

STUDIES ON PLANT DIVERSITY AND PRESENT SITUATION OF CONSERVATION IN SHENNONGJIA BIOSPHERE RESERVE, HUBEI, CHINA*

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Abstract In this paper, the forest ecosystem diversity, plant species diversity, plant genetic diversity and their present situation of conservation in Shennongjia Biosphere Reserve (Hubei, China) are analyzed. The results show:

1. The vegetation here is varied, and has obvious vertical distribution patterns. According to the present situation of vegetation and the distribution of communities, the vegetation is categorized into three vertical zones: mixed evergreen and deciduous broad-leaved forest zone (from 420 to 1 800 m), warm-temperate coniferous forest and deciduous broad-leaved forest zone (from 1 800 to 2 600 m) and cold-temperate evergreen coniferous forest zone (from 2 600 to 3 105.4 m).

2. The Reserve is very abundant in plant species diversity. It is currently discovered that there are 2 638 vascular plant species of 850 genera in 193 families (including ssp., var. and important cultivated plants, the same in following) among which 199 species of 63 genera in 30 families are ferns, 28 species of 17 genera in 6 families are gymnosperms, 2 411 species of 770 genera in 157 families are angiosperms, comprising 80.1%, 58.6%, 43.2% and 53.1%, 26.6%, 9.4% of the total families, genera, and species of Hubei and China respectively. It is quite evident that Shennongjia flora plays a very important role in Hubei flora and the flora of China.

3. There are 34 national protected plant species in Shennongjia which is 54.8% of

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Hubei's total protected plant species and 8.7% of China's total protected plant species. About 42 plant species endemic to Shennongjia, belonging to 34 genera of 22 families, are currently known. The wild economic plant resources are also abundant here. There are more than 150 species of wild fibre plants, 208 species of wild oil-bearing plants, over 190 species of wild starchy and carbohydrate plants, over 180 species of wild perfume plants, over 160 species of wild vegetables, 253 species of wild flowers and over 1 600 species of wild medicinal plants. The medicinal plant resources are especially famous for their plenty of varieties, large quantities of output, and lots of precious medicinal herbs.

4. Plant germplasm resources are very rich too. Up to now, 1 446 species of 679 genera in 161 families of plant germplasm resources have been collected. There are many wild types of modern cultivated plants, or wild close relative species of them.

5. From 1970 to 1982, here was an important lumbering area of Hubei, destroying the biological resources and seriously damaging ecological environment. As soon as the Reserve was established, the departments concerned carried on much successful protection work. Since then, the biological resources began to recover step by step. Since the core zone of the Reserve has been protected strictly, many plant populations have begun to recover. If the plants continue to recover in this way, the future prospect is very good.

Key words Shennongjia biosphere reserve, Plant diversity, Present situation of in-situ conservation

1 Introduction

Shennongjia Biosphere Reserve is a member of the World's Biosphere Reserve Network organized by Man and Biosphere (MAB), United Nations Educational, Scientific and Cultural Organization (UNESCO), located in the southwestern part of Shennongjia Forest District, Hubei Province, China, at latitude $31^{\circ}21' \sim 31^{\circ}37'N$ and longitude $110^{\circ}03' \sim 110^{\circ}34'E$. It is the only primeval forest area in central China, bounded by Fang County, Xinshan County and Badong County in Hubei and Wuxi County in Sichuan Province, covering an area of 70 467 hm^2 .

1.1 Geography and geology

Shennongjia is the watershed between the upper reaches of the Yangtze River and the upper reaches of the Han River and is situated between these two rivers. It is a transitional region from the Second Step to the Third Step in China; its geological structure belongs to the Dabashan Mountains fold belt, shaped under the Yanshan Movements. As a result of the lifting effect of the Himalayan Movements and the strong influence of denudation and erosion, the topography here is characterized by character of interlocking hills, rolling peaks and well developed valleys. Its highest peak, Shennong Peak, is 3 105.4 m above sea level, and is the highest peak in central China, with a name meaning "The Roof of Central China". However, the lowest place, Laijiahepingkou, is only 420 m above sea level, so the relative altitude of much of the area ranges from 1 000 to 2 000 m.

It belongs to a kind of deeply cut and erosion-made sub-alpine and medium topography.

