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Diversity Analysis of Flora in Secondary Growth of Forest in Fuyang, Hangzhou

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Astract: On the basis of a comprehensive survey and data collation, the floristic characteristics of secondary forests in Fuyang District, Hangzhou were studied, and the level of biodiversity in the area was assessed by investigating the plant species, their numbers and their distribution. The results showed that a total of 267 species of vascular plants belonging to 77 families and 165 genera were identified within the geographical scope of this study. In terms of specifics, ferns included 6 families, 6 genera and 8 species, while gymnosperms covered 6 families, 11 genera and 12 species, and angiosperms contained 65 families, 148 genera and 247 species. In the classification of families, 20 families contained only a single species and 42 genera also contained only a single species. In terms of family composition, Lauraceae and Rosaceae were prominent with 20 and 21 species, respectively. In the classification of genera, Holly (Ilex) was the most species-rich genus with 10 species count. The ferns in the study area are mainly characterized by a cosmopolitan distribution, an Old World tropical distribution, and an interrupted distribution between tropical Asia and tropical America. Seed plants have a diverse range of distribution areas, mainly in the tropics and temperate zones. The main vegetation types in the study area include warm coniferous forests, evergreen deciduous broadleaf mixed forests, evergreen broadleaf forests, bamboo forests, and scrub grasslands.

Keywords: Fuyang District, Hangzhou; secondary forest; flora; plant resources; geographic region

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Flora refers to the natural products formed by specific genetic variation and species evolution in the plant

kingdom under the comprehensive action of multiple factors such as long-term natural evolution, geological changes and human activity history [1][2]. The formation of flora is the result of long-term germline differentiation, reproduction and development in the long process of natural evolution of the plant kingdom [3]. To a certain extent, floristic studies can reflect the biodiversity of a region [4], [5], [6]. At the same time, the changes in plant composition and characteristics are also a reflection of the species distribution, origin and evolution process of all plant species in a region affected by the natural environment [7][8]. Therefore, the analysis of the basic characteristics of a regional flora can master the origin, distribution, evolution mode of plant species within a certain range and the relationship between plants and the surrounding environment [9][10], which is conducive to deeper exploration of the interaction between plants and the environment in different vegetation regions. Promote the sound development of regional ecological environment [11][12], and at the same time, promote the protection and sustainable development of regional biodiversity by understanding the pattern of biodiversity and exploring the causes.

At present, with the increasing abundance of species distribution data and genealogical data, domestic and foreign scholars have conducted extensive studies on the diversity pattern of various species at different spatial scales, and the diversity hotspots identified continue to increase, which greatly promotes the understanding of biological origin and evolution and the implementation of biodiversity conservation [13][14]. As an important province in Southeast China, Zhejiang Province is rich in vegetation resources and has a relatively complete forest community structure, so it is known as "Southeast plant treasure house". There are more than 3,000 kinds of vegetation resources in the province, 45 kinds of wild plants under state key protection, and a vast forest area, of which the forest area is about 5.8442 million hectares (forest coverage rate of 60.5%), the forest ecosystem diversity level is high, and the types of forest vegetation, forest types and tree age groups are relatively rich. At present, many studies have analyzed and investigated the flora of Zhejiang Province and Hangzhou City. Among them, Peng Hua et al studied the dominant and common vascular flora characteristics of evergreen broad-leaved forests or similar forests in Haidao, Zhejiang Province [15], and Cheng Liyuan et al studied the flora components of bryophyte in Qingliangfeng Nature Reserve, Zhejiang Province [16]. Zhu Hong et al. analyzed and explored the seed flora of Fushan Island in Zhoushan Province [17], while Jin Minglong and Ji Mengcheng et al. paid attention to the seed flora of West Lake Scenic Area and Xixi Wetland in Hangzhou [18][19]. These studies have not yet covered the community structure of secondary forest in Hangzhou. Therefore, based on the existing fauna studies and vegetation distribution data, this study collected and sorted out the plant information of secondary forest in Fuyang District, Hangzhou, and statistically analyzed the flora diversity and species composition, aiming to reveal the diversity of plant community characteristics in different flora regions.

