



**Report of Rapid Biodiversity Assessments at
Qixingkeng Nature Reserve, Southwest
Guangdong, 29 April to 1 May and
24 November to 1 December, 1998**

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

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Report of Rapid Biodiversity Assessments at Qixingkeng Nature Reserve, Southwest Guangdong, 29 April to 1 May and 24 November to 1 December, 1998

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Background

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

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Common geographical descriptions and their Chinese phonetics

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

Report of Rapid Biodiversity Assessments at Qixingkeng Nature Reserve, Southwest Guangdong, 29 April to 1 May and 24 November to 1 December, 1998

Objective

The hills and streams at Qixingkeng, Enping City, form the catchment for the Jinjiang Reservoir, and consequently the vegetation has not been cleared in recent years. In 1997 it was suggested by Enping Forestry Bureau officials that the site should be elevated from a city-level reserve to a provincial nature reserve. The present survey was undertaken to provide a brief assessment of the site's ecological value, and to provide data to support heightened protection for the reserve.

Methods

On 28 April a survey team from Kadoorie Farm and Botanic Garden (LC, BH, JRF, ML, GTR and LKS), South China Institute of Botany (CBH and WRJ), South China Agricultural University (XMY), South China Normal University (LZC), and Xinyang Teachers' College (LHJ) travelled from Guangzhou to Enping City in Southwest Guangdong, and met officials from the Enping City Forestry Bureau. On 29 April the team travelled from Enping City to Jinjiang Reservoir at Qingwan Zonghechang near Jinshan Hot Springs, from where they were taken by boat to the pier at Shangchong. The team stayed two nights in this village, returning to Jinshan on the evening of 1 May.

To supplement this brief survey, a smaller team (CBH, LKS, WRJ and DYF) returned to Qixingkeng from 24 November to 1 December 1998. They concentrated on the flora and bird fauna in the area further upstream, between Shiditang and Lajikeng, from 25 to 29 November.

During fieldwork visual searching for plants, mammals, birds, reptiles, amphibians, fish, ants, butterflies and dragonflies was conducted. Calls of birds and amphibians were also used in diagnosis. Estimates of the status of large and medium-sized mammals (excluding Erinaceidae, Talpidae, Soricidae, Muridae and Chiroptera) at Qixingkeng were largely based on interviews with three local people, with reference to colour pictures. For these purposes, a list of South China mammals was compiled from various sources including Guangdong Forestry Department & South China Institute of Endangered Animals (1987), Corbet & Hill (1992) and Zhang (1997).

Plant records in the surveys were made or verified by CBH, XMY or WRJ, and edited by NSC, except in the case of orchids, which were verified by GS or LC. Records of birds were made or verified by LKS, 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 rove beetles by GDR, formerly of Hong Kong.

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

- Flora, excluding Orchidaceae (Pteridophyta, Gymnospermae and Angiospermae): Anon. (1959-2000); Anon. (1996-2000); Anon. (2001); The Plant Names Project (2001);
- Orchids (Angiospermae: Orchidaceae): Chen (1999); Tsi (1999); Lang (1999); De Vogel & Turner (1992);
- Mammals (Mammalia): Wilson & Reeder (1993); Wilson & Cole (2000);
- Birds (Aves): Inskipp *et al.* (1996);

- Reptiles & Amphibians (Reptilia and Amphibia): Zhao E. *et al.* (2000), supplemented with Fei (1999);
- Fish (Actinopterygii): Nelson (1994); Wu *et al.* (1999);
- Ants (Insecta: Hymenoptera: Formicidae): named species according to Bolton (1995); unnamed species with reference numbers according to the collection currently held by KFBG;
- Dragonflies (Insecta: Odonata): Schorr *et al.* (2001a, 2001b);
- Butterflies (Insecta: Lepidoptera): Bascombe (1995);
- Rove Beetles (Insecta: Coleoptera: Staphylinidae): G. de Rougemont (unpublished).

Information on the global status of species is from IUCN publications, notably Hilton-Taylor (2000) and IUCN Species Survival Commission (2001). National conservation status of orchids is based on Wang *et al.* (in press). National protection status in China is based on Hua & Yan (1993) for animals and State Forestry Administration & Ministry of Agriculture (1999) for plants. Provincial protection status is based on Guangdong Provincial Environmental Protection Bureau & South China Institute of Botany (1988). Certain taxa, including orchids, reptiles, amphibians, fish and invertebrates, have yet to be properly assessed for global status.

Location and management

Qixingkeng City-level Nature Reserve is located at 112°02'E and 22°15'N, in the mountainous area of western Enping city, Southwest Guangdong. The reserve is over 690 ha in size, with a core area of 140 ha, a buffer area of over 150 ha and an experimental area of over 400 ha. The altitude ranges from 100 m at the reservoir to 856 m at the northwest extreme of the core area. Qixingkeng has a seasonal climate typical of the southern subtropics, with an annual precipitation of 2,660 mm and an annual average temperature of 21.5°C. The bedrock of the forest is granite and the soil type is mainly lateritic. The reserve is managed by the Enping City Forestry Bureau.

Results

Vegetation

The zonal vegetation of Qixingkeng Nature Reserve is southern subtropical monsoon evergreen broadleaf forest. However the original forest cover was lost some years ago, and the existing secondary forest was generally less than 15 m in height. Major vegetation types at Qixingkeng were as follows:

- (1) Southern subtropical monsoon evergreen broadleaf forest, found on low altitude (100-400 m) hillsides. Major dominant species included *Machilus thunbergii*, *Macaranga adenantha*, *Sapium discolor*, *Ficus variegata* var. *chlorocarpa*, *Girardinia subaequalis*, *Saurauia tristyla*, *Sterculia lanceolata* and *Schefflera octophylla*.
- (2) Southern subtropical montane evergreen broadleaf forest, distributed at intermediate altitude. Dominant species included *Syzygium hancei*, *Machilus chinensis*, *Pterospermum heterophyllum*, *Pithecellobium clypearia*, *Engelhardtia roxburghiana*, *Elaeocarpus japonicus*, *Helicia reticulata*, *Castanopsis fabri* and *Castanopsis fissa*.
- (3) Southern subtropical mixed coniferous and broadleaf forest, distributed at relatively high elevations in montane and sporadically logged regions. This vegetation type is usually formed after recent major disturbance or destruction of the original subtropical broadleaf forest. Dominant species were *Pinus massoniana*, *Schima superba*, *Liquidambar formosana* and *Castanopsis fissa*. This vegetation type encompasses a succession from *Pinus* to secondary broadleaf forest.

- (4) Hillside scrub-grassland, occurring mainly after a prolonged period of disturbance on upland open hillsides. Dominant species were *Rhodomyrtus tomentosa*, *Dicranopteris pedata*, *Baeckea frutescens*, *Blechnum orientale*, *Miscanthus sinensis* and *Thysanolaena maxima*.
- (5) Small patches of bamboo forest, distributed at 350-650 m on hillsides and near the mountain ridge. The dominant bamboo species was *Oligostachyum scabriflorum*. This species has a straight and smooth stem, with a thick and elastic wall, and thus has considerable economic value.

Flora

Table 1 lists the species of pteridophytes, gymnosperms and angiosperms found in the present surveys, with an assessment of abundance. These brief surveys detected 396 vascular plant taxa (species and varieties) in Qixingkeng, including 29 species of ferns in 21 families, three species of gymnosperms in three families, and 364 species of flowering plants in 97 families. Plants represented tropical and subtropical families, with the tropical more prevalent. Dominant families included Lauraceae, Theaceae, Euphorbiaceae, Moraceae, Papilionaceae, Rubiaceae, Myrsinaceae, Elaeocarpaceae and Verbenaceae. Most genera were pantropical and Asian tropical. The most prominent tree species in the forest were *Elaeocarpus japonicus*, *Machilus thunbergii*, *Castanopsis fabri*, *Syzygium hancei*, *Machilus chinensis*, *Schefflera octophylla*, *Engelhardtia roxburghiana*, *Sterculia lanceolata*, *Pinus massoniana*, *Castanopsis fissa* and *Schima superba*.

