

Flora-Based Study on Tree Species Characteristics of Natural Forest Communities in the Leizhou Peninsula (Postprint)

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Abstract

Traditional research approaches involving flora and important values typically begin by analyzing the floristic composition of a region, followed by analyzing the important value of a dominant species within a particular flora in that region. This approach has limitations in that it fails to simultaneously reflect the participation of different plant species from different floras in community construction and their status within the community. To address these issues, we constructed a species community index and conducted a study focusing on woody plants in the natural monsoon forests of the Leizhou Peninsula. Based on measured data from 80 fixed 20 m × 20 m plots across eight regions of the Leizhou Peninsula, we constructed a species community index using a flora + important value approach. (1) The communities of Yunjiao Village in Zhanjiang, Huguangyan in Zhanjiang, Yingfengling in Leizhou, Zurong Village in Leizhou, Shuangyang Village in Xuwen, Gaoqiao in Lianjiang, and XieXie Mountain in Lianjiang were all dominated by tropical flora distribution, with values all exceeding 0.8. Genzhuzhang in Lianjiang has a special geographical location, being dominated by East Asian and North American disjunct distribution of Flora 9, with a value approaching 0.5. (2) Flora 2 tree species held a dominant position in the composition and construction of community tree species in the Leizhou Peninsula, with a maximum value of 0.4261, and *Celtis sinensis* and *Schefflera heptaphylla* were the dominant species; Flora 3 and Flora 6 tree species were in a disadvantaged position; Flora 4 tree species held a dominant position, with a maximum value of 0.3339, and *Canarium album* was the dominant species; Flora 5 tree species held a dominant position, with a maximum of 0.3787, and *Cinnamomum burmannii* and *Cinnamomum camphora* were the dominant species; Flora 7 tree species were relatively evenly distributed within communities in the Leizhou Peninsula region, being generally adapted to various plots. This study demonstrates that the Leizhou Peninsula region exhibits distinct tropical flora characteristics; the species community index can effectively reflect the characteristics of tree species

from various floras in the composition of plant communities across plots in the Leizhou Peninsula.

Full Text

Preamble

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Study on Tree Species Characteristics of Natural Forest Communities in Leizhou Peninsula Based on Flora

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Abstract

Traditional research approaches to regional flora and important values typically analyze flora composition first, then examine the important values of dominant species within specific floristic elements. However, this design fails to simultaneously reflect how species from different floristic elements participate in community assembly and their actual status within the community. To address this limitation, we calculated a species community index (SCI) for woody plants in natural seasonal rainforests of Leizhou Peninsula using field data from eight fixed plots. The SCI integrates floristic composition and important values to characterize community structure.

Our results show: (1) Yunjiao Village and Huguang area in Zhanjiang, Yingfeng Ridge and Zurong Village in Leizhou, Shuangyang Village in Xuwen, and Gaoqiao Village and Xiexie Mountain in Lianjiang all exhibited dominant tropical floristic distributions, with SCI values exceeding 0.8. Genzhuzhang Mountain peak in Lianjiang was unique, with dominant species from Flora 9 showing an SCI near 0.5. (2) In Huguang area, Flora 2 held the highest SCI (0.4261) with *Leucaena leucocephala* as the dominant species, while Flora 3 and Flora 6 species (*Celtis sinensis* and *Schefflera heptaphylla*) were disadvantaged. Flora 4 was dominant with the highest value of 0.3339 and olive as the dominant species. Flora 5 was also dominant with an SCI of 0.3787 and *Cinnamomum*

burmannii/Cinnamomum bodinieri as dominant species. Flora 7 showed balanced distribution across Leizhou Peninsula communities, generally adapting to various plots. This study demonstrates that Leizhou Peninsula exhibits distinct tropical floristic characteristics, and the species community index effectively reflects the role of different floristic elements in community composition.

Keywords: species community index; important value; Leizhou Peninsula; flora

Introduction

Studies on floristic characteristics and evaluation of dominant species' important values are fundamental to community ecology. Most literature traditionally separates flora analysis from important value assessment [1-6], typically focusing on species, genus, and family counts within a flora while neglecting the actual status of these taxa within communities [7-12]. This approach fails to fully reflect situations where a flora may have numerous species but low important values, placing it in a secondary role despite its numerical abundance.