1. Materials and methods

1.1 Overview of the study area

The study area is located in the forest area in the east of Fuyang District, Hangzhou City, Zhejiang Province, China, under the management of the forest farm of the Institute of Subtropical Forestry, Chinese Academy of Forestry. The geographical coordinates of the area are between 119°58 'and 120°02' east and 30°03 'and 30°06' north, with a total area of 8.006 square kilometers. The research area includes four forest areas, including the headquarters of Yalin Institute, Hushan, Xinmin and Miaoshanwu, covering the artificial forest, natural forest, germplasm resource base and experimental land. The forest terrain is known for its steep slope. The region belongs to the subtropical monsoon climate zone, with four distinct seasons and abundant rainfall, mainly concentrated in spring and summer. The average annual temperature is 16.1 ° C, with January being the coldest

month and July the hottest month. From May to June, the average annual precipitation reaches 1441.9 mm. The vegetation types in the study area belong to the subtropical evergreen broad-leaved forest area in eastern China, and the vegetation area of Castanopsis castanopsis forest in Zhejiang and Anhui mountains and hills. The flora of plants mainly consists of tropical distribution and temperate distribution, with about 41.85% of tropical distribution genera and 38.86% of temperate distribution genera. Zonal vegetation is mainly composed of Cyclobalanopsis glauca, Castanopsis sclerophylla, Schima superba, Machilus thunbergii and other tree species. Vegetation types include evergreen broad-leaved forest, broad-leaved mixed forest, deciduous broad-leaved forest, coniferous forest, and broad-leaved mixed forest. The plantation was composed of Pinus elliottii Engelmann, Cunninghamia lanceolata, Symplocos sumuntia, Eurya japonica and Liquidambar formosana) mainly, In natural forests, Schima superba, Loropetalum chinense, Ilex chinensis, Pasania sieboldiana and Cinnamomum camphora are used.