Table 1. Vascular plant species and varieties recorded at Qixingkeng. Including all species recorded on 30 April (Shangchong to Shiditang) and 25-29 November (Shiditang to Lajikeng) 1998. Species which are Nationally Protected (Class I or II) (State Forestry Administration & Ministry of Agriculture, 1999), globally Threatened or Lower Risk (Near-threatened) (IUCN Species Survival Commission, 2001) or endemic to the Guangdong area are indicated.

Family	Scientific name	Remarks
PTERIDOPHYTA		
Adiantaceae	<i>Adiantum flabellulatum</i> L.	
Aspleniaceae	<i>Asplenium prolongatum</i> Hook. <i>Neottopteris nidus</i> (L.) J. Sm.	epiphytic
Athyriaceae	<i>Allantodia virescens</i> (Kunze) Ching <i>Triblemma lancea</i> (Thunb.) Ching	
Blechnaceae	<i>Blechnum orientale</i> L. <i>Woodwardia japonica</i> (L.f.) Sm.	
Cyatheaceae	<i>Alsophila spinulosa</i> (Wall. ex Hook.) R.M.Tryon	Protected II
Davalliaceae	<i>Davallia formosana</i> Hayata	
Dicksoniaceae	<i>Cibotium barometz</i> (L.) J. Sm.	Protected II
Drynariaceae	<i>Pseudodrynaria coronans</i> (Wall. ex Mett.) Ching	
Equisetaceae	<i>Equisetum debile</i> Roxb.	
Gleicheniaceae	<i>Dicranopteris pedata</i> (Houtt.) Naikaike	
Lindsaeaceae	<i>Lindsaea heterophylla</i> Dryand. <i>Lindsaea orbiculata</i> (Lam.) Mett. ex Kuhn <i>Stenoloma chusanum</i> (L.) Ching	
Lycopodiaceae	<i>Palhinhaea cernua</i> (L.) Franco et Vasc.	
Lygodiaceae	<i>Lygodium japonicum</i> (Thunb.) Sw. <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>Microsorium fortunei</i> (T. Moore) Ching <i>Pyrrhosia lanceolata</i> (L.) Farw.	
Pteridaceae	<i>Pteris semipinnata</i> L.	
Selaginellaceae	<i>Selaginella moellendorffii</i> Hieron.	
Sinopteridaceae	<i>Onychium japonicum</i> (Thunb.) Kunze	
Thelypteridaceae	<i>Cyclosorus parasiticus</i> (L.) Farw. <i>Pronephrium aspera</i> (C. Presl) W. C. Shieh & J. L. Tsai	

Family	Scientific name	Remarks
	<i>Emilia sonchifolia</i> (L.) DC.	panropical weed panropical weed introduced from South America
	<i>Epaltes australis</i> Less.	
	<i>Erechtites valerianaefolia</i> (Wolf) DC.	
	<i>Gnaphalium affine</i> d'Urv.	
	<i>Grangea maderaspatana</i> (L.) Poir.	
	<i>Gynura japonica</i> (Thunb.) Juel	
	<i>Kalimeris indica</i> (L.) Sch. Bip.	
	<i>Senecio scandens</i> Buch.-Ham.	
	<i>Siegesbeckia orientalis</i> L.	
	<i>Tithonia diversifolia</i> (Hemsl.) A. Gray *	
	<i>Vernonia cinerea</i> (L.) Less.	panropical weed
	<i>Vernonia solanifolia</i> Benth.	
	<i>Wedelia chinensis</i> (Osbeck) Merr.	
Balanophoraceae	<i>Balanophora laxiflora</i> Hemsl.	
Balsaminaceae	<i>Impatiens chinensis</i> L.	
	<i>Impatiens chlorosepala</i> Hand.-Mazz.	
Begoniaceae	<i>Begonia palmata</i> D. Don	
Burseraceae	<i>Canarium album</i> (Lour.) Raeusch.	
Caesalpiniaceae	<i>Bauhinia championii</i> (Benth.) Benth.	
	<i>Caesalpinia minax</i> Hance	
Campanulaceae	<i>Lobelia chinensis</i> Lour.	
	<i>Pentaphragma spicatum</i> Merr.	
Capparaceae	<i>Capparis cantoniensis</i> Lour.	
Caprifoliaceae	<i>Lonicera confusa</i> (Sweet) DC.	
	<i>Viburnum fordiae</i> Hance	
	<i>Viburnum odoratissimum</i> Ker Gawl.	
	<i>Viburnum punctatum</i> Merr. & Chun var. <i>lepidotulum</i> (Merr. & Chun) P.S. Hsu	
Caryophyllaceae	<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult.	
	<i>Polycarpon prostratum</i> (Forssk.) Asch. & Schweinf. ex Asch.	
Celastraceae	<i>Euonymus kwangtungensis</i> C.Y. Cheng	endemic to Guangdong & Hong Kong
	<i>Euonymus laxiflorus</i> Champ. ex Benth.	
	<i>Euonymus</i> sp.	
Chenopodiaceae	<i>Chenopodium album</i> L.	introduced from Europe
Chloranthaceae	<i>Sarcandra glabra</i> (Thunb.) Nakai	
Clusiaceae	<i>Calophyllum membranaceum</i> Gardner & Champ.	
	<i>Cratoxylum cochinchinense</i> (Lour.) Blume	
	<i>Garcinia multiflora</i> Champ. ex Benth.	
	<i>Hypericum japonicum</i> Thunb. ex Murray	
Convolvulaceae	<i>Erycibe obtusifolia</i> Benth.	
	<i>Merremia umbellata</i> (L.) Hallier. f. subsp. <i>orientalis</i> Ooststr.	
Cucurbitaceae	<i>Thladiantha cordifolia</i> (Blume) Cogn.	
Daphniphyllaceae	<i>Daphniphyllum calycinum</i> Benth	
	<i>Daphniphyllum macropodum</i> Miq.	
Dilleniaceae	<i>Tetracera asiatica</i> (Lour.) Hoog.	
Ebenaceae	<i>Diospyros eriantha</i> Champ. ex Benth.	
	<i>Diospyros morrisiana</i> Hance ex. Walpers	
Elaeocarpaceae	<i>Elaeocarpus japonicus</i> Siebold & Zucc.	
	<i>Elaeocarpus chinensis</i> (Gardner & Champ.) Hook. f. ex Benth.	
	<i>Sloanea sinensis</i> (Hance) Hemsl.	
Ericaceae	<i>Craibiodendron kwangtungense</i> S. Y. Hu	
	<i>Rhododendron simsii</i> Planch.	
Escalloniaceae	<i>Itea chinensis</i> Hook. et Arn	
Euphorbiaceae	<i>Alchornea trewioides</i> (Benth.) Müll. Arg.	
	<i>Antidesma fordii</i> Hemsl.	
	<i>Aporosa dioica</i> (Roxb.) Müll. Arg.	

