



Report of Rapid Biodiversity Assessments at Wuzhishan Nature Reserve, Central Hainan, China, 1999 and 2001

Kadoorie Farm and Botanic Garden
in collaboration with
Hainan Provincial Forestry Department
South China Institute of Botany
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Report of Rapid Biodiversity Assessments at Wuzhishan Nature Reserve, Central Hainan, China, 1999 and 2001

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Background

The present report details the findings of visits to central Hainan 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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Translation of some common Chinese geographical terms

Romanized Chinese (pinyin)	English meaning
Bei	north
Dao	island
Dong	east
Feng shui	the Chinese system of geomancy
Feng, Ding	peak
Gang	harbour
Hai	sea
He, Chuan, Jiang	river
Hu, Chi	lake
Keng, Gu	valley
Kou	outlet
Ling	range
Nan	south
Shan	mountain
Shi	city
Tun	hamlet
Wan	bay
Xi	west
Xi, Yong	stream
Xian	county
Xiang, Cun	village

Report of Rapid Biodiversity Assessments at Wuzhishan Nature Reserve, Central Hainan, China, 1999 and 2001

Objectives

- The aims of the surveys were to collect up-to-date information on the fauna and flora of Wuzhishan Nature Reserve, and to use this to help determine conservation priorities within South China. Emphasis was on groups that have not been extensively studied, including amphibians, reptiles, fish, ants, dragonflies and butterflies. The second visit, in 2001, was part of an island-wide survey for White-eared Night Heron (*Gorsarchius magnificus*). The species was described from a specimen collected at Wuzhishan in 1899.

Methods

- On 7 June 1999, members of Kadoorie Farm and Botanic Garden in Hong Kong (GS, JRF, ML, LKS, GTR), Hainan Provincial Forestry Department in Hainan (FJP, YZD), South China Institute of Botany in Guangdong (XFW, WRJ), Institute of Botany Chinese Academy of Sciences in Beijing (TZH), Hainan Normal University in Hainan (WJY), South China Normal University in Guangdong (LZC, XZ) and Xinyang Teachers' College in Henan (LHJ) assembled in Haikou. They met Mr. Wu H.S. (Deputy Director) and other officials of the Provincial Forestry Department, and outlined the aims of the KFBG South China Biodiversity Conservation Programme (SCBCP). In the evening the team went to Hainan Normal University to give two presentations (on Taiwan Country Parks and on SCBCP). On 8 to 12 June, they conducted rapid biodiversity survey at the Wuzhishan Nature Reserve.
- A smaller team comprising members of KFBG (BC, LKS, NSC), Hainan Provincial Forestry Department (FJP), Datian National Nature Reserve (WWY), and La Tour du Valat Biological Station, France (OP), conducted a survey for White-eared Night Heron at Wuzhishan on 2–4 August 2001. Other biota were also surveyed and recorded during this brief survey.
- During fieldwork visual searching for vascular plants, mammals, birds, reptiles, amphibians, fish, ants, butterflies and dragonflies was conducted. Frogs and birds were also identified by their calls. Plant records were made by field observation, with some specimens collected.
- Status of large and medium-sized mammals (excluding Insectivora, Chiroptera and Muridae) at Dayaoshan was inferred largely based on interviews with local people, with reference to colour pictures. For purposes of these interviews a list of South China mammals was compiled from various sources including Guangdong Forestry Department and South China Institute of Endangered Animals (1987), Corbet & Hill (1992) and Zhang Y. *et al.* (1997).
- Vascular plant records were made or verified by XFW, WRJ or NSC, and edited by NSC, with the exception of orchids, which were made or verified by GS and TZH. Mammal records were made by LKS, BC, ML or JRF. Records of birds were made or verified by LKS, ML or JRF, reptiles and amphibians by ML or LZC, fish by BC and CXL, ants by JRF, butterflies by GTR, dragonflies by GTR and KW of Hong Kong, and molluscs by CDN.
- Nomenclature in the report is standardised based, unless otherwise stated, on the following references:
 - Flora (Pteridophyta, Gymnospermae and Angiospermae excluding Orchidaceae): Anon. (s1959-2001); Anon. (1996-2001); Anon. (2002a, 2002b); The Plant Names Project (2002);
 - Orchids (Angiospermae: Orchidaceae): Chen (1999); Lang (1999); Tsi (1999);
 - Mammals (Mammalia): D.E. Wilson & Cole (2000);
 - Birds (Aves): Inskipp *et al.* (1996);
 - Reptiles and Amphibians (Reptilia and Amphibia): Zhao E.-M. & Adler (1993); 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 (2002). National conservation status of orchids is based on Wang *et al.* (in press). Certain taxa, including orchids, reptiles, amphibians, fish and invertebrates, have yet to be properly assessed for global status.
- 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

- Wuzhishan Nature Reserve is situated in Qiongzong Autonomous County in Central Hainan at 18 ° 49' -18 ° 58' N, 109 ° 39' -109 ° 47' E. The size of the reserve is 134 km² (Mackinnon *et al.*, 1996).
- The geology is mainly granitic and rhyolitic (Yang *et al.*, 1994; Fu & Feng, 1995). The landscape is mainly rocky hills with steep hillsides and rocky outcrops. Altitude in the nature reserve ranges from 250 m to 1,864 m at the summit of Wuzhishan, the highest peak in Hainan (Mackinnon *et al.*, 1996).
- The reserve has a seasonal monsoon climate with mean monthly temperature range from 18°C to 25.7°C. Annual precipitation is 2,300 to 2,500 mm, of which 80% occurs in the wet season from May to October (Fu & Feng, 1995). Streams drain east towards the Wanquan He, and west towards Changhua Jiang; the streams studied in these surveys were in the west drainage system.
- Wuzhishan Nature Reserve was established in 1985 as a provincial nature reserve to protect tropical rainforest ecosystem and fauna, and is classified as a Forest Ecosystem Nature Reserve (Zhang W., 1998). It is managed by the provincial Forestry Department.

Results

Vegetation

- The original vegetation of Wuzhishan would have been tropical monsoon evergreen rainforest and montane evergreen rainforest (Fu & Feng, 1995).
- During the present surveys, the following vegetation was found:
 - Above 900 m, mixed coniferous and broadleaf forest occurred, dominated by *Dacrydium pectinatum*, *Pinus* spp., *Cyclobalanopsis championii*, *C. neglecta*, and *Altingia chinensis*, 20-30 m in height and up to 80cm dbh.
 - Between 800 and 1,000 m, mature forest was present, dominated by Fagaceae, Lauraceae, Myrtaceae and Hamamelidaceae.
 - Below 800 m the tropical lowland rainforest had been heavily disturbed, and had largely given way to tall shrubland with patches of young secondary forest in ravines. The forest was dominated by *Liquidambar formosana*, *Schefflera octophylla*, *Bischofia javanica*, and *Canarium album*.

Flora

- Earlier surveys of Wuzhishan had recorded 1,882 seed plant species, in 233 families. This recorded flora is dominated by Lauraceae, Euphorbiaceae, Rubiaceae, Papilionaceae,

Orchidaceae, Poaceae, and Cyperaceae (Tang *et al.*, 2002). The present surveys recorded 432 vascular plant species, including 22 fern species in 15 families, eight gymnosperms in four families, and 402 angiosperms in 101 families. Fifty-five orchid species, recorded during two and a half days of fieldwork in 1999, are shown in Table 2; all other species (five and a half days fieldwork) are in Table 1.

- One fern (*Aleuritopteris pseudofarinosa*) is recorded from Hainan for the first time; two orchids (*Bulbophyllum insulsum* and *Schoenorchis gemmata*) are recorded from Qiongzong County for the first time.
- Many threatened and protected species were recorded in the present surveys:
- *Vatica mangachapoi* is considered globally Endangered and is under Class II National Protection in China. It is one of the dominant tree species of evergreen monsoon forest in Hainan.
 - The orchids *Anoectochilus roxburghii* and *Vanda subconcolor* are nationally Endangered. *Vanda subconcolor* is known only from Hainan and west Yunnan.
 - *Heritiera parvifolia*, *Amoora dasyclada* and *Aquilaria sinensis* are considered globally Vulnerable and under Class II National Protection in China. *Heritiera parvifolia* is also endemic to Hainan and one tree was seen on a path. *Aquilaria sinensis* has a long history of cultivation as a tree crop in South China, especially Guangdong.
 - *Cephalotaxus mannii*, *Illicium ternstroemioides* and *Hydnocarpus hainanensis* are considered globally Vulnerable. The former is also considered endangered in China (pp. 87, Vol. 4 of Anon. (1996-2001)). Plants of *C. mannii* from Hainan and South China are sometimes considered a distinct species, *C. hainanensis* H.L. Li.
 - The orchid *Dendrobium loddigesii* is vulnerable nationally.
 - Four species of the tree fern family (Cyathaceae) were recorded in the present survey. All species of this family are under Class II National Protection in China and are mainly found in relatively intact forest and margins.
 - *Helminthostachys zeylanica* is under Class II National Protection in China and is very rare in South China. Only one plant was seen in the 1999 visit.
 - *Pinus kwangtungensis* is under Class II National Protection and is mainly found in montane forest in South China.
 - *Pinus fenzeliana* is considered to be at Lower Risk (Near-threatened).
 - Although not protected in China, *Podocarpus annamiensis* is locally rare in China with only a few individuals known in Hainan, and is considered to be vulnerable in China (pp. 83, Vol. 4 of Anon. (1996-2001)).
 - An additional 22 species (*Artabotrys hainanensis*, *Artabotrys pilosus*, *Erycibe oligantha*, *Carpinus londoniana* var. *lanceolata*, *Macaranga bracteata*, *Lithocarpus fenzelianus*, *Chirita heterotricha*, *Metapetrocosmea peltata*, *Oreocharis flavida*, *Altingia obovata*, *Dehaasia hainanensis*, *Ardisia densilepidotula*, *Syzygium stenocladum*, *Polygala insularis*, *Morinda hainanensis*, *Mussaenda hainanensis*, *Nephelium topengii*, *Eurya hainanensis*, *Microcos chungii*, *Plectocomia microstachys*, *Amomum chinense* and *Dendrobium sinense*) are endemic to Hainan.
 - *Aristolochia hainanensis* is known only from Hainan and South Guangxi.
 - *Homalium hainanense* is known only from Hainan and Vietnam.
 - *Hypolytrum hainanense* and the orchid *Eria rosea* are known only from Hainan and Hong Kong.
 - The orchid *Eria thao* is known only from Hainan, Shiwandashan in Guangxi (Anon., 2001) and Vietnam.
 - The orchid *Dendrobium hainanense* is known only from Hainan, Vietnam and Thailand.
 - Though not endemic, within China *Ceratostylis subulata* is known only from Hainan, while *Panisea tricallosa* is known only from Hainan (Wuzhishan and Dingan) and southwest

Yunnan (Fungqin). One species was provisionally identified as *Holcoglossum subulifolium*, another species known only from Hainan within China.

– All recorded orchid species are listed in CITES Appendix II.

