



**Report of a Rapid Biodiversity Assessment at
Wutongshan National Forest Park, Shenzhen
Special Economic Zone, China, 16 to 17 May 2001**

**Kadoorie Farm and Botanic Garden
in collaboration with
Shenzhen Fairy Lake Botanical Garden
The National Forest Park Office of Shenzhen Special Economic Zone Government**

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Report of a Rapid Biodiversity Assessment at Wutongshan National Forest Park, Shenzhen Special Economic Zone, China, 16 to 17 May 2001

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Background

The present report details the findings of a brief trip to Shenzhen Wutongshan National Forest Park, Shenzhen Special Economic Zone by members of Kadoorie Farm & Botanic Garden (KFBG) in Hong Kong, as part of KFBG's South China Biodiversity Conservation Programme, launched in 1998. The overall aim of the programme is to minimize 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 Wutongshan National Forest Park, Shenzhen Special Economic Zone, China, 16 to 17 May 2001

Objectives

Shenzhen Wutongshan National Forest Park has quite extensive secondary forest cover. Although the vegetation has been studied and a checklist of plants produced (Zhang Shouzhou, unpublished data), little is known about the fauna. The only published faunal study, on beetles (Jia *et al.*, 2000), reported high species diversity, and concluded that Wutongshan ecosystem has high ecological integrity. The present survey aimed to improve knowledge of the fauna and flora of Wutongshan, and to use this to help determine conservation priorities within South China.

Methods

On 16 May, members of KFBG (BC, ML, LKS, NSC, GS, GTR, CW, Winky W.K. Huen, Karen K.O. Lau, Wicky T.C. Lee, Ken K.Y. So) travelled to Shenzhen, and were joined by ZSZ (Associate Researcher, Shenzhen Fairy Lake Botanical Garden), LYJ (Senior Engineer of Wutongshan National Forest Park) and several Park wardens and Botanical Garden staff. Rapid biodiversity surveys were conducted on 16 and 17 May.

During fieldwork visual searching for plants, mammals, birds, reptiles, amphibians, fish, butterflies and dragonflies was conducted. The calls of birds and amphibians were also used to survey these groups. Bird records from the lowland areas (including Shenzhen Reservoir and Shenzhen Fairy Lake Botanical Garden) were also made while travelling to and from the Forest Park by vehicle. All species identified were recorded.

Plant records in the survey were made by NSC except in the case of orchids, which were made by GS. No firm records of mammals were made. Bird records were made by LKS and CW. Reptile and amphibian records were made by ML and BC. Freshwater fish records were made by BC. Dragonfly and butterfly records were made by GTR and ML. 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. (1996-2000); Anon. (2001); and The Plant Names Project (2001);
- Orchids (Angiospermae: Orchidaceae): Chen (1999); De Vogel & Turner (1992); Lang (1999); and Tsi (1999);
- Birds (Aves): Inskipp *et al.* (1996);
- Reptiles and Amphibians (Reptilia and Amphibia): Zhao E. *et al.* (2000);
- Fish (Actinopterygii): Nelson (1994); Wu *et al.* (1999);
- 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). National conservation status of orchids is based on Wang *et al.* (in press). Assessment of regional and global restrictedness of some of the animal species is derived from Fellowes *et al.* (in press). Protection status in China is based on Hua & Yan (1993) for animals and State Forestry Administration & Ministry of Agriculture (1999) for plants. Global status of reptiles, amphibians, fish and invertebrates has yet to be properly assessed.

Location and management

The 31 km² Shenzhen Wutongshan National Forest Park is in the eastern part of Shenzhen Special Economic Zone, adjacent to Sha Tau Kok, Hong Kong (Figure 1), at about 22° 15'N, 113° 55'E. The highest point of Wutongshan is called Dawutongshan (944 m). The second highest peak is Xiaowutongshan (approximately 650 m), where there are several radio transmission stations. The Park falls within the catchment of Shenzhen Reservoir, which is about 8 km west of the Wutongshan peaks. Unlike reservoirs in Hong Kong, the shoreline is shallow with patches of emergent plants, presenting a more favourable habitat for wading birds. The streams on the southern slope drain into the Shenzhen River and finally empty into the Mai Po Inner Deep Bay Ramsar Site. Shenzhen as a whole has a tropical to subtropical monsoon climate (Chen *et al.*, 1986). Mean annual temperature at coastal Futian is 22.4 °C, and mean annual rainfall 1,926 mm, falling mostly from May to September (Zhang & Lin, 1997); rainfall at Wutongshan is likely to be higher. The geology of Wutongshan is mainly igneous. Wutongshan was designated a National Forest Park in 1989. Currently, the Park is managed by the National Forest Park Office of the Shenzhen Special Economic Zone Government. The southwest foothills of Wutongshan are managed by Shenzhen Fairy Lake Botanical Garden, which was established in 1983.

Results

Vegetation

The zonal vegetation of the area should be northern tropical monsoon broadleaf forest (Chen *et al.*, 1986), but the primary vegetation was probably cleared centuries ago. Most of the present vegetation has regenerated in the past 20-30 years following protection against anthropogenic disturbance such as logging and hill-fires. The vegetation is dominated by Lauraceae, Aquifoliaceae, Mimosaceae, Euphorbiaceae, Poaceae, and Gleicheniaceae. At the time of the visit it could be classified into the following types:

- i) Northern tropical monsoon broadleaf montane hillside forest. This was the dominant vegetation type found on north-facing hillsides above 400 m, where it was more or less continuous. Some narrow patches were also found along valleys between grass- and shrub-covered south-facing hillsides. Forests toward higher altitudes and on more open hillsides were less diverse, largely dominated by *Ilex viridus* and *Itea chinensis*, and had generally smaller trees (<20 cm dbh; <6 m tall), suggesting they have regenerated in the past 20-30 years. Some temperate or upland species, characteristic of upland habitats in southern Guangdong and Hong Kong, were also found here, including *Amentotaxus argotaenia* and *Manglietia fordiana*. Forest patches found along ravines and toward lower altitudes were more species rich, had taller (10-20 m) trees with wider girth (reaching 40 cm), and had a more well-developed liana assemblage, suggesting they were older. These patches were co-dominated by *Machilus breviflora* and *M. chekiangensis*. Other important tree species found here included *Castanopsis fabri*, *Castanopsis fissa*, and *Dendrobenthamia hongkongensis*. Although *Cryptocarya chinensis* and *Cryptocarya concinna* were represented only by saplings in this forest type, they had the potential to become future dominant species because of their ability to regenerate in the shade below the canopy.
- ii) Northern tropical monsoon broadleaf forest and tall shrub. This vegetation type was found mainly at lower altitudes below 400 m, around abandoned villages and farmland. It differed from the montane forest in the predominance of tropical families such as Acanthaceae, Annonaceae, Mimosaceae and Rubiaceae. Trees were about 4-10 m tall, occurring in sparse patches in a matrix of small trees (2-3 m) dominated by *Litsea glutinosa*, *Bridelia tomentosa*, *Eleutherococcus trifoliatus*, *Lantana camara* and *Desmos chinensis*. There were also occasional taller trees of *Albizia chinensis* and *Pithecellobium lucidium* reaching 20 m. The tall shrubs and trees supported climbers such as *Bauhinia championii*, *Byttneria aspera*,

Mikania micrantha, and *Thunbergia grandiflora*. This vegetation has evidently regenerated on abandoned farms and villages, probably in the last 20-30 years.

- iii) Hillside grass and shrub mixture. This vegetation type was found at higher altitudes above 650 m along mountain ridges and firebreaks, and also on south-facing hillsides. Vegetation was less than 2 m in height and dominated by herbs and shrubs including *Microstegium ciliatum*, *Miscanthus sinensis*, *Carex cruciata*, *Dicranopteris pedata*, *Litsea rotundifolia* var. *oblongifolia*, *Rhodomyrtus tomentosa* and *Rhododendron farrerae*. This vegetation type has resulted from recent or prolonged disturbance together with an open, exposed environment.

