COMMUNITY STRUCTURE AND CONSERVATION OF RARE AND ENDANGERED PLANTS OF GEOMANTIC FOREST IN SOUTHERN CHINA

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Abstract. Exploring the effects of urbanization on the conservation status of geomantic forest containing rare and endangered plants is very important for the ecological development of southern China. We studied the community structure and habitat characteristics of geomantic forest in Guangzhou City, southern China, as well as the population characteristics of the rare and endangered plant *Aquilaria sinensis* that resides there. The results showed that, within geomantic forest, there were 23 species vascular plants belonging to 23 genera and 14 families. This community was dominated by tropical and subtropical species. This community was mainly composed with mesophanerophytes, miphanerophytes and mesophyll. The community was less diverse than natural forests in the same region and contained one adult and eight seedling individuals of *Aquilaria sinensis*. This geomantic forest is a secondary evergreen broad-leaved forest with poor soil. In order to protect rare and endangered plants, as well as native species in this region, we suggest that all geomantic forests with rare and endangered plants in Guangzhou be set as small natural reserves that can be strictly managed. This kind of small natural reserve can facilitate the conservation of regional plant diversity and provide more ecosystem service.

Keywords: floristic composition, Shuixi Village, *Aquilaria sinensis*, soil property, urbanization

Introduction

Geomantic forest is purposely preserved to maintain the ecological environment in Southern China, Japan, and Korea, and is also shaped by both religion and the traditional culture of geomancy (Kim, 2014, 2017; Fan et al., 2019). The geomantic forest refers to the evergreen broad-leaved forest that has grown on edge of the villages for many years. The geomantic forest not only protects local plant resources but also contains rare and endangered species. In addition to protecting the environment, the geomantic forest also serves as a gene bank for the development and utilization of biological resources in the future (Cheng, 2011; Ye et al., 2013). Monsoon evergreen broad-leaved forests, with their complex community structure and rich biodiversity, are the typical zonal vegetation in southern China. They are an important part of the subtropical terrestrial ecosystem and play an important role in ecosystem services (Ren et al., 1996; Song et al., 2005). The monsoon evergreen broad-leaved forests in Southern China are mainly preserved in the form of nature reserves. Most of the geomantic forests in Guangzhou are inhabited by the

rare, endangered *Aquilaria sinensis* plant, but the forests are scattered and have been seriously damaged by deforestation and related human activities (Ye et al., 2013).

Aquilaria sinensis is a perennial tropical and subtropical evergreen tree that belongs to the Thymelaeaceae family. It is listed as a national second-class protected plant and an internationally protected tree. *Aquilaria sinensis* is a valuable resource in Chinese herbal medicine and is listed as one of the top ten broad-spectrum drugs (Mao et al., 2017; Wang et al., 2012). Due to over-harvesting, few *Aquilaria sinensis* individuals remain in the wild.

As a typical Chinese traditional forest, geomantic forest has mainly been studied in China, where research has been conducted to analyze their classification and conservation value (Hu et al., 2011; Luo et al., 2011; Tang et al., 2012; Deng, 2013; Gao et al., 2013), species composition and diversity (Liu et al., 2005; Mo et al., 2011; Lee et al., 2017; Lü et al., 2009c), community structure characteristics (Cai et al., 1998; Yang et al., 2012; Kong et al., 2013; Chen, 2017; Zhu et al., 2011; Lü et al., 2009a, b), biomass and carbon storage (Lu, 2017), spatial form and distribution (Lin et al., 2013), plant resources and utilization (Li et al., 2013), landscape reconstruction and planning, related human settlements and environmental culture (Cheng, 2011; Ye et al., 2013). The community characteristics and protection of *Aquilaria sinensis* in Guangzhou were also analyzed by several scholars (Zhu et al., 2011). In general, however, there are few studies on rare and endangered plants and their habitats in geomantic forest. The geomantic forest, home to many local native species, endemic species, and rare and endangered plants, is a local source of species diversity and provides shelter for rare and endangered plants (Ye et al., 2013). Within the Luogang District in Guangzhou City there are 15 geomantic forests, all with similar species composition and community structure (Ye et al., 2013).