- A large number of orchid species was recorded, with a high percentage of epiphytes (80%), which is characteristic of tropical forest in good condition.

Table 1. Vascular plants (excluding Orchidaceae) of Wuzhishan Nature Reserve recorded in the present surveys. Species which are Nationally Protected (Class I or II) (State Forestry Administration & Ministry of Agriculture, 1999), globally Threatened or at Lower Risk (Near-threatened) (IUCN, 2002) or globally restricted are indicated.

Family	Species	Remarks
PTERIDOPHYTA		
Adiantaceae	<i>Adiantum flabellulatum</i> L.	
Antrophyaceae	<i>Antrophyum callifolium</i> Blume	
Aspidiaceae	<i>Tectaria phaeocaulis</i> (Rosenst.) C. Chr.	
Aspleniaceae	<i>Asplenium loriceum</i> H. Christ	
	<i>Asplenium unilaterale</i> Lam.	
	<i>Neottopteris nidus</i> (L.) J. Sm.	epiphytic
Athyriaceae	<i>Diplazium donianum</i> (Mett.) Tardieu	
Blechnaceae	<i>Blechnum orientale</i> L.	
Bolbitidaceae	<i>Egenolfia appendiculata</i> (Willd.) J.Sm.	
Cyatheaceae	<i>Alsophila spinulosa</i> (Wall. ex Hook.) R.M.Tryon	Protected II
	<i>Gymnosphaera gigantea</i> (Wall. ex Hook.) Ching	Protected II
	<i>Gymnosphaera podophylla</i> (Hook.) Copel.	Protected II
	<i>Sphaeropteris brunoniana</i> (Hook.) R.M. Tryon	Protected II
Dennstaedtiaceae	<i>Microlepia hookeriana</i> (Wall. ex Hook.) C. Presl.	
Drynariaceae	<i>Pseudodrynaria coronans</i> (Wall. ex Mett.) Ching	
Gymnogrammitidaceae	<i>Gymnogrammitis dareiformis</i> (Hook.) Ching	
Helminthostachyaceae	<i>Helminthostachys zeylanica</i> (L.) Hook.	Protected II
Polypodiaceae	<i>Colysis elliptica</i> (Thunb.) Ching var. <i>pothifolia</i> Ching	
	<i>Colysis hemionitidea</i> (Wall. ex Mett.) C. Presl	
	<i>Pyrrosia lanceolata</i> (L.) Farw.	
Sinopteridaceae	<i>Aleuritopteris pseudofarinosa</i>	new Hainan record
	Ching & S.K. Wu	
Thelypteridaceae	<i>Pronephrium simplex</i> (Hook.) Holttum	
GYMNOSPERMAE		
Cephalotaxaceae	<i>Cephalotaxus mannii</i> Hook. f.	Vulnerable
Gnetaceae	<i>Gnetum montanum</i> Markgr.	
Pinaceae	<i>Pinus fenzeliana</i> Hand.-Mazz.	Lower Risk (nt)
	<i>Pinus kwangtungensis</i> Chun & Tsiang	Protected II,
Podocarpaceae	<i>Dacrycarpus imbricatus</i> de Laub. var. <i>patulus</i> de Laub.	
	<i>Dacrydium pectinatum</i> de Laub.	
	<i>Podocarpus annamiensis</i> N.E. Gray	Data Deficient
	<i>Podocarpus neriifolius</i> D. Don	
ANGIOSPERMAE		
Dicotyledonae		
Aceraceae	<i>Acer decandrum</i> Merr.	
Actinidiaceae	<i>Actinidia latifolia</i> (Gardner & Champ.) Merr.	
	<i>Saurauia tristylia</i> DC.	
Alangiaceae	<i>Alangium chinense</i> (Lour.) Harms.	
Anacardiaceae	<i>Choerospondias axillaris</i> (Roxb.) B.L. Burtt et. A.W. Hill	
	<i>Toxicodendron succedaneum</i> (L.) Kuntze.	
Annonaceae	<i>Artabotrys hainanensis</i> R. E. Fries	endemic to Hainan
	<i>Artabotrys pilosus</i> Merr. & Chun	endemic to Hainan
	<i>Desmos chinensis</i> Lour.	
	<i>Fissistigma glaucescens</i> (Hance) Merr.	
	<i>Fissistigma maclurei</i> Merr.	
	<i>Fissistigma oldhamii</i> (Hemsl.) Merr.	
	<i>Fissistigma uonicum</i> (Dunn) Merr.	

Family	Species	Remarks
	<i>Polyalthia cerasoides</i> (Roxb.) Benth. & Hook. f. ex Bedd.	
	<i>Polyalthia plagioneura</i> Diels	
	<i>Uvaria grandiflora</i> Roxb.	
	<i>Uvaria microcarpa</i> Champ. ex Benth.	
Apiaceae	<i>Eryngium foetidum</i> L.	
Apocynaceae	<i>Melodinus suaveolens</i> Champ. ex Benth.	
	<i>Rauvolfia verticillata</i> (Lour.) Baill.	
	<i>Tabernaemontana bovina</i> Lour.	
	<i>Tabernaemontana bufalina</i> Lour.	
	<i>Wrightia laevis</i> Hook. f.	
Aquifoliaceae	<i>Ilex ficoidea</i> Hemsl.	
	<i>Ilex memecylifolia</i> Champ. ex Benth.	
Araliaceae	<i>Schefflera arboricola</i> Hayata	
	<i>Schefflera octophylla</i> (Lour.) Harms	
Aristolochiaceae	<i>Aristolochia hainanensis</i> Merr.	endemic to Hainan & South Guangxi
Asclepiadaceae	<i>Dischidia chinensis</i> Champ. ex Benth.	
	<i>Graphistemma pictum</i> (Champ. ex Benth.) Benth. & Hook. f. ex Maxim.	
Asteraceae	<i>Bidens pilosa</i> L.	introduced from tropical America
	<i>Conyza bonariensis</i> (L.) Cronquist	introduced from tropical America
	<i>Conyza canadensis</i> (L.) Cronquist	introduced from N. America
	<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	introduced from Africa
	<i>Elephantopus scaber</i> L.	
	<i>Elephantopus tomentosus</i> L.	
	<i>Erechtites valerianaefolia</i> (Wolf) DC.	introduced from S. America
Balanophoraceae	<i>Balanophora laxiflora</i> Hemsl.	
Begoniaceae	<i>Begonia palmata</i> D. Don	
Betulaceae	<i>Betula alnoides</i> Buch.-Ham. ex D. Don	
Bignoniaceae	<i>Oroxylum indicum</i> (L.) Kurz	
Boraginaceae	<i>Ehretia asperula</i> Zoll. & Moritzi	
	<i>Ehretia longiflora</i> Champ. ex Benth.	
Burmanniaceae	<i>Burmannia itoana</i> Makino	
Burseraceae	<i>Canarium album</i> (Lour.) Raeusch.	
Caesalpiniaceae	<i>Bauhinia championii</i> (Benth.) Benth.	
Campanulaceae	<i>Pentaphragma spicatum</i> Merr.	
Capparaceae	<i>Capparis micracantha</i> DC.	
	<i>Stixis suaveolens</i> (Roxb.) Pierre	
Celastraceae	<i>Celastrus paniculata</i> Willd.	
	<i>Euonymus nitidus</i> Benth.	
Chloranthaceae	<i>Sarcandra glabra</i> (Thunb.) Nakai	
	<i>Sarcandra glabra</i> (Thunb.) Nakai subsp. <i>brachystachys</i> (Blume) Verdc.	
Clusiaceae	<i>Cratoxylum cochinchinense</i> (Lour.) Blume	
	<i>Garcinia oblongifolia</i> Champ. ex Benth.	
Combretaceae	<i>Combretum pilosum</i> Roxb.	
Convolvulaceae	<i>Erycibe oligantha</i> Merr. & Chun	endemic to Hainan
	<i>Merremia umbellata</i> (L.) Hallier. f.	
Corylaceae	<i>Carpinus londoniana</i> H.J.P. Winkl. var. <i>lanceolata</i> (Hand.-Mazz.) P.C. Li	endemic to Hainan
Dichapetalaceae	<i>Dichapetalum gelonioides</i> (Roxb.) Engl.	
Dilleniaceae	<i>Dillenia turbinata</i> Finet & Gagnep.	
	<i>Tetracera asiatica</i> (Lour.) Hoog.	
Dipterocarpaceae	<i>Vatica mangachapoi</i> Blanco.	Protected II, Endangered
Ebenaceae	<i>Diospyros eriantha</i> Champ. ex Benth.	
Elaeocarpaceae	<i>Elaeocarpus dubius</i> A. DC.	

Family	Species	Remarks	
Ericaceae	<i>Elaeocarpus petiolatus</i> (Jack) Wall. ex Kurz		
	<i>Rhododendron moulmianense</i> Hook. f.		
Escalloniaceae	<i>Rhododendron simiarum</i> Hance		
	<i>Itea macrophylla</i> Wall. ex Roxb.		
Euphorbiaceae	<i>Polyosma cambodiana</i> Gagnep.		
	<i>Alchornea trewioides</i> (Benth.) Müll. Arg.		
	<i>Antidesma fordii</i> Hemsl.		
	<i>Antidesma hainanense</i> Merr.		
	<i>Antidesma montanum</i> Blume		
	<i>Antidesma paniculatum</i> Roxb.		
	<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>Bridelia tomentosa</i> Blume		
	<i>Claoxylon indicum</i> (Reinw. ex Bl.) Hassk.		
	<i>Endospermum chinense</i> Benth.		
	<i>Euphorbia hirta</i> L.		
	<i>Glochidion eriocarpum</i> Champ. ex Benth.		
	<i>Glochidion lanceolarium</i> (Roxb.) Voigt		
	<i>Macaranga bracteata</i> Merr.	endemic to Hainan	
	<i>Macaranga denticulata</i> (Blume) Müll. Arg.		
	<i>Mallotus japonicus</i> (Thunb.) Müll. Arg.		
	<i>Mallotus oblongifolius</i> (Miq.) Müll. Arg.		
	<i>Mallotus paniculatus</i> (Lam.) Müll. Arg.		
	<i>Ostodes paniculata</i> Blume		
	<i>Phyllanthus emblica</i> L.		
	<i>Phyllanthus niruri</i> L.		
	Fagaceae	<i>Sapium discolor</i> (Champ. ex Benth.) Müll. Arg.	
		<i>Castanopsis carlesii</i> (Hemsl.) Hayata	
<i>Castanopsis fabri</i> Hance			
<i>Castanopsis fissa</i> (Champ. ex Benth.) Rehder & E. H. Wilson			
<i>Castanopsis hystrix</i> Miq.			
<i>Castanopsis indica</i> (Roxb. ex Lindl.) A. DC.			
<i>Cyclobalanopsis blakei</i> (Skan) Schottky			
<i>Cyclobalanopsis championii</i> (Benth.) Oerst.			
<i>Cyclobalanopsis fleuryi</i> (Hickel & A. Camus) Chun ex Q. F. Zheng			
<i>Cyclobalanopsis hui</i> (Chun) Chun ex Y.C. Hsu & H. Wei Jen			
<i>Cyclobalanopsis neglecta</i> Schottky			
<i>Cyclobalanopsis patelliformis</i> (Chun) Y.C. Hsu & H.W. Jen			
<i>Lithocarpus amygdalifolius</i> (Skan) Hayata			
<i>Lithocarpus corneus</i> (Lour.) Rehder			
<i>Lithocarpus fenestratus</i> (Roxb.) Rehder			
<i>Lithocarpus fenzelianus</i> A. Camus		endemic to Hainan	
<i>Lithocarpus harlandii</i> (Hance ex Walp.) Rehder			
Flacourtiaceae		<i>Casearia balansae</i> Gagnep.	
		<i>Homalium hainanense</i> Gagnep.	restricted to Hainan & Vietnam Vulnerable
Gesneriaceae	<i>Hydnocarpus hainanensis</i> (Merr.) Sleumer		
	<i>Scolopia saeva</i> (Hance) Hance		
	<i>Chirita heterotricha</i> Merr.	endemic to Hainan	
	<i>Metapetrocosmea peltata</i> (Merr. & Chun) W.T. Wang	endemic to Hainan	
Hamamelidaceae	<i>Oreocharis flavida</i> Merr.	endemic to Hainan	
	<i>Rhynchotechum formosanum</i> Hatus.		
	<i>Altingia chinensis</i> (Champ. ex Benth.) Oliv. ex Hance		
	<i>Altingia obovata</i> Merr. & Chun	endemic to Hainan	

