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PLANNING NETWORKS OF RESERVES IN LARGE ECOLOGICAL REGIONS:
THE CHINESE EXPERIENCE

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ABSTRACT

China has examples of all main vegetation types in the world with the sole exception of Mediterranean Schlerophyll forest. Based on the criteria of heat and moisture conditions, 29 major units of vegetation are tentatively recognized in China. Richness and diversity of plant and animal resources are stressed, especially the occurrence of a large number of relic endemic species which had disappeared in other parts of the world since the Quaternary. Up to 1981, 72 nature reserves (including 3 Biosphere Reserves) have been established, representing 0.17% of the total land area of China. Their number and area are insufficient for overall conservation purposes and are uneven in distribution. (See Table I and map 1)) Present status and future activities in planning and management of reserves are discussed.

KEYWORDS

Vegetation type, Biota, Nature Reserve

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ETABLISSEMENT DE RESEAUX DE RESERVES DANS LES GRANDES REGIONS ECOLOGIQUES:
L'EXPERIENCE CHINOISE

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RESUME

La Chine possède des échantillons de tous les principaux types de végétation se trouvant dans le monde à la seule exception de la forêt méditerranéenne à sclerophyte. En prenant comme critères de base les conditions de chaleur et de humidité, 29 unités de végétation importantes ont été provisoirement définies en Chine. La richesse et la diversité des ressources en plantes et en animaux sont soulignées, en particulier le maintien d'un grand nombre d'espèces endémiques relictuelles qui ont disparu dans d'autres parties du monde depuis le Quaternaire. A la date de l'année 1981, 72 réserves naturelles (dont 3 réserves de la biosphère) ont été établies, représentant seulement 0.17% de la surface totale des terres chinoises; leur nombre et leur superficie ne sont pas suffisantes pour assurer une conservation totale et leur répartition est inégale (voir tableau I et carte 1). Leur état actuel et les activités futures envisagées pour leur aménagement et leur gestion sont discutées.

MOTS-CLE

Type de végétation, biocénose, réserve naturelle.

The rapid growth of human population, the development of industry and agriculture production as well as communications and urbanization all have given and are still giving ever increasing impact on the biosphere. As a result, natural ecosystems like forests and grasslands kept intact with their virgin features are left less and less in number and extent all over the world and a large number of species which had evolved from millions of years extincted and some of them disappeared even before they were recognized by man. Therefore, natural conservation is not only the basis of rational and sustainable use of living natural resources for the subsistence and well-being of the present-day people, but also a vital task concerning future generations. Nowadays this viewpoint has been popularly advocated in China as in other countries.

VEGETATION TYPES AND PLANT AND ANIMAL RESOURCES OF CHINA

China is situated in the southeastern part of the Eurasian Continent with a total area of 9.6 million km². Its climate extends from cold-temperate, temperate, warm-temperate, subtropical to tropical zones, especially its territories under subtropical zone which runs from 23.5° to 34°N latitude are by far the largest in the world. In the east half of China, vegetation obviously shows latitudinal zonation, and boreal conifer forest, conifer and broadleaf mixed forest, deciduous broadleaf forest evergreen broadleaf forest, seasonal rain forest and rain forest occur successively from north to south; while in the west half longitudinal zonation of vegetation is clearly reflected by the successive appearance of forest, forest-steppe, steppe, desert-steppe and desert zones from east to west. China is a hilly and mountainous country with only about 10% of its total land area in plains. In its southwest frontier, there is the highest and largest Qinghai-Xizang plateau in the world, with an average altitude of 4000-5000 metres above sea level. The great height of this plateau hinders the cold air currents of Siberia and Mongolia from the north in winter, but intercepts the warm and moist monsoon of Indian Ocean from the south in summer; in consequence the climate of the south slope of the Himalaya Ranges is dry and cool in winter, but warm and wet in summer. Tropical rain forest occurs as far as 24-29° N latitude in China, which

is the northernmost limit of tropical rain forest in the world. To the east, China faces the Pacific Ocean which brings in abundant rainfall in summer and the rainfall of the east part of China is thus considerably higher than that of other places in the world of the same latitude. Vertical vegetation zonation in China is usually well-developed, rich and varied in species composition. For example, Changbai Mountain, 2740 meters in elevation at warm temperate zone, has 5 vertical zones from conifer broadleaf mixed forest, Boreal conifer forest, Birch Elfin wood, subalpine evergreen ericaceous shrub to alpine tundra. In another, Wolong Biosphere Reserve, at subtropical zone between 1155 and 6250 meters in altitude, there are 5 vertical vegetation zones, namely, Evergreen Broadleaf Forest, Conifer Broadleaf mixed forest, Boreal conifer forest, subalpine evergreen ericaceous shrub and alpine meadow.