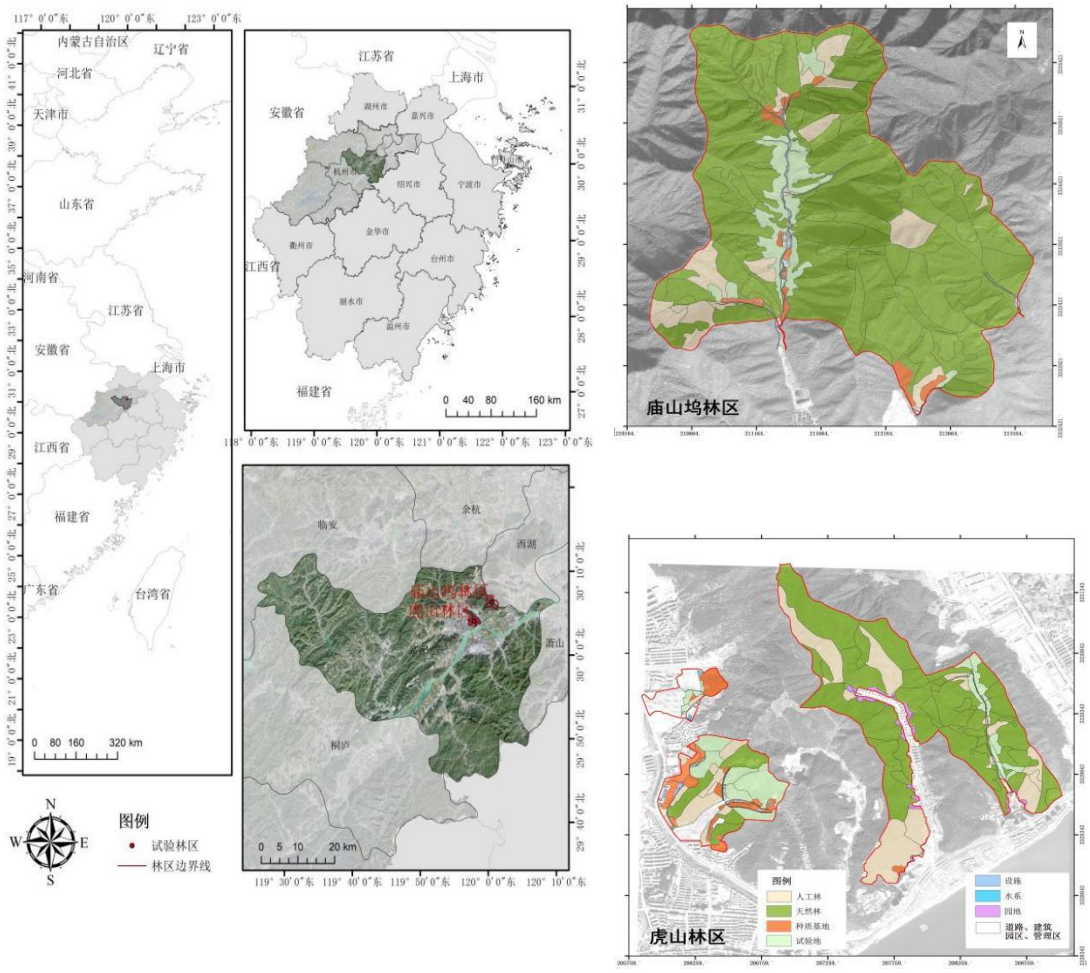

Fig.1 Location map of the test forest

1.2 Regional plant species list confirmed

Consulted the supplementary publications such as Flora of China [20], Flora of Zhejiang [21][22] and new materials of Zhejiang plants. The types of plants in Fuyang were reported in the Annals of Trees of China [23], An Overview of the Families and Genera of Angiosperms of China [24], the Distribution types of seed Plants in China [25] and their additions and corrigendum, the Map of Woody Plants in Tianmushan [26], Flora of China [27], etc. It was authenticated and verified by China Digital Herbarium (http://www.cvh.ac.cn/).

1.3 Analytical methods and data processing

In this study, the distribution types of floristic families and genera were calculated based on the distribution type system of seed plants in the world according to Mr. Wu Zhengyi and the distribution type of seed plants in China [25][28]. Excel 2007 and SPSS 24.0 statistical software were used to complete data analysis and chart arrangement, and ArcGIS platform was used to complete statistical analysis of indicators.

2 Result Analysis

Through examination, comparison and statistical analysis, a total of 267 species of vascular plants were found in the study area, including 77 families and 165 genera. Among them, there were 8 species of pteridophytes in 6 families, 6 genera, and 12 species of gymnosperms in 6 families, 11 genera. There were 247 species of angiosperms from 148 genera and 65 families, of which 20 were monotypic families, accounting for 25.97%, and 42 were monotypic genera, accounting for 25.45% of the total genera. It was found that seed plant genera were widely distributed in the study area, but endemic plants were few. There are 7 genera endemic to China, accounting for 1.6% of the total genera (including the world distribution), of which 6 are monotypic genera. 1 national Class I protected plant (Taxus mairei), Four secondary protected plants were Cinnamomum camphora, Phoebe chekiangensis, Magnolia officinalis, and Zelkova schneideriana.

2.1 Composition of community flora, genera and species

Among the 77 families, 20 species were Lauraceae and 21 species were Rosaceae. There were 6 families with 10-12 species, including Euphorbiaceae, Aquifoliaceae, Fabaceae, Fagaceae, Magnoliaceae and Theaceae, with a total of 63 species. 23.60% of the total; There were 9 families with 5-9 species and 60 species, accounting for 22.47% of the total species. There were 22 families with 2-4 species and 60 species, accounting for 22.47% of the total species. There are 35 families containing only a single species, such as the Buddlejaceae, Arecaceae, and Ginkgoaceae.

Among the 165 genera, the genus with the largest number of species is Ilex (10 species). There were 6 genera with more than 5 to 9 species and 33 species, accounting for 12.36% of the total species. There were 46 genera with 2-4 species and 111 species, accounting for 41.57% of the total species. There are 113 genera containing only one species, i.e., the Buddleja, Itea, Alpinia, etc., accounting for 67.66% of the total genera.

Table.1 The family, genus, and species composition of plants

Taxonomic group	secco		category		species	
	quantity	Proportion (%)	quantity	Proportion (%)	quantity	Proportion (%)
ferns	6	7.79	6	3.6	8	3
gymnospermia	6	7.79	11	6.67	12	4.49
angiosperms	65	84.42	148	89.7	247	92.51

2.2 Floristic geographical characteristics

2.2.1 Fern distribution type characteristics

According to the floristic classification methods of ferns from China and Zhejiang [29], it can be seen that ferns in the study area are mainly distributed in the world, in the Old world tropics, and in tropical Asia and tropical America discontinuously. Among them, the genera distributed worldwide are Pteridium, Odontosoria,

Dryopteris, and Cyclosorus. The genus Dicranopteris of Gleicheniaceae is distributed in the tropics of the Old World. The genus Dryoathyrium is distributed from tropical Asia to tropical Africa in the family Athyriaceae.