On the other hand, the influence of the Quaternary glacier on the Reserve was so small that this area became one of refuges of Tertiary flora. The Karst topography here developed very well, forming many caves, giving a fairly special environment to many species.

1.2 Climate

This area is in the eye of climatic horizontal belt, the climate here is a transitional type of the north subtropic and the warm-temperate moist monsoon, controlled mainly by subtropical climatic circulation. The annual average temperature (922 m above sea level) is $11.6 \sim 12.2$ °C, the average temperature of the coldest month (January) is $2.1 \sim -2.6$ °C, and the average temperature of the hottest month (July) is $22.4 \sim 23.7$ °C. The annual average precipitation is $861 \sim 1\,093$ mm. The annual average relative humidity is 74%. On the other hand, because the mountains here are rising and falling, they disturb and cut off the regular movements of air flow, so that the climate here has an obvious difference between the vertical and horizontal climate belt. At higher altitude areas, it is foggy and rainy in summer and autumn, and rather cold in winter, precipitation is bigger than evaporation, yearly relative air humidity is high ($> 85\%$), and yearly temperature difference is small (< 46 °C). At the lower altitude areas, the air temperature is warmer, with an obvious dry and moist season, evaporation is bigger than precipitation, yearly relative air humidity is low ($< 75\%$), yearly temperature difference is big (up to $52 \sim 58$ °C). So the climate here also has character of transition from the south to the north, with subtropical, warm-temperate, temperate and cold-temperate climate types.

1.3 Soil

In the Reserve, the soil's forming and geographical distribution carries a few characteristics of both the sub-alpine coniferous forest soil of the Hengduanshan Mountains in western China and the mixed coniferous and broad-leaved forest soil of the Qinbashan Mountains, gives a few typical characteristics of the Chinese subtropical soil. The soil vertical distribution is obvious. The forest soil from the low to the high can be classified evidently as the following: mountainous yellow-brown soil (600~1 500 m), mountainous meadow soil (above 1 700 m), mountainous brown soil (1 500~2 200 m), mountainous dark-brown soil (2 200~2 900 m), brown coniferous forest soil (above 2 900 m). Also lime soil can be found in the lower mountains and valleys.

In a word, the unique geographical and environmental condition in the Reserve gives birth to many complicated ecosystems, such as: forest ecosystems of multi-climax or multi-successional series, scrub ecosystems, mountainous herbosa ecosystems, meadow ecosystems, marsh ecosystems, valley and brook ecosystems and cave ecosystems etc., which contain a great many wild animal and plant species. This complex of ecosystems is an environment in which biodiversity continues to develop. In the Reserve, the primeval

forest is luxuriant and the forest coverage comes to 85% (68.5% in the Forest District). The precious, rare, ancient and endemic species are very abundant here, which shows that it is the cream of the biodiversity in Shennongjia Forest District.

2 Plant Diversity

Shennongjia Nature Reserve is a treasure-house of plant diversity. In this section, the forest ecosystem and its species and gene diversity are mainly introduced.

2.1 Forest ecosystem diversity

Mt. Shennongjia acts as a middle step from the low hills of southeastern China to the western high mountains and the Qingzang Plateau of China. It is situated at the transition areas of the Chinese east, south, west and north vegetation distribution, as an assembled place of the various flora, especially of the Sino-Japanese flora and the Sino-Himalayan flora, therefore the vegetation here is various, with an obvious law of vertical distribution. In each vegetation distributed belt, there are a large number of endemic, precious, rare and endangered animal and plant species as well as gene resources.

According to the studies^(1,2), the belt forest vegetation in the Reserve is mixed evergreen and deciduous broad-leaved forest. The vertical distribution of the vegetation can be obviously divided into three zones. The vegetation is classified into 13 vegetation types and further subdivided into 42 formations.

There is no obvious difference among the vegetation above 1 500 m in the south and the north slopes, but there is an obvious difference below 1 500 m. The south slopes near to the north edge of mid-sub-tropic, has a few evergreen broad-leaved forests. These rare in the north slopes, some areas have only cold-resistant evergreen broad-leaved trees. Meanwhile, the plant communities of the western flanks are dominated by evergreen broad-leaved trees such as *Quercus engleriana* (up to 1 700 or 1 800 m), but by deciduous broad-leaved trees in the eastern flanks, such as *Q. aliena* var. *acuteserrata*⁽³⁾.