Family	Species	Remarks
	<i>Distylium myricoides</i> Hemsl.	
	<i>Liquidambar formosana</i> Hance	
	<i>Rhodoleia stenopetala</i> H. T. Chang	
Hernandiaceae	<i>Illigera celebica</i> Miq.	
Hydrangeaceae	<i>Dichroa febrifuga</i> Lour.	
Icacinaceae	<i>Gomphandra tetrandra</i> (Wall.) Sleum.	
	<i>Gonocaryum lobbianum</i> (Miers) Kurz	
	<i>Mappianthes iodoides</i> Hand.-Mazz.	
Illiciaceae	<i>Illicium oligandrum</i> Merr. & Chun	
	<i>Illicium ternstroemioides</i> A.C. Sm.	Vulnerable
Juglandaceae	<i>Engelhardtia roxburghiana</i> Wall.	
	<i>Engelhardia spicata</i> Lesch. ex Blume var. <i>colebrookeana</i> (Lindl. ex Wall.) Koord. & Valetton	
Lauraceae	<i>Actinodaphne pilosa</i> (Lour.) Merr.	
	<i>Beilschmiedia tsangii</i> Merr.	
	<i>Cinnamomum burmanni</i> (Nees & T. Nees) Blume	
	<i>Cinnamomum porrectum</i> (Roxb.) Kosterm.	
	<i>Cryptocarya chinensis</i> (Hance) Hemsl.	
	<i>Cryptocarya maclurei</i> Merr.	endemic to Hainan
	<i>Dehaasia hainanensis</i> Kosterm.	
	<i>Lindera nacusua</i> (D. Don) Merr.	
	<i>Litsea acutivena</i> Hayata	
	<i>Litsea cubeba</i> (Lour.) Pers.	
	<i>Litsea glutinosa</i> (Lour.) C. B. Rob.	
	<i>Litsea monopetala</i> (Roxb. ex Baker) Pers.	
	<i>Litsea rotundifolia</i> Hemsl. var. <i>oblongifolia</i> (Nees) C. K. Allen	
	<i>Litsea variabilis</i> Hemsl.	
	<i>Litsea verticillata</i> Hance	
	<i>Machilus chinensis</i> (Champ. ex Benth.) Hemsl.	
	<i>Machilus velutina</i> Champ. ex Benth.	
Loranthaceae	<i>Dendrophthoe pentandra</i> (L.) Miq.	
	<i>Macrosolen cochinchinensis</i> (Lour.) Tiegh.	
Magnoliaceae	<i>Michelia balansae</i> (Aug. DC.) Dandy	
	<i>Parakmeria lotungensis</i> (Chun & C. H. Tsoong) Y. W. Law	
Malvaceae	<i>Urena lobata</i> L.	pan-tropical weed
Melastomataceae	<i>Blastus cochinchinensis</i> Lour.	
	<i>Melastoma candidum</i> D. Don	
	<i>Melastoma sanguineum</i> Sims	
	<i>Sonerila cantonensis</i> Stapf var. <i>strigosa</i> C. Chen	
	<i>Sonerila hainanensis</i> Merr.	
Meliaceae	<i>Amoora dasyclada</i> (F.C. How & T. Chen) C.Y. Wu	Protected II, Vulnerable
Menispermaceae	<i>Hypserpa nitida</i> Miers	
Mimosaceae	<i>Acacia pennata</i> (L.) Willd.	
	<i>Pithecellobium clypearia</i> (Jack) Benth.	
	<i>Pithecellobium utili</i> Chun & F.C. How	
Moraceae	<i>Artocarpus styracifolius</i> Pierre	
	<i>Cudrania cochinchinensis</i> (Lour.) Kudo & Masam.	
	<i>Ficus altissima</i> Blume	
	<i>Ficus auriculata</i> Lour.	
	<i>Ficus erecta</i> Thunb.	
	<i>Ficus esquiroliana</i> H. Lévl.	
	<i>Ficus fistulosa</i> Reinw. ex Blume	
	<i>Ficus hirta</i> Vahl	
	<i>Ficus hispida</i> L. f.	
	<i>Ficus langkokensis</i> Drake	
	<i>Ficus nervosa</i> B. Heyne ex Roth.	
	<i>Ficus pyriformis</i> Hook. & Arn.	
	<i>Ficus tinctoria</i> subsp. <i>gibbosa</i> (Blume) Corner	
	<i>Ficus tuphapensis</i> Drake	

Family	Species	Remarks	
Myricaceae Myrsinaceae	<i>Ficus variegata</i> Blume var. <i>chlorocarpa</i> (Benth.) King	endemic to Hainan	
	<i>Ficus vasculosa</i> Wall. ex Miq.		
	<i>Myrica rubra</i> (Lour.) Sieb. & Zucc.		
	<i>Ardisia densilepidotula</i> Merr.		
	<i>Ardisia hanceana</i> Mez		
	<i>Ardisia mamillata</i> Hance		
	<i>Ardisia quinquegona</i> Blume		
	<i>Embelia ribes</i> Burm. f.		
	<i>Embelia undulata</i> (Wall.) Mez		
	<i>Embelia vestita</i> Roxb.		
Myrtaceae	<i>Myrsine affinis</i> A. DC.	endemic to Hainan	
	<i>Mysine seguinii</i> H. Lév		
	<i>Acmena acuminatissima</i> (Blume) Merr. & L. M. Perry		
	<i>Cleistocalyx operculatus</i> (Roxb.) Merr. & L. M. Perry		
	<i>Rhodomyrtus tomentosa</i> (Aiton) Hassk.		
	<i>Syzygium araiocladum</i> Merr. & L.M. Perry		
	<i>Syzygium championii</i> (Benth.) Merr. & L.M. Perry		
	<i>Syzygium chunianum</i> Merr. & L.M. Perry		
	<i>Syzygium hancei</i> Merr. & L. M. Perry		
	<i>Syzygium stenocladum</i> Merr. & L.M. Perry		
Oleaceae	<i>Jasminum lanceolarium</i> Roxb.	endemic to Hainan	
Orobanchaceae	<i>Christisonia hookeri</i> C.B. Clarke		
Papilionaceae	<i>Bowringia callicarpa</i> Champ. ex Benth.		
	<i>Millettia pachyloba</i> Drake		
Pentaphylacaceae	<i>Ormosia semicastrata</i> Hance		endemic to Hainan
	<i>Tadehagi triquetrum</i> (L.) H. Ohashi		
Piperaceae	<i>Pentaphylax euryoides</i> Gardner & Champ.		endemic to Hainan
	<i>Peperomia blanda</i> (Jacq.) Kunth		
Polygalaceae	<i>Piper hancei</i> Maxim.		endemic to Hainan
	<i>Piper mullesua</i> Buch.-Ham. ex D. Don		
Proteaceae	<i>Polygala insularis</i> Chun & How & C.Y. Wu & S.K. Chen	endemic to Hainan	
	<i>Xanthophyllum hainanense</i> Hu		
Ranunculaceae	<i>Helicia cochinchinensis</i> Lour.	endemic to Hainan	
	<i>Helicia formosana</i> Hemsl.		
Rhamnaceae	<i>Helicia hainanensis</i> Hayata	endemic to Hainan	
	<i>Pyrola elegantula</i> Andres		
Rosaceae	<i>Thalictrum philippinense</i> C.B. Rob.	endemic to Hainan	
	<i>Rhamnus longipes</i> Merr. & Chun		
Rubiaceae	<i>Sageretia lucida</i> Merr.	endemic to Hainan	
	<i>Rhaphiolepis ferruginea</i> Metcalf		
Rubiaceae	<i>Rubus cochinchinensis</i> Tratt.	endemic to Hainan	
	<i>Rubus pirifolius</i> Sm.		
	<i>Sorbus granulosa</i> (Bertol.) Rehder		
	<i>Aidia canthioides</i> (Champ. ex Benth.) Masam.		
	<i>Antirhea chinensis</i> (Champ. ex Benth.) F.B. Forbes & Hemsl.		
	<i>Canthium dicoccum</i> (Gaertn.) Teysmann & Binnedijk		
	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.		
	<i>Chasalia curviflora</i> Thwaites		
	<i>Diplospora dubia</i> (Lindl.) Masam.		
	<i>Lasianthus chinensis</i> (Champ. ex Benth.) Benth.		
	<i>Lasianthus curtisii</i> King & Gamble		
	<i>Lasianthus fordii</i> Hance		
	<i>Lasianthus hirsutus</i> (Roxb.) Merr.		
	<i>Lasianthus wallichii</i> (Wight & Arn.) Wight		
	<i>Morinda hainanensis</i> Merr. & How		
<i>Mussaenda hainanensis</i> Merr.			
<i>Mussaenda pubescens</i> W. T. Aiton			
<i>Ophiorrhiza subrubescens</i> Drake			
<i>Pavetta hongkongensis</i> Brem.			
<i>Prismatomeris tetrandra</i> (Roxb.) K. Schum.			