For this analysis, we focused our research on the geomantic forest in Shuixi Village, which is representative of the geomantic forest in Guangzhou and is inhabited by *Aquilaria sinensis*. Shuixi Village is located in the eastern suburbs of Guangzhou. After relocation to the Huangpu District in 2014, it has become an important area for development and transformation. Shuixi Village was listed as one of the old village reconstruction projects in Guangzhou in 2016. With the growing population and increased economic development of the village, the forest faces the negative effects of human interference and climate change caused by urbanization. In this study, we examined the community structure of the geomantic forest in Shuixi Village, as well as the structure and community habitat of the *Aquilaria sinensis* population within this forest. Specifically, we addressed the following three topics: (1) the community structure and habitat of the geomantic forest, (2) the population status of *Aquilaria sinensis* in the geomantic forest and (3) the strategies to protect the geomantic forest, as well as its rare and endangered plants.

Materials and methods

Research site

The geomantic forest (Fig. 1), with an area of approximately 6 hectares, is located at the rear of Shuixi Village, in northeast Guangzhou, Guangdong Province, China, 113°28'41.6"N, 23°11'49.2"E. The forest is located about 50 m above sea level, and has an eastern slope of 15°. It belongs to the lower subtropical monsoon climate, and has an average annual temperature of 23 °C. The lowest temperature occurs in January and is 13 °C, and the highest temperature is 28 °C and occurs in August (Mao et al., 2017). The annual average humidity is about 79%, the annual average rainfall is about 1700 mm, and the rainy season is from April to October (Zhu et al., 2011; Yi et al., 2012). The zonal

vegetation in this area is the lower subtropical monsoon evergreen broad-leaved forest, and the zonal soil is laterite. Shuixi Village covers a significant area with a large population. It is surrounded by artificially planted *Acacia mangium*, *Cinnamomum burmanni*, and *Manglietia glauca*. In the geomantic forest, *Acacia mangium* covers the most area, and native species only cover about 900 m². There are some signs of deforestation and we find that human activities have affected the geomantic forest, as there are traces of raising chickens, stacking garbage and walking around the forest.

Figure 1. The community structure and habitat of the geomantic forest

Investigation and analysis methods

The typical community sampling method was used to investigate the vegetation of the geomantic forest in Shuixi Village in November 2017. Samples of soil and leaf litter were also taken for analysis. As mentioned above, the area of the geomantic forest where native species remain is about 900 m². Only eight 10 m × 10 m quadrates were established in the area containing native species. We investigated the crown density, species, plant height, and diameter at breast height (DBH) in the arbor layer, where the DBH is ≥ 1 cm. A 5 m × 5 m shrub quadrate was randomly selected from each 10 m × 10 m quadrate, and a 1 m × 1 m herb layer was randomly set in the shrub quadrate (Ren et al., 1996). The species name, height, and coverage of each individual in the shrub and herb quadrates were recorded. Three 1 m×1 m litter layers were randomly collected from each 10 m × 10 m square to measure the litter standing crop in the ground layer (Ren et al., 1998).

Five 10 m × 10 m quadrates were selected for soil property analysis. In each of the five quadrates chosen, six soil samples (0-20 cm) were randomly collected using drilling tools and mixed. Soil samples were brought back to the laboratory. Samples were air-dried and sieved for analysis of soil organic matter, pH, N, P, and K contents. The analysis method followed Peng (1996) and Ren et al. (1996). There were five replicates per site (i.e. one replicate per quadrat). In addition, the leaf area index and extinction coefficient were analyzed using the LAI-2000 plant canopy analyzer (Ren et al., 1996).