2.1.1 Mixed evergreen and deciduous broad-leaved forest zone (from 398 to 1 800 m)

2.1.1.1 Farming sub-zone (from 420 to 800 m) (data omitted)

2.1.1.2 Deciduous broad-leaved sub-zone with evergreen broad-leaved forest (from 800 to 1 500 m)

The evergreen broad-leaved forests are chiefly composed of *Quercus myrsinaefolia* forest, *Q. spinosa* forest and *Q. oxyodon* + *Q. engleriana* + *Distylium chinense* forest etc. These forests all have the character of mid-sub-tropic evergreen broad-leaved forest in physiognomy and structure, but the forest compositions are simple, usually distribute at both sides of the southern valleys, and the distribution areas are small. The deciduous broad-leaved forests are mainly made of *Q. variabilis* forest, *Q. glandulifera* forest, *Castanea seguinii* forest, and *Platycarya strobilacea* + *Carpinus fargesii* forest etc. They occupy large areas on both south and north slopes. Below 1 300 m of this sub-zone, the

warm-temperate coniferous forests, such as *Pinus massoniana* forest, and *Cunninghamia lanceolata* forest can also be found. The temperate coniferous forest——*Pinus henryi* forest normally appears with an elevational range of 1 200~1 900 m in this zone and disappears at 1 900 m. The precious and rare plants in this sub-zone mainly consist of *Eucommia ulmoides*, *Emmenopterys hernyi*, *Manglietia patungensis*, *Sinowilsonia henryi*, *Pteroceltis tatarinowii*, and *Kolkwitzia amabilis* etc., as well as the precious germplasm *Glycine soja* and so on.

2. 1. 1. 3 Deciduous broad-leaved forest sub-zone only with evergreen broad-leaved trees (from 1 500 to 1 800 m)

The evergreen broad-leaved trees mainly consist of *Cyclobalanopsis myrsinifolia*, *Quercus spinosa* etc., but they don't form a community, they are only scattered among the deciduous broad-leaved forests. The deciduous broad-leaved trees usually act as the dominant ones consisting a pure stand, such as *Quercus glandulifera* forest, *Q. aliena* var. *acuteserrata* forest, *Fagus engleriana* forest and *Populus davidiana* forest etc. This subbelt is the main distributional region of the *Pinus henryi* forest. The precious and endemic plants mostly distribute here. For example, the monotypic family and endemic Chinese species——*Davidia involucrata* and *D. involucrata* var. *vilmorineana* are not only relics of Tertiary but are also famous ornamental plants (named as “Chinese Dove Tree”). These plants are very valuable for scientific research and economy, and are protected in the First and Second Priority. The endemic Eastern Asian monotypic family species——*Cercidiphyllum japonicum*, *Tetracentron sinense* and endemic Eastern Asian species——*Euptelea pleiosperma*, are also famous ancient relics, categorized as the Second and Third Priority. The Chinese well-known plant, *Liriodendron chinense*, is an important species for the study of Eastern Asian and North-American flora (its companion species, *L. tulipifera* lives in the southeastern part of North-America). Endemic Chinese, precious and protected plants, include *Dipteronia sinensis*, *Pterostyrax psilophylla*, *Stewartia sinensis*, *Tapiscia sinensis* and *Corylus chinensis* etc. Endemic Chinese, precious and protected medicinal plants, include *Gastrodia elata*, *Dysosma versipellis* and *Coptis chinensis* etc. The precious germplasm, *Paeonia suffruticosa* var. *papaveracea*, a wild variety of *P. suffruticosa*, is very useful for scientific research and economy.

2. 1. 2 Warm-temperate coniferous forest and deciduous broad-leaved forest zone (from 1 800 to 2 600 m)

2. 1. 2. 1 Forest of *Pinus armandii* and deciduous broad-leaved forest sub-zone (from 1 800 to 2 400 m)

Pinus armandii occupies a large number of areas as a pure forest in this sub-zone, a few deciduous broad-leaved forests also distribute in a mass here, e. g. *Quercus aliena* var. *acuteserrata* forest, *Fagus lucida* forest, *F. engleriana* forest, *Populus davidiana* forest and *Betula albo-sinensis* forest etc.