Family	Scientific name	Remarks
	<i>Breynia fruticosa</i> (L.) Hook. f.	
	<i>Bridelia tomentosa</i> Blume	
	<i>Croton dinghuensis</i> H. S. Kiu	endemic to Guangdong
	<i>Croton lachnocarpus</i> Benth.	
	<i>Croton tiglium</i> L.	
	<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt.	
	<i>Glochidion eriocarpum</i> Champ. ex Benth.	
	<i>Glochidion lanceolarium</i> (Roxb.) Voigt	
	<i>Glochidion zeylanicum</i> (Gaertn.) A. Juss.	
	<i>Macaranga adenantha</i> Gagnep.	
	<i>Mallotus apelta</i> (Lour.) Müll. Arg.	
	<i>Mallotus paniculatus</i> (Lam.) Müll. Arg.	
	<i>Microdesmis caseariifolia</i> Planch.	
	<i>Phyllanthus emblica</i> L.	
	<i>Phyllanthus reticulatus</i> Poir.	
	<i>Sapium discolor</i> (Champ. ex Benth.) Müll. Arg.	
Fagaceae	<i>Castanopsis fabri</i> Hance	
	<i>Castanopsis fissa</i> (Champ. ex Benth.) Rehder & E.H. Wilson	
	<i>Cyclobalanopsis hui</i> (Chun) Chun	
Flacourtiaceae	<i>Casearia balansae</i> Gagnep.	
	<i>Casearia glomerata</i> Roxb.	
Flacourtiaceae	<i>Casearia membranacea</i> Hance	
	<i>Flacourtia rukam</i> Zoll. & A. Mortizi	
Gesneriaceae	<i>Chirita sinensis</i> Lindl.	
	<i>Chirita swinglei</i> (Merr.) W.T. Wang	
	<i>Lysionotus pauciflorus</i> Maxim.	
	<i>Rhynchotechum formosanum</i> Hatus.	
Hamamelidaceae	<i>Liquidambar formosana</i> Hance	
	<i>Rhodoleia championii</i> Hook. f.	
Hernandiaceae	<i>Illigera parviflora</i> Dunn	
	<i>Illigera rhodantha</i> Hance	
Juglandaceae	<i>Engelhardtia roxburghiana</i> Wall.	
Lamiaceae	<i>Anisomeles indica</i> (L.) Kuntze	
	<i>Isodon serra</i> (Maxim.) Kudô	
	<i>Pogostemon auricularius</i> (L.) Hassk.	
Lardizabalaceae	<i>Stauntonia chinensis</i> DC.	
Lauraceae	<i>Lindera chunii</i> Merr.	
	<i>Lindera communis</i> Hemsl.	
	<i>Litsea cubeba</i> (Lour.) Pers.	
	<i>Litsea euosma</i> W.W. Sm.	
	<i>Litsea glutinosa</i> (Lour.) C. B. Rob.	
	<i>Machilus chinensis</i> (Champ. ex Benth.) Hemsl.	
	<i>Machilus ichangensis</i> Rehder & E.H. Wilson	
	<i>Machilus thunbergii</i> Siebold & Zucc.	
	<i>Neolitsea kwangsiensis</i> H. Liu	
	<i>Neolitsea phanerophlebia</i> Merr.	
Loganiaceae	<i>Gelsemium elegans</i> (Gardner et Champ.) Benth.	
Loranthaceae	<i>Helixanthera sampsonii</i> (Hance) Danser	
	<i>Taxillus chinensis</i> (DC.) Danser	
Malvaceae	<i>Abelmodchus moschatus</i> (L.) Medic.	
	<i>Sida acuta</i> Burm. f.	
	<i>Sida rhombifolia</i> L.	
	<i>Urena lobata</i> L.	
	<i>Urena procumbens</i> L.	
Melastomataceae	<i>Barthea barthei</i> (Hance ex Benth.) Krasser	
	<i>Blastus cochinchinensis</i> Lour.	
	<i>Medinilla septentrionalis</i> (W.W. Sm.) H.L. Li	
	<i>Melastoma candidum</i> D. Don	
	<i>Melastoma sanguineum</i> Sims	
Meliaceae	<i>Amoora tetrapetala</i> (Pierre) Pellegr.	
		pantropical weed
		pantropical weed
		pantropical weed

Family	Scientific name	Remarks
Menispermaceae	<i>Diploclisia glaucescens</i> (Blume) Diels <i>Pericampylus glaucus</i> (Lam.) Merr. <i>Stephania longa</i> Lour.	
Mimosaceae	<i>Acacia pennata</i> (L.) Willd. <i>Albizia corniculata</i> (Lour.) Druce <i>Cylindrokelupha turgida</i> (Merr.) T.L. Wu <i>Pithecellobium clypearia</i> (Jack) Benth. <i>Pithecellobium lucidium</i> Benth.	
Moraceae	<i>Artocarpus hypargyreus</i> Hance ex Benth. <i>Artocarpus tonkinensis</i> A. Chev. ex Gagnep. <i>Cudrania cochinchinensis</i> (Lour.) Kudo et Masam. <i>Ficus esquiroliana</i> H. Lév. <i>Ficus fistulosa</i> Reinw. ex Blume	Vulnerable (IUCN)
Moraceae	<i>Ficus formosana</i> Maxim. form. <i>shimadai</i> Hayata <i>Ficus hederacea</i> Roxb. <i>Ficus hirta</i> Vahl <i>Ficus hispida</i> L. f. <i>Ficus microcarpa</i> L. f. <i>Ficus pyriformis</i> Hook. et Arn. <i>Ficus tinctoria</i> subsp. <i>gibbosa</i> (Blume) Corner <i>Ficus variegata</i> Blume var. <i>chlorocarpa</i> (Benth.) King <i>Ficus virens</i> Ait. <i>Malaisia scandens</i> (Lour.) Planch.	
Myricaceae	<i>Myrica rubra</i> (Lour.) Sieb. et Zucc.	
Myrsinaceae	<i>Ardisia ensifolia</i> E. Walker <i>Ardisia quinquegona</i> Blume <i>Embelia laeta</i> (L.) Mez <i>Embelia ribes</i> Burm. f. <i>Embelia vestita</i> Roxb. <i>Maesa perlarius</i> (Lour.) Merr. <i>Myrsine seguinii</i> H. Lév	
Myrtaceae	<i>Baeckea frutescens</i> L. <i>Rhodomyrtus tomentosa</i> (Aiton) Hassk. <i>Syzygium hancei</i> Merr. et L. M. Perry	
Olacaceae	<i>Erythralum scandens</i> Blume	
Oleaceae	<i>Jasminum nervosum</i> Lour. <i>Jasminum pentaneurum</i> Hand.-Mazz. <i>Ligustrum sinense</i> Lour. <i>Olea tsoongii</i> (Merr.) P.S. Green	
Onagraceae	<i>Ludwigia hyssopifolia</i> (G. Don) Exell <i>Ludwigia octovalvis</i> (Jacq.) Raven	
Oxalidaceae	<i>Oxalis corymbosa</i> DC.	
Papilionaceae	<i>Abrus mollis</i> Hance <i>Bowringia callicarpa</i> Champ. ex Benth. <i>Dalbergia hancei</i> Benth. <i>Desmodium heterocarpon</i> (L.) DC. <i>Desmodium triflorum</i> (L.) DC. <i>Flemingia macrophylla</i> Kuntze ex Prain <i>Kummerowia striata</i> (Thunb.) Schindl. <i>Millettia dielsiana</i> Harms <i>Millettia pachyloba</i> Drake <i>Ormosia glaberrima</i> Y.C. Wu <i>Ormosia microphylla</i> Merr. et L. Chen <i>Phyllodium elegans</i> (Lour.) Desv. <i>Pueraria lobata</i> (Willd.) Ohwi <i>Pueraria lobata</i> (Willd.) Ohwi var. <i>montana</i> (Lour.) Maesen <i>Tadehagi triquetrum</i> (L.) H. Ohashi	
Piperaceae	<i>Piper austrosinense</i> Y.C. Tseng <i>Piper hancei</i> Maxim.	
Pittosporaceae	<i>Pittosporum glabratum</i> Lindl. <i>Pittosporum perryanum</i> Gowda	