Data analysis

Based on the standards of Raunkiaer's Life-form Spectrum and the Flora of China and Guangdong Flora (Cai et al., 1998), various life forms of plants were comprehensively determined. Field observations and survey data were used to determine the leaf type. The basal area, frequency, relative frequency, relative density, relative significance, importance value, diversity index, ecological dominance and uniformity index were calculated (Ren et al., 1996). The species composition of the shrub layer in the community, the spatial structure, the species structure of *Aquilaria sinensis* and the soil chemical properties were determined. The relevant equations are as follows:

$$\text{Important value } IV = 100 \times (\text{relative degree} + \text{relative frequency} + \text{relative significance}) / 3 \quad (\text{Eq.1})$$

$$\text{Shannon - Wiener index } HP = -\sum (Pi \times \ln Pi) = -\sum [(Ni / N) \times \ln(Ni / N)] \quad (\text{Eq.2})$$

$$\text{Ecological dominance } C = Ni (Ni - 1) / [N (N - 1)] \quad (\text{Eq.3})$$

$$\text{Pielou evenness index } JSW = -\sum (Pi \ln Pi) / \ln S \quad (\text{Eq.4})$$

where Pi is the relative abundance of the i -th species, Ni is the number of plants of the i -th species, N is the total number of plants, and S is the total number of species (Peng, 1996; Luo et al., 2011).

The data were processed using Office Excel.

Results and analysis

Community structure

Geomantic forests are evergreen all year round, with an overall height of about 10 m and a canopy closure of about 70%. The leaf area index (LAI) of the community is 4.98 and the extinction coefficient, K , is 0.325. The canopy layer is discontinuous, and there is a notable vertical stratification of tree layer, shrub layer and herb layer.

In the 800 m² area, there are 167 individuals, some of which are monoecious, bringing the total to 178 individuals in the arbor layer. These individuals belong to 14 families and 23 genera, and have an average DBH of 6.8 cm and an average height of 5.5 m. Among 178 individuals, there are three genera and three species in each family of Euphorbiaceae, Rubiaceae and Polygonaceae. The arbor layer is dominated by families and genera of tropical and subtropical plants. There are 115 individuals shorter than 5 m, making up 65% of the total; 43 individuals between 5-10 m tall, accounting for 24% of the total and 20 individuals taller than 10 m occupying 11% of the total. There are 124 individuals with a DBH within 5 cm, accounting for 70% of the total, 33 individuals with a DBH between 5 and 10 cm, making up 18% of the total, and 21 individuals with a DBH greater than 10 cm, occupying 12% of the total. In general, the community is relatively short, with the majority of trees being small in size.

The geomantic forest community is made up of a diverse array of species. In the arbor layer, four species, including *Engelhardia roxburghiana* Wall., *Acacia mangium* Willd., *Psychotria rubra* (Lour.) Poir., and *Aporosa dioica* (Roxb.) Muell. Arg., account

for about 65% of the importance value (*Table 1*). There are only seven large *Acacia mangium* individuals, which have the largest height and DBH within the community. This species has no young individuals. As the pioneer species, it will gradually withdraw from the community. *Astragalus membranaceus*, which is the most dominant species in the arbor layer, has 31 individuals. *Psychotria rubra* and *Aporosa dioica* have the largest number of individuals, all of which are short, small trees. There are 13 species of shrubs, 10 of which are also present in the arbor layer, and one of which is also present in the herb layer (*Table 2*). There are seven species within the herbaceous layer, four of which also in the arbor layer, one of which is present in the shrub layer, and two of which are ferns (*Tables 1-3*).

According to the Raunkiaer's Life-form Spectrum, among the 23 species in the arbor layer, only five species are middle phanerophytes, and the other 18 species are small phanerophytes. Moreover, two species have large-sized leaves and five species have small-sized leaves. The other 16 species have medium-sized leaves. In the wild, plants in this community predominantly have leathery, single medium-sized leaves. The Shannon-Wiener biodiversity index of the arbor layer is 2.458, which is significantly lower than the diversity index of 4.01 in the Dinghu Mountain zonal vegetation–monsoon evergreen broad leaved forest in 1992. The indexes of ecological dominance and uniformity have little difference, as they are 0.13 and 0.784, respectively (Ren et al., 1996).