Table.2 Classification of fern distribution area

distribution type	Dedicated data characters	Proportion
World distribution	4	2.40
Old World tropical distribution	1	0.60
Tropical Asia and tropical America are discontinuous	1	0.60

Note: * Does not include worldwide distribution genera

2.2.2 Distribution characteristics of seed plants

Through the analysis of seed plants in the study area, it was found that the distribution types of genera showed diversity, mainly tropical and temperate distribution. The distribution of tropical genera accounted for 41.85%, and the distribution of temperate genera accounted for 38.86%. This data revealed that the plant community had significant characteristics of tropical origin, and showed the nature of ecological transition from tropical to temperate. The characteristics of this branch of the plant community also reflected the basic attributes of subtropical flora.

Table.3 Classification of distribution areas of seed plants

Distribution type	Dedicated data characters	Proportion
Cosmopolitan	5	3.03
Pantropic	25	15.15
Tropical Asia & Tropical America disjuncted	11	6.67
Old World Tropics	14	8.49
Tropical Asia & Tropical Austral Asia	3	1.82
Tropical Asia to Tropical Africa	5	3.03
Tropical Asia	15	9.09
North Temperate	22	13.33
East Asia & North America disjuncted	22	13.33
Old World Temperate	4	2.42
Temperate Asia	2	1.21
East Asia	26	15.76
Endemic to China	5	3.03
total	159	96.38

(1) Cosmopolitan is distributed in 5 genera (5 families), including Carex, Lysimachia, Rhamnus, Rubus and Selaginella P. Beauv.

(2) Pantropic distribution, a total of 20 genera, 14 families, They were Callicarpa, Gardenia Ellis, nom. cons.), Caesalpinia, Phyllanthus, Adinandra Jack, Millettia Wight et Arn., Triadica Lour.), Euonymus, Diospyros, Symplocos, Schoepfia, Cocculus, Dalbergia, OrmoSia, Uncaria), Ilex, Clerodendrum, Smilax, Styrax. Among them, Leguminosae has 4 genera, Euphorbiaceae, Rubiaceae and Verbenaceae have 2 genera each. Smilacaceae, Styracaceae, Liliaceae, Ilex, Menispermaceae, Olacaceae, Lauraceae, and Ebenac eae, Celastraceae and Theaceae each have 1 genus.

Tropical Asia, Tropical Austral Asia (to New Zealand) and Central and South America (Central & South America or Mexico) have 3 discontinuous genera. They were Ulmaceae, Trema, Celtis, Euphorbiaceae and Glochidion.

Tropical Asia, Africa, and Central and South America (Central & South America) intermittent distribution, there are two genera, rose Laurel Laurocerasus, Cerasus.

(3) Tropical Asia and Tropical America discontinuous distribution types include tropical genera discontinuous distribution in warm regions of America and Asia. [30] In the Old World (Eastern Hemisphere) it may extend from Asia to northeast Australia or the southwest Pacific islands. There are 11 genera, It belongs to the genus Mucuna, the family Rosaceae, the family Buddlejaceae, MyrSinaceae, Lauraceae, Sapindaceae, Euphorbiaceae and Euphorbiaceae The family Sabiaceae, Rhamnaceae and Theaceae, They were classified into the genus Fragaria, the genus Buddleja, the genus Ardisia, the genus Antidesma, the genus Sapindus, the genus Sageretia, the genus Meliosma, the genus Phoebe, and the genus Wood Litsea and Eurya.

(4) Old World Tropics

The Old World tropics refer to the Asian, African, and Oceanian tropics and their adjacent islands (also commonly referred to as the Paleotropics), to distinguish them from the American New World tropics. [31] There are 13 genera of this type, They are Alpinia, Stephania, Albizia, Euodia, Illigera, Mallotus, Melia, Zanthoxylum and Pi ttosporum, Maesa, Alangium, Syzygium, Mussaenda.

(5) Tropical Asia & Tropical Austral Asia

Tropical Asian-Oceania is the eastern wing of the Old World tropics, [32] sometimes reaching Madagascar at its western end, but generally less than the African continent. [33] Cinnamomum, Lophatherum, and Toona were cinnamomum in all.

(6) Tropical Asia to Tropical Africa is distributed in 5 genera, belonging to 4 families, There are Hedera, Premna, Miscanthus, Crassocephalum, Arthraxon.

(7) Tropical Asia (Indo-Malaysia) distribution: It is the central part of the Old World tropics. A total of 13 genera, They are Cleyera, Phyllostachys, Castanopsis, Schima, Broussonetia, Machilus, Neolitsea, and Lin dera, Duchesnea, Camellia, Cyclobalanopsis, Michelia, Sarcandra.