In arid and semi-arid area of northwest China, there are various types of grasslands and deserts. The largest and most widespread Eurasian grassland extends from the lower reach of the Danube, Romania, Soviet Union, Mongolia, and reaches its southernmost limit in China at about 35°N latitude. In short, China has examples of all the main world vegetation types with the sole exception of Mediterranean sclerophyll forest (being no winter-rain climate. According to Udvardy's classification which is generally adopted as the basis of the network of

international MAB Biosphere Reserves, China's vegetation is divided into 12 biogeographical provinces, while the tentative classification system used by the Chinese on the criteria of moisture and heat conditions, has suggested 29 vegetation types. China is extremely rich in plant and animal resources. It is estimated that higher plants (including ferns) amount to over 25000 species, belonging to 302 families and 2974 genera, of which monotypic genus is 422, oligotypic genus (2-6 species) 713, a total of 1135 genera. There are more than 190 endemic genera, many of which are before the Tertiary relic plants which had long been extincted in other parts of the world. This is mainly ascribed to the fact that a large part of China had not been seriously demolished by terrestrial glaciers in the Quaternary and that the NNE to SSW direction of most Chinese mountain ranges provided many refuges for the plants. Among the gymnosperm there are "living fossils" like *Ginkgo biloba*,

Metasequoia glyptostroboides, Cathaya angyrophylla, Pseudolarix amabilis, Amenotaxus argetrenia, Pseudotaxus chienli, Glyptostrobus pensilis, Taiwenia 2 spp, etc. Among the angiosperm, there are Davidia involucreta, Eucommia ulmoides, Rhoiptera chilantha, Trochodendron aralioides, Tetracentron Sinense, Bretschneidera sinense, Cyclocarya paliurus and so on.

China has 414 species of mammals (11.2% of the total in the world) and 1166 species of birds (8% of the total in the world). In 1963, 26 species of wild animals were declared as 1st-class protection, namely. Ailuropoda melansleuca, Rhinopithecus spp., Panthera tigris, Alligator sinensis, Crossoptilon manchuricum, Gius japonensis, Pygathreix nemaeus, Cervus nippon, Equus przewalskii, Equus hemionus, Saiga tatarica, panthelops hodgsonii, Cervus albirostris, Budoras taxicolor, Bos gaurus, Nycticeilus conony, Elephas maximus, Halobates concolor, Capricornis sumatraensis, Hydropotes inermis, Macaca cyclopsis, Celvus eldi, Lipotes vexillifer, Bucerotidae, Megalobatrachus davidiana, Moschus spp.

ESTABLISHMENT OF BIOSPHERE RESERVES AND OTHER NATURAL PROTECTED AREAS

In 1956, the 3rd session of the First National People's Congress of China passed a resolution to establish nature reserves in order to protect living resources and maintain their sustainable utilization for future generations. Up to 1980, China has established 72 nature reserves with a total area of 1.7 million hectares (0.17% of land area of China, see table 1 and map. 1). They are representative samples of typical natural landscapes and their ecosystems in different geographical zones, natural landscapes and ecosystem which have been seriously damaged and in urgent need of recovery and rescue, the habitats of threatened and other important unique species of plants and animals, the centres of rich biota and gene pools, and other places of specific conservation, monitoring and research significance.

Different types of nature reserves are established to meet the needs of science, economy, education, culture and tourism. Conflicts of different objectives are considered and priority among them is identified. Taking Great Panda as an example,

its fodder is a kind of bamboo (*Sinoarundinacea* spp.) which comes into bloom once about 100 years, large stands flowering all at the same time. In order to make the reserve large enough, we have set up 3 reserves extending several hundred kilometers in 3 provinces with a narrow corridor to connect them. The northeast tiger is a large predatory mammal which moves through different altitude zones in different seasons. A core of 80,000 hectares with absolute protection and a surrounding buffer zone of 140,000 hectares have been established in Changbai Mountain reserve. In addition a field experiment station was set up by the Academia Sinica in 1979 and a weather station has been stationed at 2700 meters for over 20 years. A guard team of wardens has been organized. Tourist routes, camping grounds and regulations for their use are announced.