Population structure of the rare species Aquilaria sinensis

There is one *Aquilaria sinensis* individual in the arbor layer, with a DBH of 8 cm and a height of 6.5 m in the geomantic forest. There are six *Aquilaria sinensis* individuals in the shrub layer, one with a basal diameter of 1.3 cm and a height of 1.7 m, four with a basal diameter of 0.7 cm and a height of 0.7 m, and one with a basal diameter of 0.4 cm and a height of 0.6 m. Two *Aquilaria sinensis* individuals occupy the herbaceous layer, with a height of 0.2 m. The importance value of *Aquilaria sinensis* is 0.72, accounting for 0.7% of the community. *Aquilaria sinensis* is a mesophanerophyte, a group which makes up a small portion of the community. *Aquilaria sinensis* is also a species with medium-sized leaves, and these types of species occupy a large portion of the community.

Soil properties of the community

The soil in the sample plot consists of a thick layer of fertile laterite. The average weight of the litter layer is $530 \pm 50.99 \text{ g m}^{-2}$, and the litter layer is rich in humus. The A layer of soil, with a thickness of 0-20 cm, has a pH of 4.46, making it acidic. The organic content is 30.48 g kg^{-1} , and the total nitrogen content is 1.18 g kg^{-1} . The main chemical properties of the soils are shown in *Table 4*. The soil of this community is similar to that of nearby Changlong Village in Longgang District and Zhongling Village in Zengcheng District, but there are some differences. Overall, the soil fertility of the sample plot is not as high as that of the zonal climax vegetation in Dinghu Mountain. This indicates that the soil fertility of the small-size geomantic forest has been influenced by human activities and needs to be improved to be on par with that of the natural soil in a large-size nature reserve. The content of organic matter and available potassium in this plot is particularly high, which may be related to activities of local villagers, such as raising chickens and stacking garbage.