From Java (or Sumatra) and the Himalayas, there is one genus, Schima of Theaceae, distributed intermittently or scattered to South and Southwest China.

From Vietnam (or Indochina Peninsula) to South China (or southwest) there are two genera, Fokienia of Cupressaceae and Alniphyllum of Styracaceae.

(8) North Temperate distribution includes 21 genera, They are ash (Fraxinus), pine (Pinus), Cupressus (Cupressus), Juniperus (Juniperus), Taxus (Taxus), Castanea (Castanea), Quercus (Quercus), Ulmus (Ulmus), Crataegus (Crataegus), and Rose Rosa, Rhus, Elaeagnus, Rhododendron, Fraxinus, Prunella, Viburnum, Lonicera, Aste r), Arisaema, Polygonatum.

The North and south temperate zones are intermittently distributed in the "whole temperate zone", and this type includes the Myrica genus.

(9) Asia & America disjuncted has 21 genera, They are Castanopsis, Lithocarpus, Mahonia, Magnolia, Sassafras, Hydrangea, Itea and Liquidamba r), Photinia, Wisteria, Lespedeza, Toxicodendron, Aralia, Lyonia, Chionanthus, Trachelos permum, Illicium, Liriodendron, Osmanthus, Torreya, Bothrocaryum.

(10) There are two genera in the Old world temperate distribution, belonging to the Rosaceae family, namely Pyrus and Firmiana.

In the Mediterranean region, West Asia (or Central Asia) and East Asia, there is a discontinuous distribution

of 1 genus, Oleaceae (Ligustrum).

(11) Temperate Asia has two genera: Exochorda and Ginkgo.

(12) East Asia has 11 genera, They are Pleioblastus, Rhododendron, Elaeocarpus, Damnacanthus, Youngia, Loropetalum, and Raphio is), Ophiopogon, Stauntonia, Vernicia.

It is distributed in Sino-Himalaya (SH), a genus belonging to the sumaceae family, and a genus of Choerospondias.

China-Japan distribution (China-Japan) total 14 genera, They were Chamaecyparis, Serissa, Fatsia, Platycarya, Pterocarya, Akebia, Nandian and Cryptom eria, Euscaphis, Hovenia, Paulownia, Eurya, Pterocarya, Idesia, Trachycarpus.

(13) Five genera are Endemic to China. They were listed as Cunninghamia, Parakmeria, Pseudolarix, Fortunearia and Camptotheca.

2.3 Main vegetation types in the study area

According to the analysis of vegetation types by referring to the Vegetation of China, it was found that the study area belonged to the subtropical evergreen broad-leaved forest area, and the forest community types were classified as follows:

Coniferous forest

I. Warm coniferous forest

Warm evergreen coniferous forest

Warm pine forest

Broad-leaved forest

II. Mixed evergreen, deciduous broad-leaved forest

Deciduous evergreen broad-leaved mixed forest

Deciduous, evergreen oak mixed forest

III. Evergreen broad-leaved forest

Typical evergreen broad-leaved forest

IV. Bamboo forest

Warm bamboo forest

Hills, mountain bamboo forest

Shrub, shrub

V. Planting grass

Warm shrub

Grass and grass

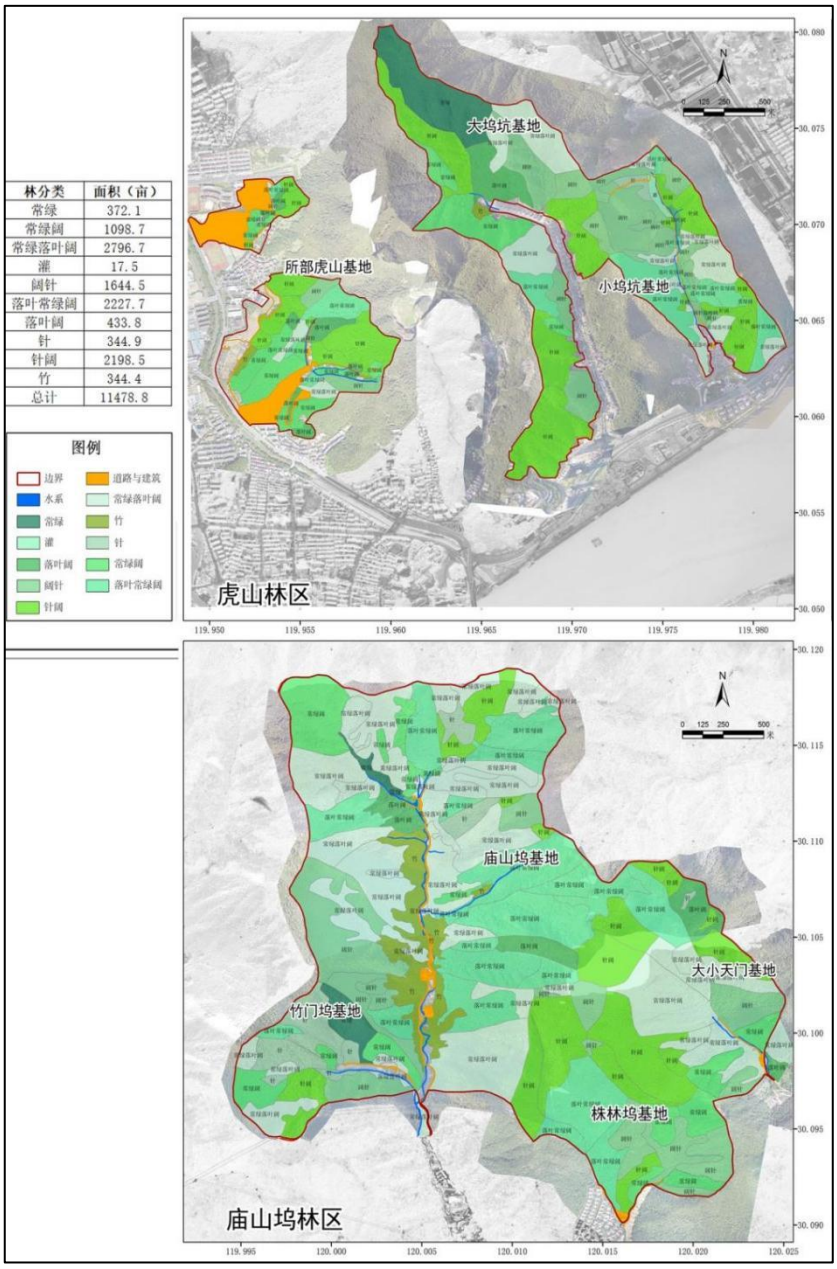

Fig.2 Map of forest type distribution in study area

2.3.1 Warm coniferous forest

Warm coniferous forest is mainly distributed in subtropical low mountains, hills and peaceful land [34] The basic vegetation type is evergreen broad-leaved forest or other types. The coniferous forests in the forest farm mainly include Masson pine forest, Chinese fir forest, foreign pine (wet pine, loblolly pine) forest; Among them, horsetail pine forest is natural forest, Chinese fir forest and foreign pine forest are artificial forest. Most understory plants belong to tropical and subtropical families, There are mainly camelliaceae (Theaceae Mirb.), Lauraceae Juss.), Fagaceae Dumort.), Rubiaceae Juss.), Ericaceae Juss.), Ardisia japonica (Thunb.) Blume, etc. The herbaceous layer mainly includes Poaceae Barnhart, Asteraceae Bercht.&j.Pll, Cyperaceae, etc. There are also some species of ferns in the white family (Gleicheniaceae C.pl.) and Osmundaceae (Osmundaceae). In this study area, Masson pine forest, which is the most widely distributed and the most abundant in resources in

southeast China, is also the representative formation of the region. The shrub layer species are Lindera Thunb., Litsea. Cuculus. Vaccinium. Eurya Thunb.), Camellia, Loropetalum R. Br. (Loropetalum R. Br.), Rosa (Rosa), Symplocos Jacq (Symplocos Jacq), Hamamelidaceae.

2.3.2 Mixed evergreen deciduous broad-leaved forest

This stand is the representative type of the study area, mainly distributed in the middle and upper, middle and lower parts of the mountain, and mainly consists of secondary forest, lacking obvious dominant species, vigorous crown growth, uneven overall shape, a variety of deciduous tree species, distinct seasons in the whole area, and rich community color