2. 1. 2. 2 Forest of *Abies fargesii* and deciduous broad-leaved forest sub-zone (from 2 400 to 2 600 m)

The forests of *Pinus armandii* + *Populus davidiana*, *Abies fargesii* + *Betula albosinensis* + spp. of *Acer* and so on are main vegetation types in this sub-zone. Many precious, rare and endemic trees, including *A. chensiensis*, *Picea brachytyla*, *P. neoveitchii* and *Taxus chinensis* etc. are still scattered in the broad-leaved forests, besides some dominant species such as *Pinus armandii* and *Abies fargesii*, *Cercidiphyllum japonicum*, *Tetracentron sinense*, *Euptelea pleiosperma* and *Dipteronia sinensis* also spread in the lower part of this belt. More attention should be paid to this, under the special climate of this belt, scores of famous medicinal plant resources grow here, such as *Coptis chinensis*, *Gastrodia elata*, *Dysosma versipellis*, *Trillium tschonoskii*, *Diphylleia sinensis*, *Aconitum henryi*, *Angelica pubescens* and *Paris polyphylla* etc. Over an elevation of 2 100 m, *Dendranthema indicum* var. *aromaticum*, a precious, newly discovered perfume plant endemic to Shennongjia appears.

2. 1. 3 Cold-temperate evergreen coniferous forest zone (from 2 600 to 3 105 m)

Above the altitude of 1 300 m in this zone, where is the easternmost distribution of *Abies fargesii* (Chinese endemic species) in China, the pure stand of *Abies fargesii* occurs and constitutes a lush sub-alpine primeval climax forest⁽⁴⁾. It is foggy and rainy in summer and autumn and windy all the year round, giving a moist environment. The bryophyte develops luxuriantly, covering the land, trunks and branches, forming a thick "carpet". The shrubs mainly consist of *Sinarundinaria nitida* (a dwarf bamboo) and spp. of *Rhododendron*. In some areas, after *Abies fargesii* failing, *Sinarundinaria nitida* normally begins to form a large area of pure communities, or forming *Arundinella hirta* (a grass) meadow further. Fire-induced grassland within the stand are usually predominated by *Sinarundinaria nitida* and/or *Arundinella hirta*. These kinds of vegetation create a very beautiful landscape in some higher altitude areas. However, the precious, rare and endemic plant distribution is smaller less. Here, *Trillium tschonoskii* is a main kind of this plant, a new medicine which can effectively cure hypertension, dizziness, headache, neurasthenis⁽⁵⁾. *Dendranthema indicum* var. *aromaticum* is distributed mostly below 2 800 m.

2.2 Plant species diversity

2.2.1 Flora

The flora is very complex here, with characteristics of ancient, endemic, precious and rare plants, named as "Green Treasure-house". From 1976 to 1978, under the leadership of Wuhan Institute of Botany, the Chinese Academy of Sciences, a comprehensive survey was completed, and the book "Plants In Shennongjia"⁽⁶⁾ was published. Later, in 1980, Wuhan Branch of the Chinese Academy of Sciences was in charge of the "Sino-American Botanical Expedition to Western Hubei"⁽⁷⁾. By sorting out all these references

and consulting other expert studies and supplements, it was recently discovered that there are 2 638 vascular plant species of 850 genera in 193 families, among which 199 species of 63 genera in 30 families are ferns, 28 species of 17 genera in 6 families are gymnosperms, and 2 411 species of 770 genera in 157 families are angiosperms⁽⁸⁾, comprising 80.1%, 58.6%, 43.2% and 53.1%, 26.6%, 9.4% of the total families, genera, and species of Hubei and China respectively as shown in Table 1. It is quite evident that Shennongjia flora plays a very important role in Hubei flora and the flora of China.

Table 1 Numbers of Shennongjia vascular flora and their proportion in Hubei and China

Item	Ferns			Seed plants						Total		
				Gymnosperms			Angiosperms					
	Fam.	Gen.	Spec.	Fam.	Gen.	Spec.	Fam.	Gen.	Spec.	Fam.	Gen.	Spec.
Shennongjia	30	63	199	6	17	28	157	770	2 411	193	850	2 638
Hubei	41	97	370	9	31	100	191	1 324	5 550	241	1 450	6 020
China	62	204	2 600	10	34	190	291	2 946	25 000	363	3 184	27 790
% in Hubei	73.2	64.9	53.8	66.7	54.8	28	82.1	58.1	43.4	80.1	58.6	43.2
% in China	48.3	30.8	7.6	60	50	14.7	53.9	26.1	9.6	53.1	26.6	9.4

* Revised from Zheng Zhong^(8,9).