Family	Scientific name	Remarks
Plantaginaceae	<i>Plantago major</i> L.	introduced
Polygalaceae	<i>Polygala latouchei</i> Franch. <i>Xanthophyllum hainanense</i> Hu	
Polygonaceae	<i>Polygonum chinense</i> L. <i>Polygonum hydropiper</i> L. <i>Polygonum lapathifolium</i> L. <i>Polygonum minus</i> Huds. <i>Polygonum perfoliatum</i> L. <i>Polygonum tenellum</i> Blume var. <i>micranthum</i> (Meisn.) C.Y. Wu	
Polygonaceae	<i>Rumex maritimus</i> L.	
Proteaceae	<i>Helicia longipetiolata</i> Merr. & Chun <i>Helicia reticulata</i> W. T. Wang	
Ranunculaceae	<i>Clematis chinensis</i> Osbeck	
Rhamnaceae	<i>Hovenia acerba</i> Lindl.	
Rhizophoraceae	<i>Carallia brachiata</i> (Lour.) Merr.	
Rosaceae	<i>Eriobotrya fragrans</i> Champ. ex Benth. <i>Laurocerasus phaeosticta</i> (Hance) C. K. Schneid. <i>Laurocerasus undulata</i> (Buch.-Ham. ex D. Don) Roem. <i>Photinia komarovii</i> (H. Lév. & Vaniot) L.T. Lu & C.L. Li <i>Photinia prunifolia</i> (Hook. & Arn.) Lindl. <i>Pygeum topengii</i> Merr. <i>Rhaphiolepis indica</i> (L.) Lindl. <i>Rosa laevigata</i> Michx. <i>Rubus alceaefolius</i> Poir. <i>Rubus leucanthus</i> Hance	
Rubiaceae	<i>Adina pilulifera</i> (Lam.) Franch. ex Drake <i>Alleizettella leucocarpa</i> (Champ. ex Benth.) Tirveng. <i>Canthium dicoccum</i> (Gaertn.) Teysmann et Binnedijk <i>Diplospora dubia</i> (Lindl.) Masam. <i>Hedyotis hedyotidea</i> (DC.) Merr. <i>Lasianthus wallichii</i> (Wight & Arn.) Wight <i>Metadina trichotoma</i> (Zoll. & Moritzi) Bakh. f. <i>Morinda umbellata</i> L. <i>Mussaenda pubescens</i> W. T. Aiton <i>Neanotis hirsuta</i> (L. f.) W.H. Lewis <i>Ophiorrhiza cantoniensis</i> Hance <i>Pavetta arenosa</i> Lour. <i>Pavetta hongkongensis</i> Brem. <i>Psychotria asiatica</i> L. <i>Uncaria rhynchophylloides</i> F.C. How <i>Wendlandia uvariifolia</i> Hance	
Rutaceae	<i>Acronychia pedunculata</i> (L.) Miq. <i>Citrus maxima</i> (Burm.) Merr. <i>Citrus reticulata</i> Blanco <i>Evodia leptota</i> (Spreng.) Merr. <i>Zanthoxylum avicennae</i> (Lam.) DC. <i>Zanthoxylum nitidum</i> (Roxb.) DC.	planted planted
Sabiaceae	<i>Sabia limoniacea</i> Wall. ex Hook. f. & Thomson var. <i>ardisioides</i> L. Chen	
Sapindaceae	<i>Dimocarpus longan</i> Lour. <i>Litchi chinensis</i> Sonn. <i>Mischocarpus pentapetalus</i> (Roxb.) Radlk.	planted planted
Sapotaceae	<i>Sarcosperma laurinum</i> (Benth.) Hook. f.	
Scrophulariaceae	<i>Lindernia anagallis</i> (Burm. f.) Pennell <i>Lindernia crustacea</i> (L.) F. -Muell. <i>Lindernia mollis</i> (Benth.) Wettst. <i>Scoparia dulcis</i> L.	weed from tropical America
Sterculiaceae	<i>Torenia concolor</i> Lindl. <i>Byttneria aspera</i> Colebr. ex Wall.	

Family	Scientific name	Remarks
	<i>Helicteres angustifolia</i> L.	
	<i>Pterospermum heterophyllum</i> Hance	
Sterculiaceae	<i>Sterculia lanceolata</i> Cav.	
Styracaceae	<i>Styrax faberi</i> Perkins	
	<i>Styrax suberifolius</i> Hook. et Arn.	
Theaceae	<i>Apterosperma oblata</i> H.T. Chang	Vulnerable (IUCN), endemic to SW Guangdong & E Guangxi
	<i>Camellia assamica</i> (Mast.) H.T. Chang	
	<i>Camellia caudata</i> Wall.	
	<i>Camellia oleifera</i> Abel	
	<i>Camellia semiserrata</i> C. W. Chi	
	<i>Eurya ciliata</i> Merr.	
	<i>Eurya groffii</i> Merr.	
	<i>Gordonia axillaris</i> (Roxb. ex Ker Gawl.) Dietr.	
	<i>Schima superba</i> Gardn. et Champ.	
Thymelaeaceae	<i>Wikstroemia indica</i> (L.) C. A. Mey.	
	<i>Wikstroemia nutans</i> Champ. ex Benth.	
Tiliaceae	<i>Microcos paniculata</i> L.	
	<i>Triumfetta cana</i> Blume	
	<i>Triumfetta rhomboidea</i> Jacq.	
Ulmaceae	<i>Gironniera subaequalis</i> Planch.	
Urticaceae	<i>Archiboehmeria atrata</i> (Gagnep.) C.J. Chen	
	<i>Boehmeria nivea</i> (L.) Gaudich.	
	<i>Pouzolzia zeylanica</i> (L.) Benn. et R. Br. ex Benn. <i>et al</i>	
Verbenaceae	<i>Callicarpa nudiflora</i> Hook. & Arn.	
	<i>Clerodendrum canescens</i> Wall. ex Walp.	
	<i>Clerodendrum chinense</i> (Osbeck) Mabb. var. <i>simplex</i> (Moldenke) S.L. Chen	
	<i>Clerodendrum fortunatum</i> L.	
	<i>Verbena officinalis</i> L.	
	<i>Vitex quinata</i> (Lour.) F. N. Williams	
Violaceae	<i>Viola diffusa</i> Ging.	
	<i>Viola inconspicua</i> Blume	
Vitaceae	<i>Cissus hexangularis</i> Thorel ex Planch.	
	<i>Tetrastigma planicaule</i> (Hook. f.) Gagnep.	
Monocotyledonae		
Araceae	<i>Acorus gramineus</i> Sol.	
	<i>Alocasia macrorrhiza</i> (L.) Schott	
	<i>Pothos repens</i> (Lour.) Druce	
Areaceae	<i>Calamus rhabdocladus</i> Burret	
	<i>Rhapis excelsa</i> (Thunb.) A. Henry ex Rehder	
Commelinaceae	<i>Amischartolype hispida</i> (Less. & A. Rich.) D.Y. Hong	
	<i>Commelina communis</i> L.	
	<i>Murdannia triquetra</i> (Wall. ex C.B. Clarke) A. Brückn.	
Cyperaceae	<i>Carex nemostachys</i> Steud.	
	<i>Carex scaposa</i> C.B. Clarke	
	<i>Cyperus cyperoides</i> (L.) Kuntze	
	<i>Gahnia tristis</i> Nees	
	<i>Kyllinga brevifolia</i> Rottb.	
	<i>Scleria levis</i> Retz.	
Dioscoreaceae	<i>Dioscorea cirrhosa</i> Lour.	
Lilaceae	<i>Dianella ensifolia</i> (L.) DC.	
Lilaceae	<i>Ophiopogon stenophyllus</i> (Merr.) L. Rodr.	
	<i>Paris polyphylla</i> Sm. var. <i>chinensis</i> (Franch.) H. Hara	
	<i>Smilax china</i> L.	
Musaceae	<i>Musa balbisiana</i> Colla	
Orchidaceae	<i>Ania</i> sp.	terrestrial
	<i>Anoectochilus roxburghii</i> (Wall.) Lindl.	Vulnerable in

