Postprint: Research on Plant Landscape and Application in Traditional Dai Villages of Dehong, Yunnan

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Abstract

The plant landscapes of traditional villages reflect an ethnic group' s accumulated knowledge and application experience of plants through long-term practice, possessing both regional naturalness and cultural characteristics, thus holding important reference significance for village ecological environment construction and sustainable utilization of ethnobotanical plants. This study conducted an investigation of plant landscapes and their applications in 19 traditional Dai villages in the Daying River and Ruili River basins of Dehong Prefecture, Yunnan Province. The results indicate that the horizontal distribution of plant landscapes in traditional Dai villages in Dehong follows a pattern of outside the village (forest green patches + farmland green patches + embankment protection green belts) —village edge (protective green ring + banyan tree green patches) —inside the village (green points + green lines); vertical distribution comprises five landscape layers; there are a total of 181 common plant species, belonging to 73 families, within the villages; plants within the villages are mostly artificially cultivated, possessing strong practicality, with main application functions concentrated in food, medicine, ornamental, protective isolation, aromatics and seasoning, etc.; the plant-related cultural landscapes of Dai villages exhibit religious overtones. It is recommended to strengthen the spatial connectivity of horizontal plant distribution and establish a stable green space system pattern; maintain the vertical landscape layers of plants, and promote the application of plants' construction functions; make full use of plant resources to form industrial advantages; preserve outstanding plant cultural landscapes. Ultimately, promote traditional application experience of plants in village construction, and facilitate the sustainable protection and development of ethnic villages and plants. The research findings provide a scientific basis for the construction of human settlements of the Dai people in Dehong and the application of ethnobotany.

Full Text

Study on Plant Landscape and Application in Traditional Dai Villages of Dehong, Yunnan

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Abstract

The plant landscape of traditional villages reflects a nation's accumulated knowledge and experience in plant cognition and application through long-term practice. These landscapes embody both regional natural characteristics and cultural significance, offering important reference value for village ecological construction and sustainable utilization of ethnobotanical resources. This study investigated plant landscapes and their applications in 19 traditional Dai villages located in the Dayingjiang and Ruilijiang river basins of Dehong Prefecture, Yunnan Province.

The results reveal that the horizontal distribution of plant landscapes in Dehong' s traditional Dai villages follows a pattern of five spatial forms across three zones: outside the village (forest patches + farmland patches + embankment protection belts) —village edge (protective green rings + *Ficus altissima* patches) — inside the village (green nodes + green lines). Vertically, the landscape exhibits five distinct layers. A total of 181 plant species belonging to 73 families were documented within the villages. Most plants are cultivated with strong practical functions, primarily concentrated in food, medicine, ornamental, protective isolation, and aromatic seasoning applications. The plant cultural landscape exhibits distinct religious characteristics.

We recommend strengthening spatial connectivity in horizontal plant distribution to establish a stable green space system pattern, maintaining vertical landscape layers while promoting applications of plant construction functions, fully utilizing plant resources to develop industrial advantages, and preserving excellent plant cultural landscapes. Ultimately, disseminating traditional plant application experience in village construction will promote sustainable conservation and development of both ethnic villages and plant resources. These findings provide a scientific basis for human settlement construction and ethnobotanical applications in Dehong' s Dai communities.

Keywords: Dehong Dai; traditional villages; plants; landscape; application

Introduction

Plant landscapes in traditional villages result from communities using plants to improve ecology, construct spaces, beautify environments, and apply them for food, medicine, and cultural purposes. These landscapes reflect a nation' s accumulated plant cognition and application experience through long-term practice, representing an intersection of ethnobotany and human settlement studies. Pei Shengji (2013) argues that with rural revitalization, the application of ethnobotany in regional environmental construction has become an important research direction. Home et al. (2014) suggest that through rural ecological green space construction, traditional dominant tree species can be preserved while enhancing the ornamental value and continuity of agricultural landscapes. Wu and Jian (2017) studied the ecological symbiosis model between plants and dwellings in the semi-humid region of the Loess Plateau. Tang and Yan (2017) explored greening planning and spatial layout of courtyard plants in new rural areas of Henan Province, concluding that courtyard greening plays a significant role in improving rural environments. Other scholars have focused on biodiversity studies of village fengshui forests (Zhang et al., 2015; Xu et al., 2012).