China does not have a very large area within the tropics, but tropical rain forest occurs as an outlier at the northernmost limit, with different features in physiomy, structure and species composition from those in Malaysia. China has only 5 genera and less than 20 species of Dipterocarpaceae (by contrast 25 genera and about 500 species in Malaysia). There are fewer epiphytes and climbing palms but a higher percentage of mesophyllous and microphyllous plants. Several nature reserves were established in tropical rain forests in Guangdong and Yunnan provinces. China's mangroves have 12 families, 15 genera and 24 species of plants, almost 85% of that of mangroves in Malaysia, but is less tall (average height 3-5 metres in contrast to 30 metres or higher in Malaysia). A reserve was newly set up in the north coast mangrove of Hainan Island.

Subtropical evergreen broadleaf forest is the most widely distributed in China, extending to almost 15 provinces. They are dominated by Fagaceae (mainly *Castanopsis* spp.), Lauraceae, Theaceae, Magnoliaceae and Hamamelidaceae and separated into 1 moister east subgroup and 1 dryer west subgroup. Quite a number of nature reserves were set up in this vegetation type, some of them on limestone hills. Dinghu mountain reserve is a subtropical seasonal rain forest about 400 years old, with a rich flora of higher plants amounting to 1700 species. An ecosystem experimental station was established by Academia Sinica there to carry on integrated research.

In addition, several natural reserves are located in wetlands such as Niaodao (water fowl Island) reserve in Qinghai province, and Ealong reserve in Heilongkong province.

In order to accelerate international communications and exchange of experiences, on the criteria of representativeness, diversity, original state and efficiency of conservation, Changbai, Wolong and Dinghu reserves were selected to join the network of international biosphere reserves. A joint research program on Great panda has been launched between China and WWF in Wolong reserve. Forest Law, Environmental protection Act and regulations for natural reserves have been recently promulgated. A draft list of 290 threatened plants has been prepared in 1981. All these marked a new developmental stage in natural conservation in China.

FUTURE ACTIVITIES

At present, total area of different types of natural reserves is only 1.7 million hectares, mere 0.17% of China's total land area, well below the average figure 4% of many countries. It is therefore suggested to expand the conservation area to at least 1% of the total land area before the 90's. The present 72 natural reserves are uneven in geographical distribution, large area of desert, steppe, and marine ecosystem has not been covered. Among Holdvady's 12 biogeographical provinces in China, only three of them have each 1 reserves and the remaining are to be included. In combination with our 29 vegetation types, a network of nature reserves must be carefully planned. Landscapes, ecosystems and living organisms of universal significance representing the evolution of earth and biological co-evolution would be valuable to be included into the World Heritage Convention.

Through several thousand years of productive practice, Chinese people have bred a large number of fine varieties of farm crops, timber trees, livestock, fowls and developed unique man-made ecosystems. It is of great significance to establish reserve of their representative examples for further development and improvement in harmony with the environment.

It is decided to hold a symposium on the planning and management of nature reserves in summer 1982 in Wuyishan Forest Reserve, Fujian province which will be sponsored by 15 scientific