Flora

Three hundred and seventy-two species of plant were found in the study area in this rapid survey (Table 1, Table 2). They include 29 species of ferns in 18 families, five species of gymnosperms in four families, 17 species of orchids (Table 2) and 320 species of other flowering plants in 100 families (Table 1). The flora was dominated by Euphorbiaceae, Asteraceae, Lauraceae, Rubiaceae, Moraceae, Papilionaceae, Orchidaceae and Poaceae. Although the flora recorded was quite diverse given the short period of survey, it is typical of relatively degraded and young secondary vegetation of the region, with relatively few forest-dependent plant species. Thus it closely resembles the flora of similar vegetation in nearby Hong Kong. Naturalised exotic species were also abundant especially in human-disturbed areas and beside villages at lower altitudes.

The survey revealed some species of conservation concern. *Amentotaxus argotaenia* is considered globally Vulnerable and is rare with a scattered distribution in South China. *Ixonanthes chinensis* is globally Vulnerable and under Class II national protection, but is locally common in Hong Kong (Corlett *et al.*, 2000) and widespread in South China. *Brainea insignis* and *Cibotium barometz* are also Class II protected, although they are fairly common in Guangdong. *Hedyotis loganioides* is endemic to Guangdong. Although *Aquilaria sinensis*, *Cinnamomum camphora* and *Dimocarpus longan* are globally Vulnerable and Class II protected in China, the plants found in this area are probably planted or naturalized as they have a long history of planting as tree-crops in the region.

All plant species recorded have also been found in Hong Kong, with the exception of *Ainsliaea macroclinidioides*, *Lithocarpus uvariifolius*, and *Tricyrtis macropoda*. All three were found at high altitude forest margins, and are widespread species in South China. The locally abundant lowland species, *Albizia chinensis*, has been planted in Hong Kong but no wild plants have been recorded there so far.

Table 1. Vascular plant species recorded in Shenzhen Wutongshan National Forest Park on 16 and 17 May 2001. Not including Orchidaceae (see Table 2). Rank of local abundance: "+" = very rare; "++" = rare; "+++" = common; "++++" = very common. 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 endemic to South China are indicated in notes. Introduced and invasive species are also indicated.

Family	Species	Remarks
PTERIDOPHYTA		
Adiantaceae	<i>Adiantum flabellulatum</i> L.	
Aspleniaceae	<i>Asplenium normale</i> D. Don	
Blechnaceae	<i>Blechnum orientale</i> L.	
	<i>Brainea insignis</i> (Hook.) J. Sm.	Protected II
	<i>Woodwardia japonica</i> (L.f.) Sm.	
Davalliaceae	<i>Davallia formosana</i> Hayata	
Dicksoniaceae	<i>Cibotium barometz</i> (L.) J. Sm.	Protected II
Dryopteridaceae	<i>Dryopteris decipiens</i> (Hook.) Kuntze	
	<i>Dryopteris podophylla</i> (Hook.) Kuntze	

Family	Species	Remarks
Equisetaceae	<i>Equisetum debile</i> Roxb.	
Gleicheniaceae	<i>Dicranopteris pedata</i> (Houtt.) Nakaike <i>Diplopterygium chinensis</i> (Rosenst.) DeVol	
Lindsaeaceae	<i>Stenoloma chusanum</i> (L.) Ching	
Lycopodiaceae	<i>Palhinhaea cernua</i> (L.) Franco et Vasc.	
Lygodiaceae	<i>Lygodium scandens</i> (L.) Sw.	
Marattiaceae	<i>Angiopteris fokiensis</i> Hieron.	
Nephrolepidaceae	<i>Nephrolepis auriculata</i> (L.) Trimea	
Osmundaceae	<i>Osmunda vachellii</i> Hook.	
Polypodiaceae	<i>Colysis elliptica</i> (Thunb.) Ching <i>Lemmaphyllum microphyllum</i> C. Presl <i>Pyrrosia lanceolata</i> (L.) Farw. <i>Pyrrosia lingua</i> (Thunb.) Farw	
Pteridaceae	<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>latiusculum</i> (Desv.) Underw. ex A. Heller <i>Pteris dispar</i> Kunze <i>Pteris semipinnata</i> L. <i>Pteris vittata</i> L.	
Selaginellaceae	<i>Selaginella doederleinii</i> Hieron <i>Selaginella moellendorffii</i> Hieron.	
Thelypteridaceae	<i>Pronephrium aspera</i> (C. Presl) W. C. Shieh & J. L. Tsai	
GYMNOSPERMAE		
Gnetaceae	<i>Gnetum luofuense</i> C. Y. Cheng <i>Gnetum parvifolium</i> (Warb.) Chun	
Pinaceae	<i>Pinus massoniana</i> Lamb.	
Taxaceae	<i>Amentotaxus argotaenia</i> (Hance) Pilg.	
Taxodiaceae	<i>Cunninghamia lanceolata</i> (Lamb.) Hook.	planted
ANGIOSPERMAE		
Dicotyledonae		
Acanthaceae	<i>Thunbergia grandiflora</i> Roxb.	introduced
Actinidiaceae	<i>Actinidia latifolia</i> (Gardner et Champ.) Merr. <i>Saurauia tristyla</i> DC.	
Alangiaceae	<i>Alangium chinense</i> (Lour.) Harms.	
Amaranthaceae	<i>Amaranthus viridis</i> L.	
Anacardiaceae	<i>Rhus chinensis</i> Mill. <i>Toxicodendron succedaneum</i> (L.) Kuntze.	
Annonaceae	<i>Desmos chinensis</i> Lour.	
Annonaceae	<i>Fissistigma oldhamii</i> (Hemsl.) Merr. <i>Fissistigma uonicum</i> (Dunn) Merr. <i>Uvaria grandiflora</i> Roxb. <i>Uvaria microcarpa</i> Champ. ex Benth.	
Apiaceae	<i>Centella asiatica</i> (L.) Urb.	
Apocynaceae	<i>Alyxia sinensis</i> Champ. ex Benth. <i>Melodinus suaveolens</i> Champ. ex Benth. <i>Urceola rosea</i> (Hook. & Arn.) D.J. Middleton	
Aquifoliaceae	<i>Ilex asprella</i> (Hook. et Arn.) Champ. ex Benth. <i>Ilex kwangtungensis</i> Merr. <i>Ilex lohfauiensis</i> Merr. <i>Ilex pubescens</i> Hook. et Arn. <i>Ilex viridis</i> Champ. ex Benth.	
Araliaceae	<i>Aralia decaisneana</i> Hance <i>Dendropanax proteus</i> Benth. <i>Eleutherococcus trifolius</i> (L.) S.Y. Hu <i>Schefflera octophylla</i> (Lour.) Harms	
Asclepiadaceae	<i>Pentasacme caudatum</i> Wall. ex Wight <i>Tylophora ovata</i> (Lindl.) Hook. ex Steud.	
Asteraceae	<i>Ainsliaea macroclinioides</i> Hayata <i>Anisopappus chinensis</i> (L.) Hook. & Arn. <i>Aster ageratoides</i> Turcz. <i>Bidens pilosa</i> L.	introduced from tropical