Family	Scientific name	Remarks
	<i>Dendrobium</i> sp.	China; terrestrial
	<i>Diploprora championii</i> (Lindl.) Hook f.	epiphytic
	<i>Liparis viridiflora</i> (Blume) Lindl.	epiphytic
	<i>Pholidota chinensis</i> Lindl.	epiphytic
Pandanaceae	<i>Pandanus austrosinensis</i> T. L. Wu	
Poaceae	<i>Arundo donax</i> L.	
	<i>Coix lacryma-jobi</i> L.	
	<i>Cynodon dactylon</i> (L.) Pers.	pantropical weed, possibly of African origin
	<i>Cyrtococcum patens</i> (L.) A. Camus var. <i>latifolium</i> (Honda) Ohwi	
	<i>Eleusine indica</i> (L.) Gaertn.	
	<i>Imperata koenigii</i> (Retz.) P. Beauv.	
	<i>Ischaemum indicum</i> (Houtt.) Merr.	
	<i>Microstegium vagans</i> (Nees ex Steud.) A. Camus	
	<i>Miscanthus floridulus</i> (Labill.) Warb. ex K. Schum et Lauterb.	
	<i>Miscanthus sinensis</i> Andersson	
	<i>Neyraudia arundinacea</i> (L.) Henr.	
	<i>Oligostachyum scabriflorum</i> (McClure) Z.P. Wang & G.H. Ye	
	<i>Paspalum conjugatum</i> Bergius	
	<i>Paspalum orbiculare</i> Forst.	
	<i>Pogonatherum crinitum</i> (Thunb.) Kunth	
	<i>Sacciolepis indica</i> (L.) Chase	
	<i>Setaria palmifolia</i> (J. Koenig) Stapf	
	<i>Sporobolus indicus</i> (L.) R. Br. var. <i>major</i> (Büse) Baaijens	
	<i>Themeda villosa</i> (Poir.) A. Camus	
	<i>Thysanolaena maxima</i> (Roxb.) Kuntze	
Zingiberaceae	<i>Alpinia hainanensis</i> K. Schum.	
	<i>Costus tonkinensis</i> Gagnep.	
	<i>Curcuma aromatica</i> Salisb.	

Of the species recorded, *Apterosperma oblata* and *Artocarpus hypargyreus* are listed as globally Vulnerable by IUCN; *A. oblata* is endemic to southwest Guangdong and eastern Guangxi. The orchid *Anoectochilus roxburghii* is Vulnerable in China. *Alsophila spinulosa* and *Cibotium barometz* are nationally protected species (Class II). In addition, there were three taxa endemic to Guangdong: *Croton dinghuensis*, *Ilex asprella* var. *tapuensis*, and *Euonymus kwangtungensis*. *Ardisia ensifolia* and *Ormosia microphylla* are new distribution records for Guangdong; they have previously been recorded from Guangxi, Guizhou and Yunnan. National conservation status of orchids is currently under review, but all species recorded are listed under CITES Appendix II.

Mammals

No direct records of mammals were made during these surveys. Three local farmers were interviewed about the status of mammals at Qixingkeng; one of them, Mr. Kung, was interviewed separately. Table 2 lists species reported to occur locally, at present or in the past.

On 1 December a dead Chinese Pangolin *Manis pentadactyla* was seen in a kitchen near Jinshan Hot Springs. It may have been caught in the Qixingkeng area.

Table 2. The status of mammals (excluding Erinaceidae, Talpidae, Soricidae, Muridae and Chiroptera) at Qixingkeng, Guangdong based on interviewing three farmers. Species names and sequence follow Wilson & Cole (2000); synonyms and names commonly used by Chinese scientists are included in brackets. (+ = "rare", ++ = "common", +++ = "abundant")

Scientific name	English name	Farmer A+B	Mr. Kung	Probable status
<i>Cuon alpinus</i>	Dhole	-	+	insecure or extirpated

Scientific name	English name	Farmer A+B	Mr. Kung	Probable status
<i>Nyctereutes procyonoides</i>	Raccoon Dog	+	+	insecure
<i>Vulpes vulpes</i>	Red Fox	+	+	insecure
<i>Prionailurus bengalensis</i> (<i>Felis bengalensis</i>)	Leopard Cat	++	++	present
<i>Panthera pardus</i>	Leopard	-	+	very insecure or extirpated
<i>Panthera tigris</i>	Tiger	-	+	extirpated
<i>Lutra lutra</i>	Eurasian Otter	+	+	insecure
<i>Melogale moschata</i>	Chinese Ferret-badger	+++	+++	present
<i>Mustela kathiah</i>	Yellow-bellied Weasel	+++	+++	present
<i>Martes flavigula</i>	Yellow-throated Marten	+++	+++	present
<i>Paguma larvata</i>	Masked Palm Civet	+++	+++	present
<i>Paradoxurus hermaphroditus</i>	Asian Palm Civet	-	+++	uncertain
<i>Prionodon pardicolor</i>	Spotted Linsang	+	+	insecure
<i>Viverra zibetha</i>	Large Indian Civet	+	+	insecure
<i>Viverricula indica</i>	Small Indian Civet	++	++	present
<i>Sus scrofa</i>	Wild Boar	+++	+++	present
<i>Muntiacus muntjak</i>	Indian Muntjac	+++	++	present
<i>Muntiacus reevesi</i>	Chinese Muntjac	+++	-	uncertain
<i>Manis pentadactyla</i>	Chinese Pangolin	+	+	insecure
<i>Hystrix brachyura</i> (<i>H. hodgsoni</i>)	Malayan Porcupine	+++	+++	present
<i>Lepus sinensis</i>	Chinese Hare	+	+	insecure

The reports of Tiger *Panthera tigris* and Leopard *Panthera pardus* (both Class I protected species in China) at Qixingkeng must be considered doubtful. Dhole *Cuon alpinus*, too (a globally Vulnerable, Class II protected species), is now also probably extinct locally. Eurasian Otter *Lutra lutra* is globally Vulnerable and Class II protected in China; Malayan Porcupine *Hystrix brachyura* is also globally Vulnerable. Chinese Pangolin is Lower Risk (Near-threatened) globally, and Class II protected in China. Spotted Linsang *Prionodon pardicolor*, Large Indian Civet *Viverra zibetha* and Small Indian Civet *Viverricula indica* are Class II protected in China.

The Qixingkeng mammal fauna appears to include a number of species which are declining in South China, including several medium-sized carnivores and *Manis pentadactyla*. The site may be an important refuge for these species in highly-populated southern Guangdong.

Birds

A total of 69 bird species were recorded (Table 3). The most frequently encountered species were Red-whiskered Bulbul *Pycnonotus jocosus*, Rufous-capped Babbler *Stachyris ruficeps*, Yellow-bellied Prinia *Prinia flaviventris* (the April-May visit only), Japanese White-eye *Zosterops japonicus*, White-browed Laughingthrush *Garrulax sannio*, Chestnut Bulbul *Hemixos castanonotus*, Great Tit *Parus major* and Large Hawk Cuckoo *Hierococcyx sparveroides* (April-May only). None of the species were outside their recorded range.

Table 3. Birds recorded at Qixingkeng, 29 April to 1 May 1998 and 24 November to 1 December 1998. Sequence follows Clements (2000).

Scientific name	English name
<i>Tachybaptus ruficollis</i>	Little Grebe
<i>Bubulcus ibis</i>	Cattle Egret
<i>Butorides striatus</i>	Little Heron
<i>Aviceda leuphotes</i>	Black Baza
<i>Elanus caeruleus</i>	Black-shouldered Kite
<i>Milvus migrans</i>	Black Kite
<i>Spilornis cheela</i>	Crested Serpent Eagle
<i>Accipiter trivirgatus</i>	Crested Goshawk
<i>Accipiter virgatus</i>	Besra