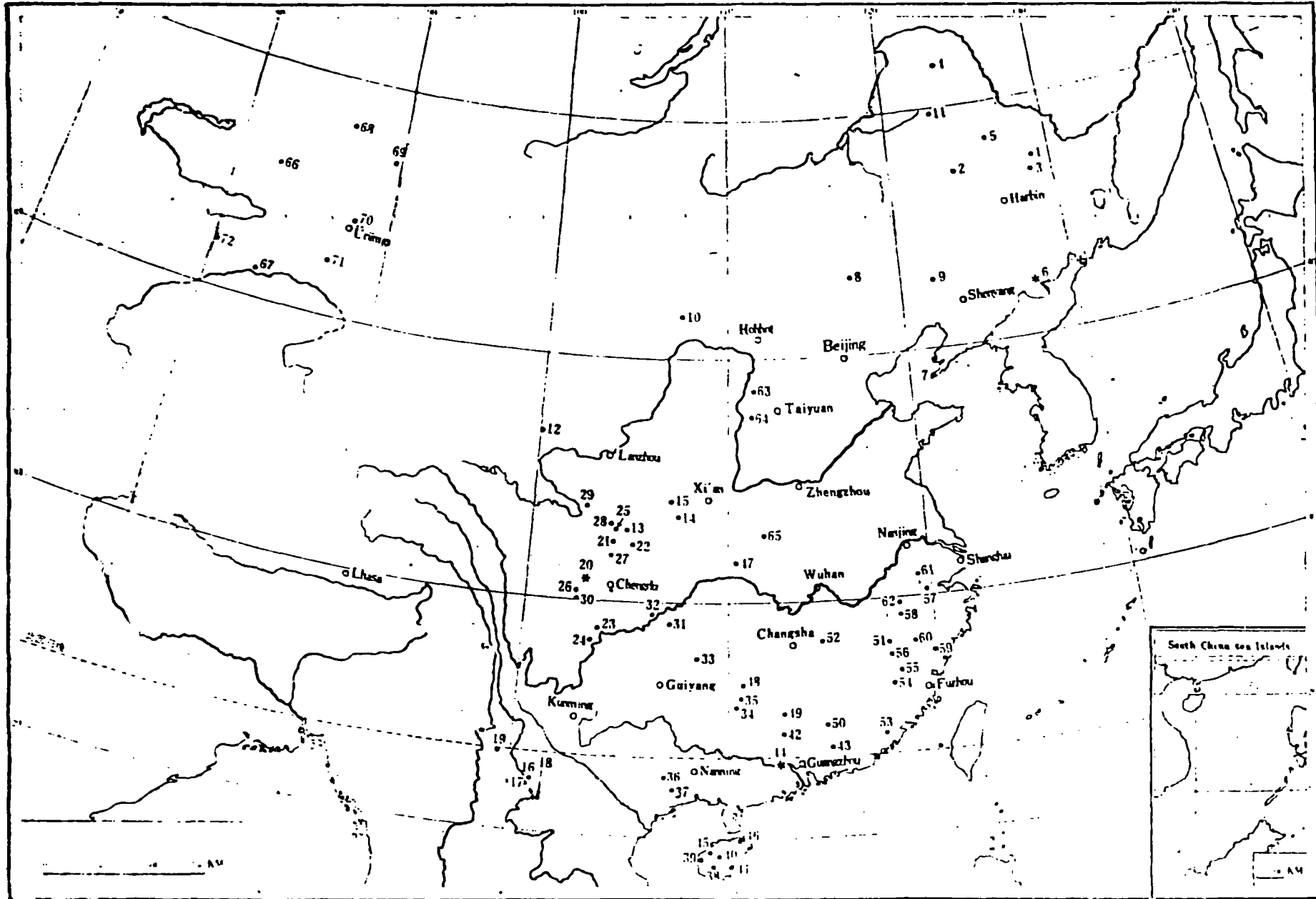
societies, including Chinese MAB National Committee. The main objective of the symposium is to exchange experience and viewpoint of people who have worked in different reserves all over the country and to review the results of scientific research of past several years.

Research in natural reserves must be mainly based on the integrated and multidisciplinary study of ecosystems, and in this respect the training of young scientists and the installation of adequate instruments and facilities are very important for us. For the past two years, scientists from many different countries have visited our reserves under the support of the International MAB Secretariat, who have brought us their experience and expertise. A training course on systems analysis was held in 1980 with the assistance of Unesco and the British National MAB Committee. We look forward to cooperating with other countries in the future with enthusiasm.

To do the work well in nature conservation, it is absolute necessary to have the support and collaboration from the great mass of the people. And to bring people of all social strata to realise the great significance of nature conservation, we must make full use of all kinds of publicity means (booklets, newspapers, films, television, broadcast and so on). We have much work to do in these fields and wish to learn the advanced experience of other countries.