Family	Species	Remarks
	<i>Blumea riparia</i> DC.	America
	<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	introduced from Africa
	<i>Eupatorium catarium</i> Veldkamp	introduced from South America
	<i>Farfugium japonicum</i> (L. f.) Kitam.	
	<i>Gynura divaricata</i> (L.) DC.	
	<i>Mikania micrantha</i> Kunth	naturalised exotic
	<i>Senecio scandens</i> Buch.-Ham.	
	<i>Sonchus oleraceus</i> L.	introduced
	<i>Tithonia diversifolia</i> (Hemsl.) A. Gray	introduced from tropical America
	<i>Wedelia trilobata</i> (L.) Hitchc.	introduced from tropical America
Begoniaceae	<i>Begonia palmata</i> D. Don	
Boraginaceae	<i>Ehretia longiflora</i> Champ. ex Benth.	
Caesalpiniaceae	<i>Bauhinia championii</i> (Benth.) Benth.	
	<i>Caesalpinia crista</i> L.	
	<i>Caesalpinia vernalis</i> Champ. ex Benth.	
Campanulaceae	<i>Codonopsis lanceolata</i> (Siebold & Zucc.) Trautv.	
Capparaceae	<i>Crateva trifoliata</i> (Roxb.) B.S. Sun	
Caprifoliaceae	<i>Lonicera macrantha</i> (D. Don) Spreng.	
	<i>Viburnum odoratissimum</i> Ker Gawl.	
	<i>Viburnum sempervirens</i> Koch	
Celastraceae	<i>Celastrus monospermus</i> Roxb.	
	<i>Celastrus orbiculatus</i> Thunb.	
	<i>Euonymus nitidus</i> Benth.	
Chloranthaceae	<i>Chloranthus serratus</i> (Thunb.) Roem. & Schult.	
	<i>Sarcandra glabra</i> (Thunb.) Nakai	
Clusiaceae	<i>Calophyllum membranaceum</i> Gardner & Champ.	
	<i>Cratoxylum cochinchinense</i> (Lour.) Blume	
	<i>Garcinia oblongifolia</i> Champ. ex Benth.	
Connaraceae	<i>Rourea microphylla</i> (Hook. & Arn.) Planch.	
Convolvulaceae	<i>Ipomoea cairica</i> (L.) Sweet	pan-tropical weed
Cornaceae	<i>Dendrobenthamia hongkongensis</i> (Hemsl.) Hutch.	
Daphniphyllaceae	<i>Daphniphyllum calycinum</i> Benth	
Droseraceae	<i>Drosera burmannii</i> Vahl	
	<i>Drosera spathulata</i> Labill. var. <i>loureiri</i> (Hook. & Arn.) Y.Z. Ruan	
Ebenaceae	<i>Diospyros eriantha</i> Champ. ex Benth.	
	<i>Diospyros kaki</i> Thunb.	
	<i>Diospyros morrisiana</i> Hance ex. Walpers	
Elaeagnaceae	<i>Elaeagnus loureiri</i> Champ. ex Benth.	
Elaeocarpaceae	<i>Elaeocarpus sylvestris</i> (Lour.) Poir.	
Ericaceae	<i>Enkianthus quinqueflorus</i> Lour.	
	<i>Rhododendron farrerae</i> Tate	
	<i>Rhododendron moullainense</i> Hook. f.	
	<i>Rhododendron simsii</i> Planch.	
	<i>Vaccinium bracteatum</i> Thunb.	
Escalloniaceae	<i>Itea chinensis</i> Hook. et Arn	
Euphorbiaceae	<i>Antidesma bunius</i> (L.) Spreng.	
	<i>Antidesma fordii</i> Hemsl.	
	<i>Antidesma paniculatum</i> Roxb.	
	<i>Aporosa dioica</i> (Roxb.) Müll. Arg.	
	<i>Bischofia javanica</i> Blume	
	<i>Breynia fruticosa</i> (L.) Hook. f.	
	<i>Bridelia insulana</i> Hance (<i>B. balansae</i> Tutch.)	
	<i>Bridelia tomentosa</i> Blume	
	<i>Claoxylon indicum</i> (Reinw. ex Bl.) Hassk.	
	<i>Croton lachnocarpus</i> Benth.	
	<i>Croton tiglium</i> L.	
	<i>Glochidion eriocarpum</i> Champ. ex Benth.	

Family	Species	Remarks
	<i>Glochidion lanceolarium</i> (Roxb.) Voigt	
	<i>Glochidion puberum</i> (L.) Hutch.	
	<i>Glochidion wrightii</i> Benth.	
	<i>Macaranga sampsoni</i> Hance	
	<i>Mallotus apelta</i> (Lour.) Muell.-Arg.	
	<i>Phyllanthus emblica</i> L.	
	<i>Phyllanthus reticulatus</i> Poir.	
Fagaceae	<i>Sapium discolor</i> (Champ. ex Benth.) Müll.-Arg.	
	<i>Castanopsis carlesii</i> (Hemsl.) Hayata	
	<i>Castanopsis fabri</i> Hance	
Fagaceae	<i>Castanopsis fissa</i> (Champ. ex Benth.) Rehder et E. H. Wilson	
	<i>Cyclobalanopsis litseoides</i> (Dunn) Schottky	
	<i>Cyclobalanopsis myrsinifolia</i> (Blume) Oerst.	
	<i>Lithocarpus hancei</i> (Benth.) Rehder	
	<i>Lithocarpus uvariifolius</i> (Hance) Rehder	
Flacourtiaceae	<i>Casearia glomerata</i> Roxb.	
	<i>Homalium cochinchinense</i> (Lour.) Druce	
	<i>Xylosma longifolium</i> Clos	
Gentianaceae	<i>Gentiana loureiroi</i> (G. Don) Griseb.	
	<i>Tripterospermum nienkui</i> (C. Marquand) C.J. Wu	
Gesneriaceae	<i>Aeschynanthus acuminatus</i> Wall. ex A. DC.	
	<i>Chirita sinensis</i> Lindl.	
Haloragidaceae	<i>Haloragis chinensis</i> (Lour.) Merr.	
	<i>Haloragis micrantha</i> (Thunb.) R. Br.	
Hamamelidaceae	<i>Altingia chinensis</i> (Champ. ex Benth.) Oliv. ex Hance	
	<i>Eustigma oblongifolium</i> Gardner & Champ.	
	<i>Liquidambar formosana</i> Hance	
	<i>Rhodoleia championii</i> Hook. f.	
Hydrangeaceae	<i>Dichroa febrifuga</i> Lour.	
Icacinaceae	<i>Mappianthes iodoides</i> Hand.-Mazz.	
Ixonanthaceae	<i>Ixonanthes chinensis</i> Champ.	Vulnerable
Juglandaceae	<i>Engelhardtia roxburghiana</i> Wall.	
Lamiaceae	<i>Anisomeles indica</i> (L.) Kuntze	
	<i>Perilla frutescens</i> (L.) Britton	
Lauraceae	<i>Cinnamomum camphora</i> (L.) J. Presl.	Protected II probably planted & naturalised
	<i>Cryptocarya chinensis</i> (Hance) Hemsl.	
	<i>Cryptocarya concinna</i> Hance	
	<i>Lindera communis</i> Hemsl.	
	<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>Machilus breviflora</i> (Benth.) Hemsl.	
	<i>Machilus chekiangensis</i> S.K. Lee	
	<i>Machilus polyneura</i> H.T. Chang	
	<i>Machilus thunbergii</i> Siebold & Zucc.	
	<i>Machilus wangchiana</i> Chun	
Loganiaceae	<i>Buddleja asiatica</i> Lour.	
	<i>Gelsemium elegans</i> (Gardner et Champ.) Benth.	
Magnoliaceae	<i>Magnolia championii</i> Benth.	
	<i>Manglietia fordiana</i> Oliv.	
Malpighiaceae	<i>Hiptage benghalensis</i> (L.) Kurz	
Malvaceae	<i>Urena lobata</i> L.	pan-tropical weed
Malvaceae	<i>Urena procumbens</i> L.	
Melastomataceae	<i>Melastoma dodecandrum</i> Lour.	
	<i>Melastoma sanguineum</i> Sims	
Menispermaceae	<i>Cocculus orbiculatus</i> (L.) DC.	
	<i>Diploclisia glaucescens</i> (Blume) Diels	
	<i>Hypserpa nitida</i> Miers	
	<i>Stephania longa</i> Lour.	