Family	Species	Remarks
	<i>Psychotria asiatica</i> L.	
	<i>Psychotria serpens</i> L.	epiphytic
	<i>Psychotria tutcheri</i> Dunn	
	<i>Saprosma ternatum</i> Hook. f.	
	<i>Tarennoidea wallichii</i> (Hook. f.) Tirveng. & Sastre	
	<i>Uncaria hirsuta</i> Havil.	
	<i>Wendlandia uvariifolia</i> Hance	
Rutaceae	<i>Acronychia pedunculata</i> (L.) Miq.	
	<i>Clausena excavata</i> Burm. f.	
	<i>Evodia glabrifolia</i> (Champ. ex Benth.) C.C. Huang	
	<i>Evodia leptota</i> (Spreng.) Merr.	
	<i>Luvunga scandens</i> (Roxb.) Buch.-Ham. ex Wight & Arn.	
	<i>Toddalia asiatica</i> (L.) Lam.	
	<i>Zanthoxylum avicennae</i> (Lam.) DC.	
	<i>Zanthoxylum nitidum</i> (Roxb.) DC.	
Sabiaceae	<i>Meliosma angustifolia</i> Merr.	
Santalaceae	<i>Dendrotrophe frutescens</i> (Champ. ex Benth.) Danser	
Sapindaceae	<i>Amesiodendron chinense</i> (Merr.) Hu	
	<i>Nephelium topengii</i> (Merr.) H.S. Lo	endemic to Hainan
Sapotaceae	<i>Pouteria annamensis</i> (Pierre) Baehni	
	<i>Sarcosperma laurinum</i> (Benth.) Hook. f.	
Scrophulariaceae	<i>Buchnera cruciata</i> Buch.-Ham. ex D. Don	
	<i>Limnophila rugosa</i> (Roth) Merr.	
	<i>Limnophila sessiliflora</i> (Vahl) Blume	
	<i>Lindernia antipoda</i> (L.) Alston	
	<i>Lindernia crustacea</i> (L.) F. -Muell.	
	<i>Lindernia mollis</i> (Benth.) Wettst.	
Simarubaceae	<i>Brucea javanica</i> (L.) Merr.	
Staphyleaceae	<i>Turpinia montana</i> (Blume) Kurz	
Sterculiaceae	<i>Byttneria aspera</i> Colebr. ex Wall.	
	<i>Heritiera parvifolia</i> Merr.	Protected II, Vulnerable, endemic to Hainan
	<i>Pterospermum lanceifolium</i> Roxb.	
	<i>Sterculia lanceolata</i> Cav.	
Styracaceae	<i>Alniphyllum fortunei</i> (Hemsl.) Makino	
Symplocaceae	<i>Symplocos adenopus</i> Hance	
	<i>Symplocos anomala</i> Brand	
	<i>Symplocos cochinchinensis</i> (Lour.) S. Moore	
	<i>Symplocos congesta</i> Benth.	
	<i>Symplocos glauca</i> (Thunb.) Koidz.	
	<i>Symplocos lancifolia</i> Siebold & Zucc.	
	<i>Symplocos poilanei</i> Guill.	
Theaceae	<i>Adinandra hainanensis</i> Hayata	
	<i>Cleyera obscurinervia</i> (Merr. & Chun) H.T. Chang	
	<i>Eurya ciliata</i> Merr.	
	<i>Eurya hainanensis</i> (Kobuski) H. T. Chang	endemic to Hainan
	<i>Eurya nitida</i> Korthals	
	<i>Gordonia axillaris</i> (Roxb. ex Ker Gawl.) Dietr.	
	<i>Schima superba</i> Gardn. & Champ.	
	<i>Ternstroemia gymnanthera</i> (Wight & Arn.) Bedd.	
Thymelaeaceae	<i>Aquilaria sinensis</i> (Lour.) Spreng.	Protected II, Vulnerable
Tiliaceae	<i>Microcos chungii</i> (Merr.) Chun	endemic to Hainan
	<i>Microcos paniculata</i> L.	
Ulmaceae	<i>Gironniera subaequalis</i> Planch.	
	<i>Trema orientalis</i> (L.) Blume	
Urticaceae	<i>Oreocnide frutescens</i> (Thunb.) Miq.	
	<i>Pouzolzia zeylanica</i> (L.) Benn. & R. Br. ex Benn. et al	
Verbenaceae	<i>Callicarpa formosana</i> Rolfe (C. <i>pedunculata</i> R. Br.)	
	<i>Callicarpa nudiflora</i> Hook. & Arn.	
	<i>Clerodendrum japonicum</i> (Thunb.) Sweet	

Family	Species	Remarks
	<i>Tsoongia axillariflora</i> Merr.	
Violaceae	<i>Viola diffusa</i> Ging.	
Viscaceae	<i>Viscum liquidambaricola</i> Hayata	
Vitaceae	<i>Leea indica</i> (Burm. f.) Merr. <i>Tetrastigma planicaule</i> (Hook. f.) Gagnep.	
Monocotyledonae		
Amaryllidaceae	<i>Curculigo capitulata</i> (Lour.) Kuntze <i>Curculigo orchioides</i> Gaertn.	
Araceae	<i>Acorus gramineus</i> Sol. <i>Alocasia macrorrhiza</i> (L.) Schott <i>Arisaema pattaniense</i> Gagnep. <i>Pothos repens</i> (Lour.) Druce <i>Rhaphidophora hongkongensis</i> Schott	
Areaceae	<i>Calamus rhabdocladus</i> Burret <i>Caryota ochlandra</i> Hance <i>Daemonorops margaritae</i> (Hance) Becc. <i>Licuala fordiana</i> Becc. <i>Licuala spinosa</i> Thunb. <i>Pinanga discolor</i> Burret <i>Plectocomia microstachys</i> Burret	endemic to Hainan
Commelinaceae	<i>Rhapis excelsa</i> (Thunb.) A. Henry ex Rehder <i>Commelina paludosa</i> Blume <i>Pollia secundiflora</i> (Blume) Bakh. f.	
Cyperaceae	<i>Cyperus laxus</i> Lam <i>Gahnia tristis</i> Nees <i>Hypolytrum hainanense</i> (Merr.) Ts. Tang & F. T. Wang	restricted to Hainan & Hong Kong
	<i>Hypolytrum nemorum</i> (Vahl) Spreng.	
Liliaceae	<i>Mapania wallichii</i> C.B. Clarke <i>Aspidistra elatior</i> Blume <i>Dianella ensifolia</i> (L.) DC. <i>Ophiopogon platyphyllus</i> Merr. & Chun <i>Smilax lanceifolia</i> Roxb.	
Marantaceae	<i>Phrynium oliganthum</i> Merr. <i>Phrynium placentarium</i> (Lour.) Merr. <i>Phrynium rheedei</i> Suresh & Nicolson	
Musaceae	<i>Musa balbisiana</i> Colla	
Pandanaceae	<i>Pandanus austrosinensis</i> T. L. Wu <i>Pandanus forceps</i> Martelli	
Poaceae	<i>Lophatherum gracile</i> Brongn. <i>Schizostachyum pseudolima</i> McClure <i>Thysanolaena maxima</i> (Roxb.) Kuntze	
Taccaceae	<i>Tacca chantrieri</i> André	
Zingiberaceae	<i>Alpinia brevis</i> T. L. Wu & S. J. Chen <i>Alpinia chinensis</i> (J. König) Roscoe <i>Alpinia hainanensis</i> K. Schum. <i>Alpinia maclurei</i> Merr. <i>Amomum chinense</i> Chun <i>Costus speciosus</i> (J. Koenig) Smith <i>Plagiostachys austrosinensis</i> T.L. Wu & S.J. Chen <i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	endemic to Hainan

Table 2. Orchids recorded at Wuzhishan Nature Reserve and neighbouring areas from 9 to 11 June 1999.

Species	Habitat	Remarks
<i>Acampe rigida</i> (Buch.-Ham. ex Sm.)	on tree trunks	epiphytic
<i>Agrostophyllum callosum</i> Rchb. f.	on tree trunks in forest beside path	epiphytic
<i>Ania</i> (cf. <i>hookeriana</i>) sp.	forest floor beside path	terrestrial
<i>Anoectochilus roxburghii</i> (Wall.) Lindl.	forest floor with rich humus	terrestrial, Endangered nationally
<i>Bulbophyllum affine</i> Lindl.	on tree trunks in forest	epiphytic
<i>Bulbophyllum ambrosia</i> (Hance) Schltr.	on tree trunks in forest and forest edge	epiphytic
<i>Bulbophyllum delitescens</i> Hance	on rock beside stream in forest	epiphytic
<i>Bulbophyllum insulsum</i>	on tree trunks in forest	epiphytic, new record for county
<i>Bulbophyllum reptans</i> (Lindl.) Lindl.	on rock and tree trunks in forest	epiphytic
<i>Bulbophyllum stenobulbon</i> Par. & Rchb. f.	on tree trunks in forest	epiphytic, new record for Hainan
<i>Bulbophyllum</i> sp.	on tree trunk in forest	epiphytic
<i>Calanthe</i> sp.	on forest floor with rich humus	terrestrial
<i>Ceratostylis subulata</i> Blume	on tree trunks in forest	epiphytic, restricted within China to Hainan
<i>Cephalantheropsis gracilis</i> (Lindl.) S.Y. Hu	on forest floor with rich humus	terrestrial
<i>Cleisostoma filiforme</i> (Lindl.) Garay	on tree trunks	epiphytic
<i>Cleisostoma paniculatum</i> (Kar Gawl.) Garay	on tree trunks	epiphytic
<i>Cleisostoma simondii</i> (Gagnep.) Seidenf.	on tree trunks	epiphytic
<i>Coelogyne fimbriata</i> Lindl.	on rocks and tree trunks in forest	epiphytic
<i>Cymbidium dayanum</i> Rchb. f.	on rotten wood on forest floor	epiphytic
<i>Cymbidium</i> sp.	on tree trunks	epiphytic
<i>Dendrobium acinaciforme</i> Roxb.	on tree trunks	epiphytic
<i>Dendrobium aduncum</i> Lindl.	on tree trunks in forest	epiphytic
<i>Dendrobium densiflorum</i> Lindl.	on tree trunks in forest	epiphytic
<i>Dendrobium hainanense</i> Rolfe	on tree trunks in forest	epiphytic, globally restricted
<i>Dendrobium loddigesii</i> Steud.	on tree trunks in forest	epiphytic, Vulnerable nationally
<i>Dendrobium salaccense</i> (Blume) Lindl.	on rock in stream	epiphytic
<i>Dendrobium sinense</i> T. Tang & F.T. Wang	on tree trunks in forest	epiphytic, endemic to Hainan
<i>Dendrobium williamsonii</i> Day & Rchb. f.	on tree trunks in forest	epiphytic
<i>Epigeneium fargesii</i> (Finet) Gagnep.	on tree trunks in forest	epiphytic
<i>Eria pannea</i> Lindl.	on tree trunks in forest and forest edge	epiphytic
<i>Eria rosea</i> Lindl.	on rocks and tree trunks	epiphytic, restricted to Hainan & Hong Kong
<i>Eria thao</i> Gagnep.	on tree trunks in forest and forest edge	epiphytic, globally restricted
<i>Eria</i> sp.	on tree trunks in forest	epiphytic
<i>Flickingeria fimbriata</i> (Blume) Hawkes	on tree trunks in forest	epiphytic
<i>Flickingeria angustifolia</i> (Blume) Hawkes	on tree trunks and branches in forest	epiphytic
<i>Goodyera viridiflora</i> (Blume) Blume	forest floor with rich humus	terrestrial
<i>Habenaria ciliolaris</i> Kraenzl.	forest floor with rich humus	terrestrial
<i>Habenaria rhodocheila</i> Hance	forest-edge floor with rich humus	terrestrial
<i>Holcoglossum</i> (cf. <i>subulifolium</i>) sp.	on tree trunks in forest	epiphytic
<i>Liparis bootanensis</i> Griff.	on rocks and tree trunks in forest	epiphytic
<i>Liparis stricklandiana</i> Rchb. f.	on tree trunks in forest	epiphytic
<i>Liparis</i> (cf. <i>bootanensis</i>) sp.	on tree trunk in forest	epiphytic