2.2.2 National protected species

In the Reserve, there are 34 national protected plant species, representing 54.8% of Hubei and 8.7% of China species as it is shown in Table 2.

The first class protected species: *Davidia involucrata*.

The second class protected species: *Cercidiphyllum japonicum*, *Tetracentron sinense*, *Davidia involucrata* var. *vilmoriniana*, *Eucommia ulmoides*, *Emmenopterys henryi*, *Manglietia patungensis*, *Liriodendron chinense*, *Picea noveitchii*, *Ginkgo biloba*, *Sinowilsonia*

Table 2 Comparison of national protected plants between Shennongjia, Hubei and China

Item	Protected class			Total
	I	II	III	
Shennongjia	1	14	19	34
Hubei	3	24	35	62
China	8	159	222	389
% in Hubei	33.3	58.3	54.2	54.8
% in China	12.5	8.8	8.5	8.7

henryi, *Changnienia amoena*, *Eurycorymbus cavaleriei*, *Bretschneidera sinensis* and *Cephalotaxus oliveri*.

The third class protected species: *Amentotaxus argotaenia*, *Abies chensiensis*, *Picea brachytyla*, *Magnolia officinalis*, *Pteroceltis tatarinowii*, *Euptelea pleiosperma*, *Dipteronia sinensis*, *Pterostyrax psilophylla*, *Stewartia sinensis*, *Kolkwitzia amabilis*, *Coptis chinensis*, *Dysosma versipellis*, *Trillium tschonoskii*, *Gastrodia elata*, *Paeonia suffruticosa* var. *papaveracea*, *Tapiscia sinensis*, *Corylus chinensis*, *Glycine soja* and *Phoebe zhenna*.

2.2.3 Species endemic to Shennongjia

On the basis of the authors' preliminary study, about 42 plant species endemic to Shennongjia, belonging to 34 genera of 22 families are currently known. These include

Polystichum shennongense, *Dryopteris infrapuberula*, *D. apicifixa*, *Pyrrosia pseudocalvata*, *Matteuccia orientalis* f. *monstra*, *Lunathyrium shennongense*, *Athyrium amplissimum*; *Clematis shenlungchiaensis*, *Thalictrum shennongjiaense*, *Paeonia qiui*, *Aristolochia heterophylla* var. *linearifolia*, *Impatiens odontophylla*, *Gomphogyne hupehensis*, *Clematoclethra fififormis*, *C. franchetii* var. *latifolia*, *Potentilla gelida*, *Armeniaca hongpingensis*, *Rubus lasiostylus* var. *hubeiensis*, *Salix bikouensis* var. *villosa*, *Fagus hayatae*, *Quercus shennongii*, *Ilex shennongjiaensis*, *Euonymus verrucosoides* var. *viridiflorus*, *Rhamnus blinii*, *R. leptophylla* var. *villosissima*, *R. rugulosa* var. *glabrata*, *Artemisia anomala* var. *tomentella*, *A. pleiocephala*, *A. shennongjiaensis*, *Ixeris denticulata* spp. *pubescens*, *Saussurea hemsleyana*, *S. macrota*, *Dendranthema indicum* var. *aromaticum*, *Catalpa longicarpa*, *Scutellaria franchetiana* var. *serratifolia*, *Polygonatum verticillatum* var. *laojunnshanense*, *Neottianthe monophylla*, *Carex laevisissima*, *C. ligulata* var. *glabriutriculata*, *C. purplevaginalis*, *C. stipata* and *Deschampsia caespitosa* var. *exarista*^(8~17). Among these species, 7 are ferns, 35 are angiosperms, no gymnosperms.