Family	Species	Remarks
Mimosaceae	<i>Tinospora sinensis</i> (Lour.) Merr. <i>Albizia chinensis</i> (Osbeck) Merr. <i>Pithecellobium clypearia</i> (Jack) Benth. <i>Pithecellobium lucidum</i> Benth.	
Moraceae	<i>Ficus erecta</i> Thunb. <i>Ficus fistulosa</i> Reinw. ex Blume <i>Ficus formosana</i> Maxim. <i>Ficus hirta</i> Vahl <i>Ficus hispida</i> L. f. <i>Ficus pandurata</i> Hance <i>Ficus pumila</i> L. <i>Ficus sarmentosa</i> Buch.-Ham. ex Sm. var. <i>impressa</i> (Champ.) Corner <i>Ficus subulata</i> Blume <i>Ficus variegata</i> Blume var. <i>chlorocarpa</i> (Benth.) King <i>Ficus variolosa</i> Lindl. ex Benth. <i>Ficus virens</i> Ait.	
Myricaceae	<i>Myrica rubra</i> (Lour.) Sieb. et Zucc.	
Myrsinaceae	<i>Ardisia crenata</i> Sims <i>Ardisia quinquegona</i> Blume <i>Embelia laeta</i> (L.) Mez <i>Embelia ribes</i> Burm. f. <i>Maesa japonica</i> (Thunb.) Moritzi et Zoll. <i>Maesa perlarius</i> (Lour.) Merr. <i>Mysine seguinii</i> H. Lévl	
Myrtaceae	<i>Baeckea frutescens</i> L. <i>Cleistocalyx operculatus</i> (Roxb.) Merr. et L. M. Perry <i>Rhodomyrtus tomentosa</i> (Aiton) Hassk. <i>Syzygium buxifolium</i> Hook. et Arn. <i>Syzygium hancei</i> Merr. et L. M. Perry <i>Syzygium jambos</i> (L.) Alston	
Oleaceae	<i>Fraxinus</i> sp. <i>Ligustrum amamianum</i> Koidz. <i>Osmanthus matsumuranus</i> Hayata	
Oxalidaceae	<i>Oxalis corniculata</i> L.	
Papilionaceae	<i>Abrus mollis</i> Hance <i>Dalbergia balansae</i> Prain <i>Dalbergia hancei</i> Benth. <i>Dalbergia millettii</i> Benth. <i>Millettia nitida</i> Benth. <i>Millettia pachycarpa</i> Benth. <i>Mucuna birdwoodiana</i> Tutch. <i>Ormosia emarginata</i> (Hook. & Arn.) Benth.	endemic to Guangdong & Hainan
Pentaphylacaceae	<i>Phyllodium elegans</i> (Lour.) Desv. <i>Podocarpium laxum</i> (DC.) Yen C. Yang & P.H. Huang <i>Pentaphylax euryoides</i> Gardner & Champ.	
Piperaceae	<i>Piper hancei</i> Maxim. <i>Piper hongkongense</i> C. DC.	
Pittosporaceae	<i>Pittosporum glabratum</i> Lindl.	
Plantaginaceae	<i>Plantago major</i> L.	introduced
Polygonaceae	<i>Polygonum chinense</i> L.	
Proteaceae	<i>Helicia cochinchinensis</i> Lour. <i>Helicia kwangtungensis</i> W.T. Wang	
Rhamnaceae	<i>Berchemia floribunda</i> (Wall.) Brongn. <i>Rhamnus crenata</i> Siebold & Zucc. <i>Ventilago leiocarpa</i> Benth.	
Rosaceae	<i>Photinia benthamiana</i> Hance <i>Photinia raupingensis</i> K.C. Kuan <i>Pyrus calleryana</i> (L.) Lindl. <i>Rhaphiolepis indica</i> (L.) Lindl.	

Family	Species	Remarks
Rubiaceae	<i>Rubus leucanthus</i> Hance	endemic to Guangdong
	<i>Rubus pirifolius</i> Sm.	
	<i>Rubus reflexus</i> Ker	
	<i>Rubus rosifolius</i> Sm.	
	<i>Adina pilulifera</i> (Lam.) Franch. ex Drake	
	<i>Diplospora dubia</i> (Lindl.) Masam.	
	<i>Gardenia jasminoides</i> J. Ellis	
	<i>Hedyotis consanguinea</i> Hance	
	<i>Hedyotis</i> sp.	
	<i>Hedyotis hedyotide</i> (DC.) Merr.	
	<i>Hedyotis loganioides</i> Benth.	
	<i>Mussaenda pubescens</i> W. T. Aiton	
	<i>Paedaria pertomentosa</i> Merr. ex Li	
	<i>Pavetta hongkongensis</i> Brem.	
Rutaceae	<i>Psychotria asiatica</i> L.	epiphytic
	<i>Psychotria serpens</i> L.	
	<i>Acronychia pedunculata</i> (L.) Miq.	
	<i>Evodia glabrifolia</i> (Champ. ex Benth.) C.C. Huang	
	<i>Evodia lept</i> (Spreng.) Merr.	
	<i>Fortunella hindsii</i> (Champ. ex Benth.) Swingle	
	<i>Zanthoxylum ailanthoides</i> Siebold & Zucc.	
	<i>Zanthoxylum avicennae</i> (Lam.) DC.	
	<i>Zanthoxylum nitidum</i> (Roxb.) DC.	
	<i>Meliosma rigida</i> Siebold et Zucc.	
Sabiaceae	<i>Sabia limoniacea</i> Wall. ex Hook. f. & Thomson	Vulnerable; planted & naturalised
	<i>Dendrotrophe frutescens</i> (Champ. ex Benth.) Danser	
Santalaceae	<i>Dimocarpus longan</i> Lour.	
Sapotaceae	<i>Sarcosperma laurinum</i> (Benth.) Hook. f.	
Sargentodoxaceae	<i>Sargentodoxa cuneata</i> (Oliv.) Rehder & E.H. Wilson	
Saururaceae	<i>Houttuynia cordata</i> Thunb.	
Schisandraceae	<i>Kadsura coccinea</i> (Lem.) A.C. Sm.	
Scrophulariaceae	<i>Adenosma glutinosum</i> (L.) Druce	introduced from America
Solanaceae	<i>Solanum americanum</i> Mill.	
Staphyleaceae	<i>Solanum virginianum</i> L.	introduced
	<i>Turpinia montana</i> (Blume) Kurz	
Sterculiaceae	<i>Byttneria aspera</i> Colebr. ex Wall.	
	<i>Helicteres angustifolia</i> L.	
Styracaceae	<i>Sterculia lanceolata</i> Cav.	
	<i>Styrax confusus</i> Hemsl.	
Symplocaceae	<i>Symplocos glauca</i> (Thunb.) Koidz.	
	<i>Symplocos lancifolia</i> Siebold & Zucc.	
Theaceae	<i>Symplocos sumuntia</i> Buch.-Ham. ex D. Don	probably planted & naturalised
	<i>Adinandra millettii</i> (Hook. & Arn.) Benth. & Hook. f. ex Hance	
	<i>Camellia kissii</i> Wall.	
	<i>Camellia sinensis</i> (L.) Kuntze	
	<i>Eurya chinensis</i> R. Br.	
Thymelaeaceae	<i>Eurya nitida</i> Korthals	planted
	<i>Gordonia axillaris</i> (Roxb. ex Ker Gawl.) Dietr.	
	<i>Schima superba</i> Gardn. et Champ.	
	<i>Tutcheria championii</i> Nakai	
	<i>Aquilaria sinensis</i> (Lour.) Spreng.	
Tiliaceae	<i>Wikstroemia nutans</i> Champ. ex Benth.	Protected II, Vulnerable; probably planted & naturalised
	<i>Microcos paniculata</i> L.	
Ulmaceae	<i>Celtis tetrandra</i> Roxb. subsp. <i>sinensis</i> (Pers.) Y.C. Tang	
	<i>Celtis timorensis</i> Span.	
	<i>Trema tomentosa</i> (Roxb.) Hara	