Among research on Dai plants, the Xishuangbanna Tropical Botanical Garden of the Chinese Academy of Sciences has produced the most work, primarily focusing on Xishuangbanna Dai plant culture and applications. Dehong, however, is China' s largest Dai settlement area, yet research on Dehong Dai villages and their plants remains relatively scarce, constraining conservation and development efforts. This study investigates plant landscapes and applications in 19 traditional Dai villages across the Dayingjiang and Ruilijiang basins in Dehong Prefecture, aiming to provide scientific evidence for ecological construction and ethnobotanical development in Dehong Dai communities.

1.1 Study Area Overview

Dehong, meaning "place downstream of the Nu River" in the Dai language, is the Dehong Dai and Jingpo Autonomous Prefecture in Yunnan Province. Located on China' s southwestern border adjacent to Myanmar, it hosts one-third of the nation' s Dai population, making it China' s largest Dai settlement area. Historically, this region established the largest Dai kingdom—Mengguozhanbi—and was first recorded in history as the Elephant-Riding Kingdom. As of October 2017, 816 Dai natural villages were distributed in low-altitude valleys of 800–1,200 m elevation throughout Dehong.

In terms of floristic regionalization, Dehong belongs to the Yunnan-Myanmar-Thailand region of the Malayan forest subkingdom in the Paleotropical kingdom, representing a critical and hotspot area for vegetation geography and biodiversity conservation. It serves as a transitional zone from the Southeast Asian (Indo-Malaysian) tropical flora to the East Asian subtropical-temperate flora (Zhu et al., 2004). The valley areas inhabited by the Dai people experience foehn effects with sinking warm air currents. In winter, the Gaoligong Moun-

tains to the northeast block the dry, cold Siberian air masses, while summer brings warm, moist airflows from the Indian Ocean. This creates a climate characterized by year-round warmth, humid and rainy summers, and dry, sunny winters—a typical south subtropical monsoon climate. The vegetation consists primarily of rainforests, seasonal rainforests, and evergreen broad-leaved forests (Liu and Zhao, 2009).

1.2 Sampling

Using stratified sampling, we first selected 19 representative Dai villages with traditional characteristics across Dehong Prefecture. Plant landscape surveys were then conducted in these villages. The specific villages include: Mangbie, Longyi, Longxing, Haixian, Manya, Nanhuan, Jiewu, Bankan, Nanyong, Wengleng, Laxian, Manmian, and Manke from the Dayingjiang River basin; and Dadenghan, Dengxiu, Mangling, Hansha, and Jiele from the Ruilijiang River basin.

1.3 Survey Content and Methods

The initial survey was conducted in April 2010, with supplementary surveys in October 2013 and October 2017. Survey content included: horizontal plant distribution, vertical landscape layers, plant species identification, plant practicality assessment, and plant cultural landscape documentation for each selected village. Methods employed included measurement and positioning, specimen collection, identification, interviews, and photography.

2.1 Horizontal Distribution of Plants in Dai Villages

Within the village domain of traditional Dehong Dai villages, plants exhibit five spatial forms—patches, belts, rings, lines, and nodes—distributed across three zones to create a three-tier spatial pattern. From outside to inside: outside the village (forest patches + farmland patches + embankment protection belts) —village edge (protective green rings + *Ficus altissima* patches) —inside the village (green nodes + green lines)

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2.1.1 Plant Distribution Outside the Village Forests represent the most species-rich patches, located behind Dai villages. Guided by the ecological belief that "forests bring water, water brings farmland, and farmland sustains people," the Dai people prohibit arbitrary logging or excavation of forest vegetation. Consequently, forest vegetation remains lush and biodiverse, serving as a valuable germplasm resource bank that preserves rare species such as *Shorea assamica*, *Saraca griffithiana*, *Gnetum brunonianum*, and *Olax acuminata*, and functioning as an ecological barrier for the villages.