Scientific name	English name
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Bambusicola thoracica</i>	Chinese Bamboo Partridge
<i>Turnix tanki</i>	Yellow-legged Buttonquail
<i>Amauornis akool</i>	Brown Crake
<i>Charadrius dubius</i>	Little Ringed Plover
<i>Scolopax rusticola</i>	Eurasian Woodcock
<i>Streptopelia orientalis</i>	Oriental Turtle Dove
<i>Macropygia unchall</i>	Bar-tailed Cuckoo Dove
<i>Chalcophaps indica</i>	Emerald Dove
<i>Hierococcyx sparverioides</i>	Large Hawk Cuckoo
<i>Eudynamis scolopacea</i>	Asian Koel
<i>Phaenicophaeus tristis</i>	Green-billed Malkoha
<i>Centropus sinensis</i>	Greater Coucal
<i>Centropus bengalensis</i>	Lesser Coucal
<i>Alcedo atthis</i>	Common Kingfisher
<i>Ceryle lugubris</i>	Crested Kingfisher
<i>Eurystomus orientalis</i>	Dollarbird
<i>Hirundo daurica</i>	Red-rumped Swallow
<i>Motacilla alba</i>	White Wagtail
<i>Motacilla flava</i>	Yellow Wagtail
<i>Anthus richardi</i>	Richard's Pipit
<i>Anthus hodgsoni</i>	Olive-backed Pipit
<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul
<i>Pycnonotus sinensis</i>	Light-vented Bulbul
<i>Hemixos castanonotus</i>	Chestnut Bulbul
<i>Hypsipetes leucocephalus</i>	Black Bulbul
<i>Monticola solitarius</i>	Blue Rock Thrush
<i>Turdus merula</i>	Eurasian Blackbird
<i>Turdus naumanni</i>	Dusky Thrush
<i>Prinia atrogularis</i>	Hill Prinia
<i>Prinia flaviventris</i>	Yellow-bellied Prinia
<i>Prinia inornata</i>	Plain Prinia
<i>Orthotomus cuculatus</i>	Mountain Tailorbird
<i>Orthotomus sutorius</i>	Common Tailorbird
<i>Phylloscopus proregulus</i>	Pallas's Leaf Warbler
<i>Phylloscopus inornatus</i>	Yellow-browed Warbler
<i>Cyornis hainanus</i>	Hainan Blue Flycatcher
<i>Saxicola torquata</i>	Common Stonechat
<i>Garrulax pectoralis</i>	Greater Necklaced Laughingthrush
<i>Garrulax chinensis</i>	Black-throated Laughingthrush
<i>Garrulax canorus</i>	Hwamei
<i>Garrulax sannio</i>	White-browed Laughingthrush
<i>Pomatorhinus ruficollis</i>	Streak-breasted Scimitar Babbler
<i>Pnoepyga pusilla</i>	Pygmy Wren Babbler
<i>Stachyris ruficeps</i>	Rufous-capped Babbler
<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta
<i>Parus major</i>	Great Tit
<i>Aethopyga christinae</i>	Fork-tailed Sunbird
<i>Dicaeum concolor</i>	Plain Flowerpecker
<i>Dicaeum ignipectus</i>	Fire-breasted Flowerpecker
<i>Zosterops japonicus</i>	Japanese White-eye
<i>Lanius schach</i>	Long-tailed Shrike
<i>Garrulus glandarius</i>	Eurasian Jay
<i>Dendrocitta formosae</i>	Grey Treepie
<i>Corvus macrorhynchus</i>	Large-billed Crow
<i>Sturnus sericeus</i>	Red-billed Starling
<i>Lonchura striata</i>	White-rumped Munia
<i>Emberiza fucata</i>	Chestnut-eared Bunting
<i>Emberiza pusilla</i>	Little Bunting
<i>Emberiza spodocephala</i>	Black-faced Bunting

The bird fauna appeared depauperate in forest specialists, with no recorded owls, barbets, woodpeckers, trogons, minivets or forktails. However, the presence of a variety of raptors and babblers indicated that the secondary forest habitat around Qixingkeng Nature Reserve was quite biodiverse.

Black Baza *Aviceda leuphotes*, Black-shouldered Kite *Elanus caeruleus*, Black Kite *Milvus migrans*, Crested Goshawk *Accipiter trivirgatus*, Crested Serpent Eagle *Spilornis cheela*, Peregrine Falcon *Falco peregrinus*, Barred Cuckoo Dove *Macropygia unchall*, Lesser Coucal *Centropus bengalensis* and Greater Coucal *Centropus chinensis* are Class II protected species in China.

Reptiles and Amphibians

A total of 18 species of amphibian (one caecilian, one newt and 16 anurans), three species of lizard and seven species of snake were recorded (Table 4). The most frequently found species in the paddy fields were Gunther's Frog *Rana guentheri*, Paddy Frog *Rana limnocharis* and Ornate Pygmy Frog *Microhyla ornata*. The commonest species found along streams was the skink *Sphenomorphus incognitus*.

Table 4. Amphibian and reptile species found at Qixingkeng, 29 April to 1 May 1998. Sequence follows Zhao E.-M. & Adler (1993).

Species	Habitat	
<i>Ichthyophis bannanicus</i>	stream	✓
<i>Paramesotriton hongkongensis</i>	stream	✓
<i>Bufo melanostictus</i>	village	✓
	stream	✓
<i>Amolops ricketti</i>	stream	✓
<i>Occidozyga lima</i>	paddy field	✓
<i>Occidozyga martensii</i>	marsh	✓
	pool	✓
	paddy field	✓
<i>Rana guentheri</i>	paddy field	✓
	stream	✓
<i>Rana limnocharis</i>	grassland	✓
	pool	✓
	paddy field	✓
	ag.field	✓
	stream	✓
<i>Rana livida</i>	stream	✓
<i>Rana taipehensis</i>	paddy field	✓
	ditch	✓
<i>Philautus odontotarsus</i>	pool	✓
	marsh	✓
	bamboo forest	✓
<i>Polypedates megacephalus</i>	pool	tadpoles
	paddy field	✓
<i>Kalophrynus interlineatus</i>	paddy field	✓
<i>Kaloula pulchra</i>	paddy field	✓
<i>Microhyla butleri</i>	paddy field	✓
<i>Microhyla heymonsi</i>	paddy field	tadpoles
	pool	tadpoles
	plantation	✓
<i>Microhyla ornata</i>	paddy field	✓
<i>Microhyla pulchra</i>	paddy field	✓
<i>Hemidactylus bowringi</i>	village	✓
<i>Calotes versicolor</i>	paddy field	✓
<i>Sphenomorphus incognitus</i>	stream	✓
<i>Ramphotyphlops braminus</i>	plantation	✓

Species	Habitat	
<i>Calamaria septentrionalis</i>	found dead in stream	✓
<i>Enhydryis plumbea</i>	paddy field	✓
<i>Lycodon subcinctus</i>	paddy field	✓
<i>Sinonatrix aequifasciata</i>	stream	✓
<i>Pareas margaritophorus</i>	village	✓
<i>Ptyas korros</i>	stream	✓

Two apparently new Guangdong records were made during this survey: the treefrog *Philautus odontotarsus* and the skink *Sphenomorphus incognitus*. These two species are fairly widespread in southern China (Zhao E.-M. & Adler, 1993). Two Chinese endemics with a restricted range within South China were also recorded: the caecilian *Ichthyophis bannanicus* and the newt *Paramesotriton hongkongensis*. The presence of these two amphibians in the main stream indicates that the stream and the riparian vegetation have never been seriously disturbed. In addition, an injured Greater Green Snake, *Cyclophiops major*, was found in a plantation near Qingwan.

Fish

At least 26 species of freshwater fish were recorded at Qixingkeng (Table 5). Some specimens await specialist verification. The most frequently encountered species were the cyprinid *Parazacco spilurus spilurus*, the loach *Misgurnus anguillicaudatus*, the paradisefish *Macropodus opercularis* and the snakehead *Channa asiatica*.

Table 5. Freshwater fish species recorded at Qixingkeng, 29 April to 1 May 1998. Sequence of genera follows Nelson (1994).

