	
<i>Tagiades litigious</i>	farmland, forest	
<i>Telicota/ Potanthus</i> sp.	farmland, forest	
<i>Thoressa submacula</i>	farmland, forest	new Guangxi record
<i>Graphium agamemnon</i>	river, farmland	
<i>Graphium sarpedon</i>	river, shrubland	
<i>Graphium (Paranticopsis) macareus</i>	river, shrubland	
<i>Graphium (Paranticopsis) xenocles</i>	farmland, forest	new Guangxi record
<i>Graphium (Pathysa) antiphates</i>	river, shrubland	
	farmland, forest	
<i>Lamproptera meges</i>	river, farmland	
	river, shrubland	
<i>Papilio bianor</i>	river, farmland	
	river, shrubland	
<i>Papilio castor</i>	farmland, forest	
<i>Papilio helenus</i>	river, shrubland	
	farmland, forest	
<i>Papilio memnon</i>	river, farmland	
	farmland, forest	
<i>Papilio nephelus</i>	river, farmland	
	river, shrubland	
	farmland, forest	
<i>Papilio paris</i>	river, farmland	
	river, shrubland	
	farmland, forest	
<i>Papilio polytes</i>	river, farmland	
	farmland, forest	
<i>Papilio protenor</i>	river, shrubland	
	farmland, forest	
<i>Papilio xuthus</i>	river, farmland	
<i>Troides</i> sp.	farmland, forest	
<i>Appias lycnida</i>	river, shrubland	
<i>Delias pasithoe</i>	farmland, forest	

Species	Habitat	Notes
<i>Eurema blanda</i>	river, farmland	
<i>Eurema laeta</i>	farmland, forest	
<i>Abisara echerius</i>	farmland, forest	
<i>Acytolepis puspa</i>	river, farmland	
	farmland, forest	
<i>Ancema ctesia</i>	farmland, forest	
<i>Curetis dentata</i>	farmland, forest	
<i>Heliophorus ila</i>	farmland, forest	
<i>Jamides bochus</i>	farmland, forest	
<i>Rapala sp. (nissa?)</i>	farmland, forest	
<i>Tongeia filicaudis</i>	farmland, forest	new Guangxi record
<i>Zemerus flegyas</i>	river, shrubland	
	farmland, forest	
<i>Apatura (Rohana) parisatis</i>	farmland, forest	
<i>Argyreus hyperbius</i>	farmland, forest	
<i>Ariadne ariadne</i>	farmland, forest	
<i>Athyma cama</i>	river, shrubland	
<i>Athyma jina</i>	farmland, forest	new Guangxi record
<i>Athyma nefte</i>	river, farmland	
	farmland, forest	
<i>Athyma perius</i>	river, farmland	
	river, shrubland	
<i>Athyma selenophora</i>	river, farmland	
	farmland, forest	
<i>Cethosia biblis</i>	farmland, forest	
<i>Cethosia cyane</i>	river, farmland	
<i>Charaxes bernardus</i>	river, shrubland	?new Guangxi record
<i>Charaxes marmax</i>	river, shrubland	
<i>Danaus genutia</i>	river, farmland	
	farmland, forest	
<i>Discophora sondaica</i>	river, farmland	
<i>Euploea midamus</i>	farmland, forest	
<i>Euploea mulciber</i>	farmland, forest	
<i>Euthalia pratti</i>	farmland, forest	new Guangxi record
<i>Faunis aerope</i>	river, shrubland	
	farmland, forest	
<i>Hestina assimilis</i>	river, shrubland	
<i>Hypolimnas bolina</i>	farmland, forest	
<i>Ideopsis similis</i>	farmland, forest	
<i>Kallima inachus</i>	farmland, forest	
<i>Lethe confusa</i>	farmland, forest	
<i>Lethe (Neope) muirheadii</i>	river, shrubland	? new Guangxi record
<i>Limnitis (Bhagadatta) austenia</i>	farmland, forest	
<i>Limnitis (Parathyma) sulphitia</i>	river, shrubland	
	farmland, forest	
<i>Melanitis leda</i>	river, farmland	
	farmland, forest	
<i>Melanitis phedima</i>	farmland, forest	
<i>Mycalesis gotama</i>	river, farmland	
	farmland, forest	
<i>Mycalesis zonata</i>	farmland, forest	
<i>Neptis clinia</i>	farmland, forest	new Guangxi record
<i>Neptis hylas</i>	river, farmland	
	river, shrubland	
	farmland, forest	
<i>Neptis miah</i>	river, farmland	
<i>Neptis nata (?)</i>	river, farmland	
<i>Neptis (Phaedyman) columella</i>	farmland, forest	
<i>Polygonia c-aureum</i>	farmland, forest	
<i>Polyura arja</i>	river, shrubland	
<i>Polyura athamas</i>	river, shrubland	