Figure 1: Figure 1

Farmland constitutes the largest green patch in Dai villages. With fertile soil and a suitable climate, vegetation persists year-round, ensuring landscape quality. To prevent flooding and stabilize riverbanks, the Dai plant trees along rivers to form protective embankment belts

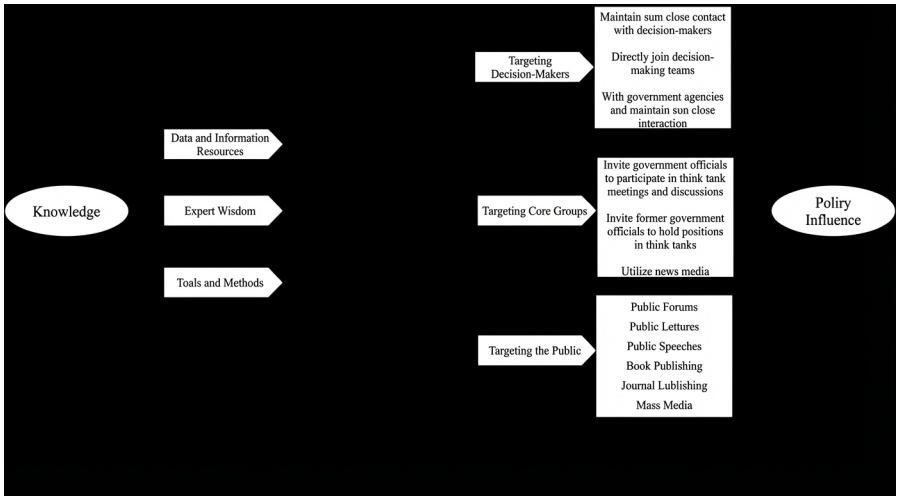

Figure 2: Figure 2

. Initially planted with only arbor species, these belts have naturally evolved into multi-layered plant communities with the following structure: *Bambusa pallida* + *Bambusa multiplex* + *Bambusa lapidea* + *Salix tetrasperma* + *Salix sinopurpurea* −*Cinnamomum glanduliferum* + *Cinnamomum iners* + *Phoebe*

microphylla + *Celtis sinensis* –*Crotalaria pallida* + *Ervatamia divaricata* + *Ficus esquiroliana* + *Psychotria rubra* –*Ceratopteris thalictroides* + *Phragmites communis* + *Thysanolaena maxima* (Dong, 1994).

2.1.2 Plant Distribution at the Village Boundary The village boundary features a 3-10 m wide ring-shaped plant community dominated by bamboo (*Bambusa*) mixed with Araceae, Rosaceae, and Agavaceae species

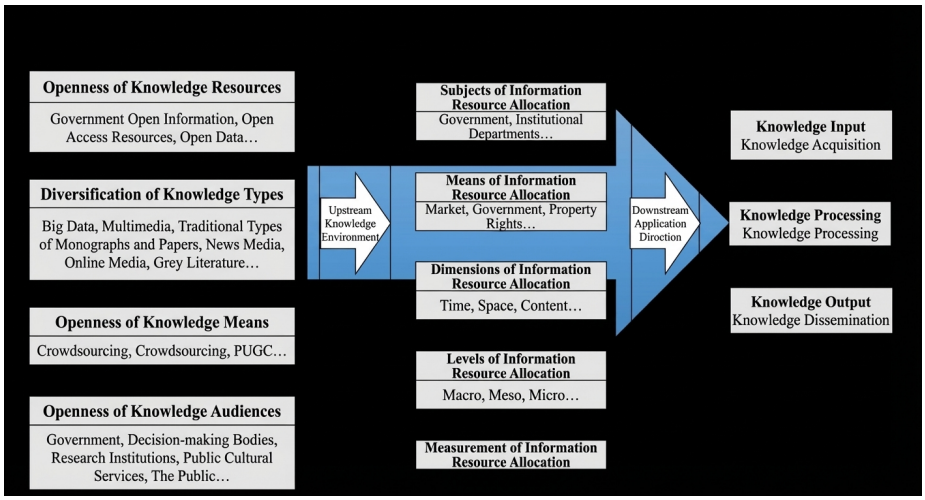

Figure 3: Figure 3

. As Dai villages typically stand in open fields exposed to wind, extensive bamboo planting provides protection against wind and sand.