Family	Species	Remarks
Urticaceae	<i>Boehmeria nivea</i> (L.) Gaudich.	
Verbenaceae	<i>Gonostegia hirta</i> (Hassk.) Miq.	
	<i>Callicarpa brevipes</i> (Benth.) Hance	
	<i>Callicarpa formosana</i> Rolfe	
	<i>Callicarpa rubella</i> Lindl.	
	<i>Clerodendrum canescens</i> Wall. ex Walp.	
	<i>Clerodendrum cyrtophyllum</i> Turcz.	
	<i>Clerodendrum fortunatum</i> L.	
	<i>Lantana camara</i> L.	introduced
	<i>Vitex negundo</i> L.	
Violaceae	<i>Viola verecunda</i> A. Gray	
Vitaceae	<i>Ampelopsis cantoniensis</i> (Hook. & Arn.) Planch.	
	<i>Ampelopsis sinica</i> (Miq.) W.T. Wang var. <i>hancei</i> (Planch.) W.T. Wang	
	<i>Cayratia corniculata</i> (Benth.) Gagnep.	
	<i>Tetragymma hemsleyanum</i> Diels & Gilg	
	<i>Tetragymma planicaule</i> (Hook. f.) Gagnep.	
Monocotyledonae		
Amaryllidaceae	<i>Curculigo orchioides</i> Gaertn.	
Araceae	<i>Acorus gramineus</i> Sol.	
	<i>Alocasia macrorrhiza</i> (L.) Schott	
	<i>Pothos chinensis</i> (Raf.) Merr.	
Areaceae	<i>Rhapis excelsa</i> (Thunb.) A. Henry ex Rehder	
Commelinaceae	<i>Cyanotis vaga</i> (Lour.) Roem. & Schult.	
Commelinaceae	<i>Floscopa scandens</i> Lour.	
Cyperaceae	<i>Murdannia nudiflora</i> (L.) Brenan	
	<i>Carex cruciata</i> Wahlenb.	
	<i>Carex nemostachys</i> Steud.	
	<i>Carex truncatigluma</i> C.B. Clarke	
	<i>Cyperus cyperoides</i> (L.) Kuntze	
	<i>Fimbristylis thomsonii</i> Boeck.	
	<i>Gahnia tristis</i> Nees	
	<i>Hypolytrum nemorum</i> (Vahl) Spreng.	
	<i>Lepidosperma chinensis</i> Nees & Meyen	
	<i>Scirpus ternatanus</i> Reinw. ex Miq.	
		<i>Dioscorea cirrhosa</i> Lour.
Dioscoreaceae	<i>Dioscorea hispida</i> Dennst.	
Liliaceae	<i>Asparagus cochinchinensis</i> (Lour.) Merr.	
	<i>Dianella ensifolia</i> (L.) DC.	
	<i>Lilium brownii</i> F.E. Brown ex Miellez	
	<i>Liriope spicata</i> (Thunb.) Lour.	
	<i>Smilax china</i> L.	
	<i>Smilax corbularia</i> Kunth	
	<i>Smilax lanceifolia</i> Roxb.	
	<i>Tricyrtis macropoda</i> Miq.	
	<i>Veratum schindleri</i> Loes.	
Musaceae	<i>Musa balbisiana</i> Colla	
Orchidaceae	(see Table 2)	
Pandanaceae	<i>Pandanus austrosinensis</i> T. L. Wu	
Poaceae	<i>Imperata koenigii</i> (Retz.) P. Beauv.	
	<i>Ischaemum indicum</i> (Houtt.) Merr.	
	<i>Ischaemum</i> sp.	
	<i>Microstegium ciliatum</i> (Trin.) A. Camus	
	<i>Miscanthus floridulus</i> (Labill.) Warb. ex K. Schum et Lauterb.	
	<i>Miscanthus sinensis</i> Andersson	
	<i>Paspalum conjugatum</i> Bergius	
	<i>Paspalum orbiculare</i> Forst.	
	<i>Setaria palmifolia</i> (J. Koenig) Stapf	
	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	
Zingiberaceae	<i>Alpinia hainanensis</i> K. Schum.	

Seventeen species of orchids were found at Wutongshan (Table 2). All species have been recorded in Hong Kong. Three species (*Eulophia zollingeri*, *Hetaeria cristata* and *Spiranthes hongkongensis*) are new records for Shenzhen. Apart from the restricted *Spiranthes hongkongensis*, all are widespread in South and Southwest China.

Table 2. Orchids recorded in Wutongshan National Forest Park on 16 and 17 May 2001. (Scale of abundance: “+” = 1 individual/clump, “++” = 2-5, “+++” = 6-10, “++++” = 11-15, “+++++” ≥ 16). All species are listed under CITES Appendix II.

Scientific name	Habitat	Remarks
<i>Ania</i> sp.	on forest floor beside stream	terrestrial
<i>Bulbophyllum kwangtungense</i> Schltr.	on mossy rocks	epiphytic
<i>Bulbophyllum odoratissimum</i> (Sm.) Lindl.	on mossy rocks	epiphytic
<i>Coelogyne</i> cf. <i>fimbriata</i> Lindl.	on mossy rocks	epiphytic
<i>Eria corneri</i> Rchb. f.	on base of tree trunk and mossy rock	epiphytic
<i>Eulophia zollingeri</i> (Rchb. f.) J.J. Sm.	on floor	saprophytic; new to Shenzhen
<i>Goodyera procera</i> (Ker Gawl.) Hook.	cracks and crevices of rock face with humus, beside and in stream	terrestrial
<i>Hetaeria cristata</i> Blume	on forest floor beside stream	terrestrial; new to Shenzhen
<i>Liparis bootanensis</i> Griff.	on mossy rocks beside stream	epiphytic
<i>Liparis nervosa</i> (Thunb.) Lindl.	on shrub and grass mixed slope beside road, and on forest floor beside stream	terrestrial
<i>Liparis stricklandiana</i> Rchb. f.	on mossy rocks beside stream	epiphytic
<i>Liparis viridiflora</i> (Blume) Lindl.	on mossy rocks beside stream	epiphytic
<i>Malaxis latifolia</i> Sm.	on forest floor beside stream	terrestrial
<i>Pholidota cantonensis</i> Rolfe	on mossy rocks	epiphytic
<i>Pholidota chinensis</i> Lindl.	on mossy rocks	epiphytic
<i>Spathoglottis pubescens</i> Lindl.	on open grass slope beside road	terrestrial
<i>Spiranthes hongkongensis</i> S.Y. Hu & Barretto	on grass lawn	terrestrial; new to Shenzhen; endemic to Hong Kong and Guangdong

The orchid species recorded in this survey have similar habitats to those in nearby Hong Kong. However species richness recorded was lower than that in comparable habitats and elevations in Hong Kong, such as Tai Mo Shan and Sunset Peak. *Pholidota cantonensis* is very rare in Hong Kong, and *Bulbophyllum kwangtungense* is rare (Siu, 2000), but the population size of these species was not low at Wutongshan and they are quite common in South China. *Spiranthes hongkongensis* is endemic to Hong Kong and Guangdong, and Wutongshan is only the second site in Guangdong where it has been recorded by our team.

The secondary woodland along the stream beside the Xiaowutongshan radio transmission stations appeared suitable habitat for *Paphiopedilum purpuratum*, but the species was not found. Fairy Lake Botanical Garden staff noted the species had occurred in that area but it had been depleted or even eliminated by over-collection. The species is over-exploited for ornamental purposes throughout South and Southwest China, and is nationally endangered (Wang *et al.*, in press).

National protection status of orchids is currently under review. All orchid species recorded are listed in CITES Appendix II.

Mammals

No firm mammal records were made during the survey. Prints of a small carnivore, probably a weasel or a small mongoose, were found near small pools close to the summit of Dawutongshan. According to brief interviews with the park wardens, Wutongshan has, as expected, a depauperate mammalian fauna very similar to neighbouring Hong Kong. Readers are referred to Goodyer (1992), Reels (1996) and Pei (2001) for the extant mammalian fauna of Hong Kong.

Birds

Sixty-seven bird species were recorded in Wutongshan area on 16 and 17 May (Table 3). Forty-seven species were recorded inside the Forest Park. The most frequently encountered species inside the Park were Grey-chinned Minivet *Pericrocotus solaris*, Red-whiskered Bulbul *Pycnonotus jocosus*, Light-vented Bulbul *Pycnonotus sinensis* and Red-billed Leiothrix *Leiothrix lutea*. Most frequent at the lowland areas outside the Forest Park were Little Egret *Egretta garzetta*, House Swift *Apus affinis*, Barn Swallow *Hirundo rustica*, Red-whiskered Bulbul *Pycnonotus jocosus*, Light-vented Bulbul *Pycnonotus sinensis* and Japanese White-eye *Zosterops japonicus*.