<i>Liparis</i> sp.	forest floor with rich humus	terrestrial
<i>Luisia</i> sp.	on tree trunks	epiphytic
<i>Malaxis</i> sp.	forest floor with rich humus	terrestrial
<i>Nephalaphyllum cristatum</i> Rolfe	on tree trunks and forest floor with rich humus	terrestrial
<i>Oberonia</i> sp.	on tree trunks in forest	epiphytic
<i>Panisea tricallosa</i> Rolfe	on tree trunks in forest	epiphytic, restricted within China
<i>Pholidota chinensis</i> Lindl.	on tree trunks in forest	epiphytic
<i>Platanthera</i> sp.	forest floor with rich humus	terrestrial
<i>Schoenorchis gemmata</i> (Lindl.) J.J. Sm.	on tree trunks in forest	epiphytic, new record for the county
<i>Tainia</i> sp.	forest floor with rich humus	terrestrial
<i>Thelasis pygmaea</i> (Griff.) Blume	on rocks and tree trunks beside stream	epiphytic
<i>Tropidia curculigoides</i> Lindl.	forest floor with rich humus	terrestrial, primitive orchid
<i>Vanda subconcolor</i> T. Tang & F.T. Wang	on tree trunk in forest	epiphytic, known only from Hainan and W Yunnan, Endangered nationally

Mammals

- One Pallas's Squirrel *Callosciurus erythraeus* was heard in forest in 1999. Another individual was seen later.
- One Maritime Striped Squirrel *Tamiops maritimus* was seen once in forest, and another in 1999. Many individuals were seen in 2001.
- A small mustelid was seen at 690 m crossing a stream on a dead tree in August 2001. It was probably a Yellow-bellied Weasel *Mustela kathiah* but its identity could not be confirmed due to poor light.
- One Leopard Cat *Prionailurus bengalensis* was seen crossing the road in August 2001.
- The status of mammals was inferred (Table 3) based on an interview with an official of Wuzhishan Nature Reserve, and on recorded distributions, including past records from Wuzhishan (Guangdong Institute of Entomology and Zhongshan University, 1983; Zhang Y. *et al.* 1997). Reports of species not previously recorded from Hainan are here considered doubtful.

Table 3. The inferred status of mammals at Wuzhishan Nature Reserve, Hainan, based on interviewing an official of the Nature Reserve and on past distribution records. "+" = rare, "++" = quite common, "+++" = abundant. Sequence follows D.E. Wilson & Cole (2000).

Scientific name	English name	Historic records	Mr Huang	Probable status
<i>Hylomys hainanensis</i> (recorded as <i>Neohylomys hainanensis</i>)	Hainan Gymnure	✓	+++	present
<i>Crociodura horsfieldii</i>	Horsfield's Shrew	✓	(not asked)	present
<i>Mogera insularis</i>	Insular Mole	✓	(not asked)	present
<i>Tupaia belangeri</i>	Northern Tree Shrew	✓	+++	present
<i>Hipposideros armiger</i>	Great Roundleaf Bat	✓	(not asked)	present
<i>Pipistrellus abramus</i>	Japanese Pipistrelle	✓	(not asked)	present
<i>Macaca mulatta</i>	Rhesus Monkey	(Qiongzong)	+++	present
<i>Nomascus</i> (cf. <i>nasutus</i>) sp. (recorded as <i>Hylobates concolor</i>)	Eastern Crested Gibbon	extirpated	extirpated	extirpated
<i>Cuon alpinus</i>	Dhole		+	doubtful
<i>Prionailurus bengalensis</i>	Leopard Cat	✓	+++	present
<i>Neofelis nebulosa</i>	Clouded Leopard	✓	+	insecure
<i>Herpestes javanicus</i>	Javan Mongoose	✓	-	insecure
<i>Herpestes urva</i>	Crab-eating Mongoose	✓	+++	present
<i>Amblonyx cinereus</i>	Oriental Small-clawed Otter		++	insecure

Scientific name	English name	Historic records	Mr Huang	Probable status
<i>Lutra lutra</i>	Eurasian Otter	✓	++	insecure
<i>Melogale moschata</i>	Chinese Ferret-badger		+++	present
<i>Martes flavigula</i>	Yellow-throated Marten		++	insecure
<i>Mustela kathiah</i>	Yellow-bellied Weasel	✓	+++	present
<i>Ursus thibetanus</i>	Asiatic Black Bear	✓	+++	present
<i>Viverra zibetha</i>	Large Indian Civet	✓	-	insecure
<i>Viverricula indica</i>	Small Indian Civet	✓	++	insecure
<i>Prionodon pardicolor</i>	Spotted Linsang		++	doubtful
<i>Paradoxurus hermaphroditus</i>	Asian Palm Civet	✓	++	uncertain
<i>Paguma larvata</i>	Masked Palm Civet	✓	+++	present
<i>Sus scrofa</i>	Wild Boar	✓	+++	present
<i>Cervus unicolor</i>	Sambar	✓	+++	present
<i>Cervus eldii</i>	Eld's Deer	✓	-	insecure or extirpated
<i>Muntiacus muntjak</i>	Indian Muntjac	✓	+++	present
<i>Muntiacus reevesii</i>	Chinese Muntjac		+++	doubtful
<i>Manis pentadactyla</i>	Chinese Pangolin	✓	+	insecure
<i>Callosciurus erythraeus</i>	Pallas's Squirrel	✓	+++	present
<i>Dremomys pyrrhomerus</i>	Red-cheeked Squirrel	✓	+++	present
<i>Ratufa bicolor</i>	Black Giant Squirrel	✓	-	insecure or extirpated
<i>Tamiops maritimus</i> (recorded as <i>T. swinhoei</i>)	Maritime Striped Squirrel	✓	+++	present
<i>Hylomys alboniger</i>	Particolored Flying Squirrel	✓	+++	present
<i>Hylomys phayrei</i> (recorded as <i>Petinomys elictilis</i>)	Indochinese Flying Squirrel	✓	-	insecure or extirpated
<i>Petaurista philippensis</i> (recorded as <i>P. hainana</i>)	Indian Giant Flying Squirrel	✓	+++	present
<i>Chiropodomys gliroides</i>	Pencil-tailed Tree Mouse	✓	(not asked)	present
<i>Mus musculus</i>	House Mouse	✓	(not asked)	present
<i>Leopoldamys edwardsi</i> (recorded as <i>Rattus edwardsi</i>)	Edwards's Long-tailed Giant Rat	(Qiongzong)	(not asked)	present
<i>Niviventer confucianus</i> (recorded as <i>Rattus niviventer</i>)	Chinese White-bellied Rat	(Qiongzong)	(not asked)	present
<i>Niviventer fulvescens</i> (recorded as <i>Rattus fulvescens</i>)	Chestnut White-bellied Rat	✓	(not asked)	present
<i>Rattus nitidus</i>	Himalayan Field Rat	✓	(not asked)	present
<i>Rattus norvegicus</i>	Brown Rat	(Qiongzong)		
<i>Rattus rattus</i>	House Rat	(Qiongzong)	(not asked)	present
<i>Rattus tanezumi</i> (recorded as <i>R. flavipectus</i>)	Tanezumi Rat	(Qiongzong)	(not asked)	present
<i>Rattus turkestanicus</i> (recorded as <i>R. rattoides</i>)	Turkestan Rat	✓	(not asked)	present
<i>Hystrix brachyura</i>	Malayan Porcupine		+++	present
<i>Atherurus macrourus</i>	Asiatic Brush-tailed Porcupine		+++	present

- Some of the species suspected to occur are of particular conservation concern:
 - Hainan Gymnure *Hylomys hainanensis* is globally Endangered, and Class II Protected in China.
 - Clouded Leopard *Neofelis nebulosa* and Eld's Deer *Cervus eldii* are globally Vulnerable, and Class I Protected in China.
 - Asiatic Black Bear *Ursus thibetanus* is globally Vulnerable, and Class II Protected in China.
 - Malayan Porcupine *Hystrix brachyura* is globally Vulnerable.
 - Chinese Pangolin *Manis pentadactyla*, Rhesus Monkey *Macaca mulatta* and Oriental Small-clawed Otter *Amblonyx cinereus* are globally Near-threatened and Class II Protected in China.

- Yellow-throated Marten *Martes flavigula*, Eurasian Otter *Lutra lutra*, Small Indian Civet *Viverricula indica*, Sambar *Cervus unicolor* and Indian Giant Flying Squirrel *Petaurista philippensis* are Class II Protected in China.

Birds

- Forty-four species of birds were recorded in Wuzhishan Nature Reserve during the 1999 survey. The team's main ornithologist (LKS) was sick for part of the survey, which may have limited the total. No additional species were recorded in 2001; detailed findings of the 2001 survey will be reported elsewhere.
- The most frequently encountered species included Black-browed Barbet *Megalaima oorti*, Grey-cheeked Fulvetta *Alcippe morrisonia* and Rufous-capped Babbler *Stachyris ruficeps*.
- In 1999 several individuals of Mountain Tailorbird *Orthotomus cucullatus* were seen and heard near the Wuzhishan summit. This is apparently the first record of the species from Hainan.
- On 2 August 2001, two Bonelli's Eagle *Hieraetus fasciatus* were recorded near Wuzhishan Town. This is the first record from Hainan.
- In 1999 a bird matching the description of a female Red Avadavat *Amandava amandava* was seen feeding its two young, but the identification was not confirmed.

Table 4. Birds recorded at Wuzhishan Nature Reserve, June 1999. Sequence follows Clements (2000).