Species	Habitat	Notes
<i>Polyura eudamippus</i>	farmland, forest	
<i>Polyura narcea</i>	river, shrubland	
<i>Polyura nepenthes</i>	river, shrubland	
<i>Precis (Junonia) almana</i>	river, farmland	
	farmland, forest	
<i>Precis (Junonia) iphita</i>	river, shrubland	
<i>Precis (Junonia) orithya</i>	river, farmland	
	farmland, forest	
<i>Pseudergolis wedah</i>	farmland, forest	new Guangxi record
<i>Stibochiona nicea</i>	farmland, forest	
<i>Stichopphthalma</i> sp.	farmland, forest	
<i>Symbrenthia hypselis</i>	farmland, forest	
<i>Symbrenthia lilaea</i>	river, shrubland	
	farmland, forest	
<i>Thaumantis diores</i>	river, farmland	
	farmland, forest	
<i>Ypthima baldus</i>	farmland, forest	
<i>Ypthima lisandra</i>	river, farmland	
<i>Ypthima</i> sp.	farmland, forest	

The relatively higher species counts (40 and 45 species) inside the reserve on 21 and 22 July may be attributed to the better forest encountered there, as indicated by the presence of the nymphalids *Bhagadatta austenia*, *Euthalia pratti*, *Kallima inachus*, *Stibochiona nicea* and *Stichopphthalma* sp., and of the lycaenid *Tongeia filicaudis*.

Summary of flora and fauna

The vegetation of the Mulun area is predominantly limestone mixed evergreen and deciduous broadleaf forest and montane dwarf forest. The karst forest in the reserve is the best preserved in Guangxi. Only limited parts of the reserve could be visited in the present survey, due to time limitations and adverse weather. Two hundred and three plant species were recorded. Orchid species richness was relatively high (47 species) and half the orchid species recorded were terrestrial. A high proportion of them were forest-dependent species (such as *Anoectochilus* spp. and *Cymbidium lancifolium*), indicating the healthy condition of the forest. The plant community contained a high proportion of limestone specialists as well as regionally restricted species, for instance *Hemiboaea magnibracteata*, *Cryptocarya microcarpa*, *Pithecellobium multifoliatum*, *Phaius columnaris* and *Paphiopedilum micranthum*. Sixteen globally or nationally threatened or protected plant species were found including the globally Endangered *Garcinia paucinervis* and *Dendrocnide urentissima*, and six nationally Endangered orchids (*Anoectochilus zhejiangensis*, *Bletilla formonsana*, *Cymbidium ensifolium*, *Dendrobium officinale*, *Nervilia fordii* and *Phaius columnaris*). With the neighbouring Maolan National Nature Reserve in Guizhou, Mulun is among the most important refuges in China for primary and secondary karst forest flora (Zhou Z.X., 1987).

Fauna of conservation concern include the Vulnerable Fairy Pitta and a number of species of restricted distribution, such as the lizard *Tropidophorus guangxiensis*, the snake *Amphiesma optata*, the toad *Bufo cryptotympanicus* and the fish *Triblophysa* sp., *Paracheilognathus meridianus* and *Sinocyclocheilus lateristriatus*. The terrestrial animal groups studied, like the plants, were diverse, and the composition indicated the high integrity of the forest ecosystem. The aquatic fauna also reflected high stream integrity, and the spring-fed stream water supported species requiring cool, clean water. A number of animal species were found that are thought to be new to science, and the reserve is likely to harbour more undiscovered species.

Threats and problems

The karst landscape generally has impoverished soil derived from limestone, with low soil coverage and porous bedrock. Thus karst forest is particularly susceptible to degradation following deforestation and disturbance, and recovery is slow. In the past the Mulun vegetation was protected from human disturbance by poor accessibility and low population density. But improved communication and transport have led to some changes. At the time of the survey all the flat land visited had been deforested and turned into agricultural fields. Much of the lowland within the reserve is now under cultivation, although some fields have been abandoned. Trees over a large area had been cut down for plantations of edible *Amorphophallus* species. Besides this habitat destruction, the pressure to harvest natural resources was substantial. Villagers still collected firewood from the reserve and caused a certain degree of deforestation and disturbance. Increased awareness of the economic value of plants and animals, combined with the gradual increase of populations at the edge of the reserve, has put increasing pressure on the reserve's biodiversity. Various plants such as *Picrasma quassioides*, *Machilus pauhoi* and *Calocedrus macrolepis* were felled in large quantities for production of medicinal plasters, glue and farming tools, respectively. Orchids and other medicinal herbs, such as *Paphiopedilum micranthum* and *Dyosma versipellis*, were also collected in large quantities to meet market demands.

Opportunities and recommendations

The importance of Mulun has been recognised in the awarding of National Nature Reserve status. Reserve staff are also enthusiastic for their conservation role, and this should be developed with capacity building initiatives.