To address these limitations, we propose the Species Community Index (SCI) to characterize how floristic elements participate in forest community assembly. Based on Wu Zhengyi' s classification of distribution types of Chinese seed plant genera [14], which identifies 15 distribution types and variants, the SCI integrates important values of all species within each floristic element to reveal their collective role in community structure. This index offers advantages over traditional methods by simultaneously reflecting both floristic composition and species' ecological status, providing crucial insights for understanding community assembly processes and competitive dynamics among floristic elements.

Tropical seasonal rainforests represent the zonal vegetation of China' s northern tropical margin and constitute an important component of Leizhou Peninsula' s flora. However, long-term human disturbance has eliminated primary climax communities, leaving only rare secondary fragments [13]. Studying the SCI in these remaining secondary seasonal rainforests can enhance our understanding of woody plant community composition, status, and trends, providing essential references for ecological restoration of the peninsula' s tropical forests serving 80 million people.

1. Study Area Overview

Leizhou Peninsula (109°30' -110°55' E, 20°12' -21°35' N) lies at mainland China' s southernmost tip, covering 12,470 km². The terrain is relatively flat, sloping gently from north to south. Geological substrates include basalt, granite, or sandstone, forming acidic latosol or lateritic red soil. Coastal areas feature

saline soil, sandy soil, and mangrove acid sulfate soil. The climate shows distinct northern tropical maritime characteristics, with abundant heat resources (annual mean temperature 22.8–23.5°C), hot rainy summers, and typhoon influences. Spring and autumn occur in early May and early November, respectively.

2. Survey Methods and Plots

We surveyed eight remaining natural forest areas across Leizhou Peninsula:

1. **Yingfeng Ridge** (Leizhou): 247 m elevation, secondary seasonal rainforest
2. **Huguang area** (Zhanjiang): 42 m elevation
3. **Yunjiao Village** (Zhanjiang): 16 m elevation
4. **Gaoqiao natural forest** (Lianjiang): 73 ha area
5. **Xiexie Mountain** (Lianjiang): 210 m elevation, well-preserved primary forest
6. **Genzhuzhang Mountain** (Lianjiang): 210 m elevation, tropical-subtropical transitional forest
7. **Zurong Village** (Leizhou): 82 m elevation, well-preserved fragment
8. **Shuangyang Village** (Xuwen): 121 m elevation, rare primary fragment

In each area, we established 20 m × 20 m plots and measured all trees with diameter at breast height (DBH) > threshold, recording species, DBH, height, and crown width.

3. Establishment of Species Community Index

The SCI characterizes how floristic elements contribute to forest community assembly. Important values (IV) for trees and shrubs were calculated separately for each plot based on relative density, relative dominance, and relative frequency [13], then averaged across plots. Using Wu Zhengyi's 15 distribution types [14], we calculated SCI as the sum of important values for all species within each floristic element. The mathematical formulation integrates these values through piecewise functions, with the domain comprising the union of all floristic elements. Data were processed using SPSS 20.0 and Excel 2007.

4. Results

4.1 SCI Analysis of Eight Regional Plots

The eight plots showed distinct SCI compositions. Yunjiao Village was dominated by pantropical (Flora 1), paleotropical (Flora 2), and tropical Asia to tropical Australasia distributions. Huguang area and Yingfeng Ridge showed

absolute dominance by Flora 1. Zurong Village, Shuangyang Village, Gaoqiao, and Xiexie Mountain were dominated by tropical Asian distributions (Flora 4), though with varying emphasis: Zurong favored Flora 2, Shuangyang and Gaoqiao favored Flora 4, and Xiexie Mountain favored Flora 5. Genzhuzhang Mountain uniquely showed East Asian–North American disjunct distribution (Flora 7) as dominant, reflecting its transitional location and cold air influence, while retaining tropical characteristics.