2.2.4 Wild economic plants

The wild economic plant resources are also abundant here. As the initial statistics, there are more than 150 species of wild fibre plants, 208 species of wild oil-bearing plants, over 190 species of wild starchy and carbohydrate plants, over 180 species of wild perfume plants, over 160 species of wild vegetables, 253 species of wild flowers and over 1 600 species of wild medicinal plants. The medicinal plants are especially famous for their plenty of varieties, large quantities of output, and lots of precious medicinal herbs, having been named as a "Natural Medicine Garden".

The medicinal plant resources in Shennongjia have their historic origin. The name "Shennongjia" comes from a legend that a Chinese ancestor, King Yan, named "Shennong", built frameworks for collecting herbal medicines, and tasted various herbs. According to the "Shennongjia Traditional Chinese Medicine Resources"⁽¹⁸⁾, there are 2 128 kinds of traditional Chinese medicines in the Reserve, among which, 1 886 species are medicinal plants (including cultivated plants), belonging to 816 genera of 195 families. Among these, there are 35 species in 15 families of fungi, 6 species in 4 families of lichens, 5 species in 4 families of bryophytes, 103 in 24 families of pteridophytes, 20 species in 6 families of gymnosperms, 1 715 species in 142 families of angiosperms. Among these wild medicinal plants, *Eucommia ulmoides*, *Magnolia officinalis*, *Gastrodia elata*, *Coptis chinensis*, *Dysosma versipellis*, *Trillium tschonoskii*, *Paris polyphylla* and *Balanophora involucreta* etc. are the precious or traditional medicinal plants endemic to China. As a tentative statistics, more than 50 of anti-cancer medicinal plant species and 100 special advanced health protection medicinal ones have been found, such as, *Gynostemma pentaphyllum*, *Cephalotaxus fortunei*, *C. sinensis*, *Rosa roxburghii* and *Taxus chinensis* etc.

2.3 Plant genetic diversity

In the Reserve, plant germplasm resources are very abundant. The national scientific key task project in China's "The Seventh Five-Year-Plan"—— "Crops Germplasm Resources Investigation in Shennongjia and the Yangtze Three Gorges Area" was accomplished by the Hubei Academy of Agriculture Sciences and the Chinese Academy of Agriculture Sciences from 1986 to 1990^[19]. Researchers collected 9 526 living crop germplasm resources, belonging to 1 446 species of 697 genera of 161 families (including 159 cultivated plants) were collected in this investigation. Among 9 526 living crop germplasm resources, there are 2 391 food-stuff, 870 oil-bearing plants, 3 497 vegetables, 602 fruits, tea, and mulberries, 241 fibre-bearing plants, 422 flowers, 1 333 special crops, and 170 special plants. There are many wild types or modern cultivated plants, or wild close relative species of them, for instance, *Coix lacryma-jobi*, *Glycine soja*, *Armeniaca hongpingensis*, *Actinidia* spp., *Vigna vexillata*, *Vitis davidii*, *Morus* spp., *Paeonia suffruticosa* var. *papaveracea*, *Allium* spp., *Crataegus hupehensis*, *C. wilsonii*, *Malus hupehensis*, *Eriobotrya japonica*, *Fragaria orientalis*, *Castanea seguinii*, *Prunus serrulata*, *Dioscorea japonica*, and *Chimonanthus praecox* etc.

3 Present Situation of Conservation

Before 1962, this was a primeval forest with few human foot prints in it, but since then, the roads began to be built. Especially from 1970 to 1982, this became an important cutting area, causing serious destruction to the biological resources and the ecological environment. But due to the inconvenient transportation, and shorter cutting time, 60% of the primeval forest survived very well in the Reserve. As soon as the Reserve was established, the departments concerned carried on much successful protection work. Since then, the biological resources began to recover step by step. Because data materials are lacking, only the conservation situation of the plant populations of the most recent two decades is provided here briefly.