There has already been a concerted effort to reduce consumption of forest resources. With funding from Guangxi Forestry Department and Kadoorie Farm and Botanic Garden, reserve management authorities have replaced 'tiger stoves' used by villagers with energy-efficient stoves. A longer-term solution may be the introduction of systems based on biogas or appropriate solar technology as it becomes available. The possibility of relocating villagers from the edge of the core area has been raised. Whether or not the residents are moved, non-exploitative means of using the forest resources should be promoted. Residents should also receive benefits from protecting, and not depleting, biodiversity.

For certain threatened species, active conservation measures may be required. *In situ* conservation of the orchid *Paphiopedilum micranthum* has been identified as a priority due to the healthy populations occurring locally (Li, 2001). Generally, an ecosystem approach would be most beneficial, and emphasis should be placed on protecting and restoring the karst forest. In some areas at least, lowland forests should be re-established by planting native tree species in abandoned cultivated fields. This could be achieved through establishing small-scale tree nurseries in the villages, with training provided by regional experts such as staff of the Guangxi Institute of Botany. The funding requirements for such nurseries would not be high.

Although the porous limestone reduces the prevalence of aboveground streams, those streams examined at Mulun were found to be exceptionally rich in fish, and supported good dragonfly assemblages. The freshwater habitats should be protected from disturbance, including over-fishing. Further research is also needed on the limestone stream and cave fauna.

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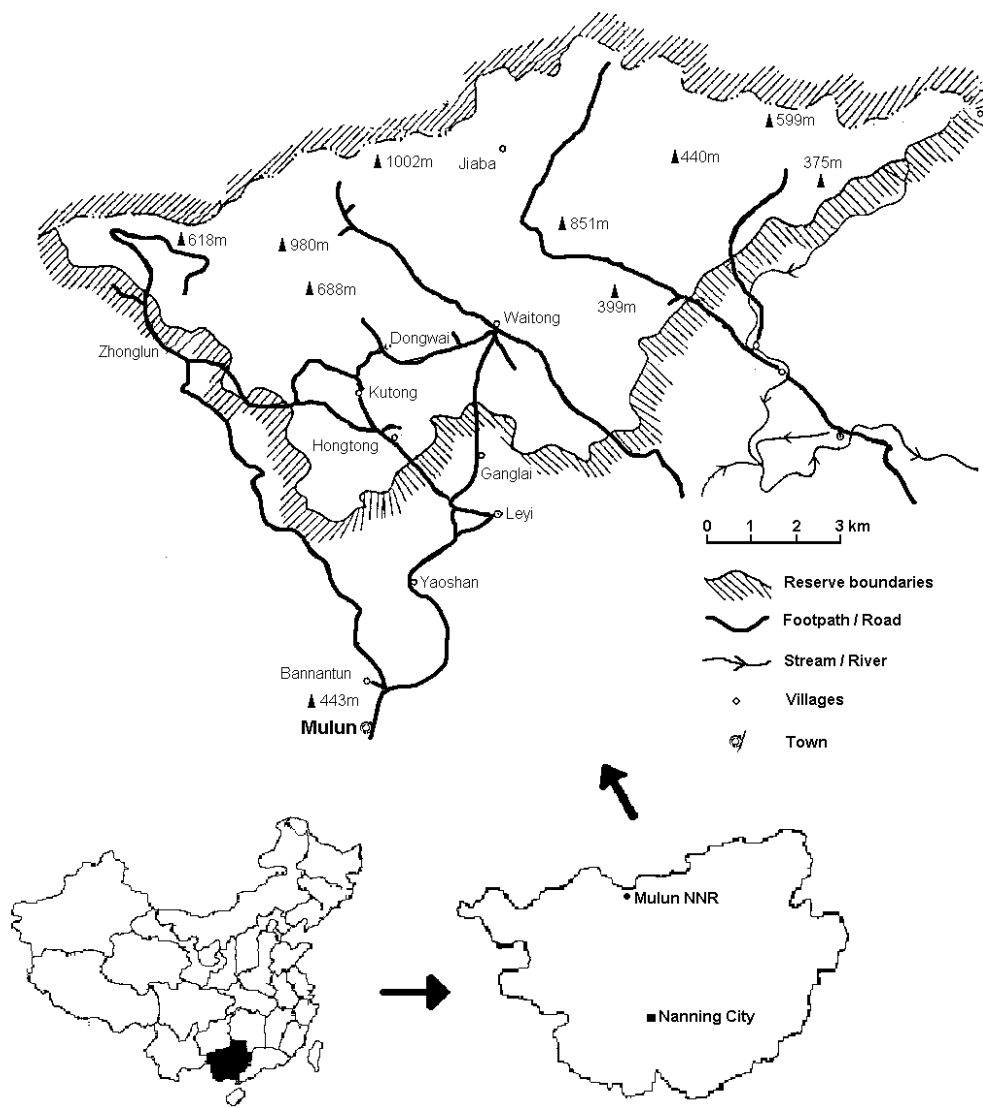


Figure 1. Map showing location of Mulun National Nature Reserve, North Guangxi, China.