Scientific name	English name
<i>Milvus migrans</i>	Black Kite
<i>Spilornis cheela</i>	Crested Serpent Eagle
<i>Accipiter trivirgatus</i>	Crested Goshawk
<i>Accipiter badius</i>	Shikra
<i>Chalcophaps indica</i>	Emerald Dove
<i>Ducula aenea</i>	Green Imperial Pigeon
<i>Ducula badia</i>	Mountain Imperial Pigeon
<i>Surniculus lugubris</i>	Drongo Cuckoo
<i>Otus spilocephalus</i>	Mountain Scops Owl
<i>Glaucidium brodiei</i>	Collared Owlet
<i>Glaucidium cuculoides</i>	Asian Barred Owlet
<i>Hirundapus cochinchinensis</i>	Silver-backed Needletail
<i>Cypsiurus balasiensis</i>	Asian Palm Swift
<i>Megalaima oorti</i>	Black-browed Barbet
<i>Dendrocops canicapillus</i>	Grey-capped Pygmy Woodpecker
<i>Pericrocotus solaris</i>	Grey-chinned Minivet
<i>Pycnonotus sinensis</i>	Light-vented Bulbul
<i>Alophoixus pallidus</i>	Puff-throated Bulbul
<i>Hypsipetes mcclllandii</i>	Mountain Bulbul
<i>Hypsipetes leucocephalus</i>	Black Bulbul
<i>Hemixos castanonotus</i>	Chestnut Bulbul
<i>Brachypteryx leucophrys</i>	Lesser Shortwing
<i>Orthotomus cucullatus</i>	Mountain Tailorbird
<i>Phylloscopus hainanus</i>	Hainan Leaf Warbler
<i>Abroscopus albogularis</i>	Rufous-faced Warbler
<i>Cyornis hainanus</i>	Hainan Blue Flycatcher
<i>Copsychus malabaricus</i>	White-rumped Shama
<i>Enicurus leschenaulti</i>	White-crowned Forktail
<i>Rhipidura albicollis</i>	White-throated Fantail
<i>Garrulax chinensis</i>	Black-throated Laughingthrush
<i>Pomatorhinus hypoleucos</i>	Large Scimitar Babbler
<i>Pomatorhinus ruficollis</i>	Streak-breasted Scimitar Babbler
<i>Napothera epilepidota</i>	Eyebrowed Wren Babbler
<i>Stachyris ruficeps</i>	Rufous-capped Babbler
<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta
<i>Yuhina zantholeuca</i>	White-bellied Yuhina
<i>Sitta solangiae</i>	Yellow-billed Nuthatch
<i>Parus major</i>	Great 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 japonicus</i>	Japanese White-eye
<i>Lanius schach</i>	Long-tailed Shrike

- In addition to the above, the following species were recorded at Wuzhishan in 1988 by King & Liao (1988): Chinese Pond Heron *Ardeola bacchus*, Cattle Egret *Bubulcus ibis*, Chinese Francolin *Francolinus pintadeanus*, Hainan Partridge *Arborophila ardens*, Red Junglefowl *Gallus gallus*, White-breasted Waterhen *Amaurornis phoenicurus*, Oriental Pratincole *Glareola maldivarum*, Large Hawk Cuckoo *Hierococcyx sparverioides*, Indian Cuckoo *Cuculus micropterus*, Asian Koel *Eudynamis scolopacea*, Greater Coucal *Centropus sinensis*, Collared Scops Owl *Otus bakkamoena*, Grey Nightjar *Caprimulgus indicus*, White-throated Needletail *Hirundapus caudacutus*, Fork-tailed Swift *Apus pacificus*, House Swift *Apus affinis*, Common Kingfisher *Alcedo atthis*, Oriental Dwarf Kingfisher *Ceyx erithacus*, White-throated Kingfisher *Halcyon smyrnensis*, Dollarbird *Eurystomus orientalis*, Barn Swallow *Hirundo rustica*, Striated Swallow *Hirundo striolata*, White Wagtail *Motacilla alba*, Yellow Wagtail *Motacilla flava*, Grey Wagtail *Motacilla cinerea*, Red-throated Pipit *Anthus cervinus*, Scarlet Minivet *Pericrocotus flammeus*, Orange-headed Thrush *Zosterops citrina*, Yellow-bellied Prinia *Prinia flaviventris*, Narcissus Flycatcher *Ficedula narcissina*, Blue-and-white Flycatcher *Cyanoptila cyanomelana*, Siberian Blue Robin *Luscinia cyane*, Oriental Magpie Robin *Copsychus saularis*, Common Stonechat *Saxicola torquata*, Black-naped Monarch *Hypothymis azurea*, Japanese Paradise-flycatcher *Terpsiphone atrocaudata*, Asian Paradise-flycatcher *Terpsiphone paradisi*, Lesser Necklaced Laughingthrush *Garrulax monileger*, Grey Laughingthrush *Garrulax maesi*, Hwamei *Garrulax canorus*, Spot-necked Babbler *Stachyris striolata*, Dusky Fulvetta *Alcippe brunnea*, Black Drongo *Dicrurus macrocercus*, Ashy Drongo *Dicrurus leucophaeus*, Crow-billed Drongo *Dicrurus annectans*, Greater Racket-tailed Drongo *Dicrurus paradiseus*, White-shouldered Starling *Sturnus sinensis*, White-rumped Munia *Lonchura striata* and Scaly-breasted Munia *Lonchura punctulata*. Some of these species are winter visitors or migrants, and are unlikely to have been in the area during the present survey in June. Together these bring the recorded Wuzhishan avifauna to 93 species.
- Some of the species recorded on the present surveys are of particular conservation importance:
 - Hainan Leaf Warbler *Phylloscopus hainanus* is globally Vulnerable and endemic to Hainan.
 - Black Kite *Milvus migrans*, Crested Serpent Eagle *Spilornis cheela*, Bonelli's Eagle *Hieraaetus fasciatus*, Crested Goshawk *Accipiter trivirgatus*, Shikra *Accipiter badius*, Green Imperial Pigeon *Ducula aenea*, Mountain Imperial Pigeon *Ducula badia*, Mountain Scops Owl *Otus spilocephalus*, Collared Scops Owl, Asian Barred Owlet *Glaucidium cuculoides*, Collared Owlet *Glaucidium brodiei* and Silver-backed Needletail *Hirundapus cochinchinensis* are Class II Protected species in China.
- The presence of many forest-dependent species, including several pigeons and babblers, indicated that the forests at Wuzhishan had quite high integrity.

Reptiles and Amphibians

- Twenty-one species of amphibian, five species of lizard and seven species of snake were recorded from Wuzhishan (Table 5).
- The most frequently encountered species in the forest were a *Philautus* frog that resembled *P. ocellatus* but is probably a new species, and *Microhyla heymonsi*. Most frequent in the town area at lower altitude was the gecko *Hemidactylus frenatus*.

Table 5. Amphibians and reptiles of Wuzhishan and neighbouring areas. Sequence follows Zhao E.-M. & Adler (1993).

Species	Habitat	Nature Reserve
AMPHIBIA		
<i>Leptobranchium hainanensis</i>	forest stream	✓, tadpoles
<i>Bufo melanostictus</i>	forest	✓
<i>Pelophryne scalpta</i>	forest	✓
<i>Amolops hainanensis</i>	forest stream	✓
<i>Amolops torrentis</i>	forest stream	+, tadpoles
	stream in plantation	✓
	forest	✓
<i>Occidozyga martensii</i>	forest seep	✓
	roadrut pool	✓
	paddy field	✓
<i>Rana fragilis</i>	forest stream	✓
<i>Rana limnocharis</i>	forest seep	✓
	paddy field	✓
<i>Rana spinulosa</i>	forest seep	✓
	forest edge	✓
<i>Rana taipehensis</i>	forest edge (in 2001)	✓
<i>Rana versabilis</i>	forest	✓
<i>Buergeria oxycephala</i>	stream	✓
<i>Chirixalus doriae</i>	paddy field	✓
<i>Chirixalus vittatus</i>	forest seep	✓, eggs
<i>Philautus ocellatus</i>	forest/bamboo	✓
<i>Philautus</i> (nr. <i>ocellatus</i>) sp.	forest seep	✓, eggs, tadpoles
<i>Polypedates megacephalus</i>	paddy field	✓
	village	✓
<i>Polypedates mutus</i>	forest seep	✓, tadpoles
<i>Rhacophorus rhodopus</i>	forest seep	✓, tadpoles
<i>Microhyla heymonsi</i>	forest seep	✓, eggs, tadpoles
	stream	✓
	roadrut pool	eggs, tadpoles
	paddy field	✓
	forest stream	tadpoles
<i>Microhyla pulchra</i>	pool in abandoned field	tadpoles
REPTILIA		
<i>Gekko similignum</i>	village	✓
<i>Hemidactylus frenatus</i>	village	✓
<i>Acanthosaura lepidogaster</i>	forest	✓
<i>Calotes versicolor</i>	forest edge	✓
	shrubland	✓
<i>Draco maculatus</i>	forest	✓
	plantation	✓
<i>Dendrelaphis pictus</i>	forest edge (in 2001)	✓
<i>Enhydris plumbea</i>	forest seep	✓
<i>Psammodynastes pulverulentus</i>	shrubland	✓
<i>Rhabdophis adleri</i>	forest	✓
<i>Sinonatrix percarinata</i>	forest seep	✓
	roadrut pool	✓
	stream	✓
<i>Protobothrops mucrosquamatus</i>	shrubland (in 2001)	✓
<i>Trimeresurus stejnegeri</i>	forest stream	✓

- Some of the recorded species are of particular conservation importance:
 - *Leptobranchium hainanensis*, *Pelophryne scalpta*, *Amolops hainanensis*, *Amolops torrentis*, *Rana fragilis*, *Buergeria oxycephala*, *Philautus* (nr. *ocellatus*) sp., *Gekko similignum* and *Rhabdophis adleri* are known only from Hainan.

- Many forest and forest stream specialists, such as *Leptobrachium hainanensis*, *Pelophryne scalpta*, *Philautus ocellatus*, *Rhacophorus rhodopus*, *Acanthosaura lepidogaster*, *Draco maculatus* and *Rhabdophis adleri*, were present.
- Past records of amphibians include *Tylotriton hainanensis* (as *Tylotriton asperrimus*), *Rana guentheri*, *Rana rugulosa* (as *R. tigrina rugulosa*), *Rana andersonii*, *Rana livida*, *Occidozyga lima*, *Microhyla butleri* and *Microhyla ornata* (Liu *et al.*, 1973).

Fish

- Nine freshwater fish species were recorded from Wuzhishan; an additional six species were reported to be present but specimens have not been examined by specialists (Table 6).
- The most frequently encountered species included *Schistura fasciolata*, *Nicholsicypris normalis*, *Puntius semifasciolatus* and *Channa gachua*.
- *Parazacco spilurus fasciatus*, *Nicholsicypris normalis*, *Onychostoma leptura* and *Philypnus chalmersi* are restricted to the Indochina region. *Liniparhomaloptera disparis qiongzhongensis* is a subspecies (suspected to be a distinct species) apparently endemic to Hainan.

Table 6. Freshwater fish recorded from the Wuzhishan area, 1999 and 2001 (“✓” = present, “#” = unconfirmed report, “*” = nomenclature follows Pan, 1991). Sequence of families follows Nelson (1994).

Species	
<i>Parazacco spilurus fasciatus</i>	#
<i>Opsariichthys bidens</i>	✓
<i>Nicholsicypris normalis</i>	✓
<i>Puntius semifasciolatus</i> *	✓
<i>Onychostoma leptura</i>	✓
<i>Carassius auratus</i>	✓
<i>Misgurnus anguillicaudatus</i>	✓
<i>Liniparhomaloptera disparis qiongzhongensis</i>	✓, #
<i>Schistura fasciolata</i>	✓
<i>Gambusia affinis</i> *	#
<i>Oreochromis niloticus</i>	#
<i>Philypnus chalmersi</i>	#
<i>Rhinogobius giurinus</i>	#
<i>Macropodus opercularis</i>	#
<i>Channa gachua</i>	✓, #

- The presence of a variety of lotic fish species indicated the streams at Wuzhishan could support many stream fish species; this assumption is supported by many historic records (e.g. see Pan, 1991).