The vegetation destroyed from 1970 to 1981 began to recover, and now, the forest coverage is up to 85%. As far as species are concerned, the plant resources destroyed were less than that of wild animals, but their populations were still seriously destroyed. For instance, *Abies chiensiensis* had been distributed in a large area, but after cutting, there were only a few small areas of pure stand left. But for the dominant community distribution with a small area for *Cercidiphyllum japonicum*, *Tetracentron sinensis*, and *Euptelea pleiosperma* etc., other precious and rare protected plant species such as *Davidia involucrata*, *Davidia involucrata* var. *vilmoriniana*, *Emmenopterys henryi*, *Liriodendron chinense*, *Amentotaxus argotaenia*, *Kolkwitzia amabilis*, *Stewartia sinensis* and *Dipteronia sinensis* all distributed oddly. The populations of *Manglietia patungensis*, *Picea neoveitchii* and *P. brachytyla* are very small, and appear to be in a state of near extinc-

tion. Most of the plants, such as *Eucommia ulmoides*, *Sinowilsonia henryi*, *Taxus chinensis*, *Pteroceltis tatarinowii*, *Pterostyrax psilophylla*, *Stewartia sinensis*, *Coptis chinensis*, *Dysosma versipellis*, *Trillium tschonoskii*, *Gastrodia elata*, *Glycine soja* and *Phellodendron chinense* etc., still have a large population, but they do not form as a community. As the Reserve have been established only for 15 years, the resources base is still being established, so the law of the population dynamic is still unclear. But since the core zone of the Reserve has been protected strictly, many plant populations have begun to recover, if this continues, the future is bright.

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神农架生物圈保护区植物多样性及其保护现状的研究

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摘 要

对神农架生物圈保护区森林生态系统多样性、植物物种多样性、植物遗传多样性及其保护现状作了较详细的研究,结果如下。

1. 神农架生物圈保护区海拔差异大(420~3 105.4 m),生态环境相当复杂,植被垂直分布差异明显。根据植被现状,其自然植被可划分为3个植被带:海拔420~1 800 m为常绿、落叶阔叶混交林带(基带植被);海拔1 800~2 600 m为温性针叶和落叶阔叶林带;海拔2 600~3 105.4 m为寒温性常绿针叶林带。

2. 神农架地处中国地貌第二阶梯向第三阶梯之过渡地区,为东、南、西、北植物区系的汇集地,特别是中国-日本和中国-喜马拉雅植物区系的交汇地,植物物种多样性特别丰富。现已记载有维管植物193科850属2 638种。其中,蕨类植物30科63属199种,裸子植物6科17属28种,被子植物157科770属2 411种,分别占湖北省维管植物科、属、种总数的80.1%、58.6%,43.2%,为湖北省植物区系的“半壁江山”,足见其地位的重要。

3. 已发现国家第一批重点保护野生植物34种,占湖北省总数62种的54.8%,占全国总数389种的8.7%;初步统计,有神农架特有植物42种(含变种及变型),隶属于22科32属。其中,蕨类植物4科6属7种,如神农耳蕨、神农峨眉蕨等;种子植物18科26属

35种,如神农架铁线莲、洪坪杏、神农架冬青、神农香菊等;野生经济植物十分丰富,初步查明有150种野生纤维植物,208种野生油料植物,190种野生淀粉和糖类植物,180多种野生香料植物,160多种野生蔬菜,253种野生花卉及1886种药用植物(含50多种抗癌药用植物及100多种高级保健药用植物)。

4. 植物遗传多样性十分丰富。初步发现有161科697属1446种作物种质资源;具有很多现代栽培植物的野生类型或其野生近源种,如野薏苡、野大豆、洪坪杏等。

5. 神农架植物多样性破坏始于1962年,特别是从1970年至1982年,这里是湖北省重要的伐木区,植物多样性破坏较为严重。如秦岭冷杉曾有较大面积分布,但砍伐后目前只有零星小块纯林。除连香树、水青树、领春木等尚有小面积优势群落分布外,其它珍稀保护树种如珙桐、光叶珙桐、香果树、鹅掌楸、厚朴、穗花杉、猬实、金钱槭等多为零星分布。巴东木莲、大果青杆、麦吊杉等数量极少,呈濒危灭绝状态。多数种类,如杜仲、山白树、白辛树、青檀、紫茎、黄连、八角莲、延龄草、天麻、野大豆等种群数量均较多,但一般不呈群落分布。自1982年神农架自然保护区建立以来,被破坏的森林植被大都演变为天然次生林,正处各个进展演替阶段,目前森林覆盖率达到85%(神农架林区为68.5%);一些珍稀保护植物如连香树、水青树、领春木、麦吊杉等种群得到较好的发展。可以预言,神农架植物多样性保护的前景是乐观的。

关键词 神农架生物圈保护区,植物多样性,就地保护现状