4.2 Comparison of Different Plots Within the Same Floristic Type

Flora 1 (Pantropical distribution): SCI values ranked as: Zurong Village > Genzhuzhang Mountain > Huguang area > Yingfeng Ridge > Shuangyang Village > Xiexie Mountain > Gaoqiao > Yunjiao Village. Huguang area and Yingfeng Ridge, historically disturbed in the 1960s–1970s [15], now have two floristic elements co-dominating, with *Microcos paniculata* as the most important native species.

Flora 2 (Paleotropical distribution): Huguang area showed the highest SCI (0.4261) with *Leucaena leucocephala* as dominant. Species from Flora 3 (*Celtis sinensis*) and Flora 6 (*Schefflera heptaphylla*) were disadvantaged.

Flora 4 (Tropical Asian distribution): Dominant across most plots with the highest SCI value of 0.3339 and olive as dominant species.

Flora 5: Also dominant with SCI of 0.3787 and *Cinnamomum burmannii*/*C. bodinieri* as dominants.

Flora 7 (East Asian–North American disjunct): Widely distributed and well-adapted across Leizhou Peninsula, playing important roles in community regeneration with species like wild litchi.

Other floras (North temperate, Mediterranean, West to Central Asian): Showed low diversity and sporadic distribution, generally disadvantaged except at Genzhuzhang Mountain, where the north temperate *Castanopsis carlesii* dominated with an IV of 0.4787 due to subtropical monsoon influences.

shows detailed SCI values across plots and floristic types.

analyzes other floras' important values, highlighting *Castanopsis carlesii* (0.4787) at Genzhuzhang Mountain and other minor species.

5. Discussion

5.1 Discussion of SCI Across Eight Plots

Leizhou Peninsula's forest communities show distinct tropical characteristics, consistent with Han et al. [16]. The SCI effectively reveals compositional fea-

tures of different forest regions, showing which floristic elements dominate. However, interpreting SCI requires considering site conditions, intraspecific competition, and interactions among floristic elements to understand underlying mechanisms.

5.2 Discussion of Within-Flora Comparisons

Flora 1: Shows a trend where better ecological conditions correlate with lower SCI dominance, likely because these species are important for early successional recovery after disturbance [15]. Their dominance in disturbed sites like Huguang area and Yingfeng Ridge reflects post-typhoon regeneration dynamics.

Flora 2 and 3: Consistently disadvantaged across all plots, even absent from Genzhuzhang Mountain. The factors causing their secondary status require further investigation.

Flora 4: Widely distributed and adaptable across plots, dominating in mid-to-late successional stages. Despite similar climate between Zurong Village and Shuangyang Village (50 km apart, 40 m elevation difference), their SCI compositions differ significantly, suggesting site-specific factors beyond climate.

Flora 7: Shows strong adaptation to Leizhou Peninsula conditions, possibly due to soil adaptability. Its balanced distribution reflects tolerance to varied environments.

Flora 8 and 9: Similar to Flora 7 but with fewer species, generally playing secondary roles in community assembly.

Other floras: Generally disadvantaged due to unsuitable environmental conditions, though Genzhuzhang Mountain's unique location as a Yunkai Mountain branch with subtropical monsoon climate allows north temperate species like *Castanopsis carlesii* to dominate.

6. Conclusion

Leizhou Peninsula's tropical seasonal rainforest communities are predominantly composed of tropical floristic elements with distinct tropical characteristics. The species community index effectively demonstrates that: 1. Tropical floristic types (Flora 1, 4, 5) dominate community composition and structure. 2. SCI values tend to be lower in better-preserved ecological environments. 3. Flora 2 and 3 remain consistently disadvantaged in competitive interactions. 4. Flora 4 and 5 show strong adaptability and can dominate during different successional stages. 5. Flora 7, 8, and 9 serve as important community components, particularly in mid-to-late succession. 6. Other floras (north temperate, Mediterranean) play minor roles except in special transitional habitats like Genzhuzhang Mountain.

The SCI provides a robust tool for characterizing how different floristic elements contribute to community composition in Leizhou Peninsula' s natural forests.

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Note: Figure translations are in progress. See original paper for figures.

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