Table 3. Birds recorded in the Wutongshan area on 16 and 17 May 2001, with total number of individuals encountered. Sequence follows Clements (2000).

	Scientific name	English name
1	<i>Casmerodius albus</i>	Great Egret
2	<i>Egretta garzetta</i>	Little Egret
3	<i>Ardeola bacchus</i>	Chinese Pond Heron
4	<i>Bubulcus ibis</i>	Cattle Egret
5	<i>Aviceda leuphotes</i>	Black Baza
6	<i>Accipiter trivirgatus</i>	Crested Goshawk
7	<i>Accipiter virgatus</i>	Besra
8	<i>Phasianus colchicus</i>	Common Pheasant
9	<i>Rallina eurizonoides</i>	Slaty-legged Crake
10	<i>Streptopelia chinensis</i>	Spotted Dove
11	<i>Clamator coromandus</i>	Chestnut-winged Cuckoo
12	<i>Hierococcyx sparveroides</i>	Large Hawk Cuckoo
13	<i>Cuculus saturatus</i>	Oriental Cuckoo
14	<i>Cacomantis merulinus</i>	Plaintive Cuckoo
15	<i>Centropus sinensis</i>	Greater Coucal
16	<i>Centropus bengalensis</i>	Lesser Coucal
17	<i>Otus bakkamoena</i>	Collared Scops Owl
18	<i>Apus affinis</i>	House Swift
19	<i>Alcedo atthis</i>	Common Kingfisher
20	<i>Halcyon smyrnensis</i>	White-throated Kingfisher
21	<i>Halcyon pileata</i>	Black-capped Kingfisher
22	<i>Ceryle rudis</i>	Pied Kingfisher
23	<i>Megalaima virens</i>	Great Barbet
24	<i>Hirundo rustica</i>	Barn Swallow
25	<i>Motacilla alba</i>	White Wagtail
26	<i>Motacilla cinerea</i>	Grey Wagtail
27	<i>Anthus richardi</i>	Richard's Pipit
28	<i>Anthus sylvanus</i>	Upland Pipit
29	<i>Pericrocotus flammeus</i>	Scarlet Minivet
30	<i>Pericrocotus solaris</i>	Grey-chinned Minivet
31	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul
32	<i>Pycnonotus sinensis</i>	Light-vented Bulbul
33	<i>Pycnonotus aurigaster</i>	Sooty-headed Bulbul
34	<i>Hypsipetes castanonotus</i>	Chestnut Bulbul
35	<i>Hypsipetes mccllellandii</i>	Mountain Bulbul

	Scientific name	English name
36	<i>Prinia inornata</i>	Plain Prinia
37	<i>Prinia flaviventris</i>	Yellow-bellied Prinia
38	<i>Bradypterus seebohmi</i>	Russet Bush Warbler
39	<i>Orthotomus cuculatus</i>	Mountain Tailorbird
40	<i>Orthotomus sutorius</i>	Common Tailorbird
41	<i>Phylloscopus inornatus</i>	Yellow-browed Warbler
42	<i>Graminicola bengalensis</i>	Rufous-rumped Grassbird
43	<i>Cyornis hainanus</i>	Hainan Blue Flycatcher
44	<i>Copsychus saularis</i>	Oriental Magpie Robin
45	<i>Garrulax pectoralis</i>	Greater Necklaced Laughingthrush
46	<i>Garrulax chinensis</i>	Black-throated Laughingthrush
47	<i>Garrulax canorus</i>	Hwamei
48	<i>Leiothrix lutea</i>	Red-billed Leiothrix
49	<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta
50	<i>Yuhina castaniceps</i>	Striated Yuhina
51	<i>Paradoxornis webbianus</i>	Vinous-throated Parrotbill
52	<i>Parus major</i>	Great Tit
53	<i>Aethopyga christinae</i>	Fork-tailed Sunbird
54	<i>Dicaeum ignipectus</i>	Fire-breasted Flowerpecker
55	<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker
56	<i>Zosterops japonicus</i>	Japanese White-eye
57	<i>Lanius cristatus</i>	Brown Shrike
58	<i>Lanius schach</i>	Long-tailed Shrike
59	<i>Dicrurus macrocercus</i>	Black Drongo
60	<i>Urocissa erythrorhyncha</i>	Red-billed Blue Magpie
61	<i>Dendrocitta formosae</i>	Grey Treepie
62	<i>Pica pica</i>	Black-billed Magpie
63	<i>Corvus macrorhynchus</i>	Large-billed Crow
64	<i>Sturnus nigricollis</i>	Black-collared Starling
65	<i>Acridotheres cristatellus</i>	Crested Myna
66	<i>Passer montanus</i>	Eurasian Tree Sparrow
67	<i>Lonchura punctulata</i>	Scaly-breasted Munia

Among the species recorded, Rufous-rumped Grassbird *Graminicola bengalensis* is a Lower Risk (Near-threatened) species globally, and is currently considered of regional conservation concern in South China due to the low number of sites from which it has been recorded (Fellowes *et al.*, in press). Black Baza *Aviceda leuphotes*, Crested Goshawk *Accipiter trivirgatus*, Besra *Accipiter virgatus*, Greater Coucal *Centropus sinensis*, Lesser Coucal *Centropus bengalensis* and Collared Scops Owl *Otus bakkamoena* are Category II protected in China.

A female Common Pheasant *Phasianus colchicus* was seen near the summit of Dawutongshan on 17 May, with intact plumage suggesting a wild origin. This species is uncommon in suitable habitat in South China. All recent records in Hong Kong are presumed to be of escaped or released birds (Carey *et al.*, 2001).

Mountain Bulbul *Hypsipetes mcllellandii* and Mountain Tailorbird *Orthotomus cuculatus* were recorded in Hong Kong recently with uncertain origin. The Shenzhen forests are a possible source for recolonisation of these and other forest birds in Hong Kong.

Reptiles and Amphibians

Nine species of amphibian (one newt and eight anurans) and eight species of reptile (four lizards and four snakes) were found at Wutongshan (Table 4). Species of major conservation importance include *Paramesotriton hongkongensis* and *Opisthotropis andersoni*. These are of potential

global concern due to their restricted distribution (Fellowes *et al.*, in press), although both occur at a number of sites in Hong Kong. *Rana exilispinosa* is also of potential global concern due to its small global range, and over-harvesting for food in China (Fellowes *et al.*, in press). The occurrence of several forest stream species and *Achalinus rufescens* indicate that the forest and the hill streams of Wutongshan are quite intact ecologically. *Opisthotropis kuatunensis* has only recently been found in Guangdong and this constitutes the second Guangdong record. The occurrence of *Amolops ricketti* in Wutongshan is interesting because this species is apparently absent from adjacent Hong Kong where its niche is occupied by *Amolops hongkongensis*.

Table 4. Amphibians and reptiles recorded in Shenzhen Wutongshan National Forest Park on 16 and 17 May 2001. (Abundance: "+" = 1-2, "++" = 3-5, "+++" = 6-10). Sequence follows Zhao E.-M. & Adler (1993).

Species	Habitat
AMPHIBIA	
<i>Paramesotriton hongkongensis</i>	forest edge
<i>Leptolalax pelodytoides</i>	forest stream
<i>Bufo melanostictus</i>	grassland
	forest edge
	forest
	riparian forest
<i>Amolops ricketti</i>	forest stream
<i>Rana exilispinosa</i>	forest stream
<i>Rana guentheri</i>	forest stream
<i>Rana livida</i>	forest stream
<i>Polypedates megacephalus</i>	forest stream
	pond
<i>Microhyla pulchra</i>	grassland
REPTILIA	
<i>Gekko chinensis</i>	riparian forest
<i>Calotes versicolor</i>	garden
	forest edge
<i>Sphenomorphus incognitus</i>	forest stream
	riparian forest
<i>Tropidophorus sinicus</i>	forest edge
<i>Achalinus rufescens</i>	forest edge
<i>Cyclophiops major</i>	plantation edge
<i>Opisthotropis andersoni</i>	forest ditch
<i>Opisthotropis kuatunensis</i>	forest stream

Fish

Ten fish species were recorded from Wutongshan (Table 5), including three non-native species (i.e. *Tanichthys albonubes*, *Xiphophorus helleri*, and *Hyphessobrycon herbertaxelrodi*). Five species were recorded in Taishan Stream, Dawutongshan (320-475 m), and seven species including the exotics were recorded in the stream draining Xiaowutongshan. *Oreonectes platycephalus* was the most frequently encountered and generally the most abundant species in the surveyed streams.