The community has obvious stratification phenomenon, the top layer is the tree layer, the fagaceae species are the main group species, among which, Deciduous tree species are Quercus L. White oak (Quercus fabri), Liquidambar L. Liquidambar formosana Hance and so on. The evergreen is mainly Cyclobalanopsis (Cyclobalanopsis Oerst.) Cyclobalanopsis glauca (Thunb.) Oerst.), Castanopsis castanopsis, stone oak southeast stone oak and a small amount of schima, camphor, leucophyllum, Holly, 8-14m high. The shrub layer is mainly composed of camelliaceae, alum family, Rhododendron family, Roseaceae, dogwood family, Araliaceae and other species, which are generally compact in structure, with larger coverage, up to 80-90%, and more complex in composition, often with more tree saplings. Common deciduous diets include Litsea cubeba, sandalberry Symplocos tanakana, Glochidion puberum, Lespedeza thunbergii subsp. formosa, Vitex vitex negundo var. cannabifolia, Crataegus cuneata, Rubus corchorifoliu, Rubus parvifolius, Euscaphis japonica, Mallotus apelta, Mallotus tenuifolius, etc., There were no bone Ilex cornuta, ð ² wood Loropetalum chinense, mountain alum Symplocos sumuntia, Ardisia japonica, and Lindera aggregat

2.3.3 Evergreen broad-leaved forest

Evergreen broad-leaved forest is the zonal vegetation in this region, but the distribution area is small. According to the investigation, some of the vegetation sources of this type are the mixed evergreen deciduous broad-leaved forest after thinning in the past, and the rest are the main stand of Schima sinensis developed by succession, and the other part is the plantation of Nan Zhejiangensis constructed in the 1960s after clearing the stand. This type of vegetation is mainly distributed in the area with medium preference for mountain site conditions. The tree layer is mainly composed of Nana zhejiangensis, Nana tenuifolia, Schima, etc., with a height of about 15-20m, and a small amount of evergreen oak, Holly, Choerospondias axillaris, camphor and other mixed growth in the sublayer. The shrub layer is less, with camellia acuta, gingya, che ² wood, mountain alum and so on The herbaceous layer is mainly composed of pteridophytes, other species such as caress, bamboo, and some species of hemiaceae or araceae; Interlayer plants are rare, Occasionally seen are Mucuna sempervirens, Broussonetia monoica, Smilax china, Trachelospermum jasminoides, and Lygodium japonicum).

2.3.4 Bamboo forest

The distribution of bamboo forest in this forest farm is relatively small, most of which are asexual bamboo plantation built in the mid-1960s, a small amount of practical origin forest built in the early 1970s, and some of which are botanical gardens of various bamboo species built in the early 1980s. In addition, there are small areas of Phyllostachys sulphurea var. viridis, Phyllostachys heteroclada, Phyllostachys nigella and other bamboo forests with local natural distribution.

This type of vegetation is mainly distributed in the middle and lower part of the mountain, the slope and

other areas with good site conditions. The foothills of the slope are generally pure forest, and the bamboo in the lower or middle part of the slope is formed after natural expansion into the broad-leaved forest. The main mixed trees in the bamboo forest are quercus quercus, Holly, etc., and Masson pine is also mixed in a few areas.

Phyllostachys pubescens is the most widely distributed bamboo forest in China. Phyllostachys pubescens is suitable for warm and humid climate, deep soil, fertile soil and good drainage environment. It is often interleaved with evergreen broad-leaved forest or a mixed forest composed of phyllostachys pubescens and evergreen broad-leaved forest. The bamboo forest in this forest farm has neat appearance, single structure, little canopy fluctuation and single-layer horizontal canopy. Forest height 8-14m, DBH 6-13m, canopy degree above 0.9. Due to the high management level, the forest is empty, with few shrubs, herbs and interlayer plants. The common trees in the forest are ð ², Eurya, Maesa japonica, purple golden cow, Libai and Woodwardia japonica

2.3.5 Planting grass

The vegetation type of shrub in the study area belongs to warm shrub, which is the main vegetation type of barren mountains and wastelands in subtropical and tropical areas. It has the adaptive ability to tolerate drought and barren land, and is often accompanied by a few positive species of trees and shrubs, which is composed of dominant grass in subtropical and tropical drought.

In the study area, vegetation is mainly distributed in areas with harsh site conditions, such as ridge areas, where the soil layer is thin and the content of gravel is high. The vegetation appearance in this area is relatively neat, and the total community coverage is between 0.5 and 0.8. The community structure is relatively simple, with a grass layer height of 70 to 100 cm and coverage between 0.7 and 0.9. The dominant population is mainly composed of white Leymus chinensis, yellow back grass, wild ancient grass, Miscanthus, etc. The common associated species include pentacanthus sinensis, orange grass, slender stalk grass, Cryptospermopsis broadleaf, goldenrod flower, wild chrysanthemum, etc. Sporadic shrub species include oaklet, sandalwood, black rice tree, maculata, ð ², Acanthophorus, Rhododendron, white horse The seasonal changes of the grass were obvious. In spring, the herbs sprouted, left and headed, and the grass was emerald green. In summer, plant growth is vigorous, inflorescence and leaf layer constitute another seasonal landscape; From autumn to winter, the grass gradually presents a yellow scene.