Table 1. Species and its important value in arbor layer

No.	Species	Families	Genera	Lifestyle	Number of trees	Average DBH /cm	Average H /m	Importance values
1	<i>Engelhardia roxburghiana</i> Wall.	Juglandaceae	Engelhardia	Mesophanerophyte	31	15.5	9.6	26.54
2	<i>Acacia mangium</i> Willd.	Fabaceae	Acacia	Mesophanerophyte	7	41.5	21.0	16.78
3	<i>Psychotria rubra</i> (Lour.) Poir.	Psychotria	Psychotria	Microphanerophyte	45	2.5	2.8	12.04
4	<i>Aporosa dioica</i> (Roxb.) Müll. Arg.	Euphorbiaceae	Aporosa	Microphanerophyte	26	3.6	3.8	9.10
5	<i>Endospermum chinense</i> Benth	Euphorbiaceae	Endospermum	Mesophanerophyte	9	8.1	9.0	4.94
6	<i>Castanopsis chinensis</i> Hance	Fagaceae	Castanopsis	Mesophanerophyte	8	4.9	5.0	4.09
7	<i>Garcinia multiflora</i> Champ. Ex Benth.	Clusiaceae	Garcinia	Microphanerophyte	8	2.8	3.6	3.91
8	<i>Litsea rotundifolia</i> Hemsl. Var. <i>oblongifolia</i> (Nees) Allen	Lauraceae	Litsea	Microphanerophyte	7	1.9	3.0	3.19
9	<i>Acronychia pedunculata</i> (L.) Miq.	Rutaceae	Acronychia	Microphanerophyte	6	5.2	5.8	3.19
10	<i>Ardisia quinqueгона</i> Bl.	Myrsinaceae	Ardisia	Microphanerophyte	7	1.5	2.9	3.18
11	<i>Ilex asprella</i> (Hook. et Arn.) Champ. ex Benth.	Aquifoliaceae	Ilex	Microphanerophyte	4	1.4	2.4	2.15
12	<i>Cinnamomum burmanni</i> (Nees et T. Nees) Blume	Lauraceae	Cinnamomum	Microphanerophyte	3	1.5	2.8	1.50
13	<i>Glochidion eriocarpum</i> Champ. ex Benth.	Euphorbiaceae	Glochidion	Microphanerophyte	3	1.4	2.6	1.50
14	<i>Archidendron lucidum</i> Benth.	Fabaceae	Archidendron	Microphanerophyte	2	1.2	2.4	1.30
15	<i>Manglietia glauca</i> Blume	Magnoliaceae	Manglietia	Microphanerophyte	2	4.1	5.1	0.88
16	<i>Aidia pycnantha</i> (Drake) Tirveng.	Psychotria	Aidia	Microphanerophyte	2	3.4	4.1	0.86
17	<i>Schefflera octophylla</i> (Lour.) Harms	Araliaceae	Schefflera	Mesophanerophyte	2	1.3	2.2	0.84
18	<i>Aquilaria sinensis</i> (Lour.) Spreng.	Thymelaeaceae	Aquilaria	Mesophanerophyte	1	8.0	6.5	0.72
19	<i>Cratoxylum cochinchinense</i> (Lour.) Bl.	Clusiaceae	Cratoxylum	Microphanerophyte	1	4.3	4.5	0.67
20	<i>Adina pilulifera</i> (Lam.) Franch. ex Drake	Psychotria	Adina	Microphanerophyte	1	2.2	3.5	0.66
21	<i>Viburnum sempervirens</i> K. Koch	Caprifoliaceae	Viburnum	Microphanerophyte	1	1.4	2.2	0.65
22	<i>Machilus chekiangensis</i> S. Lee	Lauraceae	Machilus	Mesophanerophyte	1	1.3	2.7	0.65
23	<i>Melicope pteleifolia</i> (Champ. ex Benth.) T. Hartley	Rutaceae	Melicope	Microphanerophyte	1	1.0	2.2	0.65
	Total				178	6.8	5.5	100

Table 2. Species composition in shrub layer

No.	Species	Families	Genera	Lifestyle	Number of trees	Average H /cm	Average base diameter /cm
1	<i>Litsea rotundifolia</i> Hemsl. Var. <i>oblongifolia</i> (Nees) Allen	Lauraceae	Litsea	Microphanerophyte	5	93.3	0.6
2	<i>Garcinia multiflora</i> Champ. Ex Benth.	Clusiaceae	Garcinia	Microphanerophyte	2	80.0	0.9
3	<i>Alchornea trewioides</i> (Benth.) Muell. Arg.	Euphorbiaceae	Alchornea	Nanophanerophytes	2	100.0	0.5
4	<i>Acronychia pedunculata</i> (L.) Miq.	Rutaceae	Acronychia	Microphanerophyte	3	80.0	0.6
5	<i>Psychotria rubra</i> (Lour.) Poir.	Psychotria	Psychotria	Microphanerophyte	20	93.3	0.9
6	<i>Archidendron lucidum</i> Benth.	Fabaceae	Archidendron	Microphanerophyte	1	100.0	0.5
7	<i>Ixora chinensis</i> Lam.	Psychotria	Ixora	Nanophanerophytes	2	60.0	0.4
8	<i>Ardisia quinqueгона</i> Bl.	Araliaceae	Ardisia	Microphanerophyte	6	140.0	1.1
9	<i>Glochidion eriocarpum</i> Champ. Ex Benth.	Euphorbiaceae	Glochidion	Microphanerophyte	4	95.0	0.8
10	<i>Aquilaria sinensis</i> (Lour.) Spreng.	Thymelaeaceae	Aquilaria	Mesophanerophyte	6	100.0	0.8
11	<i>Gardenia jasminoides</i> Ellis	Psychotria	Gardenia	Nanophanerophytes	1	21	0.7
12	<i>Cinnamomum burmanni</i> (Nees et T. Nees) Blume	Lauraceae	Cinnamomum	Microphanerophyte	1	120.0	1.0
13	<i>Aporosa dioica</i> (Roxb.) Müll. Arg.	Euphorbiaceae	Aporosa	Microphanerophyte	10	103.3	0.9
	Total				63	91.2	0.8