Unique *Ficus altissima* groves are distributed at village entrances and roadsides. With large crowns and dense shade, these long-lived trees provide resting spaces for pedestrians—a benevolent practice. Consequently, increasing numbers of *Ficus altissima* have formed distinctive communities at village entrances

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2.1.3 Plant Distribution Inside the Village Plant distribution within villages is primarily constrained by architecture, appearing as point distributions in courtyards to form shade trees, or as linear plantings along courtyard edges to create flower hedges and green hedges.

2.2 Vertical Landscape Layers of Dai Village Plants

Dai village plants exhibit five vertical landscape layers, from highest to lowest: bamboo and figs –arbor trees –large shrubs –small shrubs and erect herbs – ground-covering herbs

Figure 4: Figure 4

Figure 5: Figure 5

. The highest layer consists mainly of Moraceae *Ficus* species and Poaceae Bambusoideae, planted at village boundaries with heights reaching 20 m to create a green skyline. The second layer comprises primarily fruit and shade trees. The third layer consists of large shrubs meeting protection and isolation needs. The fourth layer includes small shrubs and erect herbs, mainly ornamental and medicinal plants. The lowest layer comprises ground-covering herbs, mostly edible. Lianas connect these vertical layers, with shade-tolerant species climbing other plants and sun-loving species growing on bamboo fences.

2.3 Plant Species Composition

Surveys of common plants at village boundaries and interior spaces identified 181 species in Dehong Dai villages, including 41 arbor species in 26 families, 7 bamboo species, 36 shrub species in 16 families, 48 erect herb species in 18 families, 31 vine species in 17 families, 9 ground-cover species in 7 families, and 9 aquatic species in 8 families. Details are provided in Table 1: Common Plants List of Dai Villages.

2.3.1 Evergreen-to-Deciduous Ratio Among common plants, 44 evergreen and 33 deciduous species were recorded among trees and shrubs, yielding a 4:3 ratio. Specifically, among arbor species, 22 evergreen and 19 deciduous species gave a 1.2:1 ratio, with Moraceae *Ficus* species being most numerous. Among shrubs, 22 evergreen and 14 deciduous species gave a 1.6:1 ratio, with Euphorbiaceae species being most numerous. Consequently, Dai villages remain lush and green even in winter