Species	Habitat
<i>Parazacco spilurus spilurus</i>	stream, reservoir
<i>Rasborinus lineatus</i>	stream
<i>Capoeta semifasciolata</i>	stream
<i>Osteochilus vittatus</i>	(not recorded)
<i>Hemibarbus medius</i>	stream
<i>Microphysogobio fukiensis</i>	upper stream
<i>Carassius auratus</i>	(not recorded)
<i>Micronemacheilus pulcher</i>	upper stream
<i>Cobitis sinensis</i>	lower stream
<i>Misgurnus anguillicaudatus</i>	stream
<i>Liniparhomaloptera disparis disparis</i>	stream
<i>Pelteobagrus fulvidraco</i>	(not recorded)
<i>Leiocassis adiposalis</i>	stream
<i>Leiocassis</i> sp.	(not recorded)
<i>Pterocryptis</i> sp.	stream
<i>Monopterus albus</i>	upper stream
<i>Mastacembelus armatus</i>	stream
<i>Coreoperca whiteheadi</i>	stream
<i>Odontobutis</i> sp.	stream, reservoir
<i>Micropercops compressocephalus</i>	stream
<i>Rhinogobius giurinus</i>	(not recorded)
<i>Rhinogobius</i> sp. 1	(not recorded)
<i>Rhinogobius</i> sp. 2	(not recorded)
<i>Macropodus opercularis</i>	lower stream
<i>Channa asiatica</i>	upper stream
<i>Channa maculata</i>	(not recorded)

Species richness was very high for a single watercourse. The fish community was very diverse and intact, with species occupying most available niches. The presence of many predatory species, such as *Monopterus albus*, *Coreoperca whiteheadi* and *Channa asiatica*, also indicated that the stream ecosystem at Qixingkeng was of very high ecological integrity. A number of unidentified

species were collected, for example *Leiocassis* sp., *Odontobutis* sp. and *Rhinogobius* spp., some of which may prove to be of scientific interests. The site is of the greatest conservation value for stream fish of Guangdong Province.

Ants

Twenty-three species of ants were recorded from Qixingkeng (Table 6). The most frequently recorded species were *Pheidole nodifera* (although some field records may have been misidentifications of the very similar *P. noda*), *Camponotus nicobarensis*, *Tapinoma* sp. 1, *Anoplolepis gracilipes*, *Paratrechina* sp. 4, *Polyrhachis dives* and *Pristomyrmex pungens*.

Table 6. Ant species encountered at Qixingkeng, 29 April to 1 May 1998 (each encounter separated by at least 20 metres).

Species	Habitat
<i>Anoplolepis gracilipes</i>	grassland, shrubland
<i>Camponotus nicobarensis</i>	riparian shrubland
<i>Camponotus</i> sp.	shrubland, farmland
<i>Camponotus rufoglaucus</i>	village
<i>Cardiocondyla</i> sp. 2	riparian grassland
<i>Creumatogaster</i> (cf. <i>laboriosa</i>) sp. 3	riparian shrubland
<i>Creumatogaster</i> (cf. <i>dohrni</i>) sp. 8	riparian shrubland
<i>Dorylus</i> sp. 1	riparian shrubland
<i>Gnamptogenys bicolor</i>	riparian shrubland
<i>Hypoponera</i> sp. 3	riparian grassland
<i>Monomorium chinense</i>	riparian grassland
<i>Odontoponera</i> (cf. <i>denticulata</i>) sp. 1	riparian shrubland
<i>Paratrechina</i> (cf. <i>bourbonica</i>) sp. 4	riparian grassland
<i>Pheidole megacephala</i>	building
<i>Pheidole nodifera</i>	shrubland, farmland
<i>Pheidole</i> sp. 11	village
<i>Polyrhachis dives</i>	grassland, shrubland
<i>Polyrhachis</i> (nr. <i>phalerata</i>) sp. 18	agricultural land
<i>Pristomyrmex pungens</i>	grassland, shrubland
<i>Tapinoma</i> sp. 1	riparian shrubland
<i>Technomyrmex albipes</i>	agricultural land
<i>Tetramorium bicarinatum</i>	riparian grassland
<i>Tetramorium pacificum</i>	agricultural land

Polyrhachis sp. 18 was previously known only from Chebaling in North Guangdong, but its taxonomic status is uncertain. None of the species found are known to be highly restricted or rare, or dependent on high integrity of forest habitat. However, the better-forested slopes were not surveyed in this trip due to the heavy rain. *Anoplolepis gracilipes* and *Pheidole megacephala* are invasive exotic species, while *Paratrechina* sp. 4 and *Technomyrmex albipes* are also possibly exotic.

Dragonflies

Thirty-eight species of dragonfly were encountered in the study area over the period 29 April to 1 May 1998 (Table 7). By far the most abundant species was the ubiquitous libellulid, *Pantala flavescens*. Besides this, those most frequently recorded included the stream damselflies *Neurobasis chinensis* and *Euphaea decorata*, the massive gomphid *Gomphidia krugeri* and the libellulids *Trithemis aurora* and *T. festiva*.

Table 7. Dragonflies recorded at Qixingkeng, 29 April to 1 May 1998. Sequence follows Schorr *et al.* (2001a, 2001b).

Species	Notes
<i>Mnais mneme</i>	riparian shrub/forest
<i>Neurobasis chinensis</i>	riparian shrub/forest

Species		Notes
<i>Rhinocypha perforata</i>	riparian shrub/forest	
<i>Agriocnemis pygmaea</i>	paddy	
<i>Cercion</i> sp.	paddy	pending identification
<i>Ceriagrion auranticum</i>	riparian shrub	
<i>Ischnura mildredae</i>	paddy	
<i>Pseudagrion pruinosum</i>	riparian shrub/forest	
<i>Pseudagrion spencei</i>	riparian shrub/forest	
<i>Euphaea decorata</i>	riparian shrub/forest	
<i>Lestes praemorsus</i>	paddy	
<i>Coeliccia cyanomelas</i>	riparian shrub/forest	
<i>Copera ciliata</i>	riparian shrub	
<i>Copera marginipes</i>	paddy, riparian shrub/forest	
<i>Protosticta beaumonti</i>	riparian shrub/forest	Guangdong & Hong Kong endemic
<i>Anax guttatus</i>	grassland, riparian shrub/forest	
<i>Tetracanthagyna waterhousei</i>	riparian shrub	
<i>Idionyx victor</i>	riparian shrub/forest	
<i>Macromia</i> sp. nov.	riparian shrub	Guangdong endemic
<i>Gomphidia krugeri</i>	riparian shrub/forest	
<i>Heliogomphus retroflexus</i>	riparian shrub/forest	
<i>Ictinogomphus pertinax</i>	riparian shrub	
<i>Nihonogomphus lieftincki</i>	riparian shrub	
<i>Sinictinogomphus clavatus</i>	grassland/paddy	
<i>Stylurus chunliuae</i>	riparian shrub/forest	
<i>Brachydiplax chalybea</i>	grassland/paddy	
<i>Brachythemis contaminata</i>	paddy	
<i>Crocothemis servilia</i>	paddy	
<i>Neurothemis fulvia</i>	grassland/paddy	
<i>Neurothemis tullia</i>	grassland/paddy	
<i>Orthetrum luzonicum</i>	grassland/paddy	
<i>Orthetrum pruinosum</i>	paddy, riparian shrub	
<i>Palpopleura sexmaculata</i>	grassland/paddy	
<i>Pantala flavescens</i>	ubiquitous	
<i>Rhyothemis variegata</i>	grassland/paddy	
<i>Trithemis aurora</i>	paddy, riparian shrub/forest	
<i>Trithemis festiva</i>	paddy, riparian shrub/forest	
<i>Zygonyx</i> sp.	riparian shrub/forest	not collected

Most species encountered during the survey are common and widespread in Guangdong, with the notable exception of an undescribed species of *Macromia* – the only new provincial record of this dragonfly survey. Also, an endemic Guangdong species, *Protosticta beaumonti*, was encountered, as were five gomphids and the massive aeshnid *Tetracanthagyna waterhousei*. The presence of this suite of riverine species indicates the high ecological integrity of the streams and the riparian vegetation.

Butterflies

Thirty-nine species of butterfly were recorded during the survey period (Table 8), of which the most frequently encountered were *Pieris canidia* (Common White), *Euploea midamus* (Blue-spotted Crow) and *Zizeeria maha* (Pale Grass Blue).

Table 8. Butterflies recorded at Qixingkeng, 29 April to 1 May 1998. Sequence of families follows Bascombe (1995).