Table 3. Species composition in grass layer

No.	Species	Families	Genera	Lifestyle*	No. of trees	Average H/cm	Coverage /%
1	<i>Pteris semipinnata</i> Linn	Pteridaceae	Pteris	Fern	5	45.0	6.0
2	<i>Litsea rotundifolia</i> Hemsl. Var. <i>oblongifolia</i> (Nees) Allen	Lauraceae	Litsea	Microphanerophyte	3	10.0	1.0
3	<i>Psychotria rubra</i> (Lour.) Poir.	Psychotria	Psychotria	Microphanerophyte	4	17.5	3.5
4	<i>Ixora chinensis</i> Lam.	Psychotria	Ixora	Nanophanerophytes	3	25.0	2.0
5	<i>Ardisia quinqueгона</i> Bl.	Myrsinaceae	Ardisia	Microphanerophyte	2	35.0	4.0
6	<i>Adiantum flabellulatum</i> Linn.	Adiantaceae	Adiantum	Fern	4	15.0	3.0
7	<i>Aquilaria sinensis</i> (Lour.) Spreng.	Thymelaeaceae	Aquilaria	Mesophanerophyte	2	20.0	4.0
	Total				23	24.5	23.5

Table 4. Chemical properties of the soils

Location	pH value	Organic matter / (g*kg-1)	Total N / (g*kg-1)	Total P / (g*kg-1)	Effective P /ppm	Total K /%	Available K /ppm
Shuixi Village *	4.46 ± 0.06	30.48 ± 2.38	1.18 ± 0.06	0.252 ± 0.03	3.95 ± 2.67	3.19 ± 0.15	52.32 ± 12.09
Zhongling Village**	4.42	15.06	0.70	0.15	1.53	1.41	20.11
Changlong Village 1**	3.84	14.70	8.20	0.31		1.80	
Changlong Village 2**	3.76	37.60	1.97				
Mount Dinghu**	4.10	24.80	2.00	0.80	4.60	3.70	14.20

*The data measured in Shuixi Village include standard deviation. **The data measured in Zhongling Village are from our investigation. The data measured in Changlong Village 1 are cited from Zhu Baozhu (2011). The data measured in Changlong Village 2 are cited from Cai Xi'an (1998). The data measured in Mount Dinghu are cited from Peng Shaolin (1996)

Discussion

The community structure indicates that the geomantic forest is a secondary monsoon evergreen broad-leaved forest. There are artificially planted *Acacia mangium* individuals outside the native species community. The community species are somewhat similar to those seen in the monsoon evergreen broad-leaved forest at Dinghu Mountain, despite the presence of *Acacia mangium*. However, the geomantic forest in Shuixi Village also shows tropical and subtropical properties in its floristic composition, community life type and leaf type spectrum. However, there are no plate-like roots, cladanthly, drip-tip plants, or woody vines that are typically observed in natural vegetation. Compared with natural forests, the number of species in the geomantic forest in Shuixi Village is smaller, the population density is lower, the overall height of the vegetation is shorter and the DBH of the vegetation is smaller. There are only three layers in this community, arbor, shrub and herb, meaning that the liana layer, three sub-layers of the arbor and five sub-layers of shrub and herb that are present in natural forests are missing in the Shuixi village forest. Although the community is mainly composed of species with medium-sized leaves, it is different from the structure of natural forests, which have reasonable proportions of species with various types of leaves. The mesophanerophytes and mphanerophytes are the main components of the community, and there are no phaenerophytes. This is mainly due to the fact that the community is not mature enough. In addition, the community's diversity index is significantly lower than that of Dinghu Mountain (Ren et al., 1996). Therefore, this geomantic forest is a lower subtropical monsoon evergreen broad-leaved forest displaying secondary growth after human disturbances. However, the species coefficient of this forest is 100%, indicating that it still has a large development trend with its species richness (Cai et al., 1998).