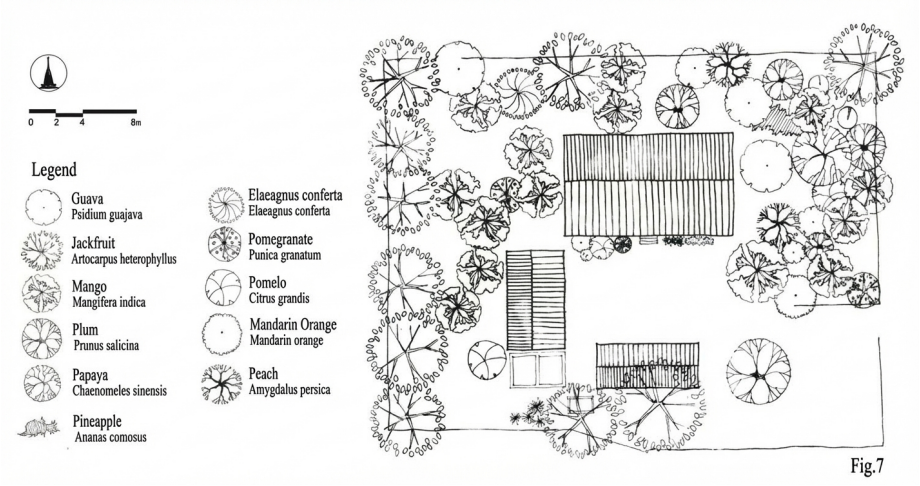

Figure 6: Figure 6

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2.3.2 High-Frequency Family and Genus Analysis The surveyed plants demonstrate rich diversity. Families with highest species frequency include: Moraceae (6 species) and Anacardiaceae (6 species) among arbor trees; Euphorbiaceae (5 species) and Solanaceae (5 species) among shrubs; Araceae (6 species), Zingiberaceae (5 species), Solanaceae (5 species), and Agavaceae (5 species) among herbs; and Fabaceae (5 species) and Araceae (5 species) among vines. Additionally, Poaceae Bambusoideae is well-represented with 7 species.

2.4 Practical Plant Applications in Dai Villages

The survey revealed that most village plants are cultivated for practical purposes

Figure 7: Figure 7

. The most prominent functional categories are: food, medicine, ornamentation, protective isolation, and aromatic seasoning.

A total of 73 common food plants were identified (40.3% of all species), including 24 leaf vegetables, 7 flower vegetables, 35 fruit species, and 7 root vegetables such as *Pistacia chinensis*, *Crateva unilocularis*, *Ehretia dunniana*, *Toona sinensis*, *Artocarpus heterophyllus*, and *Mangifera indica*. Sixty medicinal plants (33.1%) include species like *Eranthemum pulchellum*, *Vitex trifolia*, *Laggera pterodonta*, and *Senecio scandens*. Forty-five ornamental species (24.9%) include 14 foliage plants, 20 flowering plants, 7 fruiting plants, and 4 form plants, with high ornamental value such as *Ficus altissima*, *Pandanus tectorius*, *Heliconia rostrata*, and *Tacca chantrieri*. Twenty-nine species (16%) serve protective isolation functions, including *Lantana camara*, *Mussaenda pubescens*, and *Euphorbia neriifolia*. Eighteen aromatic species (10%) include 9 for incense and 9 for seasoning, such as *Ocimum basilicum*, *Perilla frutescens*, *Agastache rugosa*, *Dichondra*

repens, *Mentha haplocalyx*, *Elsholtzia cypriani*, and *Polygonum hydropiper*. Details are provided in Table 1.

2.5 Plant Cultural Landscape in Dai Villages

Dai culture is primarily influenced by primitive religion and Theravada Buddhism, with beliefs in "animism" and emphasis on merit accumulation. These beliefs manifest in distinctive plant cultural landscapes:

Sacred Tree Landscapes: The Dai people often wrap colorful threads around large, flourishing trees and offer fruits and flowers to pray for family peace and prosperous descendants. Primary species for such rituals include *Ficus altissima*, *Ficus microcarpa*, and *Ficus auriculata*

Figure 8: Figure 8

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Flower Sealing Landscapes: During Spring Festival, the Dai paste red paper strips on household plants to ward off evil and bless healthy plant growth

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Stone-Bench-Enveloping Trees: As previously mentioned, *Ficus altissima* are planted near village entrances to provide resting shade for pedestrians. Flat stones placed beneath these trees for seating are gradually enveloped by the trees' powerful root systems, creating unique stone-bench-enveloping tree landscapes