Table 5. Fish recorded in Shenzhen Wutongshan National Forest Park on 16 and 17 May 2001 (Abundance: "+" = rare, "++" = average, "+++" = abundant). Sequence follows Nelson (1994).

Species
<i>Zacco platypus</i>
<i>Tanichthys albonubes</i>
<i>Oreonectes platycephalus</i>
<i>Liniparhomaloptera disparis disparis</i>
<i>Pseudogastromyzon myersi</i>
<i>Hyphessobrycon herbertaxelrodi</i>
<i>Pterocryptis</i> sp.
<i>Glyptothorax pallozonum</i>

<i>Xiphophorus helleri</i> (red form) <i>Rhinogobius duospilus</i>

The torrent loach *Pseudogastromyzon myersi* and torrent catfish *Glyptothorax pallozonum* are globally restricted to eastern Guangdong. The stream catfish *Pterocryptis* sp. awaits specialist identification. All other native species recorded are widespread and common in South China including Hong Kong.

Xiphophorus helleri and *Hyphessobrycon herbertaxelrodi* are exotic species from Central and South America respectively. *Tanichthys albonubes* is native to Guangdong but there has been no confirmed record of wild fish in the last couple of decades. The population encountered here is believed to derive from escaped stock from the nearby tropical fish farm.

Dragonflies

Seventeen dragonfly species were recorded (Table 6). The stream at Xiaowutongshan, with more gentle flow and smaller rocks, yielded more species than the cascade-boulder stream at Dawutongshan.

Table 6. Dragonflies recorded in Shenzhen Wutongshan National Forest Park on 16-17 May 2001. Sequence follows Schorr *et al.* (2001a, 2001b).

Species <i>Mnais mneme</i> <i>Neurobasis chinensis</i> <i>Rhinocypha perforata</i> <i>Philoganga vetusta</i> <i>Euphaea decorata</i> <i>Agriomorpha fusca</i> <i>Drepanosticta hongkongensis</i> <i>Sinosticta ogatai</i> <i>Coeliccia cyanomelas</i> <i>Copera marginipes</i> <i>Leptogomphus elegans</i> <i>Hydrobasileus croceus</i> <i>Orthetrum glaucum</i> <i>Orthetrum triangulare</i> <i>Tramea virginia</i> <i>Trithemis aurora</i> <i>Zygonyx iris</i>
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The most interesting findings were the records of *Drepanosticta hongkongensis* and *Sinosticta ogatai*. These two species of global conservation concern (Fellowes *et al.*, in press) were previously thought to be endemic to Hong Kong (Reels, 2001). *Mnais mneme*, *Philoganga vetusta*, *Agriomorpha fusca* and *Leptogomphus elegans* are globally restricted, and known from a limited number of sites in Hong Kong (Fellowes *et al.*, in press), but do not appear to be highly restricted within South China. *Zygonyx iris* is also of potential global concern, due to its narrow global range. All dragonfly and damselfly species found in this survey have been recorded in Hong Kong.

Butterflies

Twenty-seven butterfly species were recorded (Table 7). All are common in South China, with the exception of *Choaspes benjaminii* and *Dodona egeon*. *D. egeon* is considered of regional concern in South China (Fellowes *et al.*, in press), due to the low number of sites from which it is known, while *C. benjaminii* is also scarce regionally.

Table 7. Butterflies recorded in Shenzhen Wutongshan National Forest Park on 16-17 May 2001. Sequence of families follows Bascombe (1995).

Species
<i>Choaspes benjaminii</i>
<i>Hasora</i> sp.
<i>Iambrix salsala</i>
<i>Graphium sarpedon</i>
<i>Papilio helenus</i>
<i>Papilio paris</i>
<i>Papilio polytes</i>
<i>Troides</i> sp.
<i>Delias pasithoe</i>
<i>Eurema hecabe</i>
<i>Eurema laeta</i>
<i>Hebomoia glaucippe</i>
<i>Pieris canidia</i>
<i>Dodona egeon</i>
<i>Zemeros flegyas</i>
<i>Zizeeria maha</i>
<i>Argyreus hyperbius</i>
<i>Athyma nefte</i>
<i>Cyrestis thyodamas</i>
<i>Danaus genutia</i>
<i>Euploea midamus</i>
<i>Ideopsis similis</i>
<i>Mycalesis zonata</i>
<i>Neptis hylas</i>
<i>Parantica aglea</i>
<i>Parantica sita</i>
<i>Polygonia (Kaniska) canace</i>

Summary of flora and fauna

Although vegetation at Wutongshan is mainly recently regenerated secondary forest with relatively young trees, canopy cover is relatively high especially on the north-facing slopes above 400 m. The flora is quite diverse, but typical of degraded secondary vegetation of the region. A few globally Vulnerable and nationally protected plant species were found, with *Amentotaxus argotaenia* of particular concern, but most are common in South China.

The near-continuous forests and streams of Wutongshan support a diverse fauna. Some species are of global conservation concern, such as Rufous-rumped Grassbird *Graminicola bengalensis* and the dragonflies *Drepanosticta hongkongensis* and *Sinosticta ogatai*. Others with restricted global ranges include the fish *Glyptothorax pallozonum*, the snake *Opisthotropis andersoni*, the newt *Paramesotriton hongkongensis* and the frog *Rana exilispinosa*. While the overcast and showery conditions during the survey were sub-optimal for recording dragonflies and butterflies, a number of the species recorded are rare or restricted within the Pearl River Delta area, making the Wutongshan populations an important gene pool regionally.

The present survey has added to knowledge of the current regional distribution, and hence status, of various species. Certain species found only rarely in Hong Kong were present. Most are likely to have been breeding residents (at least some of the time) in Hong Kong prior to past deforestation (Mountain Bulbul, Mountain Tailorbird and Grey-cheeked Fulvetta) and hunting (Common Pheasant). *Amolops ricketti* might actually be at the edge of its natural range, as its niche is occupied in Hong Kong by the related *A. hongkongensis*. Certain species found at higher altitudes, such as the plants *Ainsliaea macroclinioides*, *Lithocarpus uvariifolius* and *Tricyrtis*

macropoda, have ranges centred further north, but their past occurrence in Hong Kong cannot be ruled out.

Several stream species once considered endemic to Hong Kong (*Paramesotriton hongkongensis*, *Opisthotropis andersoni*, *Drepanosticta hongkongensis* and *Sinosticta ogatai*) were found at Wutongshan, and some of these have been reported farther from Hong Kong. The present record of *O. kuatunensis* is only the second from Guangdong. More surveys are required in the remaining forests and streams of southern Guangdong to clarify faunal distributions.

Threats and problems

No signs of logging were found on this survey but the popularity of Wutongshan for visitors may lead to certain disturbance to its wildlife. During this very brief visit, for example, the team witnessed two visitors dig up the roots of the vine *Dioscorea cirrhosa* from the forest, and others were queuing to collect 'spring water' from a small seepage stream supporting the globally-restricted snake *Opisthotropis andersoni*. Hunting and over-collection of wildlife may still occur according to park wardens, especially for commercially valuable species such as freshwater turtles and *Paphiopedilum purpuratum* (Hong Kong Lady's-Slipper Orchid). Traffic appears to be a problem, as flattened corpses of herpetofauna such as newts *Paramesotriton hongkongensis* were frequently seen on roads.