In terms of the soil chemical properties, the fertile lateritic soil of this geomantic forest is the same as that of the monsoon evergreen broad-leaved forest in Dinghu Mountain. However, aside from the organic matter and available potassium levels, other indicators of the soil health in the geomantic forest are lower than those for the soil in the Dinghu Mountain forest. Moreover, soil indicators in the geomantic forest in Shuixi Village are also different from those of the other nearby geomantic forests (Fan et al., 2019). There are two possible reasons for the increased soil fertility in this geomantic forest. First, the geomantic forest is close to the village where there are chickens and garbage, which may contaminate the soil. Second, the vegetation is inferior to what is observed in natural forests, which is the result of various types of disturbances. Despite this, the geomantic forest in Shuixi Village still has high soil fertility and can ensure the growth of the native vegetation.

There are nine *Aquilaria sinensis* individuals in the geomantic forest in Shuixi Village. These individuals have a certain age structure, indicating that they are still capable of self-renewal, and the habitat of this community is suitable for the regeneration and growth of *Aquilaria sinensis*. In particular, the acidic soil (pH 4.46) of the geomantic forest in Shuixi Village makes it suitable for *Aquilaria sinensis* growth. The nutrient content of the soil in the Shuixi Village geomantic forest is generally lower than that of the forest in Dinghu Mountain, however, *Aquilaria sinensis* can adapt to nutrient-poor environments (Wang et al., 2012). The poor soil affects the secretion of the resin from *Aquilaria sinensis*, and in terms of resin quality, growth in barren soil may be better than growth in fertile soil (Luo et al., 2011).

With the rapid development of society and the acceleration of urbanization in Southern China, the disturbance of the monsoon evergreen broad-leaved forest in Shuixi Village is becoming more serious. Both the distribution and area of the forest are shrinking. Meanwhile, the forest quality is decreasing, leading to a simplified community structure, decreased function, invasion of exotic species, and the disappearance of a large number of rare species. In this area, the ability of the forest to positively influence climate regulation and water conservation will be weakened to some extent, and the soil will be degraded. The geomantic forest in Shuixi Village is a natural secondary forest but it is also part of the urban landscape. The geomantic forest is well-preserved compared to other types of forests, but it also reveals the influence of urbanization and human disturbance on natural forest (Chen et al., 2018). This forest is a local species bank and the provenance of rare and endangered plants in the region. It is also part of a unique environmental and cultural tradition in Southern China, making it an important resource for studying zonal forest communities, local culture and history. Furthermore, the forest provides certain ecological services, as well as landscape cultural value. Overall, the geomantic forest is an important element in the construction of rural landscapes and it needs to be actively preserved (Lin et al., 2013).

Conclusion

Shuixi Village in Guangzhou is representative of the other villages located in the center of the Guangdong-Hong Kong-Macao Greater Bay Area and its geomantic forest is characteristic of those seen in urban cities. The geomantic forest in the region can help preserve and recover the monsoon evergreen broad-leaved forest in the region, and maintain the harmony between humans and nature, thus promoting sustainable ecological development in the Greater Bay Area. The nature reserves were effectively protected by regulations and laws. However, there are no such regulations or laws in place to protect geomantic forests. Therefore, setting environmental regulations for geomantic forests, where most rare and endangered plants grow, will provide ecological support for sustainable development and will improve the ecological civilization in the Greater Bay Area. In addition, the dynamic monitoring and ecosystem service on geomantic forest is needed in future.

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