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Figure 9: Figure 9

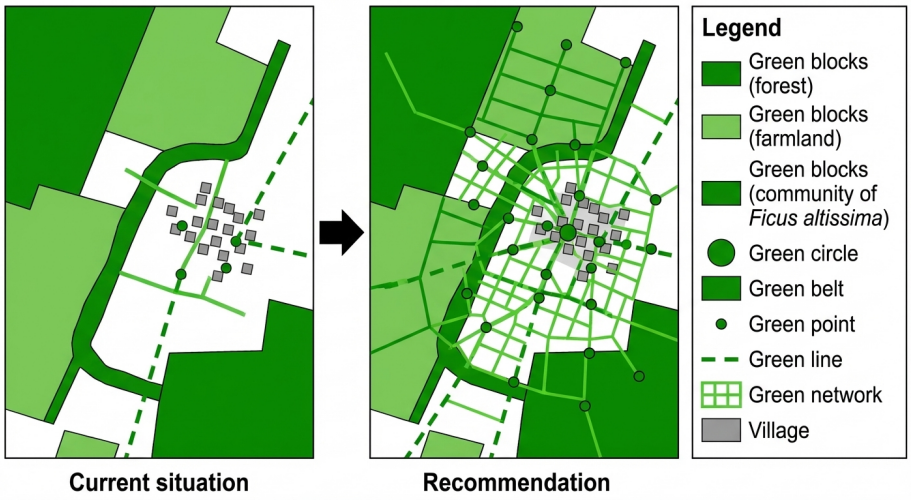

Figure 10: Figure 10

3.1 Strengthen Spatial Connectivity in Horizontal Plant Distribution to Establish a Stable Green Space System Pattern

Within Dehong Dai village domains, the five-form, three-zone horizontal distribution pattern already provides rich green space forms and multi-layered spatial structures, but the various green patches remain relatively isolated and lack connectivity. Huang et al. (2006) argue that green corridor networks can strengthen connections between isolated patches and enhance ecosystem stability. We recommend adding network-shaped green spaces during village ecological construction, specifically by increasing road greening to radiate green spaces throughout the village via the road network. This would maximize the scale benefits of the green space system while improving pedestrian comfort

Figure 11: Figure 11

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3.2 Maintain Vertical Landscape Layers and Promote Plant Construction Functions

The five vertical landscape layers in Dehong Dai villages demonstrate traditional applications of plant spatial construction functions. Huang et al. (2016), in studying ancient village defense systems in Haikou, identified special functions of plants in village security. The Dehong Dai utilize plants taller than buildings with dense foliage to enclose and cover village spaces, creating green overhead interfaces that provide "concealment" ; employ plants above eye level with dense branches for courtyard isolation, forming green vertical planes that protect

privacy; and use low-growing, highly ornamental plants to beautify ground-level interfaces, creating intimate viewing scales. This vertical landscape reflects Dai understanding and utilization of plant construction functions, offering valuable references for building village spaces, regulating microclimates, and creating garden-like living environments.

3.3 Leverage Rich and Practical Plant Resources to Develop Industrial Advantages

Through long-term production and living practices, the Dai people have selected numerous plants with food, medicinal, ornamental, protective, and aromatic functions for village cultivation. Pei Shengji (2013) argues that such traditional plant utilization represents long-term accumulated experience, offering strong operability for ethnobotanical diversity conservation and providing references for sustainable resource use. However, current Dai utilization remains at a traditional level. We recommend vigorously integrating resources and introducing technologies to transform resource advantages into industrial advantages, establishing brands for Dai flowers, fruits, and medicines to drive village economic development.

3.4 Preserve Excellent Plant Cultural Landscapes

Dai plant cultural landscapes embody spiritual 寄托 through plants, reflecting religious and cultural beliefs. As religious beliefs fade, these cultural landscapes risk disappearance, requiring positive guidance to preserve plant-protecting practices. For example, sacred tree rituals protect trees and should be preserved, but inappropriate offerings of fruits and food in tree holes damage plants and require improvement. Ultimately, excellent traditional practices that benefit social progress should be preserved.

Through their interaction with nature, Dehong Dai communities have accumulated rich plant knowledge and application experience, utilizing plants'ecological, construction, aesthetic, practical, and cultural functions to create ecological, beautiful, and comfortable living spaces. This traditional knowledge and experience provide important references for human settlement construction and ethnobotanical diversity conservation and utilization in the Dehong region.

Note: Except for Figure 3, which is a satellite image screenshot, all figures and drawings are original work by the authors.

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