Low-lying areas, especially, have a number of well-established exotic species of plants and fish, some of which may cause problems for native wildlife. The tropical fish farm, situated by the entrance to the National Forest Park, risks accidentally introducing more aggressive alien species into the stream system. Encroachment of invasive exotic plants such as *Mikania micrantha*, *Lantana camara* and *Thunbergia grandiflora* in low altitude tall shrublands and abandoned farmlands can severely limit succession on these fertile hillsides. One area where invasive plants have colonised is the orchards inside and close to the Forest Park, from 150 to 320 m. Native trees and shrubs have also been destroyed in these areas, and the pesticides used are potential pollutants in the adjoining streams.

The release of confiscated animals has been undertaken in Wutongshan in the past. Officials responsible for placement of confiscated wildlife must be cautious because this can cause introduction of disease to wild populations, conflicts with surviving wild populations, genetic contamination with non-native subspecies, and even local extinctions through competition and predation by non-native species, which are often misidentified.

Opportunities and recommendations

The managers of the Park are determined and quite effective in protecting the forest from large-scale human disturbance, as demonstrated by the well-maintained firebreak and the re-establishment of extensive secondary forest cover on the hillslopes. It is not clear, however, that biodiversity conservation, particularly of fauna, is a major management objective. The park wardens seemed to know little about the fauna in the Park, or the threats outlined above. Habitat conservation is a priority. It will be necessary to limit the extension of the orchards in the Park, and to monitor the impacts of such developments on the secondary woodlands and streams of the area.

A programme of capacity building for staff might begin with participation in a detailed (non-destructive) inventory and investigation into the fauna of Wutongshan, and the application of the results of research, monitoring and patrolling to management actions for biodiversity

conservation. Better patrols and enforcement will be needed to curtail the hunting and over-collection of turtles, orchids and other threatened fauna and flora. Road casualties for wildlife could be minimised by the construction of speedbumps along the paved road.

The mountain range interconnecting Wutongshan, Qiniangshan of Dapeng Peninsula, and Robin's Nest of Hong Kong, probably has the highest continuous natural forest cover in the Pearl River Delta region. It is recommended that an in-depth biodiversity survey be conducted in the whole area, to investigate the possibility of establishing the first sizeable forest nature reserve in the Delta. This could be most effectively carried out through collaboration between respective departments of the Shenzhen and Hong Kong Governments, with advice from various research institutes and universities in Guangdong and Hong Kong.

Vegetation at lower altitudes is to some extent degraded and fragmented, as it has only recently regenerated from abandoned farmland. Habitats could be further improved for lowland fauna if regeneration were facilitated by the removal of climbers, particularly *Mikania micrantha*, and replanting with native tree species. So long as climber distribution is not continuous, this removal could be achieved by manual means, avoiding the need for herbicide or biological control. Since the soil of these areas is in good condition, it could support tree species typical of mature lowland forest in the region, such as *Syzygium odoratum*, *Endospermum chinensis*, *Lithocarpus elizabethia*, *Aphananthe cuspidate*, *Machilus chinensis*, *Cryptocarya* spp., *Elaeocarpus dubius* and *Canarium album* (also see Chapter 4 and Appendix 4 of Chu (1998) for more species). Advice for nursing seedlings and reforestation can be obtained from KFBG and from South China Agricultural University, both of which are running native tree nursery projects aimed at reforestation in South China.

Fairy Lake Botanical Garden is a popular tourist spot for citizens of Shenzhen, and Wutongshan has a high potential for developing domestic ecotourism. An integrated environmental education programme should be developed for Wutongshan and Fairy Lake making use of their complementary features, reducing the visitor pressure on Fairy Lake. More educational displays, with information on Guangdong wildlife and their associated environment, may help to promote nature education in Shenzhen Special Economic Zone. Appropriate facilities, such as signposts, benches and rubbish bins, should be provided to meet the needs of the visitors. However, further encroachment of tourist facilities on natural habitats at Wutongshan should not be allowed without full environmental impact assessment for the Park and nearby areas, and appropriate mitigation to ensure biodiversity value is upheld and improved. IUCN guidelines on various subjects, including ecotourism, reintroduction and the control of alien invasive species, give valuable guidance which should be followed as far as possible.

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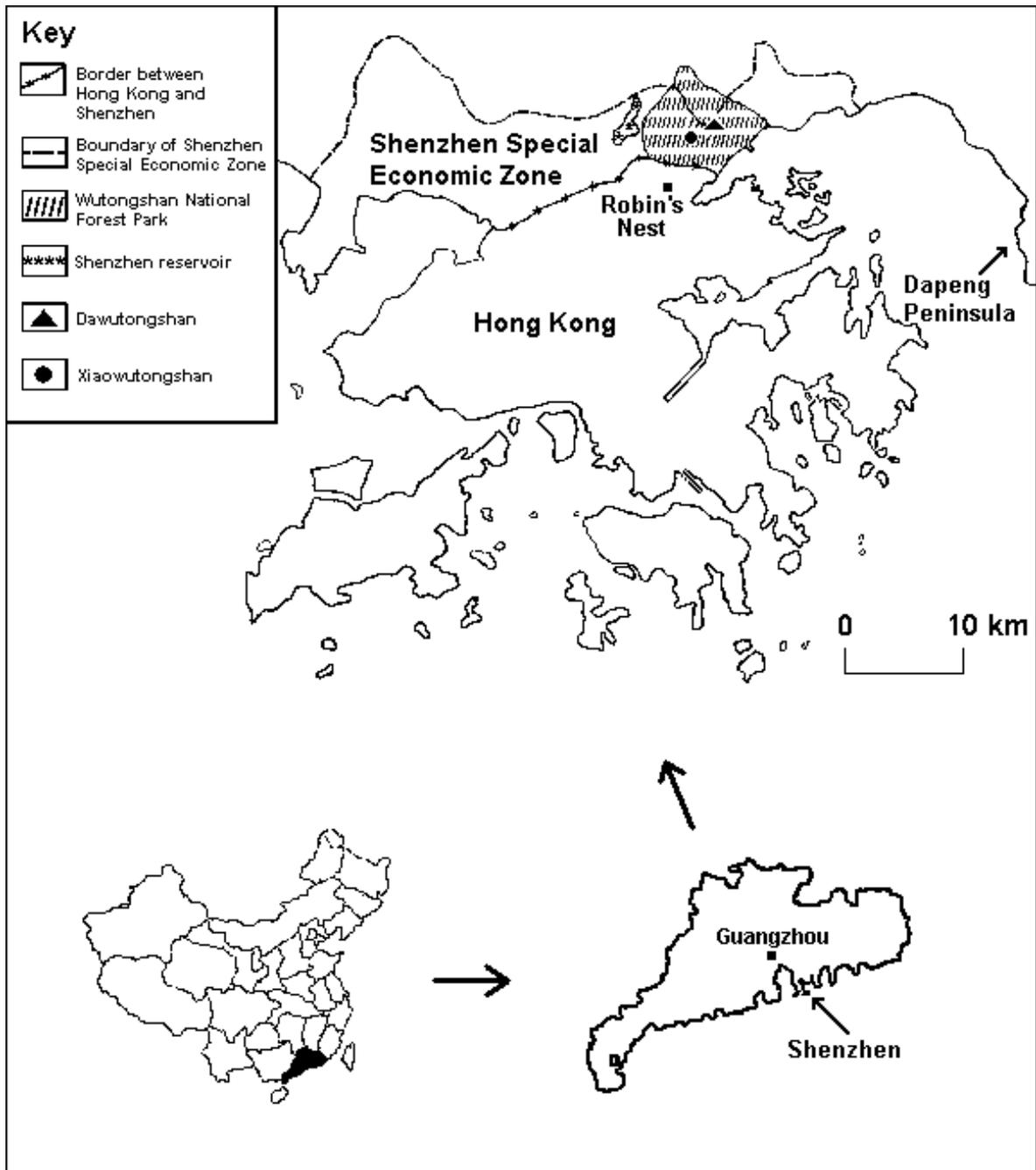


Figure 1. Map showing location of Wutongshan National Forest Park, Shenzhen Special Economic Zone, China.