Ants

- Seventy-six ant species were recorded from the Wuzhishan area (Table 7). Many of these could not be reliably named, and some may be new to science.
- The most frequently recorded in the forest reserve included *Technomyrmex albipes*, *Pachycondyla* sp. 1, *Pachycondyla* sp. 2 and *Tetramorium nipponense*. Most frequent on the outer trail were *Odontoponera* sp. 1, *Pheidole* sp. 40, *Anoplolepis gracilipes*, *Camponotus nicobarensis* and *Crematogaster* sp. 2.
- Only four species (*Camponotus* sp. 41, *Crematogaster* sp. 20, *Pachycondyla* sp. 1 and *Paratrechina* sp. 9) were recorded above a certain altitude.

Table 7. Ant species recorded in and around Wuzhishan Nature Reserve, June 1999. * Species with a strong forest association.

Species	Habitat
<i>Aenictus (aratus) group</i> sp. 5	broadleaf forest
<i>Aenictus (dentatus) group</i> sp. 4	broadleaf forest
<i>Aenictus (laeviceps) group</i> sp. 2	forest, grass lawn
<i>Anoplolepis gracilipes</i>	open vegetation
<i>Aphaenogaster (cf. exasperata)</i> sp. 2 *	30m broadleaf forest
<i>Camponotus (cf. jianghuaensis)</i> sp. 15	forest, shrubland
<i>Camponotus nicobarensis</i>	<i>Liquidambar</i> forest
<i>Camponotus rufoglaucus</i>	open forest, shrubland
<i>Camponotus</i> sp. 41 *	open 4m montane pine & broadleaf
<i>Cataulacus granulatus</i>	broadleaf forest
<i>Cerapachys sulcinodis</i> *	closed 20m broadleaf
<i>Crematogaster (cf. biroii)</i> sp. 4	open 15m <i>Liquidambar</i>
<i>Crematogaster (cf. dohrni)</i> sp. 8	low shrubland
<i>Crematogaster (cf. laboriosa)</i> sp. 3	shrubland
<i>Crematogaster (cf. travancorensis)</i> sp. 2	open vegetation
<i>Crematogaster</i> sp. 20	open 5m broadleaf & pine
<i>Crematogaster</i> sp. 21 *	closed 20m broadleaf
<i>Diacamma (nr. rugosum)</i> sp. 1	open vegetation
<i>Dolichoderus (thoracicus) complex</i> sp. 3	forest, shrubland
<i>Gnamptogenys bicolor</i>	<i>Liquidambar</i> forest
<i>Gnamptogenys binghami</i> *	open 30m broadleaf & conifer
<i>Hypoponera</i> sp. 3 *	closed 25m broadleaf & conifer
<i>Kartidris (cf. galos)</i> sp. 1 *	25m broadleaf forest
<i>Leptogenys kitteli</i> *	broadleaf forest
<i>Leptogenys (cf. diminuta)</i> sp. 20	forest
<i>Leptogenys (cf. kraepelini)</i> sp. 7 *	closed 25m broadleaf
<i>Meranoplus bicolor</i>	open 15m <i>Liquidambar</i>
<i>Myrmoteras (cf. cuneinodum)</i> sp. 1 *	open 30m broadleaf & bamboo
<i>Odontomachus monticola</i> *	forest, shrubland
<i>Odontoponera (cf. denticulata)</i> sp. 1	forest, shrubland, grassland
<i>Oecophylla smaragdina</i>	closed 25m <i>Liquidambar</i>
<i>Pachycondyla (javana) group</i> sp. 1 *	closed broadleaf forest
<i>Pachycondyla (javana) group</i> sp. 20 *	closed 25m broadleaf
<i>Pachycondyla (cf. luteipes)</i> sp. 2 *	closed broadleaf forest
<i>Pachycondyla (cf. nigrita)</i> sp. 17 *	broadleaf forest
<i>Pachycondyla rufipes</i>	open <i>Liquidambar</i> forest/path
<i>Pachycondyla (cf. sauteri)</i> sp. 7	closed 25m broadleaf & conifer
<i>Paratrechina (cf. bourbonica)</i> sp. 4	grass lawn
<i>Paratrechina (cf. opaca)</i> sp. 26 *	closed 30m broadleaf
<i>Paratrechina (nr. indica)</i> sp. 9 *	closed broadleaf forest
<i>Pheidole capellini</i> *	closed 30m broadleaf
<i>Pheidole gatesi</i> *	closed 25m broadleaf forest
<i>Pheidole (cf. noda)</i> sp. 1	closed 20m broadleaf
<i>Pheidole (cf. yeensis)</i> sp. 40	forest, open vegetation
<i>Pheidole</i> sp. 7 *	forest, shrubland
<i>Pheidole</i> sp. 11	broadleaf forest
<i>Pheidole</i> sp. 13-A *	broadleaf forest
<i>Pheidole</i> sp. 28	grass lawn
<i>Pheidole</i> sp. 34	open <i>Melastoma</i> shrubland
<i>Pheidologeton (cf. melasolenus)</i> sp. 8 *	closed 30m broadleaf
<i>Plagiolepis</i> sp. 5	open 15m <i>Liquidambar</i>
<i>Polyrhachis (cf. bicolor)</i> sp. 17 *	broadleaf forest
<i>Polyrhachis demangei</i>	open 15m <i>Liquidambar</i>
<i>Polyrhachis halidayi</i>	forest, shrubland
<i>Polyrhachis (cf. phalerata)</i> sp. 2 *	closed 25m <i>Liquidambar</i>
<i>Polyrhachis tyrannica</i>	broadleaf forest
<i>Polyrhachis vigilans</i> *	closed 25m broadleaf & conifer
<i>Polyrhachis wolffi</i> *	open broadleaf forest

Species	Habitat
<i>Prenolepis</i> (cf. <i>emmae</i>) sp. 1 *	closed broadleaf forest
<i>Pristomyrmex pungens</i>	forest, shrubland, grassland
<i>Pristomyrmex</i> sp. 4 *	closed 30m broadleaf
<i>Pseudolasius</i> sp. 1	closed riparian 15m broadleaf
<i>Pyramica canina</i> *	closed broadleaf forest
<i>Recurvidris</i> sp. *	closed 30m broadleaf
<i>Rhoptromyrmex</i> (cf. <i>wroughtonii</i>) sp. 1	open vegetation
<i>Strumigenys</i> sp. *	closed 20m broadleaf
<i>Tapinoma</i> sp. 1	open vegetation
<i>Technomyrmex albipes</i>	broadleaf forest
<i>Technomyrmex</i> sp. 2 *	broadleaf forest
<i>Technomyrmex</i> sp. 6	open low shrubland
<i>Tetramorium</i> (cf. <i>tonganum</i>) sp. A	closed 25m broadleaf & conifer
<i>Tetramorium nipponense</i> *	broadleaf forest
<i>Tetramorium</i> (cf. <i>shensiense</i>) sp. 6	broadleaf forest
<i>Tetraoponera allaborans</i>	open 5m broadleaf
<i>Tetraoponera attenuata</i>	broadleaf forest
<i>Tetraoponera rufonigra</i>	shrubland

- *Crematogaster* sp. 20 and *Plagiolepis* sp. 5 are known only from Wuzhishan.
- *Myrmoteras* sp. 1, *Polyrhachis* sp. 17 and *Pristomyrmex* sp. 4 are known only from tall natural forests.
- The percentage of forest-dependent species (not including new species) recorded in the reserve near and above the resort was 54%, a moderate figure indicating a mixture of high-integrity forest and open habitat. The percentage along the outer trail was 17%, indicating very low integrity.
- The African exotic ant *Anoplolepis gracilipes* was widespread in open vegetation below a certain altitude.

Dragonflies

- Twenty-nine dragonfly species were recorded from Wuzhishan (Table 8). Of these four (*Bayadera kirbyi*, *Drepanosticta zhoui*, *Planaeschna celia* and *Oligoaeschna sabre*) were previously undescribed.
- The most frequently encountered species included *Euphaea ornata*, *Pseudolestes mirabilis* and *Orthetrum glaucum*.
- The records of *Heliogomphus retroflexus*, *Merogomphus paviei*, *Phaenandrogomphus tonkinicus* are apparently the first from Hainan.

Table 8. Dragonfly species recorded from the Wuzhishan area, 8-11 June 1999. Sequence of families follows Schorr *et al.* (2001a, 2001b).

Species	Notes
<i>Philoganga robusta</i>	
<i>Mnais mneme</i>	
<i>Rhinocypha f. fenestrella</i>	
<i>Bayadera kirbyi</i>	new species (K.D.P. Wilson & Reels, 2001)
<i>Euphaea ornata</i>	
<i>Pseudolestes mirabilis</i>	Hainan endemic
<i>Coelliccia cyanomelas</i>	
<i>Coelliccia scutellum hainanense</i>	Hainan endemic subspecies
<i>Drepanosticta zhoui</i>	new species (K.D.P. Wilson & Reels, 2001)
<i>Prodasineura autumnalis</i>	
<i>Oligoaeschna sabre</i>	new species (K.D.P. Wilson & Reels, 2001)
<i>Planaeschna celia</i>	new species (K.D.P. Wilson & Reels, 2001)
<i>Tetraanthagyna waterhousei</i>	
<i>Idionyx victor</i>	
<i>Amphigomphus hansonii</i>	

Species	Notes
<i>Gomphidia k. kruegeri</i>	
<i>Heliogomphus retroflexus</i>	
<i>Heliogomphus scorpio</i>	
<i>Lamelligomphus camelus</i>	
<i>Leptogomphus celebratus</i>	Hainan endemic
<i>Merogomphus paviei</i>	
<i>Phaenandrogomphus tonkinicus</i>	
<i>Diplacodes trivialis</i>	
<i>Neurothemis fulvia</i>	
<i>Orthetrum glaucum</i>	
<i>Orthetrum pruinosum</i>	
<i>Orthetrum sabina</i>	
<i>Trithemis aurora</i>	
<i>Trithemis festiva</i>	

- Many of the dragonflies recorded are of particular conservation importance:
 - *Bayadera kirbyi*, *Planaeschna celia* and *Oligoaeschna sabre* are known only from Wuzhishan.
 - An additional three taxa (*Pseudolestes mirabilis*, *Coeliccia scutellum hainanense* and *Leptogomphus celebratus*) are endemic to Hainan.
 - *Paragomphus pardalinus* is known only from Hainan, Guangdong and Guangxi.
 - *Amphigomphus hansonii* and *Lamelligomphus camelus* are known only from Hainan and Fujian.
- Many of the dragonflies present, including all the new species, are forest-dependent.