MAP 1

BIOSPHERE RESERVES AND OTHER NATURE PROTECTED AREAS IN CHINA



• Biosphere Reserves

Table 1

Present Situation of Natural Reserves in China

No	Name	Province	Location	Area (ha)	Main protected object	Established
1	Fengling Reserve	Heilongjiang	48°01'-48°09'N	18400	Red pine deciduous broadleaf mixed forest	1963
2	Zalong Reserve	Heilongjiang	47°N	42000	Red crowned crane & other rare water fowls and wetland ecosystem	1976
3	Liangshui Reserve	Heilongjiang	47°3'N 129°E	6394	Red pine virgin forest	1980
4	Huzhong Reserve	Heilongjiang	52°5'N 123°40'E	196000	Temperate conifer forest and wild animals	1958
5	Wendang Reserve	Heilongjiang	48°45'N 126°10'E	70000	Volcano and its ecosystem	1980
6	Changbaishan Reserve	Jiling	41°42'-42°25'N 127°38'-128°18'E	215110	Natural environment and ecosystems northeast tiger, Panax schingsong	1960
7	Snake Island Reserve	Liaoning	38°58'N 121°E	about 100	Snakes and migratory birds	1963
8	Baiyinaobao Reserve	Inner Mongolia	43°16'N 47°29'E	6000	Picea asperata stand in fixed sandunes	1979
9	Dachinggan Reserve	Inner Mongolia	42°45'N 122°11'E	8465	Broadleaf relic forest	1980
10	Suolin	Inner Mongolia	41°26'N 106°56'E		Desert steppe	1980
11	Hama Reserve	Inner Mongolia	49°-50°N 123°20'-123°56'E	240000	Natural ecosystem	1958

12	Water Fowl Island Reserve Qinghai	Qinghai	36°59'N 99°51'E	7850	Water fowls	1975
13	Baishuijiang Reserve	Gansu	32°36'N 104°45'E	95292	Natural ecosystem and giant panda, golden haired Monkey, etc.	1978
14	Taibaishan Reserve	Shanxi	34°N 107°40'E	54158	Natural ecosystems	1965
15	Foping Reserve	Shanxi	33°50'N 107°48'E	335000	Giant panda and natural ecosystems	1978
16	Mangyang Reserve	Yunnan	23°6'-23°24'N 100°-101°E	32800	Tropical rain forest & seasonal rain forest, and elephant, Gaur, green peafowl, hornbill, etc.	1958
17	Mengluen Reserve	Yunnan	21°41'N 101°25'E	6267	Tropical seasonal rain forest and rain forest	1958
18	Mengla Reserve	Yunnan	21°25'N 101°52'E	6723	Tropical rain forest	1958
19	Nangunhe Reserve	Yunnan	23°10'N 99°12'E	6000	Tropical seasonal rain forest, elephant	1980
20	Wolong Reserve	Sichuan	31°51'N 102°50'E	200000	Natural ecosystem, giant panda and other rare animals	1975
21	Wanglang Reserve	Sichuan	32°25'N 104°20'E	27700	Giant panda, etc.	1963
22	Tangjiahe Reserve	Sichuan	32°38'N 105°10'E	40000	Natural ecosystem, giant panda and other rare animals	1978

23	Mabiandafengshi Reserve	Sichuan	28°45'N 103°38'E	30000	Natural ecosystem, giant panda and other rare animals	1978
24	Meigudafengshi Reserve	Sichuan	28°18'N 103°7'E	16000	Giant panda, etc.	1978
25	Jiuzhaigou N.	Sichuan	33°10'N 104°18'E	60000	Giant panda and natural landscape	1978
26	Fengtongzhai Reserve	Sichuan	30°22'N 102°48'E	40000	Natural ecosystem, giant panda and other rare animals	1975
27	Xiaozhaizigou Reserve	Sichuan	30°10'N 103°52'E	6700	Giant panda, etc.	1979
28	Baihe Reserve	Sichuan	33°10'N 104°15'E	20000	Golden-haired monkey, etc.	1963
29	Tiebu Reserve	Sichuan	33°35'N 102°53'E	23000	Sika deer, etc.	1965
30	Labuhe Reserve	Sichuan	30°10'N 102°47'E	12000	Takin, etc.	1963
31	Jinfoshan Reserve	Sichuan	29°10'N 107°7'E	900	Cathaya forest	1979
32	Jinyunshan Reserve	Sichuan	29°32'N 106°30'E	1400	Subtropical forest and natural landscape	1979
33	Fanjingshan Reserve	Guizhou	27°43'-28°N 108°37'-108°48'E	36700	Grey golden-haired monkey, etc.	1978
34	Huabing Reserve	Guangxi	25°40'-25°46'N 109°48'-109°53'E	13918	Cathaya and subtropical evergreen broadleaf forests	1961
35	Miaopershan Reserve	Guangxi	25°56'-26°N 110°20'-110°23'E	1559	Deciduous and evergreen broadleaf forests and wildlife	1976