3 Discussion and conclusion

The characteristics of flora directly reflect the composition, distribution pattern, origin, development and evolution of plant communities in a certain region [35]. The floristic diversity distribution pattern of secondary forest in southwest Hangzhou revealed in this study is of great significance for further research on the origin, species distribution pattern, community structure formation and evolution of typical secondary forest in southeast China. From the perspective of floristic pattern, the results are roughly the same as those of previous studies [36][37], which provides a scientific basis for regional biodiversity pattern, the protection of endemic and endangered plants, and the statistics, development and utilization of plant resources. Jin Xiaofeng [38] pointed out that the floristic characteristics of seed plant genera in Baizu Mountain, Zhejiang Province are mainly distributed in temperate zone, and most of them are distributed in north temperate zone. Meanwhile, Ding Bingyang [39] et al. also found that the distribution of genera in Fengyang Mountain is mainly temperate zone, which is basically consistent with the results in this study. It shows that the flora in the middle and mountainous areas of Minzhe and Zhejiang hills generally have temperate distribution characteristics. Lou Luhuan et al. [40] showed that genera with pan-tropical distribution and Old World temperate distribution accounted for the

majority when studying the seed flora composition of Gutian Mountain in Zhejiang province. Shen Qi [41] and Li Zifang [42] et al studied the flora diversity of Xixi Wetland in Hangzhou, and the results showed that plants in this area showed characteristics of pan-tropical distribution. Zhang Kaidi [43], Wang Guoming [44], Wan Liqin [45] and other scholars have analyzed the floristic characteristics of the plant communities in the islands of Zhejiang Province, and concluded that the distribution type of genera is typical of the pantropical distribution type, which also indicates that the species of wetland ecosystem are affected by local climate and are different from the vegetation types in mountain areas. These results indicate that the subtropical evergreen broad-leaved forest, as a representative vegetation type in Zhejiang province, is influenced by flora to a certain extent and has an obvious zonal distribution pattern. It also illustrates the similarity of flora characteristics in different regions under the same vegetation landscape pattern, which can better understand species, community and vegetation diversity. It can also trace the evolution and succession of plants.

By studying the floristic characteristics of secondary forest in Fuyang District of Hangzhou, it was found that there were many angiosperms in the study area, indicating that they occupy a major position in the ecosystem. The distribution types of vascular plants in the genus are relatively complex, which also indicates that the vascular flora in this region is widely related to the flora around the world, and the floristic composition is complex and diverse. In terms of the composition of families and genera, lauraceae, Rosaceae and Ilexia contain more species, indicating that the vegetation in the study area has specific advantages and adaptability, and the distribution of these dominant species reflects the adaptability of plants to different environmental conditions. In terms of the number of species, lauraceae (20 species) and Rosaceae (21 species) were absolutely dominant, followed by 10-12 species including Euphorbiaceae, ilicaceae, legumes, Fagaceae, Magnoliaceae and camelliaceae, and 35 families containing only a single species, such as Dipteraceae, palm, and Ginkgo, etc., in terms of the subordinate composition, among 165 genera, The genus containing more species is Ilexia (10 species), and there are 6 genera containing more than 5 to 9 species, with a total of 33 species, and only one genus containing single species, such as Ichthyogramma, Mousespina, and Alpinia, etc., indicating that the number of vascular plant species varies greatly among different distribution types. Under such distribution pattern, it can be seen that compared with the floristic characteristics of species families, The composition and distribution type of species genus can directly show the evolution and variation of plants, and can also explain the characteristics of the flora of a region. In terms of plant distribution, it can be seen that seed plants have a wide range of distribution types, without any specificity or uniformity, and the distribution range of ferns is relatively limited, mainly worldwide distribution, tropical distribution in the old world, and intermittent distribution in tropical Asia and tropical America. At the same time, rare, endangered and endemic plants were also found, which also shows the importance of biodiversity conservation in specific areas. It can be seen from the vegetation types of forest in the study area that warm coniferous forest, evergreen deciduous mixed broad-leaved forest, evergreen broad-leaved forest, bamboo forest and shrub are the main forest components in the region.

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