Butterflies

- A high total of 97 species was recorded at Wuzhishan over the survey period (Table 9). Several of these could not be firmly identified.
- The most frequently encountered species included *Papilio helenus*, *Jamides alecto* and *Parantica sita*.

Table 9. Butterfly species recorded from the Wuzhishan area, 8-11 June 1999. Sequence of families follows Bascombe (1995).

Species	Notes
<i>Celaenorrhinus leucocera</i>	
<i>Gerosis phisara</i>	
<i>Hasora taminatus</i>	
<i>Notocrypta curvifascia</i>	
<i>Polytremis lubricans</i>	
<i>Pyronaura margherita</i>	
<i>Telicota ohara</i>	
<i>Graphium chironides</i>	
<i>Graphium doson</i>	
<i>Papilio (Chilasa) agestor</i>	
<i>Papilio alcmenor</i>	on summit
<i>Papilio demoleus</i>	
<i>Papilio helenus</i>	
<i>Papilio memnon</i>	
<i>Papilio nephelus</i>	
<i>Papilio paris</i>	
<i>Papilio polytes</i>	
<i>Papilio protenor</i>	
<i>Teinopalpus aureus</i>	on summit
<i>Troides helena</i>	
<i>Troides sp.</i>	
<i>Appias albina</i>	
<i>Appias lyncida</i>	
<i>Appias nero</i>	
<i>Appias remedios</i>	on summit

Species	Notes
<i>Delias acalis</i>	
<i>Delias pasithoe</i>	
<i>Eurema hecabe</i>	
<i>Eurema</i> sp.	
<i>Hebomoia glaucippe</i>	
<i>Ixias pyrene</i>	
<i>Pieris (Talbotia) naganum</i>	
<i>Prioneris thestylis</i>	
<i>Abisara echerius</i>	
<i>Acytolepis puspa</i>	
<i>Arhopala bazalus</i>	
<i>Chrysozephyrus</i> sp.	
<i>Dodona eugenes</i>	
<i>Jamides alecto</i>	
<i>Jamides bochus</i>	
<i>Jamides celeno</i>	on summit
<i>Neopithecops zalmora</i>	
<i>Prosotas nora</i>	
<i>Taraka hamada</i>	
<i>Zizeeria maha</i>	
<i>Acraea issoria</i>	
<i>Apatura (Mimathyma) ambica</i>	
<i>Apatura (Rohana) parisatis</i>	
<i>Argyreus hyperbius</i>	
<i>Athyma cama</i>	
<i>Athyma selenophora</i>	
<i>Charaxes bernardus</i>	
<i>Chersonesia risa</i>	
<i>Cirrochroa tyche</i>	
<i>Cupha erymanthis</i>	
<i>Cyrestis cocles</i>	
<i>Cyrestis thyodamas</i>	
<i>Euploea core</i>	
<i>Euploea midamus</i>	
<i>Euploea mulciber</i>	
<i>Euthalia niepelti</i>	
<i>Euthalia phemius</i>	
<i>Euthalia</i> sp.	
<i>Faunis eumeus</i>	
<i>Ideopsis similis</i>	
<i>Lethe (Neope) bremeri</i>	
<i>Lethe (Neope) muirheadii</i>	
<i>Lethe insana</i>	
<i>Lethe rohria</i>	
<i>Lethe verma</i>	
<i>Lethe vindhya</i>	
<i>Limenitis (Parasarpa) dudu</i>	
<i>Limenitis (Sumalia) daraxa</i>	on summit
<i>Mandarinia regalis</i>	
<i>Mycalesis francisca</i>	
<i>Mycalesis sangaica</i>	
<i>Mycalesis</i> sp.	
<i>Neorina (Ethope) henrici</i>	
<i>Neptis hylas</i>	
<i>Pantoporia hordonia</i>	
<i>Parantica aglea</i>	
<i>Parantica sita</i>	
<i>Parantica</i> sp.	
<i>Penthema</i> sp.	
<i>Precis (Junonia) atlites</i>	
<i>Precis (Junonia) orithya</i>	

Species	Notes
<i>Ragadia crisilda</i>	
<i>Stibochiona nicea</i>	
<i>Stichophthalma neumogeni</i>	
<i>Stichophthalma</i> sp.	
<i>Symbrenthia hypselis</i>	
<i>Tirumala limniace</i>	
<i>Tirumala septentrionis</i>	
<i>Vanessa cardui</i>	
<i>Vindula erota</i>	
<i>Ypthima baldus</i>	
<i>Ypthima motschulskyi</i>	

- A high proportion of species (e.g. *Papilio alcmenor*, *Teinopalpus aureus*, *Appias nero*, *Appias remedios*, *Chersonesia risa*, *Cyrestis cocles*, *Ethope henrici*, *Lethe insana*, *Lethe vindhya*, *Mandarina regalis*, *Mimathyma ambica*, *Penthema* sp., *Ragadia crisilda*, *Stibochiona nicea*, *Sumalia daraxa*, *Chrysozephyrus* sp., *Pyronaura margherita*) are rare in South China, and apparently restricted to upland and/or primary forest.
- The high incidence of forest species reflects the relatively undisturbed condition of the Wuzhishan forest.

Molluscs

- A total of six species of land snail, four species of slug and two species of freshwater snail were recorded at Wuzhishan (Table 10).
- The most frequently encountered terrestrial mollusc was *Microcystis schmackeriana* while the two species of stream snails, *Brotia microsculpta* and *Semisulcospira paludiformis*, were similarly abundant.

Table 10. Molluscs of Wuzhishan, June 1999.

Species	Habitat
<i>Pearsonia gredleri</i>	montane forest
<i>Microcystis schmackeriana</i>	montane forest
<i>Macrochlamys cincta</i>	montane forest
<i>Macrochlamys dolani</i>	forest/shrubland
<i>Sitalina petasus sinensis</i>	forest
<i>Camaena hainanensis</i>	montane forest
<i>Camaena xanthoderma polyzona</i>	forest
<i>Bradybaena similis</i>	forest
<i>Philomycus pictus</i>	parkland
<i>Vaginulus alte</i>	forest
<i>Brotia microsculpta</i>	forest stream
<i>Semisulcospira paludiformis</i>	forest stream

- *Pearsonia gredleri* is a Hainan endemic.
- The high proportion of forest species at Wuzhishan reflects the high integrity of the forest.

Summary of flora and fauna

- Wuzhishan has relatively intact tropical montane evergreen rainforest above 800 m, and tropical montane mixed coniferous and broadleaf forest above 900 m. The flora is rich, with 432 vascular plant species recorded in the present surveys. They include 14 globally Threatened or nationally Protected species, among them *Heritiera parvifolia*, *Vatica mangachapoi*, *Amoora dasyclada*, *Cephalotaxus mannii* and *Hydnocarpus hainanensis*. In addition 32 Hainan endemic or highly restricted species were found in the present surveys.

- The mammals of Wuzhishan have not been systematically surveyed in recent years, but past records and indirect reports suggest a rich mammal fauna including globally Threatened Hainan Gymnure, Clouded Leopard and Asiatic Black Bear. However many of these are insecure due to the high hunting pressure, and some, including Eastern Crested Gibbon and possibly Eld's Deer, have been extirpated. A number of regionally rare forest bird species, such as frugivorous pigeons and babblers, were present.
- The herpetofauna included a number of species which are confined to the forested areas of Hainan, such as *Leptobrachium hainanensis*, *Pelophryne scalpta*, *Philautus ocellatus*, and *Rhabdophis adleri*, as well as several other restricted and forest-dependent species.
- The insect fauna was quite rich, and included species of dragonfly and ant known only from Wuzhishan. The proportion of forest-dependent ants, dragonflies, butterflies and molluscs was high in the upper parts of the reserve.
- Wuzhishan has the highest-altitude forest in Hainan, with a unique flora including epiphytic *Cymbidium* orchids characteristic of northwest China.
- Wuzhishan Nature Reserve was predicted to be of local biodiversity significance by MacKinnon *et al.* (1996). The findings of the present survey suggest the reserve is of national significance, though ongoing degradation might reduce this.

Threats and problems

- Good forests are restricted to higher altitude only. The foothills of Wuzhishan have been deforested and used for swidden agriculture.
- At the time of the visits, it was evident that people often entered the Nature Reserve to collect wildlife of economic value, such as orchids. Hunting was very serious. The survey team heard a number of gunshots each day during both the 1999 and 2001 visits, and in 1999 a large party of ten hunters, all with rifles, was seen at the edge of the Reserve. Although guns were sometimes confiscated from local villagers, they were reportedly returned within a few days in most cases. The impacts of this hunting on wild animals were obvious, with very few signs of mammals in the forest. Fruiting fig trees were seen with many uneaten figs beneath them, indicating a depleted mammal and bird fauna.
- Some orchids were threatened by over collection for ornamental purposes, such as *Dendrobium densiflorum* and *Cymbidium* species.
- Electrofishing was seen in a stream close to the Reserve in 2001. A detailed survey of a large stream draining good secondary forests by the reserve entrance yielded very little aquatic life during the 2001 survey; the reserve warden reported the stream had been poisoned in recent months. In view of the remoteness of this stream, it is probable that other stream systems closer to human habitation in the Wuzhishan area have been affected by the same destructive fishing methods.
- Many tourists visit Wuzhishan because it is the highest peak on Hainan. To get to the summit, they have to enter the core area of the Reserve, which is theoretically a controlled area. Visitors have various impacts, including serious litter along the trails and disturbance. In 1999 there were no education facilities or materials available along the trails.
- There was apparently inadequate funding to resolve management problems. Reportedly there was an agreement to channel funds from the resort into the Nature Reserve by way of rent. However the resort had not made much money and the rent promised to the Reserve had not been fully paid.

Opportunities

- The large tourist resort at the entrance of the Reserve provides good rooms, food and various recreational facilities. A large number of visitors, including tour groups, visit Wuzhishan because it is the highest peak on Hainan and has spectacular scenery. Given the rich flora (such as orchids) and fauna (e.g. birds and butterflies) in the Reserve, there is a great potential to develop eco-tourism and to raise environmental awareness among visitors. An education centre has already been built near the resort, by the German Government (GTZ) and Hainan Provincial Forestry Department. Other aspects of ecotourism development might be applied, with reference to available guidelines (e.g. Ceballos-Lascuráin, 1996).
- The resort had installed a waste treatment system to minimize local pollution, though in 1999 the system was not in use (possibly due to low visitor numbers). Its operation would help to protect the surroundings.
- Although the lower-altitude parts of the Nature Reserve consist mainly of secondary shrubland and abandoned farmland, these are of high potential ecological value if left undisturbed for some years, allowing the vegetation to regenerate and animals to return. This regeneration will depend on controls on grazing, collection of firewood and hunting. The nearby low- to mid-altitude forest patches might act as a seed source for vegetation regeneration, making active afforestation unnecessary if the above negative factors are controlled.

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Figure 1. Map showing location of Wuzhishan Nature Reserve, Central Hainan, China.