36	Longgang Reserve	Guangxi	22°20'N 106°50'E	7997	Limestone evergreen monsoon forest and white-headed leaf monkey	1979
37	Longrui Reserve	Guangxi	22°17'N 107°10'E	2062	White-headed leaf monkey and natural ecosystem	1980
38	Jianfengling Reserve	Guangdong	18°10'N 108°52'E	1635	Mountain tropical rain forest and rare animals	1960
39	Datian Reserve	Guangdong	18°N 100°E	2533	Hainan thamin	1976
40	Bangxi Reserve	Guangdong	19°20'N 109°25'E	333	Hainan thamin	1976
41	Nanwan Reserve	Guangdong	18°35'N 110°E	933	Macaque	1976
42	Qingxidong Reserve	Guangdong	24°50'N 113°40'E	3133	South subtropical forest and water deer	1976
43	Xingang Reserve	Guangdong	23°43'N 114°40'E	933	Water deer	1976
44	Dinghushan Reserve	Guangdong	23°10'N 112°30'E	1140	South subtropical seasonal rain forest	1956
45	Bawangling Reserve	Guangdong	19°46'N 109°E	2000	Tropical dry evergreen forest and rare animals	1980
46	Dongzhaigang Reserve	Guangdong	19°58'N 110°22'E	2600	Mangrove	1980
47	Shennongjia Reserve	Hubei	31°27'N 110°20'E	2000	Different ecosystems and golden-haired monkey, Chinese dove trees	1979
48	Ziyunshan Reserve	Hainan	26°33'N 110°28'E	666	Evergreen broadleaf forest	1973

49	Mangshan Reserve	Hunan	25°50'N 113°55'E	637	Evergreen broadleaf forest	1958
50	Jioulanshan Reserve	Jiangxi	24°30'N 114°27'E	700	Subtropical evergreen broadleaf forest	1976
51	Qianshan Reserve	Jiangxi	27°50'N 117°45'E	1400	Subtropical evergreen broadleaf forest	
52	Guangshan Reserve	Jiangxi	28°40'N 114°35'E	800	Subtropical evergreen broadleaf forest	1976
53	Nanjingyuetu Reserve	Fujian	24°30'N 117°2'E	20	Subtropical rain forest	1963
54	Shenkou Reserve	Fujian	26°11'N 117°26'E	800	Castanopsis kawakami forest	1964
55	Wanmulin Reserve	Fujian	27°03'N 118°04'E	110	Subtropical evergreen broadleaf forest	1957
56	Wuyishan Reserve	Fujian	27°40'N 117°40'E	56666	Natural environment and ecosystems	1979
57	Xitinnushan Reserve	Zhejiang	30°10'-30°30'N 119°30'-119°40'E	2000	Ginkgo biloba and deciduous broadleaf forest	1975
58	Gutianshan Reserve	Zhejiang	29°10'N 118°25'E	722	Subtropical evergreen broadleaf forest	1975
59	Wuyunling Reserve	Zhejiang	27°30'N 119°50'E	466	Subtropical evergreen broadleaf forest	1975
60	Fongyangshan Reserve	Zhejiang	28°5'N 119°10'E	2866	Subtropical evergreen broadleaf forest	1975

61	Alligator Sanctuary	Anhui	30°6'-31°6'N 118°-119°6'E		Alligator	1977
62	Qingliangfeng Reserve	Anhui	29°53'N 118°27'E	2666	Rare trees and wild animals	1979
63	Luyashan Reserve	Shanxi	39°29'N 111°40'E	21200	Warm temperate conifer forest, birds	1979
64	Pangquangou Reserve	Shanxi	37°50'N 111°25'E	8000	Rare birds and warm temperate conifer forest	1979
65	Baotianmanmuhuding Reserve	Henan	33°6'N 111°41'E	6333	Warm temperate secondary forest	1980
66	Baerluke Reserve	Xinjiang	46°9'-46°22'N 82°49'E		Deciduous broadleaf forest mainly	1980
67	Sarya Reserve	Xinjiang	41°15'N 82°45'E		Populus euphratica riparian forest	1980
68	Aertai Reserve	Xinjiang	47°45'-48°30'N 86°30'-87°E	7000	Natural environment and ecosystems	1980
69	Buergenhe Reserve	Xinjiang	41°30'-41°50'N 89°30'-90°20'E		Rare animals	1980
70	Tianchi Reserve	Xinjiang	44°10'N 87°58'E	5000	Natural environment and ecosystems	1980
71	Bayinbuluke Reserve	Xinjiang	42°18'N 86°24'E	10000	Swan and other waterfowls habitats	1980
72	Tuomuerteng Reserve	Xinjiang	41°15'N 80°15'E		Alpine and nival ecosystem, wild animals	1980