Species	Habitat (altitude 100-200m)
<i>Papilio bianor</i>	riparian shrub/woodland
<i>Papilio helenus</i>	grassland, riparian shrub/ woodland
<i>Papilio memnon</i>	grassland, riparian shrub/ woodland
<i>Papilio paris</i>	riparian shrub/woodland
<i>Papilio polytes</i>	riparian shrub/woodland
<i>Papilio protenor</i>	grassland, riparian shrub/ woodland

Species	Habitat (altitude 100-200m)
<i>Papilio (Chilasa) clytia</i>	paddy
<i>Graphium sarpedon</i>	riparian shrub/woodland
<i>Cepora nerissa</i>	grassland, riparian shrub/ woodland
<i>Eurema hecabe</i>	riparian shrub/woodland
<i>Hebomoia glaucippe</i>	riparian shrub/woodland
<i>Ixias pyrene</i>	riparian shrub/woodland
<i>Pieris (Artogeia) canidia</i>	grassland/paddy
<i>Pieris (Artogeia) rapae</i>	village/paddy
<i>Prioneris thestylis</i>	riparian shrub/woodland
<i>Acytolepis puspa</i>	riparian shrub/woodland
<i>Heliophorus epicles</i>	riparian shrub/woodland
<i>Jamides bochus</i>	riparian shrub/woodland
<i>Udara albocaerulea</i>	riparian shrub/woodland
<i>Zemerus flegyas</i>	riparian shrub/woodland
<i>Zizeeria maha</i>	riparian shrub/woodland
<i>Acraea issoria</i>	riparian shrub/woodland
<i>Argyreus hyperbius</i>	riparian shrub/woodland
<i>Charaxes marmax</i>	riparian shrub/woodland
<i>Danaus genutia</i>	paddy
<i>Euploea midamus</i>	grassland, paddy, riparian shrub
<i>Euploea mulciber</i>	paddy
<i>Euthalia niepelti</i>	riparian shrub/woodland
<i>Faunis eumeus</i>	riparian shrub/woodland
<i>Lethe confusa</i>	riparian shrub/woodland
<i>Lethe (Neope) muirheadii</i>	village
<i>Lexias dirtea eleanor</i>	riparian shrub/woodland
<i>Melanitis leda</i>	riparian shrub/woodland
<i>Mycalesis mamerta</i>	riparian shrub/woodland
<i>Neptis hylas</i>	riparian shrub/woodland
<i>Polyura</i> sp.	riparian shrub/woodland
<i>Symbrenthia lilaea</i>	riparian shrub/woodland
<i>Vanessa indica</i>	grassland
<i>Ypthima baldus</i>	riparian shrub/woodland

No new provincial records were made, and a high proportion (87%) of the species found have also been recorded from Hong Kong. Considering the length of the survey period (three days), 39 species is an unexceptional total. Unsurprisingly, there is little in the list that would indicate undisturbed forest as the better forests in the reserve were not surveyed due to adverse weather conditions.

Rove Beetles

Four species of staphylinid beetle were recorded at Qixingkeng (Table 9). *Dianous* sp. is new to science, and this is the first record of the genus from Guangdong. *Paederus nigricornis* has not previously been recorded from China.

Table 9. Rove beetles (Staphylinidae) identified from Qixingkeng, 29 April to 1 May 1998.

Species	Habitat	Notes
<i>Dianous</i> sp. nov.	on/under riparian boulders in open shrubland	Genus new to Guangdong
<i>Paederus</i> prope <i>nigricornis</i> Bnh.	banks of large stream in shrubland	<i>P. nigricornis</i> is a Himalayan species, not known from China
<i>Paederus tamulus</i> Er.	wet agricultural fields	widespread in China & Asia
<i>Stenus melanarius annamita</i> Fv.	open shrubland	widespread in China & S. Asia

Summary of flora and fauna

The botanical surveys recorded 394 vascular plant species, a rather high figure compared with other rapid surveys in the region. This is partly due to the relatively intensive survey (over five days), but the area undoubtedly has a rich flora. The flora is typical of degraded or secondary vegetation of the region, and has relatively few protected or endangered flora with only two globally Vulnerable species, one nationally Vulnerable orchid species, two nationally protected species, and an additional three regionally restricted species. The surveys extended the known range of two species previously believed to have a more western distribution.

The surveys did not give a representative picture of the terrestrial fauna, since the faunal survey team was unable to reach the core forest area. The forest bird fauna, however, was rather impoverished. The reserve may support a number of mammal species that are now scarce in southern Guangdong, due to hunting and habitat loss. The stream habitats were better sampled, and revealed a community of considerable interest. The stream had a large number of fish species compared to most streams surveyed in South China. Some of them are pending identification and may turn out to be new records or even new species. Other noteworthy species included amphibians such as the rare caecilian *Ichthyophis bannanicus* and the newt *Paramesotriton hongkongensis*, and several riverine dragonflies, including an undescribed *Macromia*. The presence of these species indicates relatively little disturbance (physical or chemical) to the stream, making it of high regional importance.

Threats and problems

The forest at Qixingkeng Nature Reserve is secondary, and is likely to have lost many species due to past clearance. Some alien invasive species, including the ants *Anoplolepis gracilipes* and *Pheidole megacephala*, were present. The current level of habitat disturbance, however, seems relatively low.

Electro-fishing is a common practice in the lower section of the main stream, and may threaten the very diverse freshwater fish fauna if not controlled. However, the impact to date seems less severe than that on most other Guangdong streams, many of which are affected by hydroelectric plants or by chemical contamination.

Opportunities and recommendations

Enping City officials were keen to have the Nature Reserve upgraded to a provincial nature reserve, and to develop ecotourism at Qixingkeng, in conjunction with the Qingwan reservoir and Jinshan hot spring. Difficulties include the lack of appropriate infrastructure such as an access road, ferry piers, paths, restaurants and perhaps accommodation, as the site is quite far from Enping City.

The streams and waterfalls are of great conservation interest, as they appear to have suffered less severe disturbance than most such habitats in the region. Controlling electro-fishing in the main stream is recommended, to preserve the diverse fauna present. On no account should more destructive processes, such as chemical contamination or construction of hydroelectric plants, be allowed. Establishment of strict no-fishing zones at intervals along the stream would be expected to help with stream conservation, as well as allowing stocks to recover for low-level sustainable harvesting outside the protected area.

The vegetation on the hills is quite young secondary forest thus unlikely to harbour many forest-dependent species. The lower section of the main Qixingkeng stream is surrounded by grassland

and shrubland, growing on areas formerly used for agriculture. Recovery of the natural forest could be enhanced by planting native tree species in these more degraded areas; however, as in parts of Hong Kong, the forest is likely to regenerate naturally if not prevented by such activities as fuel-gathering, livestock grazing and hill fires.

An essential part of managing the Nature Reserve will be to ensure that the activities of the local community are not depleting the reserve's biodiversity, and that any future ecotourism activities are in harmony with the protected-area status. Objectives of biodiversity and habitat protection should be made clear to staff and residents, as well as to visiting researchers and tourists. Zoning of the reserve should give the best protection to the habitats of greatest conservation importance, and policing these areas to minimise human impacts. Biodiversity and ecological integrity should be monitored, using appropriate indicators. The results of this monitoring should feed back to improving management to reduce threats. The building of public awareness should be an additional objective of the reserve. The community should receive benefits from the nature reserve, to ensure they have an incentive to help protect biodiversity, as promoted in the Convention on Biological Diversity. Achieving these management objectives will require well-trained and motivated staff.

The possibility of establishing a larger reserve, encompassing nearby forests in neighbouring counties, should be explored. Several new records made in these surveys reveal gaps in knowledge of the biota, which contains species characteristic of southwest China. More detailed surveys at Qixingkeng and neighbouring forest areas would be expected to yield further information of biogeographic and conservation importance.

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Figure 1 Qixingkeng Nature Reserve, Southwest Guangdong